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Italian consumers standing at the crossroads of alternative protein sources: Cultivated meat, insect-based and novel plant-based foods

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2 **Italian consumers standing at the crossroads of alternative protein sources:**  
3 **Cultivated meat, insect-based and novel plant-based foods**

4 Maria Cecilia Mancini  
5 Federico Antonioli  
6

7 **1. Introduction**

8 It is widely acknowledged that intensive livestock farming is under pressure due to several factors.  
9 Indeed, it is responsible for about 15% of anthropogenic greenhouse gas emissions (OECD & FAO,  
10 2021) and is associated with the degradation and depletion of land, soil, and water as well as  
11 biodiversity loss (Yitbarek, 2019). Not less importantly, intensive livestock farming is deemed to  
12 treat farmed animals as units of production rather than sentient beings, entailing practices that include  
13 crowded facilities, routine amputations, and brutal slaughter techniques. Besides the animal  
14 discomfort, health and quality issues can arise as animals subject to stress and pain are more prone to  
15 disease and produce lower quality products (Smith & Lewis, 2019).

16 At the same time, population growth and rising incomes in developing countries, together with the  
17 inability of Western consumers to substantially reduce meat consumption (Tobler, Visschers, &  
18 Siegrist, 2012) - despite their nominal willingness to shift towards more sustainable diets (European  
19 Commission, 2013) - will inflate the global demand for meat, with expectations suggesting an  
20 increase by more than two-thirds by 2050 (FAO, 2018).

21 Therefore, food systems are called to implement viable actions to meet the increasing demand for  
22 protein sources while addressing social and environmental priorities. One of the strategies supported  
23 by some actors of the scientific community and policymakers is the promotion of alternative sources  
24 of proteins that are obtained from novel sources, including microorganisms (fungi and bacteria), algae  
25 and microalgae, and insects (Pojić, Mišan, & Tiwari, 2018) or grown in laboratories. Within such a  
26 wider category, an increasing attention are gaining the so-called “meat analogues”, i.e. those  
27 alternatives that approximate the sensory characteristics of animal-sourced meats (Lusk, Blaustein-  
28 Rejto, Shah, & Tonsor, 2022).

29 At the moment being, several factors still affect the commercial success of the majority of novel  
30 protein sources; technical challenges prevail for some of them (Colgrave et al., 2021), whereas  
31 legislative deadlocks are slowing down the market entry of some others.

32 Nevertheless, several reports predict scenarios where the novel alternative proteins would disrupt the  
33 conventional meat industry, unlike the classic vegan and vegetarian meat replacements for which is

34 expected a growth that will not substantially threaten the existence of intensive livestock farming and  
35 the meat industry (e.g. Tubb & Seba, 2021; Gerhardt, 2020).

36 However, a key issue for the future of all novel proteins is consumers' acceptance (see, among others,  
37 Onwezen, Bouwman, Reinders, & Dagevos, 2021; Van Loo, E. J., Caputo, V., & Lusk, 2020).

38 Therefore, the research question of this paper is about the main drivers and obstacles posed by  
39 consumers' perception that foster and hamper the development of those alternative protein sources  
40 that fall within the category of "novel foods", i.e. cultivated meat, insect-based food, and novel plant-  
41 based products.

42 Cultivated meat is defined as the meat produced under lab conditions by introducing muscle cells  
43 (biopsied from donor bovine animals) to a culture medium, where they proliferate under controlled  
44 conditions and develop into muscle fibres (Post, 2012), whereas insect-based food refers to insect  
45 species used for human consumption, both whole or as an ingredient in processed food products such  
46 as burger patties, pasta, or snacks. The third category under analysis is the novel plant-based food  
47 which is made of novel plant-based ingredients, such as heme or seaweed, and includes but is not  
48 limited to those alternatives that approximate the sensory characteristics of animal-sourced meats  
49 (Lusk, Blaustein-Rejto, Shah, & Tonsor, 2022). The conventional plant-based products, such as soy  
50 burgers, are not within the scope of this review, as a category available in the market for many years,  
51 therefore lacking the "novelty" feature and, as mentioned above, is not expected to disrupt the current  
52 livestock chains.

53 More specifically, this paper aims at providing a critical assessment of the available literature on  
54 consumers' perception concerning cultivated meat, insect-based food, and novel plant-based products  
55 with reference to the Italian context.

56 The reason for investigating Italian consumers' perception towards novel proteins is that meat plays  
57 an important role in the Italian traditional cuisine and food culture. Indeed, Italy is where valuable  
58 indigenous cattle breeds are reared and well reputed PDO and PGI<sup>1</sup> meat products are produced. As  
59 Italian gastronomy impacts gourmets and foodies in Europe and worldwide, the understanding of  
60 Italian consumers can play a role to envisage the future of food cultures in other countries, especially  
61 where meat plays a crucial role in daily dishes.

62 Moreover, meat consumption is significant in Italy, making the Italian consumers of meat and meat-  
63 based products of interest if novel sources of proteins took hold as substitutes for conventional meat.

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<sup>1</sup> PDO (Protected Designation of Origin) and PGI (Protected Geographical Indication) products are the result of the combination of human and environmental factors that are characteristic of a specific territory. The PDO and PGI schemes are defined by the Regulation (EU) 1151/2012.

64 In 2021, meat consumption in Italy was about 59 kg per person per year<sup>2</sup>, comprehensive of fresh and  
65 processed meat and meat substitutes, this latter with a negligible 0.1 kg, covering all types of meat-  
66 like products that approximate certain aesthetic qualities (primarily texture, flavour, and appearance)  
67 or chemical characteristics of specific meat. According to Statista (Fig.1), a slight increase in meat  
68 consumption is forecast in the Italian market as the result of two opposite dynamics: on the one hand,  
69 an increasing trend in fresh meat and meat substitutes consumption and, on the other hand, a  
70 decreasing trend of processed meat consumption over the next few years.

71 [Figure 1 about here]

72 These data support the idea that new dietary patterns are taking hold and possibly affecting the Italian  
73 consumers' attitudes towards alternative protein sources. Indeed, according to Coop (2021), Italian  
74 consumers seem to be more and more sensitive to the negative externalities ascribed to the meat sector  
75 and its products for human health, natural resources, and animal welfare. In 2020, more than half of  
76 Italian consumers stated to have reduced meat consumption to meet the principles of ethical  
77 consumption. In the same year, 8% of Italians declared to be vegan or vegetarian (Eurispes, 2021)  
78 and a growing number of consumers labelled themselves as "part-time vegans" (Coop, 2021), a  
79 category including consumers who approach the vegan world motivated by health, animal welfare,  
80 and environmental principles but are unable to fully join a vegan lifestyle.

81 Therefore, the emerging consumption trends pose the question about the Italian consumers'  
82 acceptance of novel protein sources.

83 The remainder of the paper is the following: Section 2 describes the aim and how the literature review  
84 concerning Italian consumers' perception of three novel protein sources has been performed; Sections  
85 3, 4, and 5 focus on the Italian consumers' perception towards the cultivated meat, insect-based foods,  
86 and novel plant-based products, respectively; Section 6 provides an assessment of the state of the art;  
87 while Section 7 concludes with some final remarks.

