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Article

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CULTURED MEAT – FROM SCIENTIFIC CHALLENGE TO CONSUMER ACCEPTANCE AS SUSTAINABLE FOOD SOURCE

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Abstract

Cultured meat obtained in vitro from animal cells represents one of the recent concerns of specialists, who thus try to solve part of the issues related to animal welfare and sustainable meat production. Beyond the technical difficulties that must be overcome, the acceptance of cultured meat by consumers is not an easy goal to achieve, as it depends on factors acting both at the global and local levels. Since this paper focuses on Romanian consumers, the authors emphasize the importance of developing a general information framework that would allow first their understanding and further their acceptance of cultured meat. For this purpose, a systematic literature review, based on 34 articles, was carried out in order to observe good practices at international level, which led, in the past, to the acceptance of other significant innovations in the food field. Thus, five directions of action were identified: communication, knowledge, trust, perception, and attitudes. Based on these, a model of cultured meat acceptance by Romanian was developed. This initiative is unique in Romania so far and its results can be of interest for Romanian consumers and also for many categories of specialists, from scholars and researchers to practitioners interested in launching new products on the market or policymakers in the field of nutrition, public health, and agriculture. Further research is needed on the relationships between food security and safety, traditional meat production, and cultured meat as an alternative to real meat, before the marketplace launch of this new product.

Keywords: cultured meat, Romanian consumers, model of consumer acceptance of cultured meat, sustainable food consumption

JEL Classification: D12, D18, M31, O33, I12

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Introduction

Meat overconsumption, especially the red one, specific to nowadays' Western diet has had a negative impact both on environment and consumers' health (Allievi, Vinnari and Luukkanen, 2015; De Graaf, 2019). Indeed, it is widely accepted that food of animal origin has a greater impact on the environment than food of plant origin, since it emits higher amounts of greenhouse gases (GHGs), requires more soil and nitrogen, and affects terrestrial and aquatic biodiversity. From an environmental perspective, meat is considered the most harmful form of food consumption of all foods of animal origin (Austgulen et al., 2018). In addition, meat, alongside other energy-rich foods, is an important factor in the wide spread of non-communicable diseases (NCDs), such as type 2 diabetes, coronary diseases, obesity, cancer (Pieniak et al., 2016; Bobe, Procopie and Bucur, 2019). An overconsumption of meat particularly affects the hormonal, the immunity, and the digestive systems, mainly because the meat produced on a large scale, in industrial conditions, has, in most of the cases, hormones and antibiotics. In this context, the transition toward a low-meat diet appears to be the right choice from a human health, animal welfare and environmental protection point of view. On the basis of this increased call to reduce meat consumption, a new trend of industrial meat substitutes has emerged, where cultured meat or lab-grown meat, which represents the focus of our research, is a part of.

Cultured meat (also called lab-grown meat, cultivated meat, artificial meat or in vitro meat) is an innovative product of cellular agriculture, obtained from stem cells, which, after being taken from animals through a small biopsy of muscle tissue, are placed in a special nutrient-rich medium in a bio-reactor independent from the animal to promote growth (Post, 2012; Ben-Arye and Levenberg, 2019).

Although it is not yet available to consumers, cultured meat is described in recent literature as having positive effects in several directions, such as: environmental sustainability (because it would reduce greenhouse gas emissions from agriculture while using significantly less water and less land), animal welfare (because it is produced without the need for animals to be raised and slaughtered), food safety (because it would be less susceptible to antibiotic resistance and to zoonotic diseases spread), and world hunger issue (because it would prevent meat becoming a luxury food for most consumers) (Post, 2012; Sinke et al., 2023). Thus, cultured meat appears to have the potential to address the main challenges that meat industry is currently facing, providing potentially healthier, ethical, sustainable, and more efficient alternative to conventionally produced meat. But cultured meat also comes with drawbacks; the most frequently reported in the scientific literature refer to the safety concerns generated by the use of a potentially contaminated animal serum in the culture medium (Alexander et al., 2017), the higher energy use in cultured meat production because some biological functions are replaced by technological processes (Munteanu et al., 2021) and the potential perception of in vitro technology as unnatural and interfering too much with nature (Laestadius, 2015; Stephens et al., 2018). Moreover, Chriki and Hocquette (2020) noticed the vague status of cultured meat from a religious point of view, its compliance with certain dietary laws (e.g., Kosher for Jewish consumers or Halal for Islamic consumers) being still debatable.

