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# 1 Perception of cultured "meat" by French consumers according to 2 their diet

3

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14

## 15 Highlights

16 \* Regular meat consumers are more favourable to "cultured meat" than vegetarians and vegans

17 \* Half of the respondent think that this product will have undesirable health effects

18 \* About 29 % of the respondents do not believe that this product could be of good quality

19 \* About 22% of respondents indicate that they have no intention of buying this product

20 \* The majority of flexitarians are opposed to the use of the term "meat" for this new product

## 21 Summary

22 The culture of muscle cells for food purposes, so-called cultured "meat", is advertised by its proponents as  
23 likely to meet the growing demand for animal protein without the disadvantages of animal farming. However,  
24 while this product is still in development and not yet widely commercialised, it is already attracting various  
25 forms of criticism from consumers. The present study follows a large international online survey of 5,418  
26 consumers in France which was aimed at understanding consumer perceptions of muscle cell culture for food  
27 purposes. Based on 118 interviews conducted on volunteers with specific dietary habits (vegans, vegetarians,  
28 flexitarians, regular meat consumers), the aim of this study was to target an audience with a variety of diets

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29 and thus to analyse more closely consumers' feelings towards this product. Regular meat consumers are more  
30 favourable to this product than vegetarians and vegans whose convictions prevent them from tasting artificial  
31 "meat". The consumption of this new product would be perceived by the latter as a step backwards. Of the 118  
32 people questioned, half of them think that this product could have a negative impact on the animal industry,  
33 41% fear undesirable health effects and 29% do not believe in the quality of this product. However, this new  
34 product arouses curiosity among the respondents, the majority of whom (80%) would like to try it. While the  
35 selling price of this product is questionable, 22% of respondents indicated that they had no intention of buying  
36 it. For those who were likely to buy this product, prices were expected to be lower or equal to those of  
37 conventional meat for 72% of them. Despite the uncertainties regarding its future development, the majority  
38 of respondents were optimistic about the future of this product. 80% of them believe it will become  
39 widespread more or less quickly, whether they like it or not, mainly because French people's mentalities are  
40 changing, despite that fact that the implementation of this product would appear difficult on certain points.  
41 The vegans are more likely to be neutral than the other consumers. There is no consensus on the term "meat"  
42 for this new foodstuff, with 25% of those questioned agreeing with the term "cultured meat"(14%) in  
43 particular. The majority of flexitarians (55%) are opposed to the use of the term "meat" for this new product,  
44 whereas this term seems to be suitable for 91% of the vegans and 82% of the vegetarians. The semantic issue is  
45 important and the name of this new product must not mislead the consumer.

46

#### 47 **Keywords**

48 survey, consumers, perception, cultured "meat", dietary habits

49

#### 50 **INTRODUCTION**

51

52 Since the middle of the 20<sup>th</sup> century, in order to meet the food needs of a growing world population,  
53 agricultural production has become much more intensive. Today, intensive agriculture (and in particular  
54 confinement farming) is widely questioned, notably for ethical and environmental reasons. Indeed, many  
55 controversies concerning its environmental impact and its consequences on human health and animal welfare  
56 have been articulated. According to FAO estimates, the world's population is expected to reach 9 billion people  
57 by 2050. The increase in food needs, estimated at +70%, will accentuate the problems related to resources and

58 land availability (Chriki and Hocquette 2020). With the decrease in the amount of land allocated to agriculture,  
59 the question of how to use land to feed livestock is now widely raised (Peyraud, 2020).

60 It is in this context that in 2013, Mark Post, a Dutch researcher, produced the first *in vitro* meat burger in  
61 history (Post 2014). In principle, the product is simple: cells are taken from a living animal and grown in the  
62 laboratory in an appropriate and controlled culture medium. This new product is also called “cultured meat”,  
63 “laboratory meat” or “*in vitro* meat” by the scientific community (Chriki et al. 2020). In recent years, a large  
64 number of start-up companies have been working on this new product (Guan et al. 2021). Presented by its  
65 proponents as the solution to the current challenges in agriculture, muscle cell culture for food purposes seems  
66 to be the key to feeding humans in an environmentally friendly way (Bhat and Fayaz 2011). This new product  
67 could also satisfy animal rights activists who see it as the solution to ending animal farming and therefore  
68 animal slaughter (Bhat and Fayaz 2011). Although increasingly publicised in the media, this new product is still  
69 little known to the general public. Questions remain regarding its industrial feasibility, the sanitary and food  
70 quality of the products and their acceptability.

71 The present work follows a large international online survey conducted by the same researchers, the aim of  
72 which was to understand consumers' feelings towards this product. This survey has been translated into  
73 different languages, and the first results of this large survey concerning the Chinese (Liu et al. 2021), Brazilian  
74 (Chriki et al. 2021) and French (Hocquette et al. 2022) populations have recently been published.

75 The objective of the present work, carried out in partnership with INRAE, ISARA and Bordeaux Sciences Agro, is  
76 to analyse the perception of this product by French consumers, in particular by focusing on the respondents'  
77 answers according to their diet. In order to clarify and complete the data collected in the previous web-based  
78 survey, 118 people with different diets (regular meat eaters, flexitarians, vegetarians and vegans) were  
79 interviewed individually face-to-face (or by phone when necessary), thus enabling the previously obtained  
80 results to be studied in greater depth.

81

## 82 I. MATERIAL AND METHODS

83

### 84 I.1 Designing the survey

85 Since the aim of this study was to gain better understanding of consumers' feelings towards muscle cell culture  
86 for food purposes, we felt that an in-depth survey based on a free discussion was appropriate. To this end,  
87 approximately 118 volunteers were interviewed by telephone for about 15 minutes.

