sustainability

MDPI

Article

Do Consumers Perceive Cultivated Meat as a Sustainable Substitute to Conventional Meat? Assessing the Facilitators and Inhibitors of Cultivated Meat Acceptance

Wei Fu [1], Hongping Zhang [2,*], Jeremy E. Whaley [2] and Youn-Kyung Kim [2]

[1] Division of Social Science, Maryville College, Maryville, TN 37804, USA; wei.fu@maryvillecollege.edu
[2] Department of Retail, Hospitality, and Tourism, University of Tennessee, Knoxville, TN 37996, USA; jwhale15@utk.edu (J.E.W.); ykim13@utk.edu (Y.-K.K.)
* Correspondence: hzhan110@utk.edu

Abstract: Conventional meat production has become a force of environmental damage, but global meat consumption is predicted to continue increasing. Therefore, the technology of cultivated meat is undergoing rapid development. The current study explores what factors explain U.S. consumers' intention to purchase cultivated meat as a sustainable substitute for conventional meat by applying a dual-factor model. A total of 410 completed responses were received from a nationwide survey. Structural equation modeling was conducted to test the model and hypotheses. The results showed that physical health, animal welfare, and food quality significantly encouraged consumer acceptance of cultivated meat as a sustainable substitute for conventional meat. Food technology neophobia significantly inhibits the acceptance of cultivated meat, whereas unnaturalness did not show an impact on cultivated meat acceptance. Furthermore, the acceptance of cultivated meat as a sustainable substitute significantly enhanced consumers' purchase intention. The findings inform practitioners about promoting cultivated meat in that marketers should emphasize the benefits of cultivated meat with health, animal welfare, food quality, and the environment. While technological language should be used carefully to avoid food technology neophobia, it is also essential to educate consumers on the science of cultivated meat in order for them to understand its benefits to sustainability.

Keywords: cultivated meat; consumer acceptance; sustainability; facilitator; inhibitor

Citation: Fu, W.; Zhang, H.; Whaley, J.E.; Kim, Y.-K. Do Consumers Perceive Cultivated Meat as a Sustainable Substitute to Conventional Meat? Assessing the Facilitators and Inhibitors of Cultivated Meat Acceptance. *Sustainability* **2023**, *15*, 11722. https://doi.org/10.3390/su151511722

Academic Editors: Tunmin (Catherine) Jai and Ruirui Zhang

Received: 23 June 2023
Revised: 21 July 2023
Accepted: 26 July 2023
Published: 29 July 2023

1. Introduction

Meat has been a historical staple in many diets worldwide as a good source of protein, vitamins, and minerals for humans. Beef consumption per person is approximately sixty pounds each year [1], and global meat consumption has "more than quadrupled since 1961" [2]. However, the human appetite for animal meats has become a major driving force of environmental damages such as freshwater scarcity, air and water pollution, biodiversity loss, and the spread of disease, threatening the future of humanity [3]. These damages inflicted to the environment and humans have called for attention to sustainable development. Considering a constant increase in global population, developing a sustainable substitute for conventional meat seems to be a feasible solution to meet this growing demand for meat products. As an innovative solution for substituting conventional meat, cultivated meat was created by growing muscle tissue from animal stem cells in a laboratory rather than by harvesting it from livestock [4]. While plant-based protein products have entered the meat market, they account for only 1.4% of total meat sales in the United States [5]. Furthermore, 98% of U.S. consumers who buy plant-based meat also purchase conventional meat [5]. Therefore, this study focuses on carnivore diet consumers and their willingness to switch from conventional meat to cultivated meat.

Cultivated meat has been acknowledged to provide benefits related to food quality, health, and animal welfare. Cultivated meat production can virtually eliminate contam-

ination with disease-causing viruses; reduce the risks of emerging infectious diseases associated with the storage, production, and consumption of livestock; and lower the risk of food-borne illnesses transmitted from live animals [4,6]. Additionally, its nutritional content can be augmented to produce a more nutrient-dense meat product with lower amounts of saturated fat/cholesterol and higher amounts of vitamins and minerals [4,7]. Researchers argue that cultivated meat contains attributes (e.g., taste, nutrition, appearance, and tenderness) similar to those of conventional meat [8]. Also, because cultivated meat production uses a technology with which muscle cells are taken from an animal and cultured to grow more muscle, it can protect animals from being slaughtered and provide a painless process for the animals [9]. Perceiving these benefits can facilitate the acceptance of cultivated meat as a sustainable substitute for conventional meat [8].

However, food neophobia may be a major challenge for consumers to perceive cultivated meat as a sustainable substitute for conventional meat because they may have limited knowledge of cultivated meat technology and limited opportunities to taste cultivated meat. They may doubt this new food technology and fear trying an unfamiliar food, wondering whether the cultivated meat production process would generate long-term negative health effects following, for example, the consumption of faulty cell lines [10]. In addition, cultivated meat may be perceived as unnatural because it involves growing muscle tissues in the lab process. This perception of unnaturalness can evoke a sense of disgust or uneasy feelings, inhibiting the acceptance of cultivated meat [11,12].

The current study explores what factors explain U.S. consumers' intention to purchase cultivated meat as a sustainable substitute for conventional meat. We employ a dual-factor model that explains how facilitators and inhibitors influence purchase intention toward cultivated meat.

2. Research Background

2.1. Cultivated Meat

Cultivated meat, also labeled as clean meat, cultured meat, in vitro meat, and lab-grown meat [13], is a new food technology and brings an opportunity to change meat consumption modes and production patterns toward a more sustainable future. Scientists create cultivated meat by taking a sample of muscle cells from a living animal and adjusting the fat composites used in the production to control its nutrients (i.e., vitamins, minerals, and amino acids). These muscle cells enter a nutrient bath in a large stainless-steel vessel called a bioreactor and are converted into finished products such as chicken, beef, or steak [7,14].

Cultivated meat research started in 2002 when a U.S. National Aeronautics and Space Administration (NASA) project successfully grew fish filets from goldfish skeletal muscle cells [9]. In December 2020, regulators in Singapore approved cultivated chicken nuggets for sale in restaurants [15]. By November 2022, the Food and Drug Administration (FDA) completed its first pre-market consultation with UPSIDE Foods, a cultivated meat plant in Berkeley, CA, and confirmed its food production to be safe [16]. It is predicted that cultivated meat will soon be available on restaurant menus and grocery store shelves in the United States [17]. According to McKinsey & Company, the market of cultivated meat may reach $25 billion in annual sales by 2030, especially if cultivated meat can be distributed globally [18].

The literature illuminates that cultivated meat can serve as a sustainable substitute for conventional meat for multiple reasons. Compared to conventional meat production, which leaves a large water footprint, leading to the pollution and degradation of the environment, cultivated meat production reduces green gas emissions, land use, water use, and nutrient pollution [19,20]. Furthermore, cultivated meat production can be ethically beneficial for animal welfare and has the potential to be more sustainable than conventional meat production. Despite the growing potential of cultivated meat and the rising consumer interest in sustainable consumption, limited research has been conducted to examine whether and why consumers accept or reject consuming cultivated meat as a sustainable

substitute for conventional meat. This study will address both the benefits and challenges of cultivated meat within the framework of the dual-factor theory.