Because the success of new foods and food technologies depend to a considerable extent on whether consumers accept those innovations (Fischer and Reinders, 2022; Socaciu et al., 2022) and given the tendency of people to be reluctant to adopt food innovations, perceiving them as too industrial, unnatural or "fake" (EIT Food Trust Report, 2021), consumer

acceptance of cultured meat is an issue that requires further attention. Due to its novelty, consumer acceptance is extremely important for cultured meat, because, as Laestadius (2015) pointed out, without it there might be a product but not a market.

Although there is abundant information in scientific literature regarding the advanced technological aspects of cultured meat, significantly little research has been done with regard to its acceptance by consumers. However, here are to be mentioned the studies of Laestadius (2015), Verbeke et al. (2015), Stephens et al. (2018), Bryant and Barnett (2020) and Siegrist and Hartmann (2020) that investigated consumers' reactions towards cultured meat in the early stage of product development. Although consumers seemed open to try cultured meat, the common insights provided by these studies showed feelings of disgust and considerations of unnaturalness exhibited by consumers and highlighted consumer acceptance as important issues related to the commercial success of cultured meat.

In Romania, alongside consumers' natural tendency of reluctance towards food novelty, another important obstacle in the acceptance of cultured meat could be the privileged status of natural meat in local food culture, emphasised by the high share of meat-based products and dishes in the traditional pattern of food consumption (Voinea et al., 2020).

Because, to the authors' knowledge, there is no research addressing the issue of consumer acceptance of cultured meat in Romania until now, the aim of present paper is to fill this gap by designing a general framework for consumer acceptance which will contribute to a correct understanding of cultured meat before its commercial release. Therefore, to identify examples of good practices successfully used in the past in similar situations, a review of the specialised literature was carried out. This allowed us to select five directions of action as a basis for designing the model of cultured meat acceptance. This approach, unique in Romania so far, can be useful to consumers, specialists, and other decision-makers in the field of nutrition, public health, or agriculture.

Although paper's rhetoric is focused on cultured meat, our study should not be regarded as a pleading for agriculture transition to cultured meat production as the primary solution for the sustainable diet of the future and for cultured meat as the best alternative for conventional meat. The paper intends to bring to the foreground the need to inform and educate consumers so that when the product will be available on the market, they can make an informed purchase decision.

The study begins with an introductory section providing some background elements and presenting the general framework of contemporary food that has led to the development of cultured meat. Items of previous research in the area are also reviewed in this section. Furthermore, the methodological approach is presented, emphasising the steps followed in conducting the study. Within the next section, the results are presented and their significance is discussed. Finally, there is a section comprising the conclusions of the study, and its implications.

1. Methodology

As the main purpose of our study is to develop a model of consumer acceptance of cultured meat, we conducted a systematic review of the scientific literature to uncover different best

practices used to achieve consumer acceptance for several previous food innovations. Based on the identified predictors, we will further build a model for consumer acceptance of cultured meat, the newest food innovation that consumers are to deal with in the near future.

The review followed the steps outlined in literature (Khan et al., 2003; Dziopa and Ahern, 2011; Xiao and Watson, 2019): formulating the question, identifying relevant publications, assessing study quality, summarising the evidence, and interpreting the findings.

In the attempt to answer to the question “What were the predictors of consumer acceptance of previous significant food innovations?”, we firstly established the following food innovations as areas of interest for our approach: genetic modification of food, food irradiation, entomophagy and food nanotechnology.