88 Firstly, the following brief description of the muscle cell culture process for food purposes and its associated  
89 technology was read to each respondent: *“Cultured meat is a new biotechnology produced in laboratories using  
90 animal muscle stem cells, taken from living animals and grown in culture. The production of this product is the  
91 subject of much media enthusiasm to feed a growing human population. In order to respond to current  
92 environmental (especially global warming) and ethical issues (animal welfare, suffering and living conditions,  
93 slaughter...) but also to the limits of conventional meat production (limited agricultural resources and ever-  
94 growing population), some private scientific research start-ups are dedicated to the introduction and large-scale  
95 development of cultured meat as a new meat product of the future. This survey aims to study the opinion of  
96 consumers on this product and to investigate their likes and dislikes.”*

97 Then, the volunteers were asked to reflect on the issues surrounding cultured “meat” by answering some 20  
98 pre-defined open-ended questions. The oral questionnaire (Figure 1) was divided into two parts: the first part  
99 concerned the respondent's profile and the second part concerned their perception of this product. These  
100 interviews made it possible to collect the opinions of the respondents in detail and thus to qualitatively  
101 supplement the results obtained in a similar study conducted on the web by Hocquette et al. (2022).

102

### 103 **I.2 Selection of interviewees**

104 Respondents were asked to take part in the study via social Instagram and Facebook in early October 2020. The  
105 target audience was to be as diverse as possible without being representative of the French population, the  
106 only prerequisites being that they had to be more than 18 years of age and live in France.

107

108 In order to study the relationship between the consumers' diet and their perception of this product, volunteers  
109 adhering to four different diets (vegan, vegetarian, flexitarian or regular meat consumer) were selected. The  
110 following definitions were used to characterise each diet type.

111 - Veganism: a diet based on the absence of consumption of products derived from the exploitation of  
112 animals. A vegan eats a vegetable-based diet, with no animal products (e.g. no meat, eggs or honey). A vegan  
113 lifestyle also avoids leather, wool, silk and all other animal products.

114 - Vegetarianism: a diet based on the absence of meat and fish consumption, but allowing the  
115 consumption of eggs, cheese and milk.

116 - Flexitarianism: a diet that limits meat consumption for reasons other than financial. The flexitarian seeks  
117 a balanced and varied diet. They therefore also consume animal products.

118 - Regular meat eaters: a diet with meat each day (or at each meal), whatever the type of meat (beef,  
119 chicken, pork, ...)

120 As four people were responsible for carrying out the surveys over a three-month period, a minimum of 100  
121 respondents was expected. Furthermore, in order to be able to compare the results between the different  
122 diets, the target was to interview at least 25 people for each diet. Volunteers filled in their diet details and  
123 were contacted for statistical purposes. The interviews were then carried out by four students from Bordeaux  
124 Sciences Agro over a period of three months (October - December 2020), face-to-face when the situation  
125 allowed (when a face-to-face interview was not possible due to health constraints linked to the Coronavirus,, a  
126 phone call was organised).

127

### 128 **I.3 Processing of responses**

129 The survey processing software Sphinx was used to analyse the answers formulated by the persons  
130 interviewed.

131 The variable relating to the respondents' diet was used in order to cross-reference it with the other variables  
132 studied, as one of the main objectives of this work was to shed light on the question of the perception of this  
133 product through the perspective of the respondents' diet. Cross-tabulations between the other variables were  
134 also carried out.

135 Finally, the significance of the relationships was analysed using  $\chi^2$  tests on the percentages in the rows of the  
136 cross-tabulations (using R studio).

137

## 138 **II. RESULTS**

139

### 140 **II.1 Profile and socio-demographic characteristics of the respondents**

141 The panel was deliberately not representative of the French population, the objective being to have a sufficient  
142 share of "vegetarians" and "vegans" so as to be able to study the differences in perception of this new product

143 according to consumption habits. A total of 118 consumers were surveyed between October and December  
144 2020, of which 77 were women (64.4%) and 41 men (35.6%).

145 Of those surveyed, the majority were between 18 and 30 years of age (67% of respondents), with the older age  
146 groups being significantly fewer: 31-50 years old (16%) and 51 years and over (17%). The high proportion of 18-  
147 30 year-old respondents can be explained by the use of social networks as a means of recruiting respondents,  
148 as well as by the composition of the respondents' close network. The panel was made up of a high proportion  
149 of students and young professionals with a net monthly income of less than €1200 (62%) or between €1200  
150 and €2000 (18%).

151 The majority of respondents (47%) had attained (or would be within the year) a Master's degree (Figure 2) and  
152 only 12% had already worked or were currently working in the meat sector. Finally, 38% of individuals  
153 considered themselves familiar with the innovation sector.

154 With regard to the consumption habits of the people interviewed, the proportion of consumers who ate  
155 "regularly" or "every day/every meal" meat was equivalent to those that indicated that they "never" ate meat  
156 (35.6% and 36.4% respectively; Figure 2). The rest of the panel rarely consumed meat (less than once a month:  
157 6.8%), occasionally (less than once a week: 13.6%), while 7.6% of the panel consumed meat every day (Figure  
158 2).

159 45% of the respondents, defined themselves as "regular meat eaters", 17% as "flexitarians", 29% as  
160 "vegetarians" and 9% as "vegans"(Figure 2).

161

## 162 **II.2 How do respondents relate to the culture of muscle cells for food purposes?**

163 Almost three quarters of the respondents (72%) had already heard about the culture of muscle fibres for food  
164 purposes, either via the internet, television, social networks or scientific publications. This prior knowledge did  
165 not seem to have an impact on the general feeling of the respondents towards cultured "meat" ( $p=0.39$ ; Table  
166 1). The informative text read out to the respondents before the questionnaire was considered to be of a nature  
167 to correctly balance the knowledge between novices and experts.

168 Among the suspected limitations of cultured "meat" are, according to the respondents:

169 - the negative impact that this product would have on the meat industry (49.2%),

170 - the possible negative impact of this product on consumer health (40.7%),

171 - but also doubts about the sensory quality of this novel product (28.8%) or the safety of its manufacturing  
172 process (27.1%; Table 2).

