How To Let Consumers Meet the 'New Meat'

Investigating the effect of providing different types of information on the acceptance of cultured meat

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Abstract

A great amount of research is done on the consumer acceptance of cultured meat. However, the effects of providing different types of information on the acceptance remains insufficiently examined. This research focussed on investigating the relationship between positive information, the degree of technical information and the perceived naturalness of cultured meat to try to increase the acceptance of this novel product. An online survey was used targeting students from the Wageningen University. Participants were assigned to one of the four conditions, each with a different description of cultured meat. Perceived naturalness and acceptance were measured. Consistent with the literature, perceived naturalness predicted the acceptance. The type of description did not seem to have an effect on the perceived naturalness and acceptance. When compared to regular meat, the cultured meat received a lower acceptance than when it was evaluated on its own.

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Introduction

In the last few years, many companies and research institutes have come closer to the commercialisation of cultured meat. The development of this new technology has seen large technical improvements (Bonny, Gardner, Pethick, & Hocquette, 2017). Over the years a great deal of research is done on the consumer acceptance of this product. With this knowledge producers of cultured meat can gain useful insights as how to eventually offer the product to potential customers.

Bryant & Barnett (2018) systematically reviewed the empirical studies on consumer acceptance of cultured meat and categorised the factors found to be influencing acceptance in these studies. Among the studies different approaches can be observed. In most studies researchers provided the participants a description of cultured meat and tested their level of acceptance either through using surveys, experiments or focus groups. The findings were generally comparable. In some cases the description of cultured meat consisted of information on the production method, environmental and animal welfare benefits and other aspects compared to conventional meat (Bekker, Tobi, & Fischer, 2017; Hocquette et al., 2015; Siegrist & Sütterlin, 2017; Tucker, 2014; Verbeke, Marcu, et al., 2015; Wilks & Phillips, 2017). Participants perceived cultured meat often as unnatural or 'not real meat' and thought that it would not be tasty or healthy. Participants did recognize the benefits for the environment and animal ethics. Laestadius & Caldwell (2015) did not give a description but used comments on news stories about cultured meat on the internet to measure the level of acceptance. The findings in this study were similar to those of the studies listed before. The environmental benefits of cultured meat were generally recognized, but unnaturalness appeared to be a significant barrier to acceptance.

Building on this research, several studies found a significant difference in acceptance when providing different information about cultured meat. Bekker, Fischer, Tobi, & Van Trijp (2017) gave one group of participants positive- and the other group negative information about cultured meat. The results indicated that the explicit attitude towards cultured meat can be influenced by information about the product. Siegrist, Sütterlin, & Hartmann (2018) found that non-technical descriptions of cultured meat led to higher acceptance than technical descriptions. According to them this is largely explained by perceived unnaturalness and disgust. Verbeke, Sans, & Van Loo (2015) also used two different descriptions. The first being a basic description about the production process. The second description additionally discussed environmental benefits, health benefits and food safety benefits. Results showed that the provision of additional information increased the acceptance.

Bekker, Fischer, Tobi, & van Trijp (2017) found that a positive description led to a higher acceptance. Interestingly, the technical- and non-technical descriptions Siegrist et al., 2018 used for their experiment both also described several benefits to cultured meat; "This

production method is more environment-friendly and associated with less animal suffering compared with conventional meat production." (Siegrist et al., 2018, p. 216). With these findings, however, it cannot yet be concluded that there is a positive relation between a non-technical description and the consumer acceptance of cultured meat. It seems plausible that the provision of benefits acts as a confounding variable in the relation between the degree of technical information and the acceptance of cultured meat.

Based on this lack of knowledge it seems promising to further investigate the relationship between positive information, the degree of technical information and the acceptance of cultured meat.

Theoretical framework

Naturalness

One of the predictors Siegrist et al., (2018) used in their research to examine the acceptance of cultured meat was perceived unnaturalness. According to Rozin, Fischler, & Shields-Argelès (2012) people have positive attitudes towards foods perceived as 'natural'. It even appears to be an important factor in the acceptance of foods (Román, Sánchez-Siles, & Siegrist, 2017).

Various definitions of naturalness have been proposed by researchers. In their systematic review Román, Sánchez-Siles, & Siegrist (2017) investigated how the perceived importance of naturalness has been defined and measured. Naturalness is a collection of many attitudes on different attributes which can be grouped into three categories; (1) how the food is grown, (2) how the food is produced, and (3) the properties of the final product. In the study of Rozin, Fischler, & Shields-Argelès (2012) participants did not define 'natural' as having certain positive properties, but rather as not having certain negative properties such as human intervention and additives. This is also shown in the study of Etale & Siegrist, (2018) about human intervention in water. Rozin (2005) found that, apart from the properties of the final product, the production process an important factor in determining a product's naturalness. This preference for 'natural' products does not come from a desire to consume healthier products. Even when products are described as equally healthy, a strong preference for natural perceived products over artificial perceived products could still be observed (Rozin et al., 2004).

