



Willingness to consume insects among students in France and Ireland

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Abstract

Acceptance of insect-containing foods remains low among European consumers. This study aims to explore the factors affecting willingness to consume insects among students in two European countries with different culinary traditions, namely France and Ireland. An online survey was developed and distributed in both countries, with 183 participants (France: n = 103; Ireland: n = 80) included in total. While more participants in France (43.7%) had a positive opinion of entomophagy compared to the ones in Ireland (21.3%), no significant difference was found in their willingness to consume insects for the first time. When given information on the approval of insects as a novel food in Europe, students in France were significantly more willing to consume insects than students in Ireland. For both groups, food neophobia and disgust were impediments to entomophagy. Moreover, males older than 30 yr enrolled in engineering courses, not following a specific diet, more concerned about the environment and health and less about familiarity, culture and religion were the most willing to consume insects. Participants in France and Ireland were more willing to consume insects if they were tasty or disguised (invisible) in another product and not if they were presented in their usual form ('whole'). This case study shows that entomophagy acceptance is affected by the characteristics of the products, food neophobia, disgust and food choice motives of the consumers, while the impact of information on regulation is country dependent. These findings could be the starting point to guide the development of insect-containing foods acceptable to consumers in Europe.

Keywords

Entomophagy • food disgust • food neophobia • regulations

Introduction

Over the past 50 yr, meat intake has seen a substantial increase worldwide (Sans & Combris, 2015; Parlasca & Qaim, 2022) with daily values rising generally from 61 g to 80 g per capita (Sans & Combris, 2015). The overconsumption of meat has been linked to innumerable health issues and a high ecological footprint (Rust *et al.*, 2020). Furthermore, the human population continues to grow (United Nations, 2022), subsequently increasing the demand for meat and protein sources threatening in this way food security (Teneva *et al.*, 2023). Therefore, it has become crucial to explore alternative sustainable proteins to maintain food security and to mitigate the ecological footprint and health concerns associated with increased meat consumption.

Generally, insects are of high nutritional value (Rumpold & Schlüter, 2013; Ordoñez-Araque & Egas-Montenegro, 2021) due to the significant levels of protein they contain (44.5 g/100 g of yellow mealworm for example) (EFSA NDA

Panel *et al.*, 2021a), and they have the potential to be used as ingredients for the development of functional foods (Devi *et al.*, 2022). Moreover, insect production has been found to emit significantly less greenhouse gasses and ammonia compared to livestock production (Oonincx *et al.*, 2010; Oonincx & De Boer, 2012). Realising the potential of insects to become a sustainable alternative to conventional meat, the European Commission recently authorised the production and marketing of four insect species based on the risk assessment conducted by EFSA (EFSA NDA Panel *et al.*, 2021a, b, c, 2022). Therefore, at this stage, more initiatives can be taken to pave the way towards a wider acceptance of entomophagy. To successfully introduce insects as food, it is essential to investigate their acceptability by consumers. Generally, consumers from Western countries have been reported to be more reluctant to consume insects compared to consumers who live in Asian countries (Hartmann *et al.*, 2015; Tan *et al.*, 2015).

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This difference could be attributed to the differences in culture echoing Rozin's (2007) argument that culture is the factor that mostly influences consumer food choices. A cross-cultural study conducted by Tan *et al.* (2015) in Thailand and the Netherlands revealed that 'cultural exposure' has an influence on entomophagy perception. Similarly, Chinese consumers who generally have an entomophagy culture were reported to be more willing to consume insects than German consumers with no entomophagy culture (Hartmann *et al.*, 2015). Even between European countries, differences have been found in their entomophagy acceptance. Consumers from Norway, for example, had a higher acceptance than those from Portugal (Ribeiro *et al.*, 2022), whereas those in Finland and Sweden had a more positive perception compared to those in Germany and the Czech Republic (Piha *et al.*, 2018).

It was also noted that countries with a deep-rooted culinary tradition, such as France or Italy for example, were less open to novel foods compared to other Western countries (Siegrist & Hartmann, 2020; Toti *et al.*, 2020), as was shown when comparing Italian and Danish consumers (Verneau *et al.*, 2016). Ireland, however, which is not linked with a strong culinary tradition and long food history (Mac Con Iomaire, 2018), has different food practices to those of France, for example (Healy, 2014). Yet, Ireland is known for its farming background (Kelly, 1997) and as shown, people with a farming background tend to be more attached to their farming traditions and thus less open to try new foods particularly insect-containing foods (Verbeke *et al.*, 2015). Therefore, a comparative study between these Western countries (France and Ireland), as this study aims, can increase the understanding of the willingness towards entomophagy. In addition, since food products are now being traded on a global level, cross-cultural research has become essential in providing insight into the cultural differences in food preferences (Goldman, 2006). There is currently limited information on the entomophagy acceptance among consumers in France (Gallen *et al.*, 2019; Jellouli & Bree, 2022), as it was also highlighted in the study by Kröger *et al.* (2022), and in Ireland (Herbert & Beacom, 2021; Kane & Dermiki, 2021). Moreover, to the best of our knowledge, this is the first cross-cultural study to be conducted between these two countries among students.