173 Regarding the benefits of this product, the majority of respondents believed that it was potentially better for  
174 animal welfare (63.6%) and the environment (56.8%), but also interesting from a social (22.9%) and  
175 nutritional/sensory quality (17.0%) point of view. According to the social point of view, the respondents  
176 indicated that growing muscle fibres for food purposes had the potential to feed more people in the world,  
177 perhaps at a more affordable price than 'conventional' meat.

178 Eight out of 10 respondents were willing to try this novel food. The respondents who were willing to try it were  
179 mainly willing to do so because they were curious to discover this new product (76.0%) or because they wanted  
180 to get a feeling for it (12.0%) (Figure 3). Those who did not wish to taste it were reluctant because of a lack of  
181 interest (44.9%) but also because of their mistrust in the new product (28.8%).

182 People familiar with the innovation sector were significantly more inclined to try this product than those not  
183 familiar with this product (Table 4). On the other hand, we note that respondents who were used to consuming  
184 plant-based alternatives did not express a higher willingness to taste this product ( $\chi^2 = 3.67$ ;  $p = 29.95\%$ ; data  
185 not shown).

186 While the majority of respondents were willing to try this product (80%), only 35.6% were willing to eat it  
187 regularly (4.2% of respondents had no opinion). Of those willing to eat it regularly when it becomes available,  
188 about half (47.4%) plan to eat it at home, 27.4% would prefer to eat it in restaurants and 25.3% in ready to eat  
189 meals.

190 The price of this product was sometimes cited as a significant barrier to consumption. Thus, while 30.4% of  
191 respondents felt that this product should be sold at the same price as traditional meat, 26.1% felt it should be  
192 sold at a lower price, with 30.4% of respondents indicating that they did not intend to pay any money for this  
193 product (Figure 4).

194 Regarding the potential success of this product, the vast majority of respondents (72%) believed that it would  
195 become widespread, in the short (1-10 years; 31.3%), medium (11-20 years; 21.2%) or long term (20 years or  
196 more; 19.5%), with 28% of respondents having no idea of the likely timeframe.

197 The development of this product seemed, according to the respondents, to be conditioned by the evolution of  
198 mentalities (20.3% of respondents cited this reason) and societal issues (11,9%). According to 6.8% of  
199 respondents, this product was likely to grow should it become affordable. An effective marketing strategy was



200 also likely to facilitate the successful development of muscle fibre culture for food purposes (according to 4.2%  
201 of respondents).

202 On the other hand, the difficulty of implementing this new product, due to technological and regulatory  
203 challenges in particular, could slow down its widespread use according to 9% of respondents, with the ethically  
204 unacceptable aspect being presented as the second obstacle to the development of this product, cited by 8% of  
205 respondents (Table 2). The need to change the mentalities/habits of consumers who have a certain attraction  
206 for meat (which is an important part of a convivial meal) was also likely to slow down the development of this  
207 product for 5.9% of respondents. In addition, 1.7% of those surveyed felt that this product was a passing fad.

208 Finally, when asked whether the use of the term "meat" to describe this product would be appropriate, 62.7%  
209 of respondents replied "yes", considering that this product does indeed originate from an animal (Figure 5). For  
210 those who considered that the term "meat" was not appropriate to describe this product (31.4%), the first  
211 reason was the need to avoid confusion between traditional meat and muscle cell culture (for 25.4% of  
212 respondents). The fact that these cultured muscle cells are not really meat was the next most important reason  
213 for 16.1% of respondents. While 3.4% of the respondents opposed to the meat designation did not give a  
214 specific reason, 5.9% of them put forward the fact that this product was produced in a laboratory and could not  
215 therefore be called "meat". On the contrary, among the respondents who considered that the term "meat"  
216 could be adapted to this novel product, the reasons given were: that this product actually comes from animals  
217 (27.1%) and that the definition of the term "meat" seems to be more suitable (12.7%).

218

219 As regards the name that consumers would like to give to this product, "cultured meat" was cited by 25% of  
220 respondents, followed by "cultured meat" (doublet ???) and "ethical meat", cited by 13% and 8% of  
221 respondents respectively (Figure 5). Finally, in the "other" category, we find innovative ideas such as "meat  
222 your future", "meat taste cachet???" or "high tech meat version", but also names with more or less positive  
223 connotations such as "sustainable meat", "synthetic protein", "meat substitute" or "futuristic meat".

224

### 225 **II.3 The influence of diet on the perception of this product**

226 Diet (regular meat eaters, flexitarians, vegetarians, vegans) was studied as a criterion influencing consumers'  
227 perception of this product. The distribution of the numbers by diet was as follows: 52 regular meat eaters, 34  
228 vegetarians, 32 flexitarians and 11 vegans. Despite the inequality between classes, the numbers were sufficient

229 to identify trends. While the diet/gender dependency is not significant ( $\chi^2 = 6.25$ ;  $p = 10.1\%$ ), the dependence  
230 of diet on age is highly significant (Table 3).

231 Regarding the respondents' feeling towards this product, the diet/feeling dependency is not significant (Figure  
232 6). Nevertheless, it can be observed that "regular meat eaters" are more likely to have negative feelings  
233 towards cultured "meat", whereas vegans tend to have positive feelings (particularly with regard to social and  
234 ethical consequences).

235 In terms of the advantages and problems associated with this product, the diet/benefit dependency is not very  
236 significant ( $\chi^2=40.00$ ;  $p=0.052$ ) and the regime/problem dependency is not significant ( $\chi^2=39.81$ ;  $p=0.434$ ).

237 Regular meat eaters are significantly less likely to consume meat substitutes (58.5%) than flexitarians (95%),  
238 vegetarians (91.2%) and vegans (100%), who would be more inclined to consume these products.