Based on these findings it can be argued that a high perceived naturalness leads to a higher acceptance. Therefore, the following is hypothesised:

> **H1: A higher perceived naturalness of cultured meat leads to a higher acceptance of cultured meat compared to a low perceived naturalness**

Technical description

Based on the statement that the production process is an important factor in determining a product's naturalness (Rozin, 2005), Siegrist et al., (2018) expected that the process of growing meat in a laboratory would lead to a less natural perceived production process than that of regular meat. Even if the intrinsic properties of both final products are indistinguishable. To test this hypothesis, they divided participants into two conditions and gave them different descriptions of the production process of cultured meat. One being a more ambiguous description, and the other being a more technical description. Participants assigned to the group with the ambiguous description perceived the meat as significantly more natural than the participants who received a more technical description.

Based on this it stands to reason that a product is perceived as less natural when the description is more technical. Therefore, the following is hypothesised:

H2: A high-tech description of cultured meat leads to a lower perceived naturalness of cultured meat compared to a low-tech description.

Description of the benefits

The degree of acceptance of cultured meat will be largely based on the attitude towards the product. Attitudes are generally developed over time. They are based on gathered information about the object and stored in the brain. Upon encountering of the object this attitude is automatically retrieved (Fazio, 2007). However, with unfamiliar objects, like cultured meat, attitudes are likely formed based on the most accessible associations (Wyer, 2008). These perceptions do not necessarily have to be in line with the actual properties of cultured meat. Marcu et al. (2015) found that acceptance of cultured meat is lower due to the unfamiliarity of the product. People use anchoring to categorize the unfamiliar product and compare it with familiar practices in biotechnology. Because these associations are mostly negative (Gaskell et al., 2000) this can lead to a negative perception of cultured meat and thus a lower acceptance. When pairing the object with benefits the attitude changes positively (Verbeke, Sans, et al., 2015).

Based on this it can be argued that pairing a product with benefits changes the attitude towards the product positively due to the associations made with those benefits and thus improving the acceptance of the product. Therefore, the following can be hypothesised:

H3: A description of the benefits of cultured meat leads to a higher acceptance of cultured meat compared to a neutral description.

Due to the relative general unfamiliarity of cultured meat attitudes are probably based on the knowledge and association with similar practices such as biotechnology (Gaskell et al., 2000). If this association could be changed to aspects of cultured meat who are generally perceived as positive the acceptance should go up (Verbeke, Sans, et al., 2015). Animal welfare and the protection of the environment are generally considered as important practices (Directorate-General for Communication & Directorate-General for Environment, 2017; Directorate-General for Health and Food Safety, 2016). If cultured meat is already perceived as natural it is likely that positive associations, with for example the practices aforementioned, are already made. This could mean that a provision of benefits does not substantially change the attitude because the attitude is already formed based on the benefits. This leads to the following hypothesis:

H4: A description of the benefits of cultured meat leads to a lower increase in acceptance when the perceived naturalness is high compared to when the perceived naturalness is low.

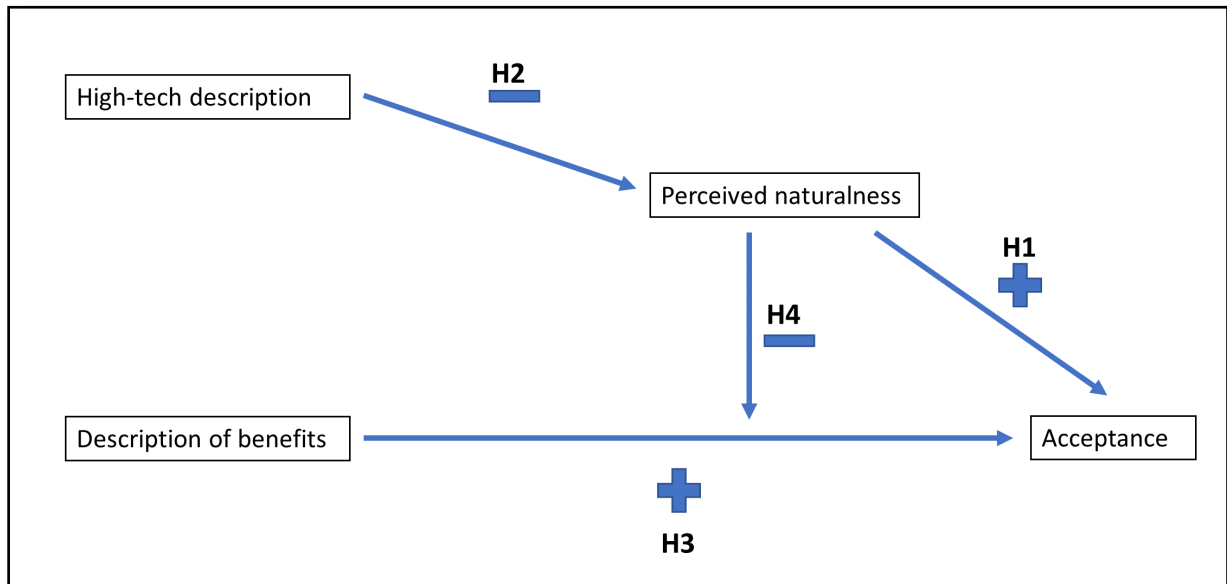The hypotheses are visualised in a conceptual model (Figure 1)