2.2. Dual-Factor Theory

The dual-factor theory was first established by Frederick Herzberg [21] to understand drivers of job satisfaction (motivation factors) and dissatisfaction (hygiene factors) among employees. Motivation factors make employees feel good about their jobs, encouraging them to work harder, while hygiene factors such as basic needs, if not satisfied, can cause employees to feel poorly about their job and leave [21]. According to Cenfetelli [22], facilitators such as a high-quality (reliable and responsive) system and current information perception encourage individuals' technology adoption, while inhibitors such as a lack of perception or a poor perception of current information and poor service quality discourage their technology adoption.

Dual-factor theory has been applied for examining consumers' intention to adopt or reject new concepts, processes, or behaviors [23–25]. Kushwah et al. [26] reviewed 89 empirical studies and summarized five motives (functional value, social value, emotional value, conditional value, and epistemic value) and two barriers (functional and psychological barriers) of organic food purchase decisions. Among the five motives, functional value was the most critical motivator, followed by social value and conditional value. In terms of the two barriers, functional barriers arose when consumers experienced significant changes due to using a new product or innovation, while a psychological barrier happened when consumers experienced conflicts with their existing values. Tandon et al. [25] examined factors that facilitated or inhibited Japanese consumers' buying behavior toward organic food. They identified natural factors, nutrition, and ecological welfare as facilitators, while they identified usage, risk, and value barriers as inhibitors. Kumar et al. [24] found that nature content (i.e., certifications, labels, packings, and brand names indicating product naturalness) and regional products were facilitators that encouraged brand love for natural products among food, cosmetics, and other fast-moving consumer goods, while usage barriers (i.e., using products inconsistent with the consumers' existing values, experiences, needs, and expectations) and image barriers (i.e., consumers' unfavorable impression towards a brand, product, or innovation) were inhibitors that impeded brand love for these natural products.

3. Research Model

Drawing upon dual-factor theory, this study tests a conceptual model depicting the relationship between two opposite influencing factors related to perceptions toward and the consumption of cultivated meats. As shown in Figure 1, the influencing factors are approached from two perspectives (facilitators and inhibitors). Facilitators include physical health, animal welfare, and food quality, while inhibitors include unnaturalness and food technology neophobia. These factors are expected to influence cultivated meats' sustainable substitutability for conventional meats and, ultimately, consumers' purchase intention.

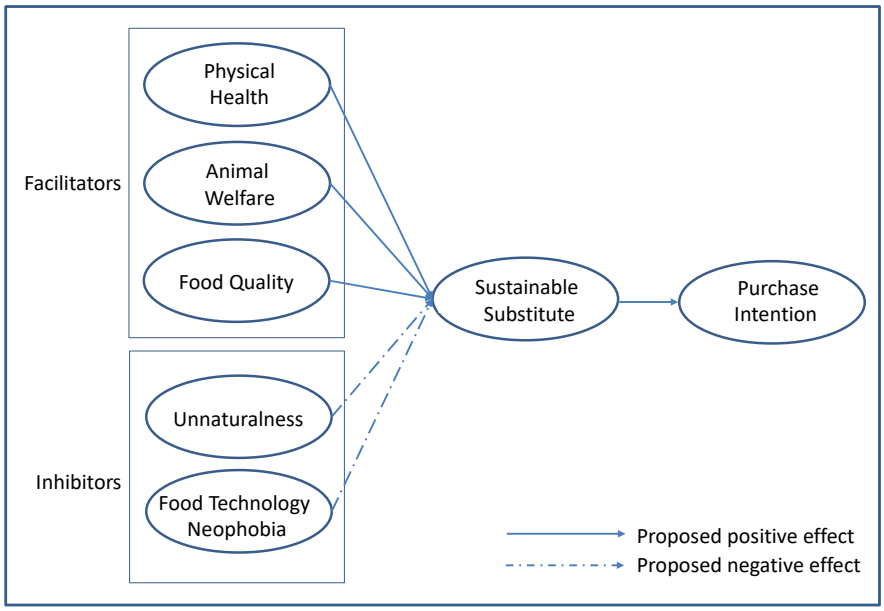

Figure 1. Research model.

4. Hypotheses Development

4.1. Facilitators of Sustainable Substitutability

The literature provides consuming cultivated meat relates to three main benefits: physical health, animal welfare, and food quality. Perceiving these benefits facilitates consumers to evaluate cultivated meat as a sustainable substitute, which is discussed below.

4.1.1. Effect of Physical Health on Sustainable Substitutability

While there is a growing public sentiment that meat consumption is problematic for both the physical environment and consumers' long-term physical health, meat remains a staple of many diets throughout the world because of its richness in protein and B vitamins [27,28]. While conventional meat production methods involve the use of antibiotics, growth hormones, and pesticides to treat pastures and grassland that livestock consumes, which may indeed threaten physical health [14], cultivated meat does not involve such compounding factors [27]. Furthermore, given that scientists prepare cultivated meat in a laboratory setting, the resulting product can provide strict consistency, ensuring health benefits to consumers. Chriki and Hocquette [6] found that cultivated meat is safer than conventional meat in potential consumers' minds because the production of cultivated meat eliminates potential contamination during the slaughter process and reduces the risks of food-borne illnesses transmitted between live animals and humans.

Worldwide, many consumers focus on sustainable practices that promote and assist them in pursuing a more sustainable lifestyle. Macdonald et al. [29] found that health-conscious consumers who purchase products and services for optimal health engage in sustainable practices that promote individual health. Indeed, those concerned with physical health seek sustainable food options such as cultivated meat to achieve their immediate and lifetime nutritional goals [30]. Therefore, our first hypothesis is as follows:

H1a. *Perceived physical health from consuming cultivated meat will lead to its positive evaluation as a sustainable substitute for conventional meat.*

4.1.2. Effect of Animal Welfare on Sustainable Substitutability

While the meat production industries increasingly focus on limiting the overall harm to animals [31], consumers' concern for animal welfare has been a critical factor influencing their decision to purchase products [32]. During the conventional meat production process, meat producers often harm animals by using both steroids to grow meat quickly and

antibiotics to fight infections [7], and these animals are ultimately slaughtered. If consumers feel as though animals are harmed during the production or harvesting process, they are less likely to purchase the product for fear of the unethical treatment of the animals [32]. In contrast, producing cultivated meat does not require using such chemical elements [7,27] but requires as little as extracting muscle cells from animals, thus preventing the animals from suffering and being killed [9].

Alonso et al. [32] argued that animal welfare plays a significant role in consumers' purchasing decisions and promoting sustainable systems. Moreover, in Bryant and Barnett's [33] study, perceived animal welfare positively influenced consumer acceptance of cultivated meat. Because the production of cultivated meat is less harmful to the animal, it becomes more favorable to those who are conscious of animal welfare [33]. Therefore, our second hypothesis is as follows:

H1b. *Perceived animal welfare from consuming cultivated meat will lead to its positive evaluation as a sustainable substitute for conventional meat.*

4.1.3. Effect of Food Quality on Sustainable Substitutability

Food quality has been associated with a food's fitness for use and consumption relative to the needs and desires of consumers and their expectations [34]. In this association, food quality is viewed as an overarching concept that includes subcomponents such as the food's taste, temperature, appearance, mouthfeel, and aroma [35–37]. Meat alternatives (e.g., cultivated meat) are made to have appearance, taste, texture, and nutrients [38] similar to those of conventional meat. Food processing biotechnology offers the possibility to produce cultivated meat that can retain its fresh color and visual appearance. Specifically, cultivated meat can have superior flavor, taste, and texture by controlling the amount of fat in cultivated meat via food bioprocessing technology, and adding protein has been approved to give cultured meat a color similar to that of conventional meat [39]. Although the final product of cultivated meat is pink rather than the traditional blood-red product seen in conventional meat [27], those who are turned off by the presence of blood in meat may find cultivated meat more appealing.