Numerous articles, empirical studies or review papers, were identified in international databases, using key-words such as: “acceptance of new foods”, “acceptance of new food technologies”, “acceptance of biotechnology”, “acceptance of genetically modified foods”, “acceptance of food irradiation”, “acceptance of irradiated foods”, “acceptance of edible insects”, “acceptance of nanotechnology foods”. A number of 34 articles from all those identified were selected as the most suitable for the purpose of our research, based on the following criteria: focus on consumer acceptance, presentation of empirical data or findings of the literature review, publication in a peer-reviewed journal, publication in English language. Then, the selected articles were grouped into five categories, as follows: genetic modification, food irradiation, entomophagy, the use of nanotechnology, and new foods and food technologies in general (Table no. 1). A summary of the evidence was done for each category from which a key-word predictor of consumer acceptance was extracted.

Table no. 1. Results of the literature review

No.	Food innovation	Study	Summary of evidence	Key-factors of consumer acceptance
1	New foods and food technologies in general	Frewer, Howard and Sheperd (1995); Siegrist (2007); Costa-Font, Gil and Traill (2008); Shepherd (2008)	The way consumers will evaluate a new food product depends on effective communication of both tangible benefits and hazards.	Communi- cation
		Siegrist, Gutscher and Earle (2005); Macready et al. (2020); Wu et al. (2021); The EIT Food Trust Report (2021)	Consumers tend to rely on the information provided by experts (scientists, authorities, and industry); high levels of trust reduce the perceived risks.	Trust
		Alhakami and Slovic (1994); Rembischevski and Caldas (2020); Rabbanee, Afroz and Naser (2021)	Food technologies that are judged high in risk tend to be judged low in benefit, and vice versa.	The perception of benefits and risks
		Siegrist (2007); Frewer et al. (2014); Román, Sánchez-Siles and Siegrist (2017); Bearth and Siegrist (2019)	Positive attitudes towards a new food or technology are associated with favouring behaviour, while negative attitudes are associated with avoidance behaviour.	Attitudes

No.	Food innovation	Study	Summary of evidence	Key-factors of consumer acceptance
2	Genetically modified foods	Hoban (1997); Byrne et al. (2002); House et al. (2002) Lusk and Sullivan (2002); Costa-Font, Gil and Traill (2008); Wunderlich and Gatto (2015)	A positive correlation between knowledge of biotechnology and consumer acceptance of genetically modified foods.	Knowledge
		Frewer, Howard and Sheperd (1995)	The acceptance of genetically modified foods is largely determined by both perceived risks and benefits.	The perception of benefits and risks
		Tenbült et al. (2005) Frewer et al. (2014)	The more a product was seen as natural by consumers, the less acceptable was its genetic engineered version.	Attitudes
		Lusk and Sullivan (2002); Costa-Font and Gil (2009)	The acceptance of the genetically modified foods starts from the trust in scientists and in public authorities, as they are considered the most reliable sources.	Trust
3	Edible insects	Lensvelt and Steenbekkers (2014) Woolf et al. (2020) Padulo et al. (2022)	Knowledge about entomophagy is positively correlated with acceptance and willingness to consume edible insects.	Knowledge
		Ruby, Rozin and Chan (2015)	Beliefs about the benefits and risks of eating insects represent one of the best predictors of insect acceptance.	The perception of benefits and risks
4	Food irradiation	Bruhn (1998); Oliveira and Sabato (2004) Behrens et al. (2009)	Knowledge is positively correlated with the acceptance of irradiated food.	Knowledge
		Sapp and Downing-Matibag (2009)	Acceptance of irradiated foods is a function of trust in societal institutions that they can manage irradiation technology.	Trust
		Bord and O'Connor (1990); Bearth and Siegrist (2019)	When food irradiation is perceived as a risky technology, fewer benefits and more risks are associated with irradiated foods	The perception of benefits and risks
5	Nano-technology	Besley (2010); Gomez-Llorente et al. (2022)	The more knowledge, the less fear for nanotechnology foods; awareness is associated with more positive views about nanotechnology	Knowledge
		Gupta, Frewer and Fischer (2017)	Consumers tend to rely to a greater extent on the information provided by experts.	Trust
		Siegrist (2007); Stampfli, Siegrist and Kastenholz (2010); Besley (2010)	Willingness to buy nanotechnology foods is strongly influenced by perceived benefits and weakly influenced by perceived risks.	The perception of benefits and risks

The review of the scientific literature in the field of food innovations led to the identification of the following key-factors of consumer acceptance: communication, knowledge, trust, perception of benefits and risks and attitudes.