Figure 1: Conceptual model of the acceptance of cultured meat

Materials and Methods

Participants and design

The study used a 2 (High-tech description x Low-tech description) x 2 (Description of benefits x No description of benefits) between subject design, resulting in four conditions. Participants were randomly assigned to one of the conditions.

A convenience sampling method was used mainly targeting students from the Wageningen University.

Materials and Manipulation

To test the hypotheses four different conditions were created. The different conditions are illustrated in Table 1

Conditions	Benefits	No benefits
High-tech	1: High-tech, benefits	3: High-tech, no benefits
Low-tech	2: Low-tech, benefits	4: Low-tech, no benefits

Table 1: conditions with the different descriptions

High-tech description:

Cultured meat is a meat substitute. It is still in development, but it is expected to be available to consumers in a few years. It is produced in a laboratory using stem cells from a live animal. A growth medium is applied to these stem cells in a bioreactor which gives them the necessary nutrition to multiply. After some time, these cells develop into muscle tissue. It can be developed to form a piece of meat similar to ground meat. The cultured meat has the same taste, texture and smell as regular ground meat.

Low-tech description:

Cultured meat is a meat substitute. It is still in development, but it is expected to be available to consumers in a few years. It is produced using tissue from a live animal. It can be developed to form a piece of meat similar to ground meat. The cultured meat has the same taste, texture and smell as regular ground meat.

Description of benefits:

Cultured meat has several advantages compared to regular meat. It is better for the environment, because the amount of energy and land necessary for the production are very low compared to regular meat. Because no animals are slaughtered in the process it is also associated with less animal suffering and risks of diseases are lower.

Participants received the description based on the condition they are assigned to. Participants in condition 3 and 4 will only receive the technical description without the description of the benefits.

Measures

To test the hypotheses, two dependent variables were measured. The 'perceived naturalness'- and the 'acceptance' of cultured meat. To measure the perceived naturalness, this study used the same question Siegrist et al., (2018) used in their study; "How much do you perceive cultured meat as natural?" Participants could move a slider from 'not natural at all' to 'very natural'. The values of the slider ranged from 0 to 100 with intervals of 1. The participants did not get to see these values.

To measure the acceptance participants indicated their agreement to the following self-constructed statements. The statements represent different sorts of acceptance to hopefully cover the whole construct. A 5-point Likert scale was used with the options 'strongly disagree', 'disagree', 'neutral', 'agree', and 'strongly agree'. Question 3, 6 and 7 are negatively framed, whereas the other questions are positively framed.
1: "I am willing to consume cultured meat"
2: "Cultured meat is a good replacement for regular meat"
3: "I would never consume cultured meat"
4: "Cultured meat is of higher quality than regular meat"
5: "I am willing to add cultured meat to my diet."
6: "I do not like the idea of consuming cultured meat"
7: "I would rather consume regular meat than cultured meat"
8: "The idea of consuming cultured meat is appealing"
9: "I am willing to purchase cultured meat"
10: "The idea of consuming cultured meat is interesting"

Demographic measures were age and gender.

Procedure

A web-based questionnaire was distributed via social media platforms. The questionnaire was displayed in Dutch to make it easier for the participants to understand the text. Firstly, the participants were told that they were participating in a study about a new meat substitute. After the confirmation of consent the participants were randomly assigned to one of the four conditions. Then they read the description about cultured meat. Which description they got to see depends on the manipulation condition they were assigned to. Subsequently, every participant had to answer the questions about 'naturalness' and 'acceptance'. Finally, the

demographic information was collected after which the participants were thanked for their participation.