Apart from one's culture, other factors have been found to affect the willingness of consumers to consume insects. Sociodemographic factors such as gender (Verbeke, 2015), age (Laureati *et al.*, 2016), level of education (Cicatiello *et al.*, 2016), field of education (Menozzi *et al.*, 2017; Kane & Dermiki, 2021) and the type of diet followed by consumers (Gere *et al.*, 2017; Sogari *et al.*, 2019; Kröger *et al.*, 2022) have been shown to influence willingness to practice entomophagy. Likewise, food neophobia and food disgust have been identified in past studies as factors that can affect entomophagy acceptance (Hartmann & Siegrist, 2016; La

Barbera *et al.*, 2018; Lombardi *et al.*, 2019; Kane & Dermiki, 2021; Alhujaili *et al.*, 2023). Willingness to consume insects has also been shown to depend on the characteristics of the product being consumed and on whether a consumer has had previous experience or knowledge of entomophagy. For example, a trend in past studies has revealed that consumers are less willing to consume insects if they are visible and presented whole in their usual form compared to if they are invisible and disguised as an ingredient of a food product familiar to them (Lammers *et al.*, 2019; Orsi *et al.*, 2019; Kane & Dermiki, 2021; Ribeiro *et al.*, 2022). Moreover, consumers who have previous experience with entomophagy are more likely to be open to trying insects again as they would have become more familiar with the concept (Hartmann *et al.*, 2015; Verbeke, 2015; Cicatiello *et al.*, 2016; Megido *et al.*, 2016; Verneau *et al.*, 2016; Lammers *et al.*, 2019; Palmieri *et al.*, 2019; Sogari *et al.*, 2019; Barton *et al.*, 2020; Petersen *et al.*, 2020). As a result, since the aforementioned factors have been shown to be relevant in influencing entomophagy acceptance, this study aimed to determine their influence on the willingness to consume insects among consumers in France and Ireland. Furthermore, as young, educated people are often more open to trying new foods (Faccio & Guiotto Nai Fovino, 2019) and are aware of sustainability issues (Su *et al.*, 2019), it would be noteworthy to investigate students' acceptability to consume insects. While there is information on students from various western countries (Sogari *et al.*, 2017; Petersen *et al.*, 2020), there is limited information regarding students in France and Ireland (Kane & Dermiki, 2021). Additionally, considering the recent development in the European Union where four insect species have been approved for marketing and human consumption (Regulation [EU] 2021/1975; Regulation [EU] 2022/169; Regulation [EU] 2022/188; Regulation [EU] 2023/58), it is important to explore entomophagy acceptance among European consumers and how knowing this new regulation affects their willingness to consume insects. Therefore, this case study aims to answer the research question which consumer-related factors affect the willingness of students in France and Ireland to consume insects as food for the first time and after knowing the regulatory framework, and which product characteristics of the insect-containing foods would influence their willingness to do so. The findings of this study could guide product development, education and marketing strategies towards the consumption of insect-containing foods in the two countries.

Materials and methods

Paradigm

A pragmatic paradigm encompassing a convergent parallel explanatory mixed-methods approach (Creswell, 2014) was

used to answer the research question of this case study. A survey consisting of open- and closed-ended questions was employed to collect qualitative (Qual) and quantitative (Quan) data. Qualitative data and review of the literature were used to explain the quantitative data collected (thus the study is explanatory). Figure 1 shows the methodological approach followed in this study. Factors affecting the willingness to consume insects as food were measured under three conditions: (1) willingness to consume insects for the first time without the provision of information, (2) willingness to consume insects after being provided with information on the current regulatory framework, and (3) willingness to consume insects based on seven product characteristics (see Figure 1).

Sample and survey design

An online survey approved by the Research Ethics Committee of the Institute of Technology Sligo (IT Sligo) in Ireland (Ref No. 2020045), was developed using Qualtrics™. This survey was distributed between 21 May and 8 June 2021, to a convenience sample (Teddlie & Yu, 2007) of students studying in IT Sligo, Galway Mayo Institute of Technology in Ireland and Polytech Clermont in France, using the internal email systems of these Institutes. It was also published on social media (Facebook and LinkedIn). The survey was distributed in the English language to the participants studying in Ireland while it was translated into French for the French participants. Translation was conducted by a translator and was back-translated by the native speakers (Ms Priya Vishnumurthy) and the rest of the authors with the help of the translator. In total, there were 225 responses; however, 37 were excluded because they did not answer all the questions and 5 either did not consent to the participant information sheet or were

not studying in France or Ireland. Thus, 183 participants were included in the analysis. There were more French participants ($n = 103$) than Irish participants ($n = 80$), yet the number of each sample was sufficient for further analysis.

The first section of the survey explored factors affecting participants' food choices, based on a combination of the multi-item food choice questionnaire developed by Steptoe *et al.* (1995) and the single-item food choice questionnaire developed by Onwezen *et al.* (2019). This section aimed to partly answer the research question exploring consumer-related factors affecting willingness and was used to identify whether acceptance is affected by food choice motives such as tradition, sensory appeal, convenience or environmental impact, as was shown in previous studies (House, 2016; Sogari *et al.*, 2017; Manditsera *et al.*, 2018; Schlup & Brunner, 2018; Kornher *et al.*, 2019). In this case, participants were asked to rank 10 items presented to them in terms of importance starting with the most important (1) to the least important (10). The next section included seven items of the Food Neophobia Scale (Ritchey *et al.*, 2003) and three items of the Food Disgust Scale (Hartmann & Siegrist, 2018) related to insects as commonly used in past studies, since insect consumption has been associated with neophobia and disgust (Hartmann & Siegrist, 2016; La Barbera *et al.*, 2018; Lombardi *et al.*, 2019). Participants were asked to rate on a five-point Likert scale their agreement to specific statements related to food neophobia and disgust (see Supplementary Table S1). Some of the statements of the food neophobia scale were reverse sentences (see Supplementary Table S1) that measured food neophilia.