88

## 892. **Aim and method**

90 In this paper, we aim at providing an assessment of the available literature on consumers' perception  
91 towards three novel protein sources, specifically cultivated meat, insect-based foods and novel plant-  
92 based products, with reference to the Italian context.

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<sup>2</sup> <https://www.statista.com/outlook/cmo/food/meat/italy?>

93 The research used reference databases (i.e., Google Scholar, Scopus, Science Direct), and included  
94 articles from academic journals and papers from conferences over six years (2016-2021). Boolean  
95 operators (AND, OR) were used in the research along with the following keywords: insect,  
96 entomophagy, plant-based, novel, pulses, algae, seaweeds, alternative protein sources, meat  
97 substitutes, meat analogues, synthetic meat, cell-based meat, cultivated meat, clean meat, animal-free  
98 meat and slaughter-free meat, chemical meat, artificial meat, and fake meat associated with the words  
99 Italian, consumer, Italian market, Italy, perception, willingness, and acceptance.

100 While the literature review specifically focused on studies regarding Italian consumers' acceptance  
101 (i.e. 5 for cultivated meat, 16 for insect-based foods and 3 for novel plant-based products Tab. 1),  
102 further wider-focus studies were included when the information provided suited the scope of the  
103 current review.

104

105 [Table 1 about here]

106

### 107 **3. Cultivated meat**

108 Cultivated meat<sup>3</sup> represents a scenario of alternative protein sources, although still in its incipient  
109 phase. Indeed, cultivated meat is yet to be scaled up at the industrial level, besides being eventually  
110 evaluated as a novel food to be allowed into EU markets (Mancini & Antonioli, 2022). Moreover,  
111 tasting experiments are not performed within the EU, and consequently, the literature investigating  
112 Italian consumers' attitude and perceptions towards this (yet abstract) food is weak.

113 The three available surveys on Italian consumers show quite convergent findings. A generally  
114 positive attitude towards cultivated meat was found, ranging from 54 % (Mancini & Antonioli, 2019)  
115 up to 78 % of the respondents willing to try cultivated meat (Palmieri & Forleo, 2021). Positive  
116 perception is mainly focused on cultivated meat as being able to reduce the negative externalities of  
117 intensive livestock farming rather than its intrinsic attributes, i.e. flavour, nutritional and safety  
118 characteristics. Such perception is reasonable since no sensory tests have been performed yet to  
119 support the intrinsic features of cultivated meat, thus entailing unfamiliar feelings among consumers.  
120 Therefore, the main leverages for fostering the acceptance of cultivated meat are rather ethical (i.e.,

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<sup>3</sup> Many terms are used for cultivated meat. Some of the most common are: cultured meat, cell-based meat, in vitro meat, clean meat, synthetic meat, artificial meat, animal-free meat, slaughter-free meat, fake meat. They refer to the same product but imply different perceptions of the product (Mancini & Antonioli, 2022).

121 animal welfare, food security, and environmental concerns) centred and sometimes led by curiosity  
122 towards an untasted food (Palmieri, Perito, & Lupi, 2020; Piochi, Micheloni, & Torri, 2022).

123 Interestingly, the findings of all surveys show that meat-eaters are potentially interested in cultivated  
124 meat more than vegetarians and vegans. This is coherent with several studies according to which  
125 people consume meat not because it comes from an animal, but rather despite the fact it comes from  
126 an animal (Broad, 2020) and cultivated meat would help to relieve their sense of guilt by providing  
127 them with a complement to conventional meat. Quite the opposite, vegetarians and vegans, despite  
128 being in favour of any alternative to intensive livestock farming, do not appear willing to taste and  
129 consume a product that is anyway derived from an animal source.

130 Both very young (under 25) (Mancini & Antonioli, 2019) and young people (under 30) (Piochi,  
131 Micheloni, & Torri, 2022) resulted to be those having the most positive attitude towards cultivated  
132 meat. The educational level proved to be significant in one survey only (Mancini & Antonioli, 2019)  
133 to the extent that the higher the education degree the more positive attitude towards cultivated meat.  
134 The positive perception by youngsters, highly educated respondents, and meat-eaters reflects a  
135 willingness to pay a premium price for cultivated meat (Mancini & Antonioli, 2019).

136 Given the unavailability of cultivated meat on EU markets and the foreseen not too short time horizon  
137 for its placement on supermarkets' shelves, the available exploratory consumer studies devoted much  
138 room to analysing the extent to which information impacts consumers' behaviour.

139 About two-thirds of the Italian consumers declared to have beforehand information on cultivated meat  
140 (Mancini & Antonioli, 2019; Piochi, Micheloni, & Torri, 2022), more than what was found in  
141 previous studies across Europe, conducted a few years earlier (Verbeke, Sans, & Van Loo, 2015).  
142 Consumers awareness has probably been boosted by the increasing attention of the media on the  
143 soaring numbers of high-tech start-ups interested in this product that are attracting huge capital,  
144 sometimes from world-renowned managers or celebrities of the entertainment industry. According to  
145 Mancini & Antonioli (2019), 64% of the participants who were somehow familiar with the topic were  
146 willing to try cultivated meat, whereas this percentage plunged to 40% for respondents who had no  
147 familiarity with it. These findings are coherent with previous research on the sense of unfamiliarity  
148 with novel technologies, such as genetically modified organisms (Frewer et al., 2013) with which  
149 cultivated meat is associated (Verbeke et al., 2015), showing that unfamiliarity leads to a lack of trust  
150 (Siegrist & Sütterlin, 2017), uncertainty, and concerns over potential adverse long-term  
151 consequences.

152 Mancini & Antonioli (2020) also analysed to what extent the provision of positive information affects  
153 the perception and acceptance of cultivated meat by measuring the variation in perception and

154 willingness to try, buy, and pay before and after the provision of positive information related to the  
155 product. The results showed that perception is significantly affected when the information concerns  
156 safety and nutritional characteristics, whereas the opposite occurs regarding the product flavour.  
157 Findings also revealed that, while the willingness to buy increases after providing positive  
158 information, the willingness to try does not. Indeed, willingness to try depends upon further stimuli  
159 other than information, suggesting a deeper analysis of the food profile, and the values underlying it,  
160 of the population of interest. Respondents' perception was less affected by additional information  
161 concerning the externalities of cultivated meat, probably because they were aware of such positive  
162 effects even before the provision of positive information.

163 In Piochi, Micheloni, & Torri (2022), the aim of the investigation was the impact of different types  
164 of information on consumers' response to cultivated meat. Four information types: human safety  
165 (HS); animal welfare (AW); environmental impact (EI); no additional information, were provided to  
166 four samples and it was found that additional information on claims related to HS, AW, and EI aspects  
167 of cultivated meat had a positive effect on increasing favour for cultivated meat and willingness to  
168 substitute conventional meat with cultivated meat. This positive effect of the information in the whole  
169 tested population was not specifically linked to any information type (no significant differences were  
170 found among the blocks of the information nor across claims) although minor effects were found in  
171 some subgroups.