239 The influence of diet on the willingness to try or not to try this new product when it becomes available is not  
240 significant ( $p=0.427$ ; Figure 7). However, flexitarians seem slightly more likely to try it than other populations.

241 On the other hand, regular meat consumers are significantly more favourable to eating this new product  
242 regularly than others. Conversely, vegetarians are the least favourable to this idea: only 12% of them would  
243 agree, compared to 53% of regular meat eaters. The diet of the respondents has no significant influence on the  
244 perception of the possible success of this product. However, it can be observed that flexitarians are more likely  
245 to think that this new product will become widespread (90% compared to 82% of vegetarians, for example)  
246 (Figure 7).

247 Vegetarians and vegans are significantly more in favour of using the term "meat" for it (only 12% of vegetarians  
248 wanted to remove the term meat, all vegans wanted to keep it or did not answer this question; Figure 8).

249 Conversely, the majority of flexitarians are against the use of the term "meat" to refer to this product (55% of  
250 them), whereas 40% consider that this term is well adapted. The data for regular meat eaters are also  
251 unexpected, since 53% of them consider that the term "meat" is well adapted to this product.

252

### 253 **III. DISCUSSION**

254

#### 255 **III.1 Profile and socio-demographic characteristics of the respondents**

256 The results of this survey were not intended to be representative of the French population, but to analyse in  
257 greater detail the drivers and barriers to the acceptance of cultured "meat" according to diet (meat

258 consumption habits). It is therefore important to recall the characteristics of the respondents. While the  
259 distribution of men and women in the French population is 48,4% and 51.6% respectively (Insee, 2021), 64% of  
260 the respondents to the survey were women. This difference in relation to the French population could be  
261 explained by the personal network of the interviewers, which is made up mainly of women. In addition, in this  
262 study, the respondents were recruited on the internet following a call for volunteers. However, the earlier  
263 study by Hocquette et al (2022), conducted in France, found a greater interest in “cultured meat” for women. It  
264 is therefore possible to assume that the larger proportion of women in the final sample is at least due to a  
265 combination of different reasons.

266 The use of social networks and the solicitation of contacts by the interviewers also explains the high proportion  
267 of 18-30 year olds who responded to the survey (67%) compared to the French population, which includes only  
268 11% of 20-29 year old citizens, since the use of social networks is more intense among younger people (Insee  
269 2020). Furthermore, it has been shown that young people are more in favour of “cultured meat” as  
270 demonstrated by different authors (reviewed by Bryant and Barnett, 2020) for instance in Brazil (Chriki et al.  
271 2021) and in France (Hocquette et al., 2022). This is not the case for older Chinese respondents (> 51 years of  
272 age) who are more willing to engage with cultured “meat” (Liu et al. 2021). These parameters must be taken  
273 into account when analysing the results observed in this study.

274 The panel studied here is made up of 29% vegetarians on purpose, although they represent only 2% of the  
275 French population. However, the initial choice was to have a proportion equal to 25% (ou bien : to have an  
276 equal proportion of 25% for vegans and vegetarians...?) for both vegans and vegetarians in the sample so as to  
277 be able to statistically compare the food groups. However, it is important to note that vegetarians are often  
278 less open to consume this new product than regular meat consumers (Bryant et al. 2020). This should be taken  
279 into consideration when analysing the results.

280 The majority of respondents had already heard of this novel product before. On the other hand, other studies  
281 (Baum et al., 2021) indicated that providing negative information about the nutritional aspect of this new  
282 product or its impact on the environment and health could make consumers more fearful, as this product is not  
283 free of health and environmental risks (Chriki and Hocquette, 2020). These two observations could then explain  
284 the independence observed in our study between prior knowledge of the product and the desire to taste or eat  
285 this type of product regularly.

286

### 287 **III.2 How do respondents relate to muscle cell culture for food purposes?**

288 This new survey confirms the observations of Bryant et al (2020) on the potential advantages of this novel  
289 product over traditional meat according to consumers: the reasons associated with animal welfare (less  
290 slaughtering of animals in particular) and respect for the environment are mainly cited.

291 Concerning the problems associated with this product, notions such as health/nutrition, distrust, disgust and  
292 organoleptic quality are regularly cited by consumers (Bryant et al. 2020; Liu et al. 2021; Chriki et al. 2021;  
293 Hocquette et al. 2022). Health effects were cited in second place, just before quality and distrust issues. The  
294 study is therefore also rather in line with the literature.

295 Overall, consumers' opinions on the selling price of this product compared to traditional meat are quite  
296 diverse, although 30% of them would agree to buy this new product at the price of farmed meat. It seems that  
297 this willingness to pay more or less for this new product varies slightly according to the country although most  
298 consumers are not willing to pay more for cultured "meat" compared to conventional meat (Bryant et al. 2020;  
299 Liu et al. 2021; Chriki et al. 2021; Hocquette et al. 2022). These authors further indicate that having tested the  
300 product once, may also be likely to encourage consumers to accept a higher price. The selling price of this  
301 product seems to be a determining argument for its acceptance.

302 The results of the survey showed that the majority of respondents believed that this product would become  
303 widespread in the longer term (>20 years). Difficulty of implementation, acceptance and well-established  
304 French habits were cited as the main reasons for a long time to generalise (more than 10 years) and may  
305 explain why French consumers may be not ready, on average, to accept cultured "meat" (Hocquette et al.,  
306 2022). This trend confirms the conclusions of Bryant et al (2020), according to whom this new product will take  
307 longer to become widespread in European countries with strong traditional values.

308 In terms of nomenclature, the study showed that the majority of consumers wanted to keep the term "meat"  
309 to name this product. On the other hand, for those consumers who were against the use of the term "meat",  
310 the main reason given was that this term could create confusion between this product and "traditional" (or  
311 conventional) meat. This last idea is corroborated by the work of Ong et al. (2020) who state that the use of the  
312 term "meat" could confuse the consumer and create misunderstandings as to the origin of the product.  
313 Furthermore, Choudhury et al. (2020) argue for the use of the terms "synthetic" or "cultured" for the labelling  
314 of this product in order not to mislead the consumer. Respondents seem to agree with this view, as 24% of  
315 them consider the term "cultured" meat to be appropriate.