As a method to control food quality, many food products throughout the world now require a certification of sustainability to ensure that food sources are not over-sourced and that the products have a certain quality, which will help them last longer [40–42]. The preparation of the cultivated meat in a lab setting, separating fat from the muscle, can provide consumers with consistent food quality that guarantees a healthier food option for a more lean and nutrient-dense food product [27]. When consumers perceive cultivated meat as having high food quality, they are more likely to perceive it as a sustainable substitute for conventional meat. Therefore, our third hypothesis is as follows:

H1c. *The perceived food quality of cultivated meat will lead to its positive evaluation as a sustainable substitute for conventional meat.*

4.2. Inhibitors of Sustainable Substitutability

While cultivated meat is an innovation that addresses some of the environmental impacts caused by meat production [18], consumers' perception is not always in line with the technical benefits of the innovation itself [43]. Concerns with unnaturalness and food technology neophobia are two factors that may hinder the acceptance of cultivated meat as a sustainable substitute and are discussed below.

4.2.1. Effect of Unnaturalness on Sustainable Substitutability

Unnaturalness has been recognized as one of consumers' most common concerns toward cultivated meat [33]. Siegrist and Hartmann [3] conducted surveys in ten countries (Australia, China, England, France, Germany, Mexico, South Africa, Spain, Sweden, and the United States) and found that participants from all of these countries perceived cultivated meat as unnatural. Siegrist et al. [11] found the unnatural impression of cultivated meat

can evoke uneasy feelings and even a sense of disgust, discouraging consumers from trying cultivated meat. Wilks et al. [44] argued that people feel instinctively disgusted by the idea of cultivated meat and then justify this feeling by pinpointing unnaturalness as the cause. This argument was later supported by a test conducted by Wilks et al. [44]. First, they broke cultivated meat production down into five stages: "extracting the cells, growing the cells, allowing the cells develop into muscle fibers, layering the fibers together, and grinding them into meat" (p. 3). Then, they asked participants to rate the unnaturalness of each stage. It turned out that "grinding cultivated meat muscle fibers into meat" was rated the most unnatural. This result suggests that the most unnatural part was not derived from a process conducted in the laboratory but from one that turned the cultivated meat into food. The feeling of disgust was attributed to the unnaturalness of eating cultivated meat.

In addition to the affective reaction, the meaning and impact of unnaturalness have further been investigated by researchers. Early qualitative exploratory studies unpacked that, when consumers are worried about unnaturalness, they are mainly concerned with the unknowns of new technologies and unethical practices [45,46]. Wilks et al. [44] discovered that when consumers are concerned about the unnaturalness of cultivated meat, they are indeed worried about its impact on health and food safety. Other studies confirmed that unnaturalness was negatively associated with the willingness to eat [11], the willingness to buy [10], and the acceptability of cultivated meat [44]. However, Wilks et al. [47] did not find a significant association between attitudes toward naturalness bias (being in favor of natural things) and attitudes toward cultivated meat. In other words, consumers' attitudes toward the naturalness of food did not predict their acceptance of cultivated meat.

In addition, unnaturalness can be perceived as being misaligned with sustainability because people tend to associate sustainability with green and natural products. Verain et al. [48] developed a Sustainable Food Choice scale to examine motivators of sustainable food consumption, which consisted of two factors: "General Sustainability" (about animal welfare, ethical concern, and environmental welfare) and "Local and Seasonal." They then validated the scale with the existing Food Choice scale of Steptoe et al. [49]. Both "General Sustainability" and "Local and Seasonal" were strongly correlated with "Natural Content" in the Food Choice scale, suggesting that consumers tend to associate sustainable food with naturalness. Cavaliere and Ventura [50] also found that consumers who care about sustainability in their food consumption are in favor of natural foods such as those grown locally, organically, and in season. Following this logic, cultivated meat is likely to be seen as unsustainable by those who equate sustainable food with natural food, especially because its whole production process is completed in labs and factories.

Thus, we argue that the more consumers consider cultivated meat as unnatural, the less likely they would accept it as a sustainable substitute for conventional meat, and our fourth hypothesis is as follows:

H2a. *The perceived unnaturalness of cultivated meat will lead to its negative evaluation as a sustainable substitute to conventional meat.*

4.2.2. Effect of Food Technology Neophobia on Sustainable Substitutability

Food technology neophobia and food neophobia have been recognized as the main reasons for rejecting cultivated meat [51]. While food neophobia has been studied in the context of food from different cultures because it captures negative reactions to "new" food [52], food technology neophobia emphasizes the technological aspect of food production and how the new food technology is perceived. The key components of the technology involved in producing cultivated meat are extracting starter cells from animals (the original cell to be cultured), cultivators (the bioreactors which provide the environment needed for cells to grow), growth media (nutrients needed for cell growth such as carbohydrates, amino acids, vitamins, etc.), and scaffolding (a structure to hold cultivated meat cells and mimic meat texture) [53].

The challenge new food technology faces is that most consumers have limited knowledge about it, which impedes the appropriate assessment of both the benefits and risks

associated with it [11]. In addition, many people worry about its unknown long-term impact [51]. Siegrist et al. [11] conducted experiments to compare consumers' reactions to technical and non-technology descriptions of cultivated meat. They found that reading technical descriptions resulted in lower acceptance of cultivated meat. Therefore, it is safe to argue that consumers with high food technology neophobia would be less likely to adopt cultivated meat as a substitute to conventional meat.

There is also a paradox faced by new food technology that it can be perceived as incompatible with sustainability. For instance, Cavaliere and Ventura [50] found that those who consumed food more sustainably also had a higher level of food technology neophobia. This indicates that consumers who value sustainable food are less likely to be in favor of new food technology. Even if cultivated meat technology is intentionally developed for sustainable agriculture, it may not be perceived as a sustainable substitute to conventional meat to these consumers. Thus, our fifth hypothesize is as follows:

H2b. *Food technology neophobia related to the production of cultivated meat will lead to its negative evaluation as a sustainable substitute to conventional meat.*

4.3. Effect of Sustainable Substitutability on Purchase Intention

Wijekoon and Sabri [54] conducted a literature review for 108 green purchase behavior studies from 2015 to 2021. They found that product sustainability was one of the main determinants of consumer's green purchase behavior that positively influenced green purchase intention. Previous studies have identified the perceived sustainability of cultivated meat as one of the main reasons for consumers to accept cultivated meat. For example, Verbeke et al. [55], in their study with Belgian college students, found that the students perceived cultivated meat as more sustainable than conventional meat and thus a possible substitute for conventional meat. Van Loo et al. [56] used experimental design to examine the impact of providing information about the sustainability-related benefits of cultivated meat. Based on the data collected from a U.S. nationwide survey, their results showed that 56% of consumers who were shown sustainability information had positive preferences for cultivated meat, whereas 47% of U.S. consumers who were not shown sustainability information were positive about cultivated meat. Silva and Semprebon [14] repeated the experiment with Brazilian consumers and found that the awareness of the sustainable benefits of cultivated meat positively affected their purchasing intention over conventional meat. Silva and Semprebon [14] also demonstrated that the sustainability appeal of cultivated meat raised consumers' intention to purchase. Hence, our sixth hypothesis is as follows:

H3. *The evaluation of cultivated meat as a sustainable substitute for conventional meat will lead to increased purchase intention.*

5. Method

5.1. Instrument Development

The survey questionnaire began with a short video of cultivated meat to help respondents clearly understand the term as they responded to survey questions. The video briefly explained how cultivated meat is grown and produced in a lab. After we identified a YouTube video briefly explaining the production process, we eliminated the sponsoring agency name and any possible benefits or risks associated with cultivated meat to reduce possible biases as respondents answered survey questions. This modification resulted in a running time of 1 min and 20 s.