172 Interestingly, both studies by Mancini & Antonioli (2019) and Piochi, Micheloni, & Torri (2022)  
173 found that the provided information impacted females' perception and acceptance more than any  
174 other subgroup whereas information was less effective among older respondents, implying that this  
175 group prefers to maintain established habits, which can be translated into a cautious attitude towards  
176 cultivated meat. Other categories who showed to be less impacted by information were those who do  
177 not eat meat, as well as those who do not intend to reduce meat consumption and those who hold a  
178 lower educational level (Mancini & Antonioli, 2020). The latter is consistent with previous research  
179 reporting that people holding a higher education degree are more likely to engage in analytical  
180 thinking (Sinclair, 2014) rather than emotional attitudes, possibly making them more available to new  
181 food scenarios than lower educated consumers.

182 Sometimes contrasting initiatives are suggested to promote cultivated meat; Palmieri & Forleo (2021)  
183 recommend marketing strategies supported by highly reputed institutions and targeted to those  
184 consumers groups that showed to be most sensitive - young individuals - with the aim of sharing solid  
185 scientific evidence about the potential advantages of new food technologies on health, whereas  
186 Mancini & Antonioli (2020) believe that too much technical information would be counterproductive

187 and rather suggest to combine information with an approach based on the “understanding of the food  
188 identity profile of the members of the population of interest [...] to tap the psychological variables  
189 linked to the system of values that drive food choices” (Faccio & Fovino, 2019, p. 10).

190

#### 1914. **Insect-based food**

192 Italy-related studies on consumers’ behaviour towards entomophagy flourished in the last years; the  
193 strong and rooted Italian food tradition embed certain food neophobia character, attracting the interest  
194 of behavioural applied economists, particularly concerning consumers’ acceptance of novel foods,  
195 such as insect-based ones (Arena et al., 2020; La Barbera, Verneau, Amato, & Grunert, 2018; La  
196 Barbera; Lombardi et al., 2019; Shelomi, 2016; Sogari, Menozzi, & Mora, 2017; Verneau et al., 2016,  
197 2020).

198 The up to now available literature concerning Italian consumers has focused on a few themes, namely,  
199 the main barriers to be overcome for reaching a higher acceptance rate towards insect-based foodstuff,  
200 consumers’ willingness to try and pay for it, as well as the role of information as a driver to increase  
201 consumers’ acceptance of edible insects.

202 More than 50% of the respondents express a low-to-negative acceptance of insect foods in Italy  
203 (Tuccillo, Marino, & Torri, 2020), with a significant exception of a segment, named ‘Rational’  
204 consumer group by Verneau et al. (2020), which shows the highest rate of interest and confirms the  
205 existence of a niche market of ‘early-adopters’ (as this group represents 20% of the respondents’  
206 panel).

207 There’s a consensus that both appearance and taste are the main barriers to be overcome, with gender  
208 and education playing a significant role (Arena et al., 2020; Cicatiello, De Rosa, & Lacetera, 2016;  
209 Palmieri, Perito, Macri, & Lupi 2019; Tuccillo, Marino, & Torri, 2020) to the extent that males, as  
210 well as higher-educated people, show a higher willingness to eat insects. Highly educated people may  
211 embed a stronger environmental awareness, explaining their more positive attitude towards insect-  
212 based food (Cicatiello, De Rosa, & Lacetera, 2016). Moreover, the current literature is unanimous in  
213 finding the more negative attitude of female consumers towards insects, even though little has been  
214 said about the motive for such difference. Cicatiello, De Rosa, & Lacetera (2016) argue that, given  
215 the yet central role of women in housework activities in Italy (as in further Mediterranean countries),  
216 the introduction of insects within the daily diet may be perceived as a household management issue.  
217 Insect foods simply do not adhere to the image of Western consumers’ food, and this probably  
218 represents the most significant barrier to the successful introduction of insect foods into Italian



219 consumers' routine: a strong cultural and psychological prejudice (Tan, Verbaan, & Stieger, 2017),  
220 as Western areas are not experienced nor familiar with insects as food, so that social norms regarding  
221 entomophagy often relates with uncleanliness and health risks (Hartmann, Shi, Giusto, & Siegrist,  
222 2015; Hartmann & Siegrist, 2017; Jensen & Lieberoth, 2019).

223 Neophobia is very often mentioned when consumers' acceptance of edible insects is considered.  
224 Indeed, almost all works blame neophobia as the main enabler for negative sentiments towards insect-  
225 based foods, although Iannuzzi, Sisto, & Nigro (2019) conclude that neophobia itself should not apply  
226 to insect foods as it entirely depends on the nature of the novel food and not on its 'novelty'. That is  
227 to say, there is an anchored behaviour that prevents some consumers to be willing to eat insect foods,  
228 hence cultural references are pivotal.

229 Research investigating the impact of information on consumers' acceptance of insect-based foods  
230 shows controversial findings, mainly dependent upon the type of information provided. Conti et al.  
231 (2018) find that providing information about the nutritional value of eating insect foods – especially  
232 on essential amino acids daily requirements – does not entail any significant increase in participants'  
233 willingness to accept them, in line with several studies (Hartmann, Shi, Giusto, & Siegrist, 2015;  
234 Verbeke, 2015; Iannuzzi, Sisto, & Nigro, 2019); on the contrary, information about the future  
235 challenge of food security that worldwide food systems will have to face seems to play a significant  
236 role in shaping insect foods acceptance into the Italian society, as also asserted by Cicatiello, De Rosa,  
237 Franco, & Lacetera (2016). According to Iannuzzi, Sisto, & Nigro (2019) and Menozzi et al. (2017),  
238 the health and environmental benefits of insect foods seem successful elements on which leveraging  
239 interventions (e.g. advertising campaigns from agri-food companies). According to Lombardi et al.  
240 (2019), when not provided with any piece of information, consumers equally-to-slightly-negative  
241 price insect foods; while, when information on the benefits of insects is given, WTP increases for all  
242 insect-based products and the disgust sensation weakens (Mancini et al., 2019). The idea that peers'  
243 recommendations together with familiarity with the food item increase the willingness to consume  
244 insect foods is cemented by the study of Sidali, Pizzo, Garrido-Pérez, & Schamel (2019), where is  
245 highlighted that introducing cultural contextual information about insects is pivotal for preventing the  
246 false assumptions on this novel food. Indeed, both either personal or close network past experiences  
247 with insect foods represent pieces of information (positively) shaping consumers' attitudes (Conti et  
248 al. 2018; Menozzi et al., 2017; Roma, Ottomano Palmisano, & De Boni 2020). Nevertheless, Arena  
249 et al. (2020) find no significant effect of information on consumers' perception of insect food, as no  
250 statistically significant difference arose between the 'informed' and 'non-informed' groups. This  
251 hints at the fact that consumers' prejudices endure even when positive information is provided (Conti,  
252 Costa, Balzaretto, Russo, & Tedesco, 2018).