316

### 317 **III.3 The influence of diet on the perception of this product**

318 The study confirms the observations made by Bryant et al. (2020) that regular meat consumers are more  
319 favourable to this product than vegetarians and vegans. Unlike for regular meat consumers, it is the beliefs of  
320 vegetarians and vegans that prevent them from trying this new product. Indeed, the consumption of this novel  
321 product would be perceived as a step backwards for people who no longer eat meat (Dupont, Fiebelkorn 2020;  
322 Chriki et al. 2020; Hopkins 2015). This refusal of a return to the past could also explain the stronger desire of  
323 vegetarians and vegans to keep the term 'meat' to name this product, since, according to them, it remains  
324 meat, because it does originate from animal cells.

325 Conversely, meat-eating populations (regular meat eaters and flexitarians) would be more likely to choose  
326 meat and plant proteins as sources of protein, and to decrease their consumption of ultra-processed products  
327 such as cultured muscle cells. Therefore, prospective studies (Slade, 2018) predicting a significant increase in  
328 the market share of this type of product in the short term (10 years) have to be nuanced, especially as  
329 European legislation on "novel foods" is restrictive: it will indeed be necessary for the promoters of these  
330 products to prove the safety of the entire production chain (plastic, biomaterials, culture medium with its many  
331 components, the animal cells used, etc.) (Ong et al., 2021). Furthermore, it is very important to remember that  
332 the use of exogenous hormones is prohibited in conventional breeding on the European continent (Directive  
333 96/22/EC of 29 April 1996) on the basis of the precautionary principle, even if these man-made hormones are  
334 biochemically identical to natural hormones. Under these conditions, it would be difficult to imagine that the  
335 European legislator would allow the use of synthetic hormones for the production of muscle cells for food  
336 purposes.

337

### 338 **CONCLUSION**

339 The study of the influence of diet (regular meat consumers, flexitarian, vegetarian or vegan) on the perception  
340 of this novel product has highlighted certain trends and confirmed previous results observed in the scientific  
341 literature. While vegetarians are more inclined to consume meat substitutes, they are, together with vegans,  
342 less favourable to consume cultured muscle cells than regular meat eaters. Finally, vegetarians and vegans are  
343 more inclined to use the term "meat" in the name of cultured muscle cells, the explanation being largely a  
344 desire to keep a barrier between this novel product and other plant-based analogues.

345 Cultured muscle cells inspire and intrigue, but opinions are quite diverse, so this new product has some way  
346 to go to convince French consumers. Future research should make it possible to answer current questions about  
347 the impact of these new products, particularly from a health and nutritional point of view. The choice of name  
348 for marketing purposes is an important issue. Transparency and marketing strategy will be essential in order not  
349 to mislead the consumer or put him/her off by the name of the product, as products derived from muscle cell  
350 culture cannot be called "meat". The selling price will also be crucial, as expectations on this criterion are very  
351 diverse with a majority expecting a low price. The marketing of the product will also be crucial for the  
352 development of muscle cell culture for food purposes. Finally, it is important to add that the regulatory hurdles  
353 will also be a major challenge for the promoters of this product because of the classification of these meat  
354 alternatives as "novel foods" in the EU legislation.

355

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What is your gender?

How old are you?

What is your level of education?

Do you consider yourself familiar with the innovation sector?

What is your net monthly income?

**Meat consumption**

Do you eat meat?

*(choice: yes, no)*

If yes: how often?

*(choice: never, less than once a month, once a month, many times per month, many times per week, every day/meal)*

If no: do you have a specific diet?

*(choice: vegan, vegetarian, flexitarian)*

Have you ever heard of cultured meat?

*(choice: yes, no, no opinion)*

If yes, how?

*(free answer)*

What does it mean to you? What do you think of it?

In your opinion, what problems could be associated with this product?

*(free answer)*

What do you think the advantages are of this product compared to traditional meat?

*(free answer)*

Would you be prepared to eat meat substitutes (plants, insects)?

*(choice: yes, no, no opinion)*

Would you be prepared to adopt alternatives (reducing food waste, better farming conditions)?

*(choice: yes, no, no opinion)*

Would you be willing to try this product?

*(choice: yes, no, no opinion)*

Why or why not?

*(free answer)*

Would you be prepared to eat this product regularly?

*(choice: yes, no, no opinion)*

Why or why not?

*(free answer)*

If you were prepared to eat this product regularly, in what context? For example, at home, in restaurants, in ready-made meals...

*(free answer)*

How much would you be prepared to pay for this product? What price do you think it should be sold at?

*(choice: At the same price as conventional meat, at a lower price, at a higher price, I'm not ready to pay for this product)*

Do you think this product could become widespread? In what time scale?

*(choice: yes, no, no opinion)*

Do you think we should call this product meat? What other term could we use?

*(free answer)*

Please feel free to talk about this survey with others, if you know people who might be willing to participate.