Questions related to previous knowledge, experience and opinion of entomophagy were included since previous studies

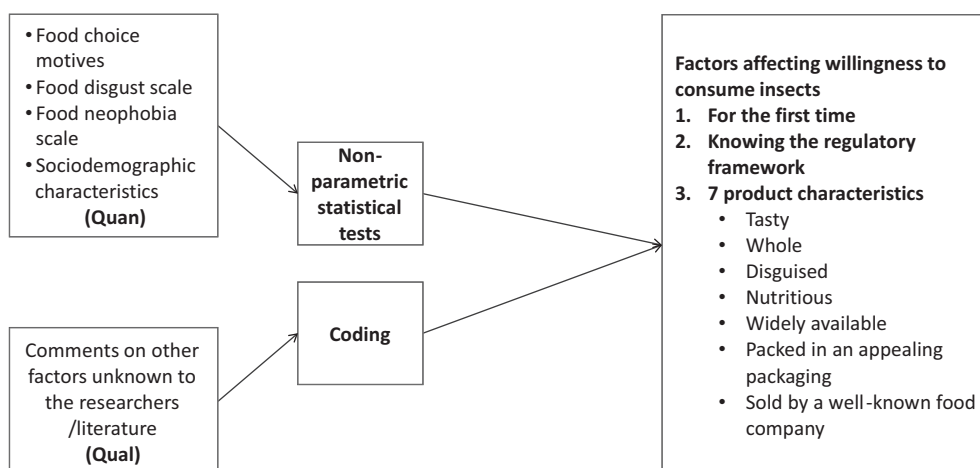


Figure 1. Representation of the mixed methods approach (Quan (quantitative) and Qual (qualitative)) used to answer the research question of this study.

had shown that people who had already tried insects were more willing to consume them again (Barton *et al.*, 2020; Kane & Dermiki, 2021). Participants with no previous experience of entomophagy were asked to indicate whether they were willing or not to consume insects for the first time. Participants were also asked to indicate on a five-point scale (from 1: "I would definitely not eat" to 5: "I would definitely eat"), their willingness to consume insects when presented with products with different characteristics regarding the visibility of the insects ('disguised' or 'whole') (Hartmann & Siegrist, 2016), taste (House, 2016; Manditsera *et al.*, 2018), nutritive qualities (Kane & Dermiki, 2021) or marketing strategies (produced and sold by a well-known food company, packed in an appealing packet, widely available) (Sogari *et al.*, 2017; Lignou & Oloyede, 2021), as seen in Figure 1.

Information about the regulatory framework regarding the production and sale of insects (EFSA NDA Panel *et al.*, 2021a) was given to the participants to determine whether knowledge of the regulatory framework would impact their willingness to consume insects. It should be noted that when this study was conducted (May to June 2021), the dried yellow mealworm/*Tenebrio Molitor* larva was the only insect species which had been approved by the European Parliament for human consumption and for this reason information on this species was included in the study. Participants were provided with this statement 'Insects grown and sold for human consumption are prepared following food safety regulations. Recently EFSA (European Food Safety Authority) has confirmed that dried yellow mealworm (*Tenebrio molitor* larva) is safe for human consumption and its consumption is not nutritionally disadvantageous (source: <https://doi.org/10.2903/j.efsa.2021.6343>)' and then they were asked 'Knowing the regulatory framework would you be willing to consume insects?' to which they had to answer yes or no.

Open-ended questions were also included whereby participants were asked to provide reasons behind their willingness or unwillingness to consume insects. In this way, qualitative data were used to explain the quantitative data obtained from the close-ended questions, with the intention of enhancing the validity of the data collection (Zohrabi, 2013). In the last section of the survey, participants were asked to provide information related to their sociodemographic information such as age, gender, nationality, farming background, level and field of studies and eating habits (whether they followed a specific diet, and which diet they followed), to explore the effect of sociodemographic characteristics on willingness to consume insects as food (Figure 1). These questions were presented at the end of the survey to avoid any bias generated by unconscious fit to stereotypes linked with answers to those questions (Steel, 1997).

Statistical analysis of quantitative data

Statistical tests were conducted using SPSS (IBM SPSS Statistics 27, IBM Corp, Armonk, NY, USA) to analyse the quantitative data derived from the closed-ended questions of the surveys. One Irish participant was neither male nor female, and only one French participant was enrolled in an environmental engineering course (see Table 1). Therefore, only in the case of assessing the effect of gender and field of study on the willingness to consume insects, these two students were not considered, respectively, because the groups were not balanced.

Four of the seven questions related to food neophobia rate the level of neophilia, and the answers to these were reverse-coded to represent food neophobia.