2. Results and discussions

The model of consumer acceptance of cultured meat is designed to serve as an instrument for consumers in making informed decision and for the actors in food chain in approaching the cultured meat-related communication strategy.

Based on the results of the undertaken systematic literature review we built up the cultured meat acceptance model based on the following drivers: communication, knowledge, trust, perception of benefits and risks, and attitudes. (Figure no. 1)

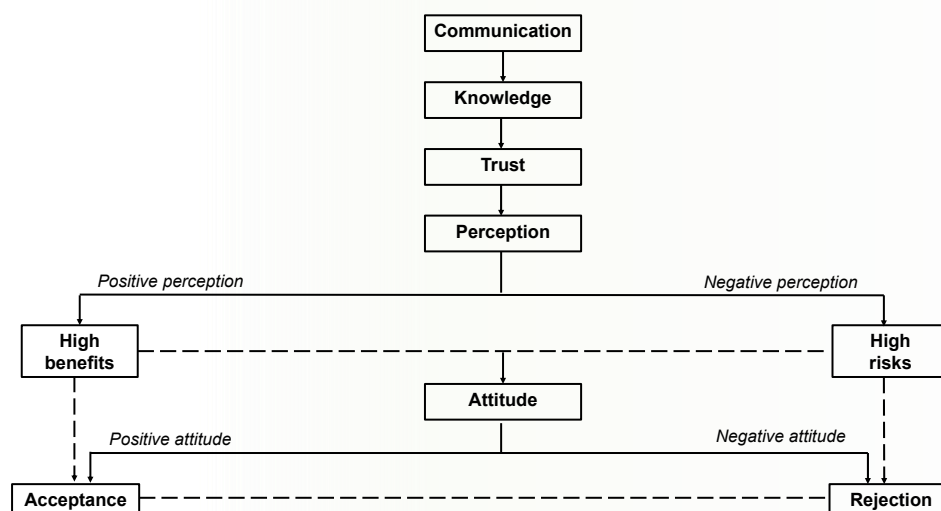


Figure no.1. The cultured meat acceptance model

Communication

New technologies enable innovations in the food sector. Since, in general, the benefits associated with an innovation in the food offer are not tangible for consumers, they must be explicitly communicated to the large public. This has never been an easy task, but it is all the more difficult when it comes to a specific technology that tends to evoke negative associations in consumer's mind (Siegrist, 2007, p. 240).

According to Costa-Font, Gil and Traill (2008), the way consumer will evaluate a new food product depends on effective provision of information regarding firstly its tangible benefits from several sources – public and private, formal and informal, etc. – being conditioned at the same time by the credibility and trustworthiness of each relevant information source. But, alongside the benefits, the drawbacks and hazards have to be communicated to the public as well. Frewer, Howard and Shepherd (1995) pointed out that it is important the dialogue be

established between communicators and the large public, in such way that the addressed issues reflect the real concerns of the public. Shepherd (2008) advocated the involvement of the public in the management of food risk issues, citing the Fischhoff 's (1995) schema of risk communication where consumers are seen as partners in this process.

Based on previous communication experience regarding food innovations, we consider that an effective communication about cultured meat should focus primarily on the benefits, emphasising its potential of mimicking the sensory and nutritional characteristics of natural meat, as well as its positive impact on human health, animal welfare, economic efficiency, and environmental sustainability. Similarly, risk messages should address specific concerns related to food safety, lack of naturalness, and energy use in order to be more relevant to Romanian consumers. In this process, the main responsibility lies with the entrepreneurs in the food industry, who should mainly focus on providing correct and honest data on the benefits and risks of artificial meat consumption and not just on its exclusively commercial promotion.