Figure 1: List of questions given to respondents



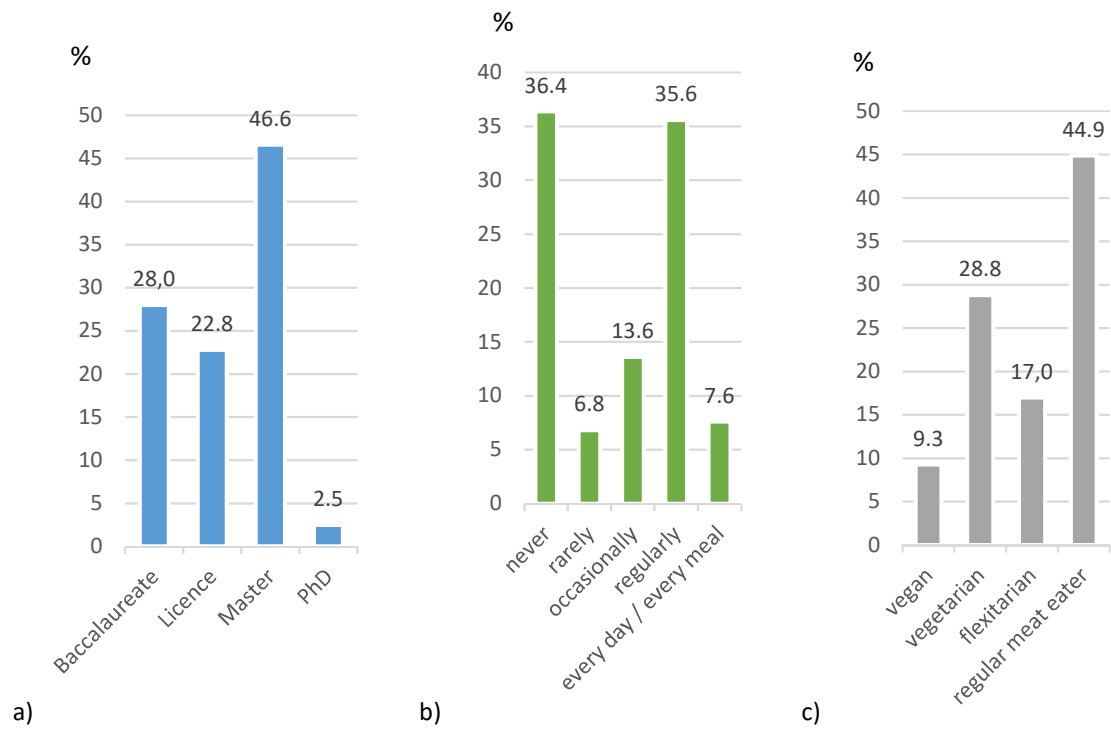
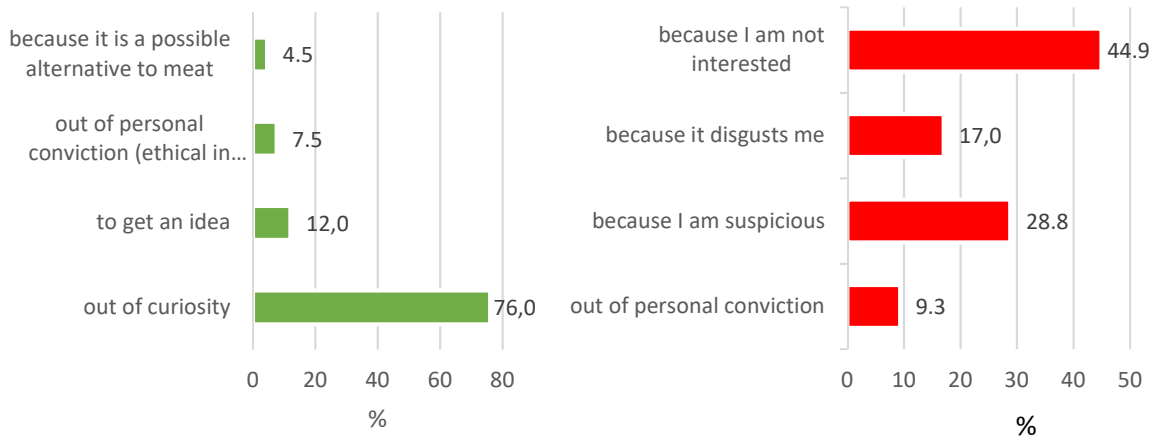


Figure 2: Profile of respondents in terms of level of education (a), level of meat eaten (b) and diet (c)

*Rarely: less than once a month; Occasionally: Once a month; Regularly: many times per month; Regularly: many times per week*



a)

b)

Figure 3: Reasons given for wanting to try this new product (a) or not (b)

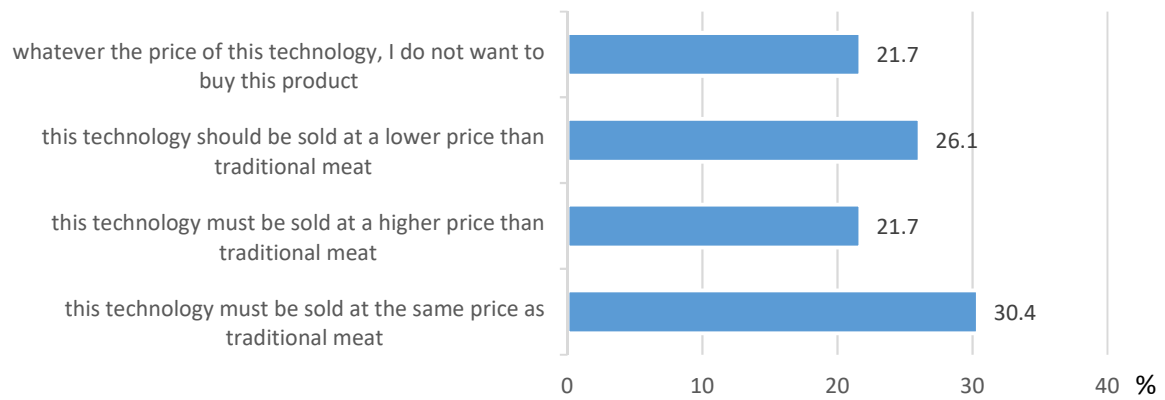
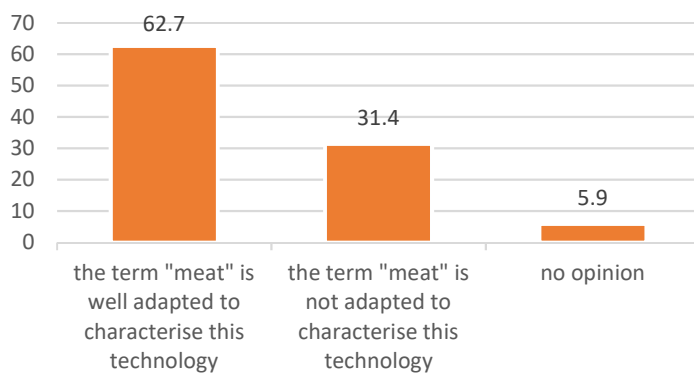