The willingness to consume insects for the first time was analysed among the participants who claimed to have never consumed insects before ($n = 120$). Thereafter, the willingness to consume insects depending on the different product characteristics and after being provided with information on the current regulatory framework (see Figure 1) was analysed among all the participants ($N = 183$).

To overcome issues of unequal variances between groups and unequal numbers of cases in the different groups, the effect of the sociodemographic characteristics, food neophobia, food disgust and food choice motives on the willingness to consume insects was analysed using non-parametric tests (see Table 2). Significance was determined at $P < 0.05$. Friedman test followed by post hoc pairwise comparison with a Bonferroni correction for multiple comparisons was used to find if there were differences in the ranks of the food choice motives and the insect-based product characteristics preferred by participants (Laerd Statistics, 2005).

Analysis of qualitative data

To analyse the effect of diet on the willingness to consume insects, the participants were grouped into two categories viz. those who follow a specific diet (vegans, vegetarians, etc.) and those who do not.

Codes were generated from the answers provided by the participants to the open-ended questions. These codes which were based on the literature (deductive) that emerged from the data (inductive) (Fereday *et al.*, 2006) were subsequently grouped into themes following the six steps of thematic analysis as described by Braun & Clarke (2006, 2021). Thereafter, content analysis (Vaismoradi *et al.*, 2013) was employed whereby the frequency of each theme was counted and presented in charts and when comparing participants studying in France and Ireland, percentages were used. Coding was done by the two researchers (PV and MD), firstly independently followed by a consensus on the final codes and themes presented.

Table 1: Profile of the participants from pooled data ($N = 183$), participants studying in France and Ireland, including comparison of the two groups (France vs. Ireland) using a Pearson chi-square test

Profile	Total ($N = 183$)		Country of study				Significance
	N	%	France ($n = 103$)		Ireland ($n = 80$)		
			n	%	n	%	
Gender							
Male	76	41.5	43	41.7	33	41.2	
Female	106	57.9	60	58.3	46	57.5	
Other	1	0.5	0	0	1	1.3	
Age (years)							
18–29	152	83.1	101	98.1	51	63.8	***
30 and older	31	16.9	2	1.9	29	36.3	
Level of education							
Secondary	48	26.2	30	29.1	18	22.5	
Third level	81	44.3	46	44.7	35	43.8	
Post-graduate	54	29.5	27	26.2	27	33.8	
Field of study							
Other engineering	49	26.8	47	45.6	2	2.5	***
Food or biological engineering	34	18.6	31	30.1	3	3.8	
Other science	32	17.5	2	1.9	30	37.5	
Environmental science	19	10.4	1	1.0	18	22.5	
Other field	19	10.4	15	14.6	4	5.0	
Social science and business	18	9.8	6	5.8	12	15.0	
Food and nutrition science	11	6.0	0	0	11	13.8	
Environmental engineering	1	0.5	1	1.0	0	0	
Following a specific diet							
No specific diet	148	80.9	91	88.3	57	71.3	*
Follow a specific diet	35	19.1	12	11.7	23	28.8	
Farming background							
Yes	35	19.1	16	15.5	19	23.8	
No	148	80.9	87	84.5	61	76.3	
Have you ever heard about entomophagy							
Yes	159	86.9	92	89.3	67	83.8	
No	24	13.1	11	10.7	13	16.3	
Opinion of entomophagy							
Positive	62	33.9	45	43.7	17	21.3	**
Neutral	83	45.4	44	42.7	39	48.8	
Negative	38	20.8	14	13.6	24	30.0	
Have eaten insects							
Yes	63	34.4	39	37.9	24	30.0	
No	120	65.6	64	62.1	56	70.0	
Number of times insects were consumed ¹							
Once	33	52.4	23	59.0	10	41.7	
A few times	29	46.0	16	41.0	13	54.2	
I usually eat insects	1	1.6	0	0	1	4.2	

In bold: the group with the highest percentage within a variable, when statistically significant differences were observed.

¹Based on the total number of participants who had consumed insects before ($N = 63$).

* = $P < 0.05$, ** = $P < 0.01$, *** = $P < 0.001$.

Table 2: Statistical tests used to investigate the effect of the different factors on the willingness to consume insects for the first time, after knowing the regulatory framework and depending on the product characteristics of the insect-based foods

Effect of	On	Statistical test used
Gender, age, diet, country of study, farming background, previous knowledge and previous experience, opinion	Willingness to consume insects for the first time AND Willingness to consume insects knowing the regulatory framework	Pearson chi-square
Food neophobia, food disgust, food choice motives		Mann–Whitney <i>U</i> test
Gender, age, specific diet, country of study, farming background, previous knowledge and previous experience	Willingness to consume insects depending on the product characteristics of the insect-based foods	Mann–Whitney <i>U</i> test
Education level, field of study, opinion on entomophagy		Kruskal–Wallis <i>H</i> test
Food neophobia, food disgust, food choice motives		Spearman's correlation

Coding was further confirmed for the French language by the translator in order to ensure the validity and reliability of the analysis.