The measurement scales employed in this study were adapted from the literature and modified to fit the cultivated meat shopping context. The final measurement items were refined based on the content validity tests, a pilot test, and a pretest. The constructs used in the survey questionnaire were adapted from the original sources of four main measures: (1) facilitators, (2) inhibitors, (3) sustainable substitute, and (4) purchase intention. Facilitators were measured by physical health [6,57,58], animal welfare [59,60], and food quality [55]. Inhibitors were measured by unnaturalness [10,61] and food technol-

ogy neophobia [52]. The scale items of sustainable substitutability were adapted from Verbeke et al. [55], and those of purchase intention were adapted from Rodgers [62]. All the items were measured on a 5-point Likert scale ranging from "strongly disagree" (1) to "strongly agree" (5).

To ensure content validity, four academic experts in food science and retailing at one of the major universities in the Southeastern United States evaluated the measurement scale items adapted from the literature to clarify the questions, readability, and content validity. After the necessary revisions by experts, the survey items were also reviewed by students in a food science class at the same university who evaluated survey items regarding wording, item clarity, and the survey format. Revisions were made based on their feedback before the pretest.

5.2. Data Administration

Quantitative online data were collected from consumer panels of a marketing research company, Dynata, in 2022. To control the quality of the responses, we asked a simple question (one muscle stem cell grows up to how many muscle cells?) regarding the video content and screened out those who did not provide a correct answer (one trillion). The survey was conducted with 150 respondents for a pretest and 500 respondents for primary data collection.

5.3. Pretesting

A pretest was conducted with 150 respondents via online survey; after excluding unusable data, a total of 131 usable surveys were obtained. The analysis revealed a need to revise some scale items due to low reliabilities (Chronbach's alphas < 0.70). Thus, scale items of animal welfare and food quality were revised to enhance clarity. For instance, one animal welfare item, "Cultivated meat is produced without causing pain to animals", was changed to "The production of cultivated meat does not cause pain to animals". Also, one food quality item, "Cultivated meat would have the same quality as farm-raised meat", was changed to "The method which produces cultivated meat would produce the same quality as farm-raised meat".

5.4. Primary Data Collection

The revised survey was administered to 500 U.S. consumers using the same marketing research company that was used in the pretest. The majority of the respondents (n = 411, 84.4%) were omnivores (includes meat and plants), and 76 respondents (15.6%) were vegetarian (including vegans and other types such as flexitarian and lacto-vegetarian). Because this study explores consumer perceptions and beliefs toward cultivated meats, only omnivore respondents were included in the analysis. In addition, 13 unusable cases were removed. The final sample consisted of 410 respondents.

The analysis of respondents' demographic information revealed that gender was fairly evenly distributed, with 53.0% females and 47.0% males. The respondents' age ranged from 18 to 88, with the median age of 40. As for annual household income, the respondents represented a wide range of income groups with the median income bracket of USD 40,000–59,999. The majority of respondents attended high school or received less education (36.1%) or earned an associate's degree (24.4%) or a bachelor's degree (25.6%). Most respondents were married (42.4%), followed by single/never married (30.2%). Approximately half (48.5%) of the respondents were employed for wages. Regarding ethnicity, the largest group (68.0%) was Caucasian, followed by African American (14.9%) and Hispanic (7.1%). The most represented religion was Christianity (62.2%), while no religion was represented by 29.0% of respondents

6. Results and Discussion

The research model and the hypotheses were tested using structural equation modeling (SEM). First, we checked the measurement model in two ways: Confirmatory Factor

Analysis (CFA) and Exploratory Graph Analysis (EGA). Then, we tested the proposed hypothesis with structural equation modeling (SEM) by examining the causal relationships among the latent variables. The measurement model and the structural model were assessed using R Software Statistics 4.2.2 with the maximum likelihood method. The model fits of the estimated models were assessed by the chi-square (χ^2) tests, the ratio of chi-square to degrees of freedom, the comparative fit index (CFI), the Tucker–Lewis index (TLI), and the root-mean-square error of approximation (RMSEA).

6.1. Measurement Model

6.1.1. Confirmatory Factor Analysis (CFA)

CFA was conducted for the measurement model that comprises all the latent constructs. CFA evaluated whether the measurement items reliably reflected the hypothesized latent constructs. The fit of the measurement model was as follows: χ^2 (303) = 474.230; χ^2/df = 1.57; CFI = 0.973; TLI = 0.968; RMSEA = 0.037. These fit indices demonstrate an excellent model fit. Table 1 illustrates factor loadings, composite reliabilities, and Average Variance Extracted (AVE) for each of the seven factors.

Table 1. Measurement items.

Factor	Item	FL	CR	AVE
Physical Health	PH1: Cultivated meat is likely to reduce diseases transmitted between live animals and humans.	0.819	0.839	0.635
	PH2: Cultivated meat is likely to reduce the risk of food-borne illnesses.	0.812		
	PH3: Cultivated meat would introduce no potential contamination during the slaughter process.	0.758		
Animal welfare	AN1: The production of cultivated meat does not cause pain to animals.	0.722	0.876	0.639
	AN2: Cultivated meat is produced while respecting animal rights.	0.856		
	AN3: Cultivated meat would improve animal welfare conditions.	0.824		
	AN4: Consuming cultivated meat means that less animals will be killed.	0.789		
Food Quality	FD1: Cultivated meat would be as tasty as farm-raised meat.	0.816	0.925	0.711
	FD2: Cultivated meat would have as good of an appearance as farm-raised meat.	0.830		
	FD3: Cultivated meat would be as tender as farm-raised meat.	0.886		
	FD4: Cultivated meat would have the same nutritional value as farm-raised meat.	0.839		
	FD5: Cultivated meat would have the same health benefits as farm-raised meat.	0.844		
Unnaturalness	UN1: Eating cultivated meat is an unnatural practice.	0.870	0.903	0.702
	UN2: Eating cultivated meat separates us further from nature.	0.692		
	UN3: Growing meat from animals' muscle stem cells is unnatural.	0.878		
	UN4: Cultivated meat is unnatural because it is grown in a lab.	0.896		
Food Technology Neophobia	NP1: Society should not depend heavily on technology such as cultivated meat to solve its food problems.	0.794	0.865	0.618
	NP2: New food technologies to produce cultivated meat may have long-term negative environmental effects.	0.827		
	NP3: It can be risky to switch to new food technologies such as cultivated meat too quickly.	0.700		
	NP4: New food technologies are likely to have long-term negative health effects.	0.816		
Sustainable Substitutability	SU1: Cultivated meat as a substitute for farm-raised meat would be a long-term solution.	0.872	0.923	0.750
	SU2: Cultivated meat as a substitute for farm-raised meat would be sustainable.	0.877		
	SU3: Cultivated meat as a substitute for farm-raised meat would be ethical.	0.860		
	SU4: Cultivated meat as a substitute for farm-raised meat would be environmentally friendly.	0.854		
Purchase Intention	PI1: I would buy cultivated meat regularly.	0.945	0.923	0.801
	PI2: I would eat cultivated meat instead of farm-raised meat.	0.937		
	PI3: I would pay more for cultivated meat than for farm-raised meat.	0.795		

Note: FL: Factor loading; CR: composite reliability.