Figure 4: Respondents' views on the market price of this new product (when available) compared to traditional meat



Names suggested	Occurrence (%)
Artificial meat	25.4
Cultured meat	13.6
Ethical meat	8.5
Meat substitute	8.5
Cellular meat	6.8
In vitro meat	5.1
Lab meat	1.7
Other	13.6
No opinion	17

Figure 5: Suitability or otherwise of the term 'meat' for this product and names suggested by respondents

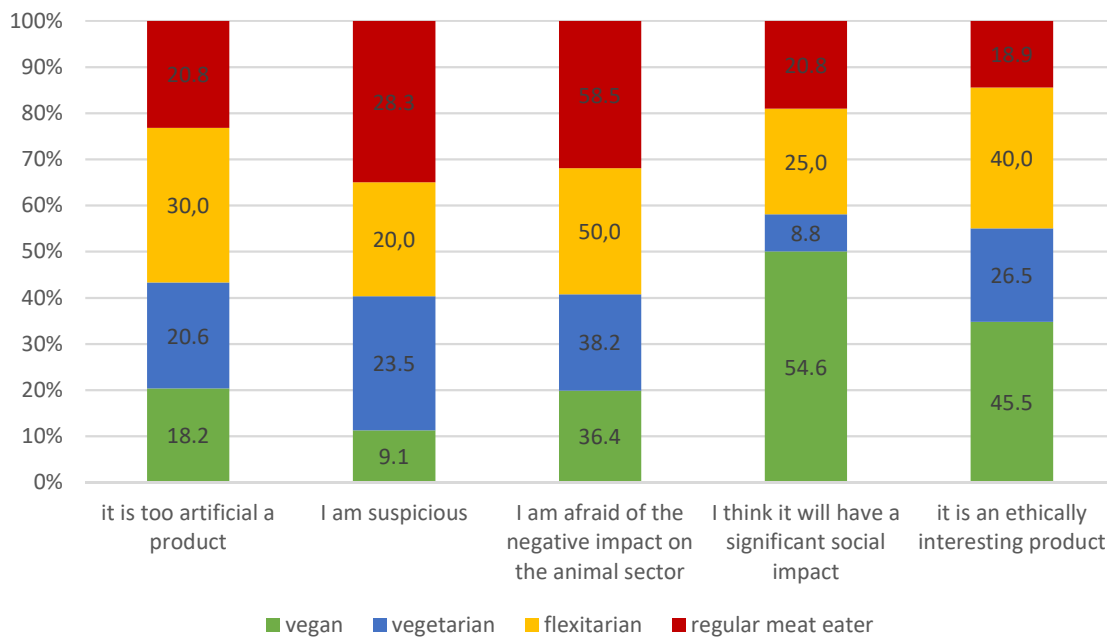


Figure 6: Influence of diet (vegan, vegetarian, flexitarian or regular meat eater) on feelings about this new product  
 Chi<sup>2</sup> value = 65.09; p = 0.143

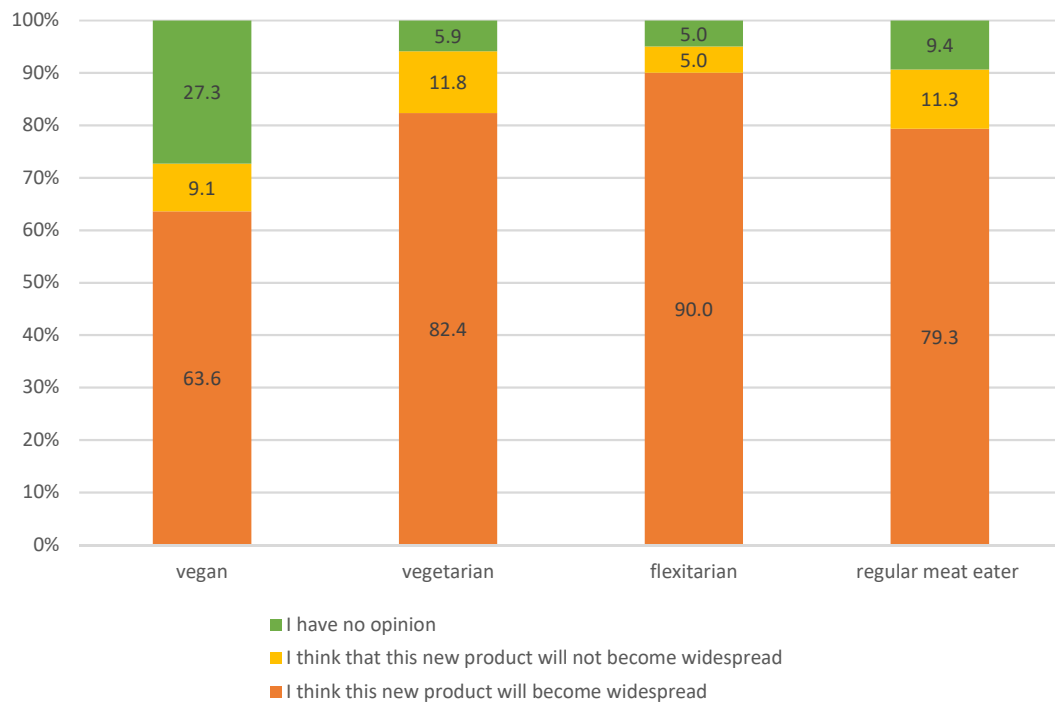


Figure 7: Influence of diet (vegan, vegetarian, flexitarian or regular meat eater) on the opinion of the generalisation of this new product