Results

Participants' profile

The profile of the participants can be seen in Table 1. Generally, about an equal percentage of females and males, as well as students, from France (56.3%) and Ireland (43.7%) participated. However, most of the participants were under the age of 30 and almost half had completed third-level education (undergraduate). Only 19% of the participants came from a farming background, and despite the higher percentage of students in Ireland coming from a farming background, this difference was not statistically significant (see Table 1). Table 1 also shows that while most of the participants (pooled data) had heard about entomophagy before, only about a third had eaten insects mostly either 'once' or 'a few times' before. Moreover, about half had a neutral opinion of entomophagy. However, there were about two times more participants in France with a positive opinion of entomophagy compared to participants in Ireland ($\chi^2(2) = 12.891, P = 0.02$).

Factors affecting willingness to consume insects

Effect of country of study

Table 3 presents information on the willingness to consume insects for the pooled data and for each country of study. As seen from the pooled data, only 49.2% of participants were willing to try insects for the first time, while after being informed about the regulatory framework, this percentage increased to 65.6% ($\chi^2(1) = 20.092, P < 0.001$). In relation to the product characteristics, participants were more willing to consume insects 'if they were tasty', followed by 'if they were disguised in another product that I like' and 'if they

were nutritious' and less willing 'if they were whole' ($\chi^2(6) = 354.611, P < 0.001$).

Participants' country of study had no significant effect ($P > 0.05$) on their willingness to consume insects for the first time; however, it significantly affected their willingness to consume insects after knowing the regulatory framework ($\chi^2(1) = 4.104, P = 0.043$), with 71.8% of students in France being more willing to consume insects after knowing the regulatory framework compared to 57.5% of students in Ireland (see Table 3). When observing the findings on the product characteristics, Mann–Whitney *U* test showed that the place of the study had a significant effect ($P < 0.05$) on the willingness to consume insects 'if they were whole', 'if they were disguised in another product that I like' and 'if they were tasty'. For these three product characteristics, willingness scores for students in France were 1.2 to 1.3 times higher than students in Ireland. Nevertheless, the place of the study had no significant effect ($P > 0.05$) on the willingness to consume insects with the other four product characteristics (see Figure 1).

Considering the mean willingness scores regarding the insect-based product characteristics, the option 'if they were tasty' had the highest mean rank for both French (mean rank = 5.62, $\chi^2(6) = 250.014, P < 0.001$) and Irish (mean rank = 4.95, $\chi^2(6) = 127.807, P < 0.001$) participants. Moreover, the options 'if they were disguised in a product that I like' and 'if they were nutritious' received the second (5.31) and third (4.36) highest mean ranks, respectively, for French participants and the third (4.36) and second (4.56) highest mean ranks, respectively, for Irish participants. However, the option 'if they were whole' had the lowest mean rank for both French (2.65) and Irish (2.53) participants.

To analyse the effect of participants' sociodemographic characteristics (excluding the effect of country of study) on their willingness to consume insects for the first time, after knowing the regulatory framework and based on the different product characteristics, the pooled data of both groups of students studying in France and Ireland were used. This was

Table 3: Willingness to consume insects for the first time, after knowing the regulatory framework and depending on the product characteristics for the pooled data, and for the two countries

	Total	France	Ireland	Significance
Willingness to consume for the first time				
Yes	49.2%	56.3%	40.0%	
No	50.8%	43.8%	60.0%	
Regulatory framework				
Yes	65.6%	71.8%	57.5%	*
No	34.4%	28.2%	42.5%	
Insect-based product characteristics (mean willingness score \pm s.d.)				
If they were whole	2.60 \pm 1.33	2.78 \pm 1.30	2.36 \pm 1.34	*
If they were disguised in another product that I like	3.72 \pm 1.41	4.08 \pm 1.22	3.25 \pm 1.51	**
If they were tasty	3.90 \pm 1.30	4.21 \pm 1.10	3.50 \pm 1.43	**
If they were nutritious	3.46 \pm 1.35	3.56 \pm 1.23	3.34 \pm 1.48	
If they were produced and sold by a well-known food company	3.16 \pm 1.35	3.17 \pm 1.28	3.14 \pm 1.44	
If they were packed in an appealing packet	2.96 \pm 1.31	2.97 \pm 1.26	2.95 \pm 1.39	
If they were widely available (in my usual grocery store)	3.18 \pm 1.40	3.22 \pm 1.38	3.13 \pm 1.44	

In bold: the highest significant figure within each test (comparing the two countries).

* = $P < 0.05$, ** = $P < 0.01$.

done since the respective sample sizes ($n = 103$ for French and $n = 80$ for Irish) were not large enough to be further divided into different groups within each sociodemographic category for statistical analysis.

Effect of gender and age

The effect of gender on the willingness to consume insects can be seen in Table 4. There was no significant difference ($P > 0.05$) between male and female participants in their

Table 4: Effect of gender on the willingness to consume insects for the first time, after knowing the regulatory framework and depending on the product characteristics

	Male	Female	Significance
Willingness to try insects for the first time (% within gender)			
Yes	44.8	55.2	
No	31.1	68.9	
Regulatory framework (% within gender)			
Yes	76.3	57.5	*
No	23.7	42.5	
Insect-based product characteristics (mean willingness score \pm s.d.)			
If they were tasty	4.30 \pm 1.05	3.60 \pm 1.39	*
If they were disguised in another product that I like	3.96 \pm 1.29	3.53 \pm 1.47	*
If they were nutritious	3.87 \pm 1.27	3.16 \pm 1.33	*
If they were widely available (in my usual grocery store)	3.58 \pm 1.33	2.89 \pm 1.39	*
If they were produced and sold by a well-known food company	3.51 \pm 1.30	2.90 \pm 1.33	*
If they were packed in an appealing packet	3.22 \pm 1.27	2.77 \pm 1.32	*
If they were whole	3.00 \pm 1.37	2.30 \pm 1.24	*

In bold: the highest figure within each test.