253 The little attention paid to the cuisine-related aspects has likely played a major role in the persistence  
254 of negative prejudices (Deroy, Reade, & Spence, 2015; Shelomi, 2016; Vecchione et al., 2012).  
255 Therefore, a path that seems to be crucial for a more targeted behavioural control, is the development  
256 of insect foods by mimicking those food products already rooted in Western diets, like chocolate  
257 cookies or pizza (Arena et al., 2020; Cicatiello, Vitali, & Lacetera, 2020; Iannuzzi, Sisto, & Nigro,  
258 2019; Roma, Ottomano Palmisano, & De Boni, 2020; Sogari, Menozzi, & Mora, 2017). As insect  
259 foods do not adhere to the image of Western consumers' food, processing them beyond recognition  
260 may represent an (initial) step towards their acceptance and routinely consumption. Lombardi et al.  
261 (2019) found that staple (and savoury) foods, like pasta (with insects as ingredients), are deemed more  
262 palatable than sweet foodstuffs such as chocolate bars or cookies: insects are seen as substitutes for  
263 protein hence sweet preparations are less suitable to Italian consumers, as found by more general  
264 studies (Shelomi, 2015; Tan et al., 2015). In line with their conclusions, Conti et al. (2018) find that  
265 insect (salty) snacks are higher appreciated. The way the insect food is prepared and presented  
266 undoubtedly entails a significant impact on the willingness to consume such foods: the lesser the  
267 insect is visible, the higher the probability for the consumer to eat the insect-based product, as this is  
268 valid also for other Western countries (de-Magistris, Pascucci & Mitsopoulos, 2015; Schösler, Boer  
269 de, & Boersema, 2012).

270 There's an important limitation in almost all studies cited above that referred to young and well-  
271 educated consumers, as the majority of studies took place within Italian Universities or relied on  
272 academic networks. This, on the one hand, may find a justification as young and well-educated  
273 consumers will be those potentially consuming insect foods as part of their diet in the next future  
274 (Sogari, Menozzi, & Mora, 2017, 2019), proving to represent the most interesting niche market for  
275 (insect) agri-food companies (Cicatiello et al., 2020; Gmuer, Nuessli Guth, Hartmann, & Siegrist,  
276 2016; Iannuzzi et al., 2019; Roma Ottomano Palmisano & De Boni, 2020; Schouteten et al., 2016;  
277 Verneau et al., 2020) but, on the other hand, such limitation calls for more research efforts towards  
278 different segments within the young-adults bandwidth and testing other types of insect-food products.

279 As a main result, this review suggests that insects may be first introduced as ingredients, coherently  
280 with what was reported by several Western-related works (Caparros Megido et al., 2016; Cunha,  
281 Cabral, Moura, & de Almeida, 2018; Gmuer, Nuessli Guth, Hartmann, & Siegrist, 2016; Iannuzzi,  
282 Sisto, & Nigro, 2019; Roma, Ottomano Palmisano & De Boni, 2020; Tan, Fischer, van Trijp, &  
283 Stieger, 2016). This entails that further technological improvements seem to be needed for a smoother  
284 acceptance of insect foods and to promote their introduction into regular diets (Tan, Verbaan, &  
285 Stieger, 2017). Therefore, such a transitional phase could represent the best-suited marketing strategy

286 to introduce insects into Western diets before a wider diffusion (La Barbera, F., Verneau, F., Amato,  
287 M., & Grunert, K.; Caparros Megido et al., 2016; Iannuzzi, Sisto, & Nigro, 2019; Mancini et al.,  
288 2019).

289

### 2905. **Novel plant-based products**

291 For a long time, soybean has been the most popular ingredient in plant-based meat, although  
292 companies recently started introducing other sources. Eventually, these ingredients have become  
293 prominent due to advances in technology enabling superior functionality, including more meat-like  
294 flavour profiles, textures, and appearances (Lusk, Blaustein-Rejto, Shah, & Tonsor, 2022).

295 To the best of our knowledge, two papers only (Palmieri & Forleo, 2020, 2021), that report the  
296 findings of the same survey, analysed consumers' perception of novel plant-based sources of proteins,  
297 namely seaweeds, in the Italian context at the time of this writing. A third paper focussed on  
298 consumers' perception of the construction of a microalgae production plant rather than the product  
299 microalgae itself. However, some evidence can be drawn. The theme around which Palmieri and  
300 Forleo (2020, 2021) focussed their survey was the overall acceptance, more specifically the  
301 familiarity with seaweeds, and the willingness to try them. As a result, 75% of the sample composed  
302 of 257 Italian consumers had heard about edible seaweed whereas the percentage of those who had  
303 eaten them was not very high (57%) compared with other studies such as Birch, Skallerud, & Paul  
304 (2019), which reported a past consumption of 75% for their sample of Australian consumers.  
305 Nevertheless, 77% of the sample of Italian interviewers were willing to eat seaweed, coherently to  
306 the available literature (Al-Thawadi, 2018; Bührlen, Canavari, & Breitschopf, 2005).

307 The socio-demographic predictors of acceptance, the most common objections and perceived  
308 benefits, as well as the role of information in consumers' perception, are the main issues of the third  
309 research (Lafarga et al., 2021) that investigated the attitude of citizens in Almeria (Spain) and Livorno  
310 (Italy) towards the construction of a microalgae production plant and bio-refinery. One main result is  
311 the weaker consciousness of Italian consumers compared to Spanish respondents about microalgae,  
312 provided that approximately 60–70% of the Italian respondents neither agreed nor disagreed with the  
313 production of microalgae, independently of the location of the facility. What the two cities' samples  
314 resulted to have in common is the socio-demographic response to the extent that the share of  
315 respondents over 49 years old agreeing with the construction of both microalgae's production plant  
316 and bio-refinery was higher than the sample average in both cities, and the higher the educational  
317 attainment, the higher the acceptance rate of respondents.

318 Safety, health, and the economy (i.e., the opportunity for new jobs) are the main reasons for agreeing  
319 with this type of production in the Italian sample, consistently with the motivations mentioned by  
320 Spanish citizens in a survey that took place in 2020 (Lafarga et al., 2021). Not surprisingly and  
321 coherently with other studies about consumers' perception of cultivated meat and insect-based food  
322 (e.g. Mancini & Antonioli, 2020; Conti et al., 2018), information provision positively impacts the  
323 consumers' acceptance levels. Indeed, increasing knowledge about microalgae and microalgae-  
324 derived products led to a shift from undecided respondents to positive answers. Results suggest that  
325 increasing consumer knowledge about the environmental and health benefits of microalgae could lead  
326 to a higher interest in the topic and acceptance of microalgae-based processes and products. The  
327 findings also suggest that information can be used to address consumers' worries, in particular risk  
328 perception which is the key factor influencing consumer interest in production technologies,  
329 coherently with previous research (Cardello, Schutz, & Lesher, 2007).