\*  $\chi^2 = 5.97$ ;  $p = 0.4271$

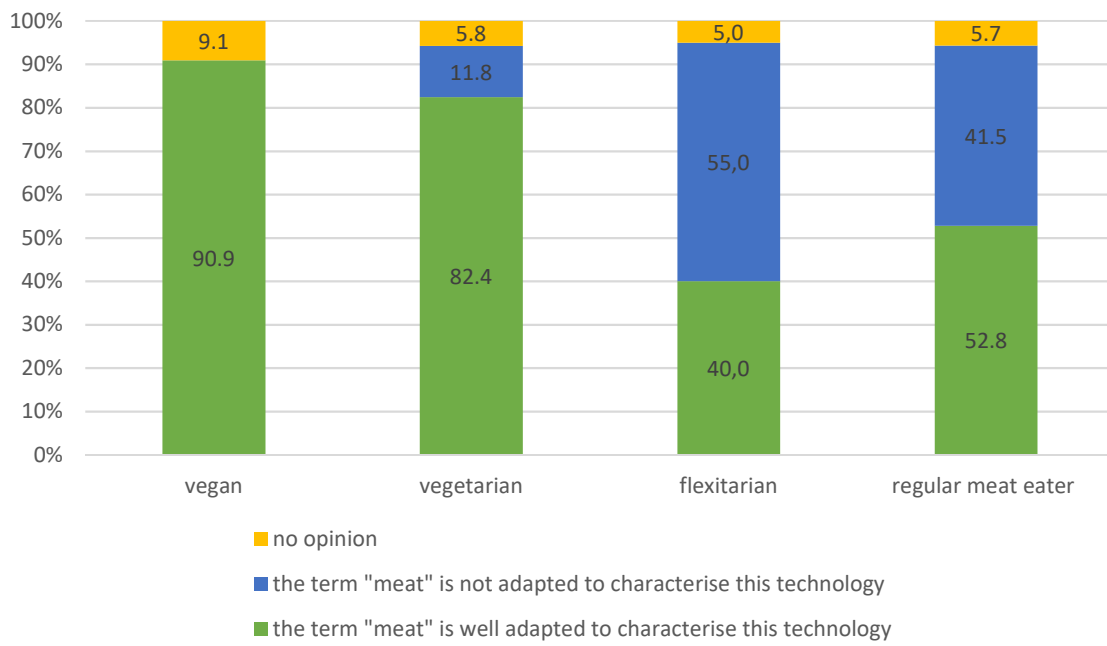


Figure 8: Influence of diet (vegan, vegetarian, flexitarian or regular meat eater) on the desire to keep the term "meat" or not in the name of this new product  
 \*  $\chi^2 = 18.97$ ;  $p = 0.03$

Table 1: Respondents' feelings about muscle fibre culture for food purposes according to their previous knowledge of the product (n = 118)

Quoted terms associated with artificial meat	Prior knowledge of the technology	
	Yes: n=85	No: n=33
Artificial, laboratory, technological	55.3 %	51.6 %
Animal (welfare, breeding)	47.4 %	57.6 %
Organoleptic qualities	38.9 %	21.2 %
Alternative	32.9 %	36.4 %
Ethical, societal issues	31.8 %	39.4 %
Health	29.4 %	15.2 %
Curiosity, questioning	29.4 %	15.2 %
Environment	28.2 %	21.2 %

\* The percentage represents the number of times the term was cited by those with and without knowledge of the technology. For example, the terms 'artificial', 'laboratory' or 'technological' were cited by 55.3% of respondents with prior knowledge of the technology.  $\chi^2 = 19.04$ ;  $p = 0.39$



Table 2: Eventual problems and possible advantages associated with this technology according to respondents (by brain storming process)

<b>Eventual problems (and frequency with which each term was cited)</b>	<b>Possible advantages (and frequency with which each term was cited)</b>
Negative impact on the animal sector (49.2%)	Positive impact on animal health (63.6%)
Risk to human health (40.7%)	Positive impact on environment (56.8%)
Lack of knowledge of the sensory quality of this product (28.8%)	Positive impact on solving the world's hunger problem (22.9%)
Risk associated with the production process (27.1%)	Positive impact on "meat" quality (17.0%)
Environmental risk of the process (23.7%)	Positive impact on human health (9.3%)
Distrust of this new product (23.7%)	Positive impact on economy (9.3%)
Too much artificialization of the product (22.0%)	<b>Positive ethical</b> impact (8.5%)
Negative social impact (21.2%)	Positive impact on traceability (3.4%)

Table 3: Distribution of the respondents depending on their age and diet

Age	Vegan (n=11)	Vegetarian (n=34)	Flexitarian (n=21)	Regular meat eater (n=52)
18-30	4.2% ++	26.3%++	13.6%	23.7% ++
31-50	4.2%	0.8%--	1.7%	9.3%
51 or older	0.8%	1.7%	2.5%	11.0%

The values indicated in the table correspond to the proportion of respondents in total.

The signs ++ / -- associated with a number in a box in the table indicate that the number is significantly higher or lower than the expected number (theoretical distribution according to the chi<sup>2</sup> test). chi<sup>2</sup> = 21.93; p = 0.12

Table 4: Influence of familiarity with the innovation on willingness to try the product  
Chi<sup>2</sup> = 10.14; p = 0.63

	Ready to taste	Not ready to taste	Total
Familiar with this innovation	90.9 %	9.1 %	100 %
<b>Somewhat</b> familiar with this innovation	50.0 %	50.0 %	100 %
Not familiar with this innovation	77.4 %	22.6 %	100 %