* = $P < 0.05$.

willingness to try insects for the first time. However, male participants were significantly more willing to consume insects after knowing the regulatory framework compared to female participants ($\chi^2(2) = 7.435, P = 0.024$). Similarly, participants' gender had a significant effect ($P < 0.05$) on their willingness to consume insects for each of the seven product characteristics studied. Depending on the product characteristic considered, male participants had 1.12–1.30 times higher mean willingness scores than female participants. However, the preference ranking of the seven product characteristics was the same for male and female participants. For instance, the statement 'if they were tasty' had the highest mean rank for both males (5.41) and females (5.26), while the statement 'if they were whole' had the lowest score for males (2.74) and females (2.50).

Participants' age (18–30 yr old vs. older than 30 yr old) had no significant effect ($P > 0.05$) on their willingness to consume insects for the first time or after knowing the regulatory framework. However, it had a significant effect ($P < 0.05$) on the willingness to consume insects for the following product characteristics; 'If they were nutritious', 'If they were produced and sold by a well-known food company' and 'If they were packed in an appealing packet'. For these three characteristics, participants over 30 yr old had about 1.2 times higher mean willingness scores than those under 30 yr old. Nevertheless, the participants' age had no significant effect ($P > 0.05$) on their willingness to consume insects when considering the other product characteristics studied (see Figure 1).

Effect of level and field of study

Participants' level of study had no significant effect ($P > 0.05$) on their willingness to consume insects under all three aspects studied. Participants' field of study could not be tested on the willingness to consume insects for the first time since there were too many groups. It was found however to have a significant effect ($P < 0.05$) on the willingness to consume insects, 'If they were disguised in another product that I like' and 'If they were tasty'. Engineering students were the most willing to consume insects when the insect-containing foods had these two product characteristics (4.32 ± 0.95 and 4.32 ± 0.98 mean willingness scores, respectively), followed by students in Food and Nutrition Science (3.73 ± 1.19 and 4.18 ± 1.17 mean willingness scores, respectively). Students in Social Science and Business were the least willing to consume insects in this case (2.89 ± 1.57 and 2.89 ± 1.61 mean willingness score, respectively).

Effect of farming background and diet

Participants' farming background had no significant effect ($P > 0.05$) on their willingness to consume insects under all three aspects studied. Similarly, following a specific diet or not had no significant effect ($P > 0.05$) on the willingness to consume

insects for the first time or after knowing the regulatory framework. However, participants who followed no specific diet were 1.2 times more willing (4.04 ± 1.21 mean willingness score) to consume insects if they were tasty than those following a specific diet (3.30 ± 1.57 mean willingness score).

Effect of previous knowledge and experience

Having heard about entomophagy before had a positive impact on the willingness to consume insects for the first time ($\chi^2(1) = 10.348, P < 0.001$) and after knowing the regulatory framework ($\chi^2(1) = 20.144, P < 0.001$) regardless of the country of study. Previous experience with entomophagy had a positive impact on the willingness to try insects after knowing the regulatory framework ($\chi^2(1) = 20.092, P < 0.001$). In addition, those with previous experience were more willing to consume insects for each of the product characteristics evaluated compared to those without experience ($P < 0.001$).

Effect of food neophobia and food disgust

The high Cronbach's alphas ($P > 0.7$) revealed that the items of the food neophobia and food disgust scales had high internal consistency; however, without factor analysis, we could not prove that the scales were unidimensional (Gliem & Gliem, 2003). For this reason, findings are reported using the individual items of each scale (see Supplementary Tables S1–S4). Generally, when observing the pooled data (results not shown), food neophobia and food disgust items had a significantly negative effect ($P < 0.05$ and $P < 0.01$) on the willingness to consume insects from any aspects tested.

Considering the willingness to consume insects for the first time and after knowing the regulatory framework, the mean food neophobia and food disgust scores of both groups were significantly higher ($P < 0.05$) for the unwilling group than for the willing group, while for the items related to food neophilia the opposite was observed (see Supplementary Tables S2 and S3).

Considering the willingness to consume insects depending on the different product characteristics, the higher the score for the different items of food neophobia and food disgust score, the lower the mean willingness score was for all product characteristics (see Supplementary Table S4). This showed that there was an effect of food neophobia and disgust on the willingness to consume insects for each of the product characteristics assessed for both groups (France vs Ireland). This effect was observed from the negative correlation between food neophobia, food disgust and the different conditions. Interestingly for the participants in Ireland, the item of food disgust 'There is a maggot in the cherry I want to eat' was not correlated with any of the product characteristics of the insect-based foods except with the statement 'I would eat them if they were whole'. The same group also found that statement more disgusting compared to the group in France.