Statistical analyses

First, a factor analysis was used to check if the measured items measured the same underlying construct.

To test hypothesis 1, 3 and 4 a general linear model was used. Here, the effect of the 'perceived naturalness' and the description of the benefits on the 'acceptance' of cultured meat was modelled. For hypothesis 4, the same model also tested if the description of the benefits acts as a moderator in the relationship between the perceived naturalness and the acceptance of cultured meat. To make the data of the variable 'naturalness' appropriate to use in the model the features were standardized by subtracting the mean.

To test hypothesis 2, a one-way ANOVA was run to model the relationship between the different tech-conditions and the 'perceived naturalness'.

To test the possibility of the 'technical description' having an indirect effect on 'acceptance' the mediation effect of 'naturalness' was modelled.

An alpha level of .05 was used for all statistical tests.

Data

249 responses were gathered of which 24 responses were deleted from the dataset due to incomplete responses. This results in a data sample with 225 participants with slightly more women (56.4%) than men (43.3%). The average age was 26.41 ($SD = 12.39$).

Factor analysis was used to check if the items which are supposed to measure acceptance are corresponding with each other. Bartlett's test of sphericity, which tests the overall significance of all the correlations within the correlation matrix, was significant ($\chi2$ (45) = 1209.86, p = .00). The Kaiser-Meyer-Olkin measure of sampling adequacy indicated that the strength of the relationships among variables was high (KMO = .91). This means it is acceptable to proceed with the analysis. A principal component analysis indicated that two factors gave the most interpretable solution. The first factor had an eigenvalue of 5.23 and accounted for 52.3% of the variance. The second factor had an eigenvalue of 1.36 and accounted for 13.6% of the variance. The third factor had an eigenvalue of 0.67 and accounted for 6.7% of the variance. The first two factors were the only factors with an eigenvalue larger than one and had a cumulative explained variance of more than 60%. The third factor was therefore not included for further analysis.

There are two items that do not load very high on the first factor but do on the second factor. Both these items are questions about the preference in comparison to regular meat, question four and seven. Due to these questions being similar to each other and different from the rest they will be separated from the other questions. These two items can be seen as the acceptance in comparison to regular meat. The other eight items can be summarised as the general acceptance. The means of the items of the two factors were taken together to be able to conduct statistical tests separately. The Cronbach's alpha for the general acceptance was α = .91. This means the items have a high internal consistency. The items for the acceptance in comparison to regular meat had a lower reliability with a Cronbach's alpha of α = .57. Because the two items had a close resemblance and were expected to have theoretical relevance, they were kept in the dataset for further analysis.

The average values and standard deviations of the four conditions are presented in Table 2. A first look reveals that the average rating between the different conditions do not differ greatly. Notable is the difference between the two acceptance measures. The acceptance in comparison to regular meat is on average 27.6% lower than the general acceptance.

	High-tech		Low-tech	
	Positive	Neutral	Positive	Neutral
Naturalness	M = 39.22 SD = 28.26	M = 41.11 SD = 30.33	M = 41.14 SD = 24.85	M = 42.79 SD = 28.39
General acceptance	M = 3.74 SD = 0.79	M = 3.93 SD = 0.60	M = 3.84 SD = 0.81	M = 3.83 SD = 0.73
Acceptance in comparison to regular meat	M = 2.67 SD = 0.94	M = 2.77 SD = 0.68	M = 2.78 SD = 0.83	M = 2.88 SD = 0.90

Table 2: Means and standard deviations of naturalness and the two acceptance measures

To test hypotheses 1, 3 and 4 two general linear models were used. One for the general acceptance R^2 = .24 and one for the acceptance in comparison to regular meat R^2 = .07. The features of 'naturalness' were standardized by subtracting the mean to make the variable appropriate to use in the models.

The first hypothesis stated that a higher perceived naturalness of cultured meat leads to a higher acceptance of cultured meat compared to a low perceived naturalness. The model showed that the perceived naturalness significantly predicted the general acceptance $F(1,221)$ = 69.90, p = .00. The perceived naturalness also proved to significantly predict the acceptance of cultured meat in comparison to regular meat, although the effect was smaller $F(1,221)$ = 12.72, p = .00. Based on these results the first hypothesis can be accepted. A higher perceived naturalness leads to a higher acceptance of cultured meat. Also when the cultured meat is compared to regular meat.