Knowledge

Research has shown that consumer knowledge of new products or technologies correlates positively with acceptance and willingness to consume those products.

For example, prior research on consumer acceptance of edible insects (Lensvelt and Steenbekkers, 2014; Ruby, Rozin and Chan, 2015; Woolf et al., 2021; Padulo et al., 2022) demonstrated that participants who attended an educational session that provided information about entomophagy, followed by a cooking and tasting session of edible insects, felt more knowledgeable about entomophagy, which positively correlated with acceptance and willingness to consume edible insects.

Several surveys that have been carried out worldwide (Bruhn, 1998; Oliveira and Sabato, 2004; Behrens et al., 2009) to investigate consumers' attitude to food irradiation found out that knowledge is positively correlated with acceptance of irradiated food. Generally, results suggest that when provided with science-based information, people hold more positive attitudes toward food irradiation and tend to favour irradiated food.

The study of Gómez-Llorente et al. (2022) on consumer perception on the use of nanotechnology in the agri-food sector, showed that the more knowledge, the less fear for nanotechnology foods. This resonates with the findings of Besley (2010), who reported that awareness is associated with more positive views about nanotechnology.

The findings of a large number of studies on consumer acceptance of biotechnology and genetically modified foods (Hoban, 1997; Byrne et al., 2002; Lusk and Sullivan, 2002; House et al., 2004; Costa-Font and Gil, 2009; Wunderlich and Gatto, 2015) highlighted a positive correlation between knowledge of biotechnology and consumer acceptance of genetically modified foods, since people with higher levels of scientific knowledge were usually more optimistic about biotechnology.

The same positive correlation was revealed by Rolland, Markus and Post (2020) in their study on the effect of information content on the acceptance of cultured meat, as they observed that provision of information to participants, especially on personal benefits (with regard to product safety) and societal benefits (related to reducing environmental impact, avoiding

harm to animals or reducing world hunger), importantly improves acceptance and willingness to taste. They concluded awareness of cultured meat was the best predictor of its acceptance. Similar findings can be found at Bryant and Barnett (2020) who argued that acceptance of cultured meat could be increased with positive information.

Given the predominant eating behaviour in many areas of the world, including Romania, characterised by a high consumption of meat and meat-based products, we consider that a direction of increasing consumer acceptance of cultured meat could be a strong and well-argued emphasis on the potential of cultured meat to mimic the nutritional value of real meat from the actors in the food system. In addition, as it has been proven that consumers' high level of scientific knowledge plays a decisive role in building a favourable attitude towards innovative food products, we believe that academia, nationally and internationally recognised research institutes, as well as experts in the field of food safety are the driving factors in the transition from a favourable attitude towards cultured meat to its acceptance and further consumption.

Trust

Consumer trust is an important factor influencing the perception of food innovation: the perceived risks as well as on perceived benefits. As long as acceptance of new foods and willingness to buy them is directly determined by the perceived risks and the perceived benefits, trust can be said to have an indirect impact on the acceptance of new foods or new food technologies (Siegrist, 2007, p. 242).

Both risks and benefits, the latter being embodied in the characteristics of the new products, such as health, sustainability, or safety, since they cannot be verified by the average consumer, must therefore be communicated by a credible actor in the food chain (Macready et al., 2020; EIT Food Trust Report, 2021; Wu et al., 2021). Therefore, as Gupta, Frewer and Fischer (2017) pointed out, when consumer knowledge and experience on a new food product and technology are limited, consumers tend to rely to a greater extent on the information provided by experts.

As for the trustworthiness of different information sources, Lusk and Sullivan (2002), in their study on consumer acceptance of genetically modified food, claim that consumers tend to trust more the information from government institutions, such as USDA (United States Department for Agriculture) or FDA (Food and Drug Administration), considering that these actors are much more likely to be credible in disseminating important information about biotechnology and genetically modified foods than mass media and agribusiness industry. We found similar findings in Costa-Font and Gil (2009), who showed the reasoning process that underpins the acceptance of the genetically modified foods departs from trust in scientists and in public authorities.