The construct validities of the latent constructs were evaluated by both convergent and discriminant validity. Convergent validity is determined by demonstrating that the degree to which a measure is correlated with other measures as theoretically predicted. Convergent validity was supported by the following findings: (a) factor loadings for all items were significant ($p < 0.001$); (b) the composite reliability for each construct exceeded the recommended level of 0.70 (ranging from 0.839 to 0.925); (c) the average variance extracted (AVE) for all latent variables was greater than the recommended threshold value of 0.50 (ranging from 0.618 to 0.801) [63] (see Table 1). Discriminant validity was tested by the correlations' heterotrait–monotrait ratio (HTMT). HTMT is the ratio of the between-trait correlations to the within-trait correlations. It is considered as a stringent measure that could detect the possible similarities among the latent variables. An HTMT value above 0.90 suggests a lack of discriminant validity, with a more conservative threshold value being 0.85 [64,65]. Table 2 illustrates the HTMT criterion result. All values were below 0.90, demonstrating that discriminant validity is satisfactory.

Table 2. Discriminant validity: HTMT criterion result.

Construct	1	2	3	4	5	6	7
1. Physical health	1.000						
2. Animal welfare	0.808	1.000					
3. Food quality	0.348	0.249	1.000				
4. Unnaturalness	0.367	0.378	0.796	1.000			
5. Food technology neophobia	0.806	0.768	0.447	0.537	1.000		
6. Sustainable substitutability	0.759	0.666	0.502	0.485	0.859	1.000	
7. Purchase intention	0.706	0.633	0.487	0.443	0.799	0.886	1.000

6.1.2. Exploratory Graph Analysis (EGA)

Next, we ran an Exploratory Graph Analysis (EGA), a graphic form of nomological validity that represents the degree to which a construct behaves as it should within a system of related constructs [66]. EGA is a new technique that estimates the number of factors underlying multivariate data with a visual guide–network plot. The plot not only indicates the number of dimensions to use but also how items cluster and their level of association in each cluster [67]. In EGA, nodes represent variables, and edges represent the correlations between two nodes. Because EGA is an exploratory method that does not rely on a priori conceptual assumptions, its outcome further validates the dimensionality of factors in the measurement model [67].

The EGA result produced seven factors (latent variables) with each factor forming a cluster of connected nodes (indicators) (Figure 2). The EGA provided four main communities (factors/clusters). Although three sets of factors, (1) food quality and purchase intention, (2) physical health and animal welfare, and (3) unnaturalness and food technology neophobia, have the same color codes, which means they are closely related, the graph is very similar to the seven-factor CFA model.

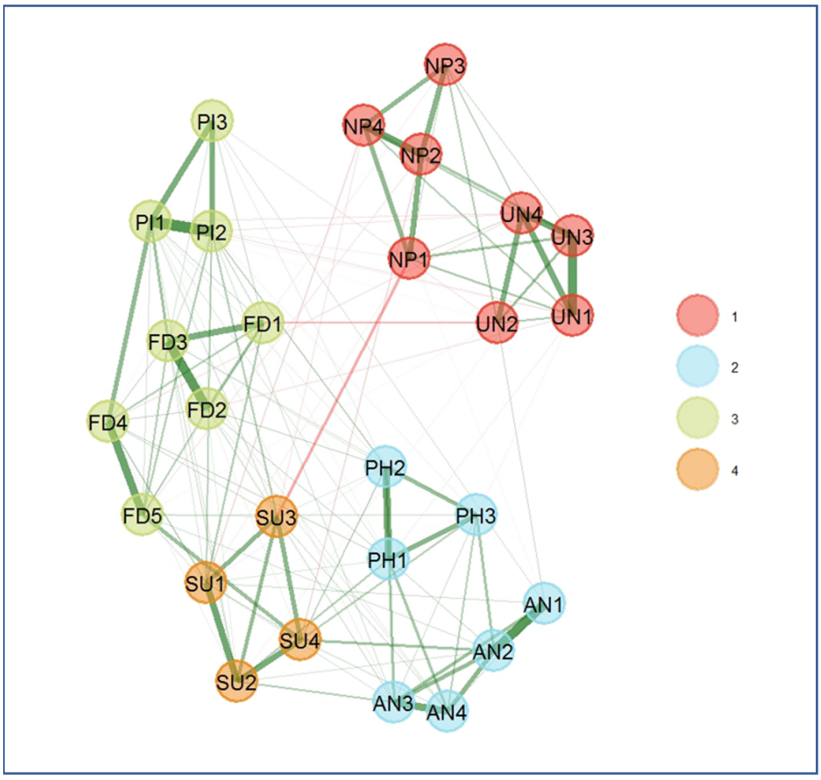

Figure 2. Exploratory Graph Analysis results. AN: Animal welfare; FD: food quality; NP: food technology neophobia; PH: physical health; PI: purchase intention; SU: sustainable substitutability; UN: unnaturalness. Each node represents an item in the scale.

6.2. Structural Model and Hypotheses Testing

The proposed research model and the hypothesized relationships among constructs were tested in the structural model (see Table 3). The fit indices of the structural model were as follows: χ^2 (308) = 560.063; χ^2/df = 1.82; CFI = 0.960; TLI = 0.954; RMSEA = 0.045. This result indicates a fairly good model fit. The result of the structural model reveals that the evaluation of cultivated meat as a sustainable substitutability was positively influenced by a perceived benefit of physical health (β = 0.175, $p < 0.05$), animal welfare (β = 0.192, $p < 0.01$), and food quality (β = 0.579, $p < 0.001$). These findings support H1a, H1b, and H1c. The results derived from inhibitors were very different. Unnaturalness did not influence consumers' evaluation of cultivated meat as a sustainable substitute (β = 0.084, $p = 0.143$), while food technology neophobia negatively influenced the evaluation (β = −0.203, $p < 0.001$). Thus, H2a was not supported, but H2b was supported. Finally, the evaluation of cultivated meat as a sustainable substitute positively influenced purchase intention (β = 0.856, $p < 0.001$), supporting H3.

Table 3. Structural model: Hypothesis testing.

	Structural Path	Standardized Estimate	Unstandardized Estimate	Standard Error	z-Value
H1a	Physical health → sustainable substitutability (SU-ST)	0.175	0.206	0.088	2.349 *
H1b	Animal welfare → SU-ST	0.192	0.279	0.089	3.135 **
H1c	Food quality → SU-ST	0.579	0.599	0.069	8.686 ***
H2a	Unnaturalness → SU-ST	0.084	0.080	0.055	1.463
H2b	Food technology neophobia → SU-ST	−0.203	−0.199	0.057	−3.507 ***
H3	SU-ST → Purchase intention	0.856	1.021	0.040	25.368 ***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

7. Implications

7.1. Theoretical Implications

The dual-factor theory is used to understand what facilitating and inhibiting factors lead to consumers' resistance to and adoption of cultivated meat as a sustainable substitute to conventional meat. The findings support previous studies that argue that facilitators influence the individual's intention to adopt new concepts, processes, or behaviors [20–22,68]. Consumers believe that meat attributes (i.e., taste, nutrition, appearance, and tenderness) are important food qualities for cultivated meat and encourage their adoption. Consumers also believe that cultivated meat is a way to reduce the use and abuse of animals via ethical and sustainable production processes. In addition, consumers believe that the sustainable production process of cultivated meat offers health benefits such as reducing potential contamination during the slaughter process and, thus, lowering the risks of food-borne illnesses. These findings support those of Szejda et al. [8] that cultivated meat is a long-term substitute for conventional meat because of benefits such as a lack of or reduced use of animals and other natural resources.