330 Although the very limited numbers of studies, the available literature agrees in providing two main  
331 recommendations for increasing seaweeds acceptance and consumption; the first one consists of the  
332 promotion of institutional and commercial campaigns to raise awareness about the health  
333 characteristics and the large variety of sensory qualities (such as flavour, texture, and colour) of  
334 seaweeds; and, the second one focuses on getting the consumers acquainted with these products  
335 through seaweeds tasting, especially combined with familiar products such as seaweed-based snacks  
336 (Chapman, Stévant, & Larssen, 2015). For instance, the Italian guidelines for healthy eating,  
337 recommending the consumption of seaweeds as a source of iodine and Vitamin B12, are mentioned  
338 as an excellent tool to increase awareness (Palmieri & Forleo, 2021). It is reasonable to envisage that  
339 more familiarity will gradually turn the consumer into a diet that includes an increasing share of this  
340 product category.

341

## 3426. Discussion

### 343 *6.1 Cross-sectional reading of the literature review*

344 The literature review conducted on consumers' perception towards novel protein sources in the Italian  
345 context reveals a common line of investigation to the extent that the surveys mainly analyse the  
346 barriers and the role of information as a driver for their acceptance.

347 According to the findings, the same profile of consumer is likely to be favourable to both cultivated  
348 meat and insect-based food, i.e. a young and highly educated consumer, with some gender  
349 differences. Indeed, males result more positive than females, this latter becoming favourable once

350 informed about the positive externalities of cultivated meat and insect-based food on the environment  
351 and food security.

352 What is very different in consumers' perceptions towards the two novel products is the distrust origin:  
353 technological for cultured meat, as this being perceived as a food disconnected from the natural  
354 production processes, whereas a culture-related opposition prevails for insects, that are out of the  
355 collective food imagination of Western consumers. The third category – novel plant-based food –  
356 seems to be less problematic, as it does not present the technological and cultural barriers of the other  
357 two novel protein sources.

358 Information results to be the best strategy to increase Italian consumer acceptance of all novel protein  
359 alternatives. Indeed, this is true for cultivated meat, especially at this stage when the consumer is not  
360 able to test the product yet and verify the contents of the information, and for insects and plant-based  
361 food as well. However, the latter categories benefit from two conditions precluded to cultivated meat.  
362 Firstly, insect foods and plant-based products are going to be or are already available for tasting, thus  
363 making their promotion easier to succeed; secondly, they can be easily used as ingredients for the  
364 production of familiar and attempting foods.

365 The main outputs of the literature review are shown in Tab. 2.

366

367 [Table 2 about here]

368

369

370 As a matter of fact, the three alternative protein sources take along specific challenges as they differ  
371 in technological innovation, face different degrees of institutional barriers and have different impacts  
372 on the environment (Mancini & Antonioli, 2022).

373 Indeed, cultivated meat requires a higher degree of technological change compared to plant-based  
374 products or edible insects (Tomiya et al., 2020) and scientists are still working to definitively  
375 overcome some major technical barriers such as an animal-free medium to meet the animal rights  
376 activists' expectations or the production of structured meat cuts, at least for beef production (Allan,  
377 De Bank, & Ellis, 2019). These challenges have led to the assertion that “in vitro meat is still in its  
378 infancy” (Chriki & Hocquette, 2020; p.7). What's promising for the future of cultivated meat is that  
379 such highly technological foods may have an advantage in that they can catch the investments of  
380 innovative companies willing to support technological breakthroughs, which does not seem to be true  
381 for other alternative protein solutions as they lack the involvement of powerful corporates (van der  
382 Weele et al., 2019).

383 The regulatory frameworks differ as well; plant-based protein sources fall under to a large extent  
384 established legislation, whereas insects are gradually gaining EU legal authorizations on diverse  
385 insect-based products<sup>4</sup>; differently from cultivated meat whose legal reference framework seems to  
386 be still very far from a setting in the EU (Seehafer & Bartels, 2019).

387 Lastly, the environmental impact differs among alternative protein categories. Although the early  
388 studies quantified drastic reductions in energy consumption, land and water usage, and energy  
389 consumption for cultivated meat compared to conventional livestock farming (Tuomisto & Teixeira  
390 De Mattos, 2011), it has been more recently acknowledged that the environmental assessment of its  
391 production needs more data, particularly related to inputs and the industrial-scale production (e.g.  
392 Mattick, Landis & Allenby, 2015). Conversely, it is well established that insects require no land,  
393 little food and water for their growth, and have a rapid growth rate (Premalatha, Abbasi, Abbasi &  
394 Abbasi, 2011), whereas plant-based foods tend to be less resource-intensive and environmentally  
395 destructive, especially due to lower levels of greenhouse gas emissions compared to raising animals  
396 for human consumption (Lynch, Johnston & Wharton, 2018) to different extents depending on the  
397 specificity of the production process.

398

## 399 6.2 *Future consumption scenarios*

400 Despite a very uncertain future for some of these alternative protein sources, the report of Tubb and  
401 Seba (2021) depicts two technological innovations - precision fermentation (i.e., the combination of  
402 precision biology with the process of fermentation) and cell-based meat as being able to reduce the  
403 cost of modern foods by up to 80% compared to the products they would replace. A second report by  
404 Gerhardt et al. (2020) predicts a scenario in which cultivated meat represents 35% of the global meat  
405 market in 2040, with the remaining shares divided between conventional (40%) and novel vegan meat  
406 replacements (25%). Unlike classic vegan replacements (e.g., tofu, seitan, mushrooms, or jackfruit),  
407 novel vegan meat replacements would benefit from sensory profiles much closer to conventional meat  
408 due to the use of haemoglobin and binders extracted via fermentation from plants. Whereas classic  
409 vegan replacements are estimated unlikely to grow beyond the current trend, the report forecasts the  
410 disruption of the conventional meat industry due to the inexorable technological progress of start-ups  
411 working on cultivated meat and novel vegan meat replacements, supported by large corporations  
412 funding. The report closes up by stating that cultivated meat will eventually prevail over the novel

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<sup>4</sup> On 10 February 2022, the Commission has authorised the placing on the market of a third insect, *Acheta domesticus* (house cricket).

413 vegan meat replacements in the long run, whereas the latter is depicted as a transitional product  
414 category that will bridge the consumers to the new food model based on cell-based meat.

415 Interestingly, consumer resistance to modern food disruption is not considered a major barrier as  
416 “resistance is never as deep-rooted or intransigent as we may think” (Tubb and Seba, 2021, p. 35).  
417 This still has to be proved in the Italian market, in particular concerning those alternative protein  
418 sources that have not been tasted by consumers yet, in particular cultivated meat and, to a large extent,  
419 insects as well. As mentioned, cultivated meat acceptance finds the main obstacles in food and food  
420 technology neophobia (Palmieri, Perito, & Lupi, 2020; Piochi, Micheloni, & Torri, 2022) and  
421 expectations of taste (Mancini & Antonioli, 2019) whereas entomophagy is mainly rejected based on  
422 the disgust factor (Sogari, Menozzi, & Mora, 2017; Tuccillo, Marino, & Torri, 2020) and the fear of  
423 health risk (Moruzzo, Mancini, Boncinelli, & Riccioli, 2021). Moreover, these two novel foods are  
424 entering the market at a very crucial moment. COVID pandemic and the recent start of the military  
425 conflict in Ukraine represent societal events that seem to beat a negative influence on the acceptance  
426 rate of technological and novelty factors in food production; indeed, Italian consumers tend to  
427 increasingly associate positive perceptions with local, traditional and natural (low-processed) foods  
428 (Coop, 2021).