The influence of consumer trust in scientists, authorities, and industry on consumer perception of risks and benefits was studied by Saba and Messina (2003) in relation to the use of pesticides in agriculture, confirming that trust had a positive influence on perceived benefits and a negative influence on perceived risks. The study of Siegrist, Gutscher and Earle (2005) emphasised that trust has an impact on the perception of new technologies, in the sense that it exerts a negative influence on the perception of risk. High levels of trust reduced perceived risks, compared to low levels of trust.

As for cultured meat, Bryant and Barnett (2020) argued that trust in the regulatory bodies responsible for ensuring food safety is all the more important for its acceptance. Consequently, in order to raise the level of trust, we believe that the responsibility of informing Romanian consumers cannot be the exclusive task of entrepreneurs, but it must be shared with high credibility experts, government bodies such as the Ministry of Health, the Ministry of Agriculture, the National Authority for Consumer Protection or the National Sanitary-Veterinary and Food Safety. These bodies may be involved in adapting the existing legislative framework or drafting new regulations related to the production, marketing and fair labelling of cultured meat, respectively in developing new methods that allow quantitative and qualitative measurements of the chemical components of this new product.

Perception of benefits and risks

Judgments of risk and benefit related to a specific issue have been found to be inversely related in many pieces of research. Alhakami and Slovic (1994) in their study on the relationship between perceived risk and perceived benefit showed technologies that are considered high risk tend to be considered low benefit and vice versa.

A great deal of study examined the influence of people's perceptions of risk and benefit on their acceptance of new food products and technologies. While Frewer, Howard and Shepherd (1995), concluded in their study that the most important determinant of consumer acceptance of genetic engineering is likely to be perceptions of benefit resulting from the application of this technology, the study of Siegrist, Gutscher and Earle (2005) and Siegrist (2007) revealed that acceptance of genetically modified foods is largely determined by both perceived risks and benefits associated with biotechnology.

A common conclusion of several studies investigating the acceptance of nanotechnology foods (Siegrist, 2007; Besley, 2010; Stampfli, Siegrist and Kastenholz, 2010) is that perceived benefits appear to be the most important predictor for willingness to buy. This is strongly influenced by perceived benefits and weakly influenced by perceived risks.

In the case of edible insects, as it was demonstrated in the study of Ruby, Rozin and Chan (2015), the beliefs about benefits (nutrition and environmental sustainability) and risks (disease and illness) of entomophagy were indicated among the best predictors of consumer acceptance.

However, as Rembischevski and Caldas (2020) highlighted in their review analysis, consumer perception of food-related benefits and risks is a very complex issue, depending not only on the objective and measurable aspects, but also on subjective aspects that define individual's values, such as social, cultural, psychological, ethical or moral ones. More than scientific knowledge, the emotional side of individuals strongly contributes to the perception of the ratio between risks and benefits. This issue was addressed by Bearth and Siegrist (2019) in their research on consumer acceptance of food irradiation. They found that consumers who exhibited negative emotions towards nuclear power perceived less benefits and more risks associated with irradiated foods and expressed a lower overall acceptance of this technology. Similar findings were previously revealed by the study of Bord and O'Connor (1990), who showed that food irradiation had been perceived as a risky technology, as consumers had associated it with nuclear power.

In the case of cultured meat, as Bryant and Barnett (2020) reported in their study, consumer acceptance could be increased with frames which invoke more positive associations.

Therefore, we believe that building a favourable perception leading to the acceptance of cultured meat is possible if consumers act on the principle of cognitive coherence. Thus, only by achieving such consistency in beliefs, they can end up adopting beneficial decisions, based both on objective, measurable elements (such as official communication, correct declaration of chemical composition, educational sessions supported by experts where the risks and benefits of consumption are extensively presented, tasting sessions, etc.) and on subjective ones (such as values, culture, ethics, psychological motivations, etc.), also specific to human nature. From an entrepreneurial point of view, the development of a successful cultured meat business directly depends on consumers' perceptions regarding the benefits and risks associated with the consumption of this new innovative product. For this reason, it is recommended that these perceptions be investigated through complex sociological and anthropological research, which, being able to go beyond the simple quantitative approach of market mechanisms, can provide valuable premises for the development of future communication strategies.