Effect of food choice motives

Looking at the pooled data, there were significant differences in the distribution of the participants' food choice motives 'It fits in my religion/tradition/culture', 'It is healthy' and 'It is environmentally friendly' ($P < 0.05$) depending on whether they were willing or not to consume insects for the first time. Those willing to consume insects for the first time were more concerned about healthy and environmentally friendly products and less concerned about tradition, religion and culture. Moreover, when considering the willingness to consume insects after knowing the regulatory framework, there were significant differences in the distribution of the food choice motives 'It has no preservatives', 'It is familiar', 'It fits in with my religion/tradition/culture', 'It is healthy' and 'It is environmentally friendly' ($P < 0.05$) between the willing and the unwilling participants in both countries (results not shown). Participants willing to consume insects after knowing the regulatory framework were more concerned about consuming healthy and environmentally friendly products with no preservatives and less concerned about religion, tradition, culture and familiarity.

Regarding the effect of participants' food choice motives on their willingness to consume insects with certain product characteristics, willingness score and food choice motives scores were reversed. Therefore, a positive correlation means that the more important a motive was for participants in their food choice, the less willing they were to consume insect-based food with such characteristics, while a negative correlation means the opposite. Regarding Irish participants, familiarity and fit with culture were positively correlated, while taste, lack of preservatives and health were negatively correlated with the different insect-based product characteristics. Yet, for French participants, visual appeal, familiarity and fit with culture were positively correlated, while taste, being animal friendly, lack of preservatives, being healthy and environmentally friendly were negatively correlated with the factors under which insects could be consumed (see Supplementary Table S5).

When comparing the two groups, there was a significant difference in the distribution of the food choice motive 'it looks appealing' which was more important for the participants in France. Friedman test showed that for participants from both countries the motive 'It tastes good' had the highest mean rank, while the motives 'It is healthy' and 'It has a good price' received the second and third highest mean ranks, respectively, while the motives 'It has no preservatives' and 'It fits with my religion/tradition/culture' had the lowest mean ranks.

Table 5 summarises the main findings derived from the analysis of the quantitative data, showing whether the factors investigated had a significant effect on the willingness to consume insects for the first time, after knowing the regulatory

Table 5: Summary of the factors affecting the willingness to consume insects as food

	Willingness to consume		
	For the 1st time	After knowing the regulatory framework	Insect-containing foods with different product characteristics
Gender	x	✓	✓
Age	x	x	✓
Diet	x	x	✓
Previous knowledge	✓	✓	✓
Previous experience	n.a.	✓	✓
Level of study	x	x	x
Field of study	x	n.a.	✓
Farming background	x	x	x
Country of study	x	✓	✓
Food neophobia	✓	✓	✓
Food disgust	✓	✓	✓
Food choice motives	✓	✓	✓

n.a. not applicable because the analysis was not possible to be conducted.

✓The statistical analysis revealed that there was a significant effect at $P < 0.05$.

xThe statistical analysis revealed that there was no significant effect.

framework and the willingness to consume insect-containing foods with different product characteristics.

Other factors affecting the willingness to consume insects

Figures 2 and 3 present the themes associated with the reasons (as generated from the analysis of the qualitative data) for which participants in France and Ireland with no previous experience of entomophagy were unwilling/willing to consume insects for the first time. Participants in both countries had mostly the same reasons for not trying insects and many were just not willing for no specific reason (see Figure 2). However, only participants in France were concerned about the product characteristics. These participants claimed that they were unwilling to consume insects in their usual form but if they were 'prepared', 'transformed' and 'cooked in a wholesome meal' they might try them. For many participants in France, sensory appeal was the reason most frequently mentioned for their unwillingness to consume insects and while it was important for the participants from Ireland, disgust and ethical concerns were the most frequent themes that emerged from their comments. Ethical concerns were associated with comments such as 'the right to live' and those associated with the diet of the participants. This is not surprising if we consider