429 The acceptance of plant-based foods seems to be less challenging, both for their availability – at least,  
430 for some of them - on supermarkets’ shelves, thus making these products more familiar to consumers,  
431 and because they are not perceived as intensively technological processed foods. Therefore, their  
432 acceptance could be quite easily increased by reducing the health risk perception through information  
433 (Lafarga et al., 2021).

434

### 435 *6.3 Communication and promotion strategies*

436 It is likely that environmental sustainability will be one of the main leverages for the promotion of  
437 alternative protein sources in the Italian market, but it is the authors’ suggestion not to underestimate  
438 that the concept of sustainability in Italian consumers’ eyes greatly differs and encompasses several  
439 values. For 33% of Italians, a food product is sustainable when organic, environmentally friendly  
440 produced and does not use additives or antibiotics. A similar percentage associates sustainability with  
441 products made from eco-friendly materials and packaging. For 25 % of Italian consumers,  
442 sustainability has to do with a controlled supply chain, local or domestic production while for 9% a  
443 food product is sustainable when fair remuneration to workers and respect for their rights is granted  
444 (Coop, 2021). Therefore, despite an increasing interest in sustainable food products, the concept of

445 sustainability is subject to a wide range of interpretations that has to be taken into account in the  
446 definition of marketing strategies for alternative protein sources.

447 What seems to be underestimated in the up-to-now available literature concerning Italian consumers'  
448 perception is the role that intermediate institutions may play, in particular producers' associations and  
449 other agents of the conventional meat supply chain. At the time being, despite some concerns  
450 expressed towards all types of alternative protein sources, the spotlight is very much on cultivated  
451 meat. In this regard, Italian producers' associations have addressed major concerns about the future  
452 of national livestock farming. With a production value of almost 10 billion euros, the Italian meat  
453 sector accounts for about one-fifth of the value of national agricultural production; in some areas, it  
454 can even exceed 30% of the value of agricultural production. Livestock farming also activates both  
455 up and downstream agents along the supply chain, such as the feed industry, with a total turnover of  
456 over 7.5 billion euros (Assalzo, 2020), besides the production of PDO and PGI meat products  
457 (Mancini, 2012) which account for 1.9 billion euros, rising to 5 billion euros on the final consumer  
458 market (Ismea - Qualivita, 2021).

459 Producers' associations also claim the remarkable role of animal husbandry in the production of  
460 biogas, electricity and hydrogen, and more generally as a main element for the circular economy.  
461 Furthermore, the by-products of livestock as manure, are a source of nitrogen, besides other essential  
462 organic minerals especially used in organic farming as soil conditioners to improve soil fertility. In  
463 such a framework, some producers' associations have taken action in consumer communication.  
464 Coldiretti, the largest Italian producer association accounting for 1.5 million members, recently issued  
465 a nine minutes video entitled "Frankenstein meat, the future to fear"<sup>5</sup> in which the association explains  
466 its reasons for claiming the potential benefits advocated by cultivated meat supporters false and  
467 misleading. It is interesting to briefly analyse the narrative and the wording chosen for the video  
468 campaign. The video starts by providing a very technical description of the process using scientific  
469 terms<sup>6</sup>. Cultivated meat is then blamed for lack of natural origin, likely to be more environmental  
470 impacting than conventional meat farming and potentially dangerous for human health because of the  
471 residues of organic and chemical molecules in the water. Much room is also devoted to the  
472 explanation of how foetal serum is provided, being extracted by pregnant cows, and the impact that  
473 foetal serum procurement will have on livestock farming that will turn to become a foetal provider.  
474 Cultivated meat is finally presented as a business that will benefit large corporations, thus contributing  
475 to the marginalisation of farmers and the local systems of production.

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<sup>5</sup> [https://www.youtube.com/watch?v=n8RLOGNQ3\\_k](https://www.youtube.com/watch?v=n8RLOGNQ3_k)

<sup>6</sup> As previously mentioned, technical descriptions of novel foods are likely to produce negative reactions by raising a sense of unfamiliarity and discomfort. See also Bryant & Dillard (2019).



476 This resembles an example of how a sectorial association is attempting to preserve the traditional  
477 meat sector by raising societal aversion, disseminating incomplete information and inflating alarmism  
478 on scientific issues that have not been cleared yet by any robust scientific result.

479 It is hardly predictable whether such communication will impact consumer behaviour in particular  
480 those segments who seem to be the potential consumers of cultivated meat: young and highly  
481 educated people who tend to prefer sources of information alternative to institutional bodies.  
482 However, it is likely that some stakeholders' lobbying activities will be able to slow down a  
483 legislation framework favourable to meat analogues and rather support regulations that act as entry  
484 barriers for companies, thus hindering their drive for innovation (Lähteenmäki -Uutela, Rahikainen,  
485 Lonkila, & Yang, 2021).

486 However, what's up most evident in Italy at the moment is the chaotic flow of information provided  
487 by media that misleads consumers. Cell-based meat is often described as an artificial product made  
488 in laboratories from scratch, whose animal cell origin is neglected; moreover, different types of meat  
489 analogues are named under the same term. Newspapers, magazines, television, and social media label  
490 both cultivated meat and plant-based meat as "synthetic meat". Because of the bivalent use of this  
491 term, many consumers believe that cell-based meat is available on the market, raising  
492 misunderstandings that will ultimately damage consumers and potential developments for such novel  
493 foods production. To this extent, producers' associations' intervention is understandable, particularly  
494 their call for a clear legislative framework on the naming/labelling of alternative (hence not even  
495 similar because of a very different nature) products - which is not the case, so far, neither at EU nor  
496 at the national level<sup>7</sup>.

497

#### 4987. **Final remarks**

499 Whereas some authors argue that alternative protein products compete against each other (Sexton,  
500 Garnett, & Lorimer, 2019), the authors' opinion is they are likely to have different roles depending  
501 on their different strengths and weaknesses. Novel plant-based food and edible insects represent a  
502 valuable alternative protein source from the nutritional perspective. Moreover, plant-based food can

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<sup>7</sup> In the case of milk alternative products, the words milk, cheese, cream, and others, were prohibited for products not derived from mammary secretions - see the European Court of Justice case of 2017 'TofuTown' decision that denied the use of dairy names even when they are sided by clarifying designators such as 'vegan' or 'plant-based' (Carreño & Dolle, 2018). Differently, although specific names for beef, pig meat, and chicken are protected, the names referring to shapes and composition of meat products (steaks, sausages, and burgers) are not (Lähteenmäki -Uutela, Rahikainen, Lonkila, & Yang, 2021). An additional confusing factor resides in the differences between EU countries' legislations. An example is provided by the French food labelling law in force since the beginning of 2021 that prevents plant-based products from using names related to the shapes and composition of meat products.