Attitudes

The concept of attitude has been used in research to explain public reactions to new foods and technologies (Frewer and Miles, 2003). Positive attitudes towards a new food or technology are associated with favouring behaviour, while negative attitudes are associated with avoidance behaviour (Siegrist, 2007, p. 237).

According to Ajzen (2001), attitude is a summary evaluation of an object, which can vary from positive to negative and is experienced as an affect. The same idea was emphasised by Southerton (2011) who defined attitude as an individual's tendency to evaluate an object as positive or negative. Generally, attitudes help people to make sense and give meaning to their experiences.

In the attitude formation process, Costa-Font, Gil and Traill (2008) emphasised the leading role of knowledge, claiming that the attitude is based on knowledge about the product itself as well as its attributes. Based on Fishbein Multiple Attribute Model (Fishbein, 1963), probably one of the most widely accepted theory of consumer attitude formation, Moynour and MacLachlan (1971) highlighted the role of perception, suggested that attitude towards a product is a function of the sum of perceived attributes weighted according to the importance they hold.

As it has been demonstrated in previous research, a highly important attribute that influences attitude toward new foods is the perceived naturalness, which refers to product origin, the technology and ingredients used and the properties of the final product (Román, Sánchez-Siles and Siegrist, 2017). According to Butu et al. (2019) and Bearth and Siegrist (2019), consumers frequently exhibit strong negative feelings of fear or even aversion toward unfamiliar and artificially sounding food products or food technologies. For example, in the case of genetically modified foods, as the study of Tenbült et al. (2005) and Frewer et al. (2014) suggested, the more a product was seen as natural by consumers, the less acceptable was its genetically engineered version.

In the case of cultured meat, consumer perception of its naturalness has aroused scholars' interest since the early stage of product development. Research to date (Kadim et al., 2015; Laestadius, 2015; Laestadius and Caldwell, 2015; Verbeke et al., 2015; Hocquette, 2016; Siegrist, Sütterlin and Hartmann, 2018; Stephens et al., 2018; Bryant et al., 2019; Bryant and Barnett, 2020; Siegrist and Hartmann, 2020) has shown this perception can range from natural to neither natural nor unnatural and to unnatural and emphasised perceived naturalness as a crucial factor for the acceptance of cultured meat. While perceived naturalness is positively associated with consumer acceptance and willingness to consume, the perceived unnaturalness may act as a psychological barrier, contributing to low acceptance of cultured meat.

Of all food products, naturalness is even more important for meat, because it represents one of the four attributes that make up the moral defense mechanism of meat-eaters, known as "4Ns justification" scheme, proposed by Piazza et al. (2015), according to which meat consumption is perceived as "natural", "normal", "necessary" and "nice" (the latter referring to hedonic pleasure derived from eating meat).

In Romania, to the inherent psychological barrier against the consumption of cultured meat, the cultural one would be added, as natural meat is deeply embedded in local food culture, being the main ingredient in most of traditional food products and dishes (Purcărea et al., 2013). The study by Voinea et al. (2020) revealed that most Romanian consumers, being typical meat-eaters, are not willing to compromise on rich taste and textural experience provided by natural meat-based products. Because, generally, the cultural pattern of food consumption and the traditional elements of food preferences are still important in Romania, it is quite likely that most consumers would exhibit a negative attitude towards cultured meat, perceiving its artificial nature in opposition to their demands for naturalness and authenticity that traditional meat can fulfil. Therefore, the acceptance of cultured meat in Romania will depend on how this conflict of cultural values will be resolved, both at the individual and collective level.