On the other hand, food technology neophobia inhibits consumers from assessing cultivated meat as a sustainable substitute for conventional meat. The strong effect of food technology neophobia may be due to consumers' limited knowledge toward cultivated meat technology and limited opportunities to view, taste, and purchase cultivated meat. Currently, cultivated meat has not been commercialized in the United States, and U.S. consumers' evaluation toward cultivated meat is mostly from media sources such as news, video, and social media. As consumers gain knowledge in technology, their evaluation toward cultivated meat may become more positive. Unnaturalness, another inhibitor, has no significant effect on sustainable substitutability. This finding suggests that consumers may put more emphasis on sustainability, which does not necessarily lead to avoidance of cultivated meat consumption just because they perceive it as unnatural.

The results demonstrate the importance of considering both facilitators (physical health, animal welfare, and food quality) and inhibitors (food technology neophobia) in evaluating cultivated meat as a sustainable substitute to conventional meat. Assessing specific benefits and challenges associated with cultivated meat will contribute to our knowledge on why consumers accept or reject cultivated meat instead of farm-raised meat.

7.2. Practical Implications

The results of this study endorse both positive and negative aspects of cultivated meat. Practitioners can benefit from the finding that three facilitators—physical health, animal welfare, and food quality—influence accepting cultivated meat as a sustainable substitute of conventional meat. First, marketers can promote positive attributes related to physical health to conventional meat eaters who are not averse to cultivated meat. Food marketers may point to reducing fat as a key benefit of cultivated meat, which will be of utmost importance for those who seek a low-fat, heart-healthy diet while enjoying meat consumption. Second, the findings support that emphasizing the well-being of the animals has the potential to improve consumers' acceptance of cultivated meat as a sustainable substitute for conventional meat. Livestock producers should become increasingly concerned with utilizing new measures for production because of the changing consumer sentiment for animal welfare. For people who do not consume meat for animal welfare reasons, cultivated meat may provide them with more protein options. Furthermore, meat producers can provide key details on product labels and develop a proper supply chain. For consumers who are concerned about animal welfare, their concern stimulates them to look for "slaughter-free" signs or labels on the products when they make purchases. Therefore, informative labels highlighting this content are likely to have a strong appeal to consumers. Third, consumers' positive perception of food quality in terms of the tastiness, texture, and appearance of cultivated meat influenced their evaluation of the meat as a sustainable substitute to conventional meat. In fact, food taste is a primary appraisal of overall food quality. Therefore, cultivated meat firms must work to ensure that cultivated

meat tastes like conventional meat [36]. However, other attributes such as appearance and texture also must be considered carefully to make consumers feel comfortable to accept cultivated meat. Restaurateurs and grocers could showcase cultivated meat as a viable substitute for conventional meat and set up an onsite taste testing area to allow consumers to try the product. Furthermore, meat producers can position cultivated meat to address its food quality on par with farm-grown meat. To do so, meat producers can approach regulatory bodies such as the FDA to obtain some type of seal or identification.

Many studies have identified that consumers perceive cultivated meat production as unnatural [51]. The current study confirmed this finding in that about 50% of the participants "agree" or "strongly agree" that cultivated meat is unnatural. However, unnaturalness was not found to be a strong inhibitor of consumers' acceptance of cultivated meat as a sustainable substitute to conventional meat. As indicated by previous studies [44–46], although unnaturalness is a primary reaction shown by consumers from any examined country, the reaction does not seem to capture specific causes, which may be related to technology, ethics, emotion, sustainability, health, safety, etc. Future research can explore the causes of perceived unnaturalness from cultivated meat.

However, food technology neophobia was identified as negatively influencing cultivated meat acceptance. As Szejda et al. [8] reported, potential cultivated meat consumers are young and highly educated. Therefore, we suggest targeting consumers who are open to new food and technology. Specifically, consumers from Gen Z are the most familiar with and open to cultivated meat, while Baby Boomers are the least open to cultivated meat. Therefore, Gen Z may be a potential growing market that cultivated meat producers should first attract. While introducing cultivated meat to its potential consumers, Siegrist et al. [11] found that non-technology descriptions of cultivated meat resulted in higher acceptance. Therefore, we recommend using less technological descriptions on the packaging and marketing materials for cultivated meat to increase customer acceptance rates. Companies that want to promote cultivated meat may consider sponsoring educational programs to facilitate consumers' understanding of this new technology. Cultivated meat firms can also sponsor food festivals for people to try and learn about cultivated meat. Finally, public health regulatory agencies promoting sustainable diets from sustainable food production systems are increasingly focusing on cell-based meat such as cultivated meat. They can use our findings to educate consumers to learn more about the technology involved in producing cultivated meat as sustainable food.

8. Limitations and Future Research

The findings of this research should be interpreted with caution as all research suffers from inherent shortcomings. Empirical research on cultivated meats is sparse at best. This study attempted to fill this gap by employing the dual-factor theory to examine the factors that facilitate and inhibit the consumption of cultivated meats. Although both facilitators and inhibitors were defined based on both a review of the literature and the findings of the qualitative research, more work (e.g., an empirical test) is needed to further verify the validity of the scales. Future researchers may conduct interviews to further explore possible consumer perceptions that might encourage or deter their consumption of cultivated meats. Also, the discriminant validity of constructs could be enhanced in future research. While the HTMT criterion results only produced values below 0.90, some variables did not meet a conservative threshold of 0.85. These cases were found between food technology neophobia and sustainable substitutability (0.859) and between sustainable substitutability and purchase intention (0.886).

This study employed a cross-sectional design, collecting data at one specific point in time. Future research may conduct a longitudinal study as cultivated meats become more popular with technological advancement, which will increase consumer acceptance. Lastly, future research can explore how consumer groups from various demographic backgrounds perceive cultivated meat consumption differently because perceptions of cultivated meats may differ among consumers who come from different generations, ethnicities, religions,

or community sizes. It is hoped that the current study will motivate future researchers to further investigate cultivated meat consumption and assist meat producers and marketers with practical information as they strive to develop the cultivated meat market.

Author Contributions: W.F.: Conceptualization, funding acquisition, investigation, resources, visualization, writing—original draft preparation, and writing—review and editing. H.Z.: Conceptualization, data curation, software, writing—original draft preparation, and writing—review and editing. J.E.W.: Conceptualization, writing—original draft preparation, and writing—review and editing. Y.-K.K.: Methodology, project administration and writing—review and editing. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the Appalachian College Association (2021-22 Faculty Fellowship #21 60002).