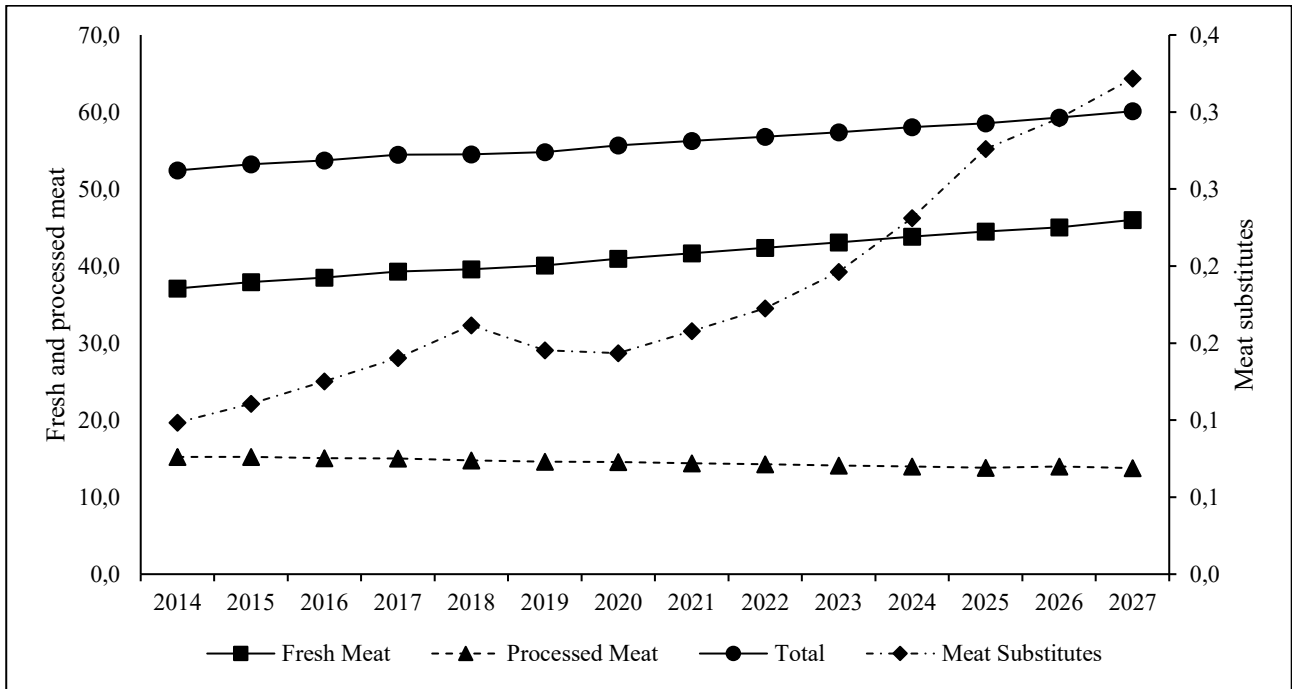
503 be made available to a wide range of consumers, embracing vegetarians and vegans as well. However,  
504 palatability, appearance, flavour, and texture still represent critical weaknesses that need to be  
505 overcome. On the opposite, cultivated meat is an animal's muscle-based product representing the  
506 only meat alternative comparable to traditional meat. This feature makes it unsuitable or undesirable  
507 for some segments of consumers but appealing to some others, specifically meat consumers who are  
508 not willing to reduce or drop out of meat consumption, but are keen to reduce their environmental  
509 impact. However, major barriers, mainly related to the scaling-up of production and the consumer  
510 market price, still have to be overcome. It is currently very hard to predict the market share that these  
511 alternative protein sources will be able to gain in the Italian market but it seems reasonable to envisage  
512 a complementary, if not even partially supplementary, relationship with traditional meat.

513 Many factors play a role in alternative protein source diffusion, including technological progress,  
514 price, industry communication, and, last but not least, institutional support. Indeed, the latter may  
515 resemble the turning point for avoiding harsh confrontations between the traditional meat sector and  
516 societal urgencies. Agri-food policies may need to seriously consider the effects of alternatives on  
517 the conventional side of the production process, offering economic and financial solutions to either  
518 support and smooth the transition from conventional to alternative, or provide aides or solutions to  
519 avoiding a massive exit from the sector and its welfare-related consequences (Mancini & Antonioli,  
520 2022). On the consumption side, the choices of today's very young consumers, supported by their  
521 ethical principles, will contribute to deciding the future of the market for these products.

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524 **Fig.1.** Meat and meat substitutes consumption per capita (kg), Italy (2014-2027)  
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526  
 527  
 528 Source: authors' elaboration on Statista <https://www.statista.com/outlook/cmo/food/meat/italy>  
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| <b>Authors</b>                    | <b>Publication year</b> | <b>Title</b>                                                                                                                                          | <b>Journal</b>                                         |
|-----------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| <i>Cultivated meat</i>            |                         |                                                                                                                                                       |                                                        |
| Piochi et al.                     | 2022                    | Effect of informative claims on the attitude of Italian consumers towards cultured meat and relationship among variables used in an explicit approach | Food Research International                            |
| Mancini, Antonioli                | 2020                    | The role of information on consumer acceptance of Novel Food: The cultured meat                                                                       | BioLaw Journal                                         |
| Mancini, Antonioli                | 2020                    | To What Extent Are Consumers' Perception and Acceptance of Alternative Meat Production Systems Affected by Information? The Case of Cultured Meat     | Animals                                                |
| Palmieri et al.                   | 2020                    | Consumer acceptance of cultured meat: some hints from Italy                                                                                           | British Food Journal                                   |
| Mancini, Antonioli                | 2018                    | 'Exploring consumers' attitude towards cultured meat in Italy                                                                                         | Meat Science                                           |
| <i>Novel plant-based products</i> |                         |                                                                                                                                                       |                                                        |
| Lafarga et al.                    | 2021                    | 'Consumer Attitudes towards Microalgae Production and Microalgae-Based Agricultural Products: The Cases of Almería (Spain) and Livorno (Italy         | ChemEngineering                                        |
| Palmieri, Forleo                  | 2021                    | An Explorative Study of Key Factors Driving Italian Consumers' Willingness to Eat Edible Seaweed                                                      | Journal of International Food & Agribusiness Marketing |
| Palmieri, Forleo                  | 2020                    | The potential of edible seaweed within the western diet. A segmentation of Italian consumers'                                                         | International Journal of Gastronomy and Food Science   |
| <i>Insect-based food</i>          |                         |                                                                                                                                                       |                                                        |
| Arena et al.                      | 2020                    | Exploring consumer's propensity to consume insect-based foods. Empirical evidence from a study in Southern Italy                                      | Applied System Innovation                              |
| Cicatiello et al.                 | 2020                    | How does it taste? Appreciation of insect-based snacks and its determinants                                                                           | International Journal of Gastronomy and Food Science   |
| Roma et al.                       | 2020                    | Insects as novel food: A consumer attitude analysis through the dominance-based rough set approach                                                    | Foods                                                  |
| Tuccillo et al                    | 2020                    | Italian consumers' attitudes towards entomophagy: Influence of human factors and properties of insects and insect-based food                          | Food Research International                            |
| Iannuzzi et al.                   | 2019                    | The willingness to consume insect-based food: An empirical research on italian consumers                                                              | Agricultural Economics                                 |
| Lombardi et al.                   | 2019                    | Willingness to pay for insect-based food: The role of information and carrier                                                                         | Food Quality and Preference                            |