However, there are also Romanian consumers aware of the meat paradox defined by Bastian and Loughnan (2017) as a moral conflict of people concerned for animal wellbeing and yet consume products which have caused animal suffering) and also worried about their own health who are willing to reduce into some extent their meat consumption (meat-reducers) or even to give it up (meat-avoiders). We estimate these latter categories of consumers are the most likely to more easily develop a positive attitude towards cultured meat.

Overall, to increase the acceptance of cultured meat among Romanian consumers, as Siegrist and Hartmann (2020) outlined in their study, communication strategies should be focused on emphasising the similarity of cultured meat to traditional meat, rather than the technical aspects of the production process, which are more susceptible to generate negative associations and disgust feelings. In other words, this emerging technology of in vitro meat should be framed in ways that resonate with people's existing views (Besley, 2010). We believe that in the process of transforming consumer perceptions into strong attitudes of acceptance or rejection towards culture meat the associations of consumer protection play a decisive role, as they can contribute to the correct information of consumers, through the studies and campaigns carried out by their own experts.

Conclusions

The food development model specific to Western societies in recent decades, widely encountered today even in Romania, is based on a diet in which highly processed and high-energy foods are predominant. This type of eating behaviour, characterised especially by overconsumption of red meat, possibly explainable in the first decades after World War II by the need to increase people's living standards, has recently led to an emphasis on issues related to the preservation of both environment and consumer health. (Allievi, Vinnari and Luukkanen, 2015; De Graaf, 2019).

Meat is the food of animal origin that raises the most serious environmental sustainability issues, as its production process requires a lot of soil and nitrogen and also emits the most greenhouse gases (Austgulen et al., 2018). Moreover, meat is responsible for the dramatic increase in the incidence of the so-called diseases of civilisation, such as obesity, type 2 diabetes, and cancer (Pieniak et al., 2016). Therefore, the need to redefine the contemporary food style through a consistent decrease in the consumption of traditional meat has become imperative. In this context, the production of industrial meat substitutes with the help of avant-garde technologies has emerged as a new trend. Among these newly developed meat analogues is cultured meat too, also called artificial meat or in vitro meat, which presents both advantages (environmental preservation, animal welfare, food safety, and consumer food security) and risks (potentially toxic animal serum in the culture environment, high energy consumption in the production process, or too much interference of its technology with nature or its uncertain status from a religious perspective, specifically in relation to dietary laws present in some religions).

The objective analysis of the ratio between the advantages and disadvantages of cultured meat is very important, considering the novelty of the product and the need to build a sustainable marketplace for it. The originality of the present work lies in the study of the acceptance potential of cultured meat among Romanian consumers, in today's food consumption background characterised by a strong traditional imprint, since foods of animal origin, including meat, are common items in Romanians' diet.

The main aim of our research is to design and, thus, put into public debate the principles of a general framework for cultured meat acceptance by Romanian consumers, before this product becomes a reality in the food market. However, our approach should not be understood as a plea for the large-scale transition of agriculture to the production of artificial meat, as a unique alternative to the traditional meat consumed today. We believe that our approach is useful, considering the biunivocal relationship between the main actors of any market - producers and consumers - and the need of the latter to be properly educated and informed when making purchasing decisions, which remains a necessary condition in a market characterised by loyal commercial relationships.

To achieve the proposed goal, the methodological approach consisted of a systematic review of the scientific literature to identify the best practices that led to consumer acceptance of several food innovations in the past, such as: food genetic modification, food irradiation, entomophagy, and food nanotechnology.

The scientific endeavour of the authors aims to conceive a general model of acceptance of cultured meat by Romanian consumers, whose purchasing decisions we consider should be made rationally and with full awareness, being correctly informed by producers who develop these products, and whose communication and promotion strategies should adhere to the

principles of fair trade. The proposed model is based on five key factors: communication, knowledge, trust, perceptions of benefits and risks, and consumer attitudes.

The authors consider that it would be useful to carry out quantitative research, which would analyse the typology of Romanian consumers and their possible predisposition to the consumption of artificial meat, to the detriment of the natural product. At the same time, the factors that could lead these consumers to partially change their consumption habits should be investigated, along with the study of product range derived from artificial meat.

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