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Review Board (or Ethics Committee) of Maryville College (protocol code: 300122.01 (240620.01 amended); date of approval: 9 February 2022).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to ethical restrictions.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. U.S. Department of Agriculture-Economic Research Service (USDA-ERS). Available online: https://www.ers.usda.gov/data-products/livestock-meat-domestic-data/livestock-meat-domestic-data/ (accessed on 11 June 2022).
2. Meat Consumption. Redefine Meat. Available online: https://www.redefinemeat.com/blog/meat-consumption/ (accessed on 14 June 2022).
3. Siegrist, M.; Hartmann, C. Perceived naturalness, disgust, trust and food neophobia as predictors of cultured meat acceptance in ten countries. *Appetite* **2020**, *155*, 104814. [CrossRef]
4. Food & Nutrition. Lab-Grown Meat: Exploring Potential Benefits and Challenges of Cellular Agriculture. Available online: https://foodandnutrition.org/march-april-2017/lab-grown-meat-exploring-potential-benefits-challenges-cellular-agriculture/ (accessed on 21 June 2023).
5. Good Food Institute. U.S. Retail Market Data for the Plant-Based Industry. Available online: https://gfi.org/marketresearch/#category-sales (accessed on 21 June 2023).
6. Chriki, S.; Hocquette, J.F. The myth of cultured meat: A review. *Front. Nutr.* **2020**, *7*, 7. [CrossRef]
7. Bhat, Z.F.; Kumar, S.; Fayaz, H. In vitro meat production: Challenges and benefits over conventional meat production. *J. Integr. Agric.* **2015**, *14*, 241–248. [CrossRef]
8. Szejda, K.; Bryant, C.J.; Urbanovich, T. US and UK consumer adoption of cultivated meat: A segmentation study. *Foods* **2021**, *10*, 1050. [CrossRef] [PubMed]
9. Cassiday, L. Clean meat. *Inform* **2018**, *29*, 6–14. [CrossRef]
10. Hwang, J.; You, J.; Moon, J.; Jeong, J. Factors affecting consumers' alternative meats buying intentions: Plant-based meat alternative and cultured meat. *Sustainability* **2020**, *12*, 5662. [CrossRef]
11. Siegrist, M.; Sütterlin, B.; Hartmann, C. Perceived naturalness and evoked disgust influence acceptance of cultured meat. *Meat Sci.* **2018**, *139*, 213–219. [CrossRef]
12. Siegrist, M.; Sütterlin, B. Importance of perceived naturalness for acceptance of food additives and cultured meat. *Appetite* **2017**, *113*, 320–326. [CrossRef]
13. Huffpost; Friedrich, B. Clean Meat: The "Clean Energy" of Food. Available online: https://www.huffpost.com/entry/clean-meat-the-clean-energy-of-food_b_57cee00ee4b0f831f705a879 (accessed on 19 July 2023).
14. Da Silva, C.P.; Semprebon, E. How about cultivated meat? The effect of sustainability appeal, environmental awareness and consumption context on consumers' intention to purchase. *J. Food Prod. Mark.* **2021**, *27*, 142–156. [CrossRef]
15. Waltz, E. Club-goers take first bites of lab-made chicken. *Nat Biotechnol* **2021**, *39*, 257–258. [CrossRef] [PubMed]
16. FDA. Human Food Made with Cultured Animal Cells. U.S. Food & Drug Administration. Available online: https://www.fda.gov/food/food-ingredients-packaging/human-food-made-cultured-animal-cells (accessed on 21 June 2023).
17. McKinsey & Company; Brennan, T.; Katz, J.; Quint, Y.; Spencer, B. Cultivated Meat: Out of the Lab, into the Frying Pan. Available online: https://www.mckinsey.com/industries/agriculture/our-insights/cultivated-meat-out-of-the-lab-into-the-frying-pan (accessed on 16 June 2021).

18. The New York Times. Toeniskoetter, C. Lab-Grown Meat Receives Clearance from F.D.A. Available online: https://www.nytimes.com/2022/11/17/climate/fda-lab-grown-cultivated-meat.html (accessed on 17 November 2022).
19. Mattick, C.S.; Landis, A.E.; Allenby, B.R.; Genovese, N.J. Anticipatory life cycle analysis of in vitro biomass cultivation for cultured meat production in the United States. *Environ. Sci. Technol.* **2015**, *49*, 11941–11949. [CrossRef] [PubMed]
20. Tuomisto, H.L.; Teixeira De Mattos, M.J. Environmental impacts of cultured meat production. *Environ. Sci. Technol.* **2011**, *45*, 6117–6123. [CrossRef] [PubMed]
21. Herzberg, F.W. Motivation trough job enrichment. In *Motivation and Productivity*; Gillerman, S.S., Ed.; BNA Inc.: Bethesda, MA, USA, 1967.
22. Cenfetelli, R.T. Inhibitors and enablers as dual factor concepts in technology usage. *J. Assoc. Inf. Syst.* **2004**, *5*, 16. [CrossRef]
23. Hsieh, P.J. An empirical investigation of patients' acceptance and resistance toward the health cloud: The dual factor perspective. *Comput. Hum. Behav.* **2016**, *63*, 959–969. [CrossRef]
24. Kumar, S.; Dhir, A.; Talwar, S.; Chakraborty, D.; Kaur, P. What drives brand love for natural products? The moderating role of household size. *J. Retail. Consum. Serv.* **2021**, *58*, 102329. [CrossRef]
25. Tandon, A.; Jabeen, F.; Talwar, S.; Sakashita, M.; Dhir, A. Facilitators and inhibitors of organic food buying behavior. *Food Qual. Prefer.* **2021**, *88*, 104077–104091. [CrossRef]
26. Kushwah, S.; Dhir, A.; Sagar, M.; Gupta, B. Determinants of organic food consumption. A systematic literature review on motives and barriers. *Appetite* **2019**, *143*, 104402. [CrossRef]
27. Eater. The Meat of the Future: How Lab-Grown Meat is Made. Available online: https://www.youtube.com/watch?v=u468xY1T8fw&t=49s (accessed on 2 October 2015).
28. Van Loo, E.J.; Hoefkens, C.; Verbeke, W. Healthy, sustainable and plant-based eating: Perceived (mis)match and involvement-based consumer segments as targets for future policy. *Food Policy* **2017**, *69*, 46–57. [CrossRef]
29. Macdonald, J.R.; Zobel, C.W.; Melnyk, S.A.; Griffis, S.E. Supply chain risk and resilience: Theory building through structured experiments and simulation. *Int. J. Prod. Res.* **2018**, *56*, 4337–4355. [CrossRef]
30. Serra-Majem, L.; Tomaino, L.; Dernini, S.; Berry, E.M.; Lairon, D.; Ngo de la Cruz, J.; Bach-Faig, A.; Donini, L.M.; Medina, F.-X.; Belahsen, R.; et al. Updating the Mediterranean diet pyramid towards sustainability: Focus on environmental concerns. *Int. J. Environ. Res. Public Health* **2020**, *17*, 8758. [CrossRef]
31. Neville, V.; Lecorpsand, B.; Mendl, M. Good science requires better animal welfare. *Science* **2022**, *376*, 809. [CrossRef]
32. Alonso, M.E.; González-Montaña, J.R.; Lomillos, J.M. Consumers' concerns and perceptions of farm animal welfare. *Animals* **2020**, *10*, 385. [CrossRef] [PubMed]
33. Bryant, C.; Barnett, J. Consumer acceptance of cultured meat: A systematic review. *Meat Sci.* **2018**, *143*, 8–17. [CrossRef] [PubMed]
34. Peri, C. The universe of food quality. *Food Qual. Prefer.* **2006**, *17*, 3–8. [CrossRef]
35. Josiam, B.M.; Malave, R.; Foster, C.; Baldwin, W. Assessing quality of food, service and customer service at a restaurant: The case of a student-run restaurant in the USA. *J. Serv. Res.* **2014**, *14*, 49–73.
36. Lee, J.; Whaley, J.E. Determinants of dining satisfaction. *J. Hosp. Mark. Manag.* **2019**, *28*, 351–378. [CrossRef]
37. Namkung, Y.; Jang, S. Does food quality really matter in restaurants? Its impact on customer satisfaction and behavioral intentions. *J. Hosp. Tour. Res.* **2007**, *31*, 387–410. [CrossRef]
38. Marcus, N.; Klink-Lehmann, J.; Hartmann, M. Exploring factors determining German consumers' intention to eat meat alternatives. *Food Qual. Prefer.* **2022**, *100*, 104610. [CrossRef]
39. Guan, X.; Lei, Q.; Yan, Q.; Li, X.; Zhou, J.; Du, G.; Chen, J. Trends and ideas in technology, regulation and public acceptance of cultured meat. *Future Foods* **2021**, *3*, 100032. [CrossRef]
40. Blackman, A.; Rivera, J. Producer-level benefits of sustainability certification. *Conserv. Biol.* **2011**, *25*, 1176–1185. [CrossRef]
41. Gulbrandsen, L.H. Dynamic governance interactions: Evolutionary effects of state responses to non-state certification programs. *Regul. Gov.* **2014**, *8*, 74–92. [CrossRef]
42. Roheim, C.A.; Zhang, D. Sustainability certification and product substitutability: Evidence from the seafood market. *Food Policy* **2018**, *79*, 92–100. [CrossRef]
43. Giordano, S.; Clodoveo, M.L.; De Gennaro, B.; Corbo, F. Factors determining neophobia and neophilia with regard to new technologies applied to the food sector: A systematic review. *Int. J. Gastron. Food Sci.* **2018**, *11*, 1–19. [CrossRef]
44. Wilks, M.; Hornsey, M.; Bloom, P. What does it mean to say that cultured meat is unnatural? *Appetite* **2021**, *156*, 104960. [CrossRef] [PubMed]
45. Laestadius, L.I. Public perceptions of the ethics of in-vitro meat: Determining an appropriate course of action. *J. Agric. Environ. Ethics* **2015**, *28*, 991–1009. [CrossRef]
46. Marcus, A.; Gaspar, R.; Rutsaert, P.; Seibt, B.; Fletcher, D.; Verbeke, W.; Barnett, J. Analogies, metaphors, and wondering about the future: Lay sense-making around synthetic meat. *Public Underst. Sci.* **2015**, *24*, 547–562. [CrossRef]
47. Wilks, M.; Phillips, C.J.C.; Fielding, K.; Hornsey, M.J. Testing potential psychological predictors of attitudes towards cultured meat. *Appetite* **2019**, *136*, 137–145. [CrossRef]
48. Verain, M.C.; Snoek, H.M.; Onwezen, M.C.; Reinders, M.J.; Bouwman, E.P. Sustainable food choice motives: The development and cross-country validation of the Sustainable Food Choice Questionnaire (SUS-FCQ). *Food Qual. Prefer.* **2021**, *93*, 104267. [CrossRef]
49. Steptoe, A.; Pollard, T.M.; Wardle, J. Development of a measure of the motives underlying the selection of food: The Food Choice Questionnaire. *Appetite* **1995**, *25*, 267–284. [CrossRef]