|                   |      |                                                                                                                                      |                                                      |
|-------------------|------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| Mancini et al.    | 2019 | Factors predicting the intention of eating an insect-based product                                                                   | Foods                                                |
| Palmieri et al.   | 2019 | Exploring consumers' willingness to eat insects in Italy                                                                             | British Food Journal                                 |
| Sidali et al.     | 2019 | Between food delicacies and food taboos: A structural equation model to assess Western students' acceptance of Amazonian insect food | Food Research International                          |
| Sogari et al.     | 2019 | The food neophobia scale and young adults' intention to eat insect products                                                          | International Journal of Consumer Studies            |
| Conti et al.      | 2018 | Survey on food preferences of university students: from tradition to new food customs?                                               | Agriculture                                          |
| Sogari et al.     | 2018 | Sensory-liking expectations and perceptions of processed and unprocessed insect products                                             | International Journal on Food System Dynamics        |
| Menozzi et al.    | 2017 | Eating novel foods: An application of the Theory of Planned Behaviour to predict the consumption of an insect-based product          | Food Quality and Preference                          |
| Sogari et al.     | 2017 | Exploring young foodies' knowledge and attitude regarding entomophagy: A qualitative study in Italy                                  | International Journal of Gastronomy and Food Science |
| Cicatiello et al. | 2016 | Consumer approach to insects as food: barriers and potential for consumption in Italy                                                | British Food Journal                                 |
| Verneau et al.    | 2016 | The effect of communication and implicit associations on consuming insects: An experiment in Denmark and Italy                       | Appetite                                             |

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531 Source: authors' elaboration.  
532 **Table 1.** List of references per category of alternative protein foods.  
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|                          | <b>Drivers for consumption</b>                                                                                                                                                                                                                                                                                                                                                             | <b>Barriers to consumption</b>                                                                                                                                                                                          | <b>WTT*</b>                                                                                                                                                                                                                                                                                                                          | <b>WTB**/<br/>WTP***</b>                                                                                                                                                                                                                                         | <b>Profile of potential consumer</b>                                                                                                                                                                                                                                                                                         | <b>Recommendations</b>                                                                                                                                                                                                                                                                                                     |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Cultivated meat</b>   | <ul style="list-style-type: none"> <li>Ethical centred externalities (Mancini &amp; Antonioli, 2019) and curiosity (Palmieri et al., 2020; Piochi et al., 2022).</li> <li>Information on safety and nutritional characteristics (information overcomes rejection in particular when addressed to females).</li> <li>Familiarity with the topic (Mancini &amp; Antonioli, 2019).</li> </ul> | <ul style="list-style-type: none"> <li>Unfamiliarity (Mancini &amp; Antonioli, 2019; Palmieri et al., 2020; Piochi et al., 2022).</li> </ul>                                                                            | <ul style="list-style-type: none"> <li>78 % of the respondents (Palmieri &amp; Forleo, 2021).</li> <li>64% of those familiar with the topic; 40% of respondents who had no beforehand information (Mancini &amp; Antonioli, 2019).</li> <li>Additional information does not increase WTT (Mancini &amp; Antonioli, 2019).</li> </ul> | <ul style="list-style-type: none"> <li>WTB increases after positive information (Mancini &amp; Antonioli, 2019).</li> <li>Youngsters, highly educated respondents, and meat-eaters are more willing to pay a premium (Mancini &amp; Antonioli, 2019).</li> </ul> | <ul style="list-style-type: none"> <li>Meat eaters (Mancini &amp; Antonioli, 2019; Palmieri et al., 2020; Piochi et al., 2022).</li> <li>Very young (&lt;25) (Mancini &amp; Antonioli, 2019) and young people (&lt;30) (Piochi et al., 2022).</li> <li>Highly educated consumers (Mancini &amp; Antonioli, 2019).</li> </ul> | <ul style="list-style-type: none"> <li>Scientific communication on health advantages to young individuals (Palmieri &amp; Forleo, 2021).</li> <li>Combining information with an approach based on the understanding of the food identity profile of the population of interest (Mancini &amp; Antonioli, 2020).</li> </ul> |
| <b>Insect-based food</b> | <ul style="list-style-type: none"> <li>Information on environmental and health related externalities (Cicatiello et al., 2016; Menozzi et al., 2017; Sisto &amp; Nigro, 2019; Sidali et al., 2019).</li> <li>Either personal or close network past experiences with insect foods (Menozzi et al., 2017; Conti et al. 2018; Roma et al., 2020).</li> </ul>                                  | <ul style="list-style-type: none"> <li>Appearance and taste (Cicatiello et al., 2016; Palmieri et al., 2019; Arena et al., 2020; Tuccillo et al., 2020).</li> <li>Cultural rejection (Iannuzzi et al., 2019)</li> </ul> | <ul style="list-style-type: none"> <li>Low WTT due to cultural prejudice (Iannuzzi et al., 2019).</li> <li>Familiarity increases WTT (Sidali et al., 2019).</li> </ul>                                                                                                                                                               | <ul style="list-style-type: none"> <li>After information, WTP increases and the disgust sensation weakens (Mancini et al., 2019).</li> </ul>                                                                                                                     | <ul style="list-style-type: none"> <li>Highly educated and male consumers (Cicatiello et al., 2016).</li> </ul>                                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>Development of insect-based foods by mimicking familiar food products (de-Magistris et al., 2015; Sogari et al., 2017; Iannuzzi et al., 2019; Lombardi et al., 2019; Arena et al., 2020; Roma et al., 2020; Cicatiello et al., 2020).</li> </ul>                                    |
| <b>Plant-based food</b>  | <ul style="list-style-type: none"> <li>Safety, health and positive economic impacts are the main reasons for consumers' acceptance of seaweed plants (Lafarga et al., 2021).</li> <li>Environmental and health related info (Lafarga et al., 2021)</li> </ul>                                                                                                                              |                                                                                                                                                                                                                         | <ul style="list-style-type: none"> <li>77% of the sample (Palmieri &amp; Forleo 2020; 2021).</li> </ul>                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                  | <ul style="list-style-type: none"> <li>The higher the educational attainment of respondents, the higher the acceptance of construction of seaweed plant (Lafarga et al., 2021).</li> <li>Over 49 years old respondents agree on seaweed plant construction above the sample average (Lafarga et al., 2021)</li> </ul>        | <ul style="list-style-type: none"> <li>Promotion through campaigns about the health characteristics and sensory qualities and getting the consumers acquainted through seaweeds tasting, combined with familiar products (Palmieri &amp; Forleo, 2020; 2021).</li> </ul>                                                   |

\*Willingness to try (WTT)\*\*willingness to buy (WTB) \*\*\*willingness to pay (WTP)

Source: authors' elaboration.

**Table 2.** Main findings of literature review on consumers' acceptance of cultivated meat, insect-based and plant-based food within the Italian context

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