The third hypothesis stated that a positive description of cultured mead leads to a higher acceptance of cultured meat compared to a neutral description. The model showed that a positive description had no significant effect on the general acceptance $F(1,221)$ = 0.05, p = .82. There was also no significant effect found on the acceptance in comparison to regular meat $F(1,221)$ = 1.75, p = .19. These results show that the third hypothesis cannot be accepted.

The fourth hypothesis stated that a description of the benefits of cultured meat leads to a higher increase in acceptance when the perceived naturalness in low compared to when the perceived naturalness is high. To test this the positive description was used as a moderator in the relationship between the perceived naturalness and the acceptance. Results show that there was no significant moderation effect of the positive description on the general acceptance $F(1,221)$ = 1.18, p = .28. Also, no significant moderation effect was found on the acceptance in comparison to regular meat $F(1,221)$ = 1.64, p = .20.

It was further hypothesised in H2 that a high-tech description of cultured meat leads to a lower perceived naturalness of cultured meat compared to a low-tech description. A one-way analysis of the variance showed that the presentation of a high-tech description (M = 40.16, SD = 26.55) or a low-tech description (M = 41.96, SD = 29.23) had no significant effect on the perceived naturalness $F(1,223)$ = 0.24, p = .63. Therefore, based on these results, the second hypothesis cannot be accepted.

Finally, it was analysed if the perceived naturalness acts as a mediator between the high-technical description and acceptance. A one-way analysis of the variance showed that the high-technical description had no significant effect on the general acceptance $F(1,223)$ = 0.78, p = .38 or on the acceptance in comparison to regular meat $F(1,223)$ = 0.30, p = .58. Also, as stated earlier, the high-tech description had no significant effect on the perceived naturalness. In this situation, therefore, it would be meaningless to conduct a formal mediation analysis. It seems that in this model naturalness does not act as a mediator between the high-technical description and acceptance.

Discussion

Although a lot of research on the consumer acceptance of cultured meat has been done, the effect of providing different types of descriptions was not yet fully explored. The aim of this research was to investigate the relationship between positive information, the degree of technical information and the acceptance of cultured meat.

From the results it became clear that a higher perceived naturalness led to a higher acceptance of cultured meat. This is in line with results from previous studies (Román et al., 2017). A positive effect also existed when the cultured meat was compared to regular meat, although the effect was notably smaller. This suggests that naturalness is a less important predictor for the acceptance of cultured meat when it is evaluated in comparison with regular meat. Also, the acceptance of cultured meat in comparison with regular meat was nearly 27.6% lower than the general acceptance. This while the comparison to regular meat was made in all conditions. This might indicate that cultured meat should not be presented as an alternative for regular meat, but rather as a new product complementary to regular meat.

The degree of technical information did not predict the perceived naturalness and therefore the acceptance of cultured meat. Although the effect of naturalness on the acceptance was significant, several participants noted to find it hard to interpret naturalness in the context of cultured meat. This may be one of the reasons why there was no significant effect of the hi-tech description on the perceived naturalness. Future research, therefore, should consider measuring if a participant indeed thinks the production process is part of the perception of naturalness. It could also be that the production process is a too small aspect of naturalness to give a significant effect. In that case the production process is not a suitable attribute to influence the acceptance of cultured meat. Perhaps the difference between the low-tech and the high-tech description was too small. Future research could focus on providing participants stronger manipulations. This study wanted to minimize the difference in text length to avoid the risk of readers fatigue and boredom.

Siegrist et al., (2018) expected that the process of growing meat in a laboratory would lead to a lower perceived naturalness of cultured meat. The hypothesis following this expectation was that a high-tech description of cultured meat would lead to a lower perceived naturalness than a low-tech description. However, the statement that the process of growing meat in a laboratory can be considered as high-tech as opposed to low-tech may be too rushed.

This study has been unable to demonstrate that the provision of information about the benefits has an effect on the acceptance of cultured meat. The theory of providing benefits to increase acceptance was largely based on the degree of familiarity of cultured meat. The familiarity, however, was not measured in this study. This limitation concerns the target group used in this study. Due to the convenient sampling method mainly students from the

Wageningen University participated in this study. For a considerable number of study programs environmental issues and sustainability are core subjects. Consequently, it is possible that the students of the Wageningen University have a positive bias and a more developed knowledge about sustainable meat alternatives than the average population. This could mean that associations were not changed by reading the description, but where already present beforehand. Future research should examine what the participant's current knowledge on cultured meat is to check for unfamiliarity. Furthermore, views on the benefits could be checked.

This study could not demonstrate an effect of the type of description on the acceptance of cultured meat. However, it seems useful for future research to keep including naturalness when investigating how the acceptance of this promising novel product can be increased.

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