50. Cavaliere, A.; Ventura, V. Mismatch between food sustainability and consumer acceptance toward innovation technologies among Millennial students: The case of Shelf Life Extension. *J. Clean. Prod.* **2018**, *175*, 641–650. [CrossRef]
51. Pakseresht, A.; Ahmadi Kaliji, S.; Canavari, M. Review of factors affecting consumer acceptance of cultured meat. *Appetite* **2022**, *170*, 105829. [CrossRef] [PubMed]
52. Cox, D.N.; Evans, G. Construction and validation of a psychometric scale to measure consumers' fears of novel food technologies: The food technology neophobia scale. *Food Qual. Prefer.* **2008**, *19*, 704–710. [CrossRef]
53. Zidarič, T.; Milojević, M.; Vajda, J.; Vihar, B.; Maver, U. Cultured meat: Meat industry hand in hand with biomedical production methods. *Food Eng. Rev.* **2020**, *12*, 498–519. [CrossRef]
54. Wijekoon, R.; Sabri, M.F. Determinants that influence green product purchase intention and behavior: A literature review and guiding framework. *Sustainability* **2021**, *13*, 6219. [CrossRef]
55. Verbeke, W.; Sans, P.; Van Loo, E.J. Challenges and prospects for consumer acceptance of cultured meat. *J. Integr. Agric.* **2015**, *14*, 285–294. [CrossRef]
56. Van Loo, E.J.; Caputo, V.; Lusk, J.L. Consumer preferences for farm-raised meat, lab-grown meat, and plant-based meat alternatives: Does information or brand matter? *Food Policy* **2020**, *95*, 101931. [CrossRef]
57. Keller, P.A. Regulatory focus and efficacy of health messages. *J. Consum. Res.* **2006**, *33*, 109–114. [CrossRef]
58. Magnusson, M.K.; Arvola, A.; Hursti, U.K.K.; Åberg, L.; Sjödén, P.O. Choice of organic foods is related to perceived consequences for human health and to environmentally friendly behaviour. *Appetite* **2003**, *40*, 109–117. [CrossRef]
59. Cembalo, L.; Caracciolo, F.; Lombardi, A.; Del Giudice, T.; Grunert, K.G.; Cicia, G. Determinants of individual attitudes toward animal welfare-friendly food products. *J. Agric. Environ. Ethics* **2016**, *29*, 237–254. [CrossRef]
60. Teng, C.C.; Lu, C.H. Organic food consumption in Taiwan: Motives, involvement, and purchase intention under the moderating role of uncertainty. *Appetite* **2016**, *105*, 95–105. [CrossRef]
61. Welin, S.; Weele, C. Cultured meat: Will it separate us from nature. In *Climate Change and Sustainable Development*; Potthast, T., Meisch, S., Eds.; Wageningen Academic Publishers: Wageningen, The Netherlands, 2012; pp. 348–351.
62. Rodgers, S. The effects of sponsor relevance on consumer reactions to internet sponsorships. *J. Advert.* **2003**, *32*, 67–76. [CrossRef]
63. Fornell, C.; Larcker, D.F. Evaluating structural equation models with unobservable variables and measurement error. *J. Mark. Res.* **1981**, *18*, 382–388. [CrossRef]
64. Hair, J.F., Jr.; Hult, G.T.M.; Ringle, C.M.; Sarstedt, M. *A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)*; Sage Publications: New York, NY, USA, 2021.
65. Henseler, J.; Ringle, C.M.; Sarstedt, M. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J. Acad. Mark. Sci.* **2015**, *43*, 115–135. [CrossRef]
66. Martarelli, C.S.; Bertrams, A.; Wolff, W. A personality trait-based network of boredom, spontaneous and deliberate mind-wandering. *Assessment* **2021**, *28*, 1915–1931. [CrossRef]
67. Golino, H.F.; Epskamp, S. Exploratory graph analysis: A new approach for estimating the number of dimensions in psychological research. *PLoS ONE* **2017**, *12*, e0174035. [CrossRef] [PubMed]
68. Rey-Moreno, M.; Medina-Molina, C. Dual models and technological platforms for efficient management of water consumption. *Technol. Forecast. Soc. Change* **2020**, *150*, 119761. [CrossRef]