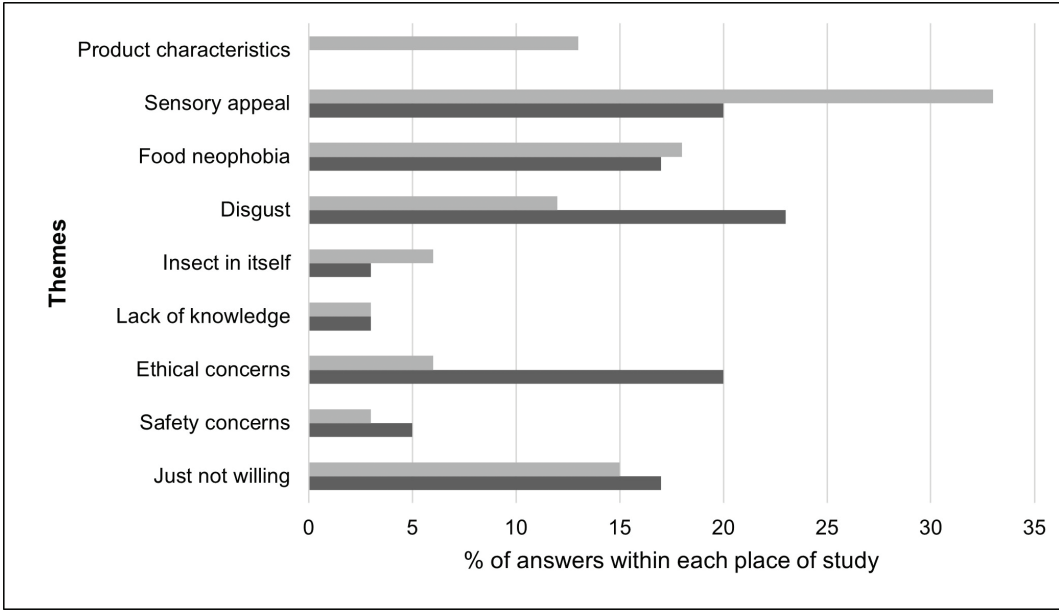


Figure 2. Themes associated with the reasons participants in France (■) and Ireland (■) with no previous experience of entomophagy were not willing to try insects and percentages of each theme within each group.

that a higher number of participants from Ireland followed a specific diet.

Although, as seen in Figure 2, a significant number of participants were not willing to consume insects for any reason, a small number of participants in Ireland when asked why they would consume insects mentioned ‘why

not’ or that they would consume under any condition (see Figure 3). The latter could be considered a positive opinion about entomophagy. Many participants in Ireland and fewer in France gave neophilia as well as environmental and animal concerns as reasons for which they were willing to try insects. In terms of neophilia, they mentioned that they

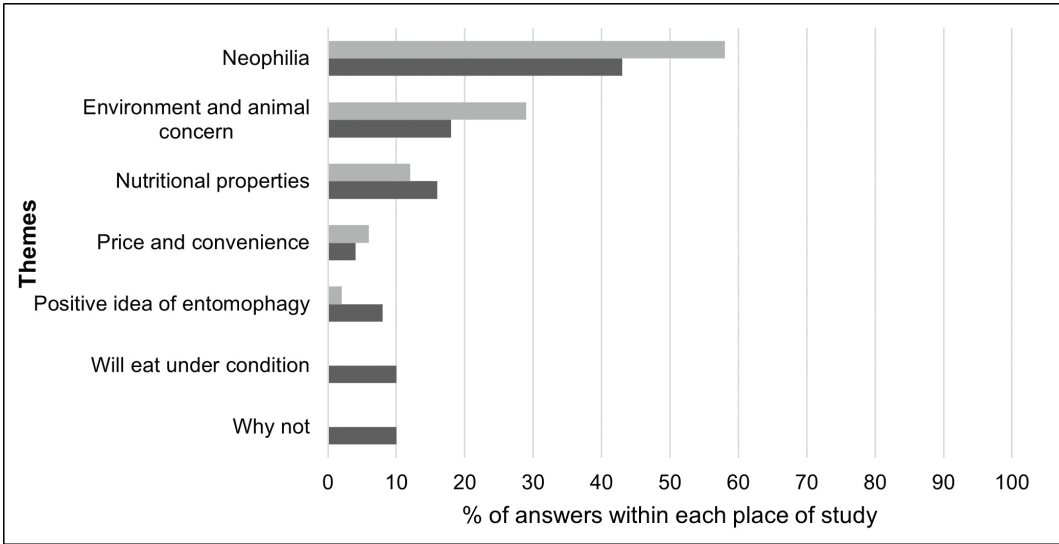


Figure 3. Themes associated with the reasons for which participants in France (■) and Ireland (■) with no previous experience of entomophagy were willing to try insects and percentages of each theme within each group.

would taste insects out of curiosity, because it is a new food or because they seek sensation which is also linked to their answer 'why not'. In both countries, a small number also mentioned the nutritional properties of insects as a driver for their consumption and an even smaller number mentioned price and convenience.

The other factors that could influence participants in France or Ireland to consume insects can be seen in Figure 4. These factors represent the themes generated from the analysis of the qualitative data derived from the open-ended question: 'Are there any other factors that would influence your decision to eat insects?'. Interestingly, a significant number of participants in Ireland mentioned they would never consume insects under any condition. Participants in France would be more influenced by texture, price, the type of insects and having them dead compared to participants in Ireland. Participants in Ireland were more concerned about the origin of insects than participants in France. Both groups preferred to have the insects processed which agrees with the fact that the statement 'I would consume insects if they were disguised in a product that I like' was ranked second highest for both groups of participants. Although texture was more important for participants in France, appearance was important for both groups while taste was less important. Some important themes

were social influence and education around insects and safety concerns in relation to consumers and the environment.

Discussion

This study explored the effect of sociodemographic factors (country of study, gender, age, level and field of study, diet, farming background, previous knowledge and experience), food neophobia, food disgust and food choice motives on the willingness of students studying in France and Ireland to consume insects as measured under three conditions (see Table 5). Of the 12 consumer-related factors investigated, only four (previous knowledge, food neophobia, food disgust and food choice motives) had a significant effect on the willingness to consume insects for the first time. This suggests that willingness to consume insects regardless of the product characteristics or information surrounding entomophagy, depends on participants' usual food choice motives, whether they have heard of entomophagy before or not as well as the extent to which they fear novelty or feel disgust towards entomophagy. The findings on the importance of food neophobia and disgust are further supported by the qualitative data that revealed that participants in both countries would

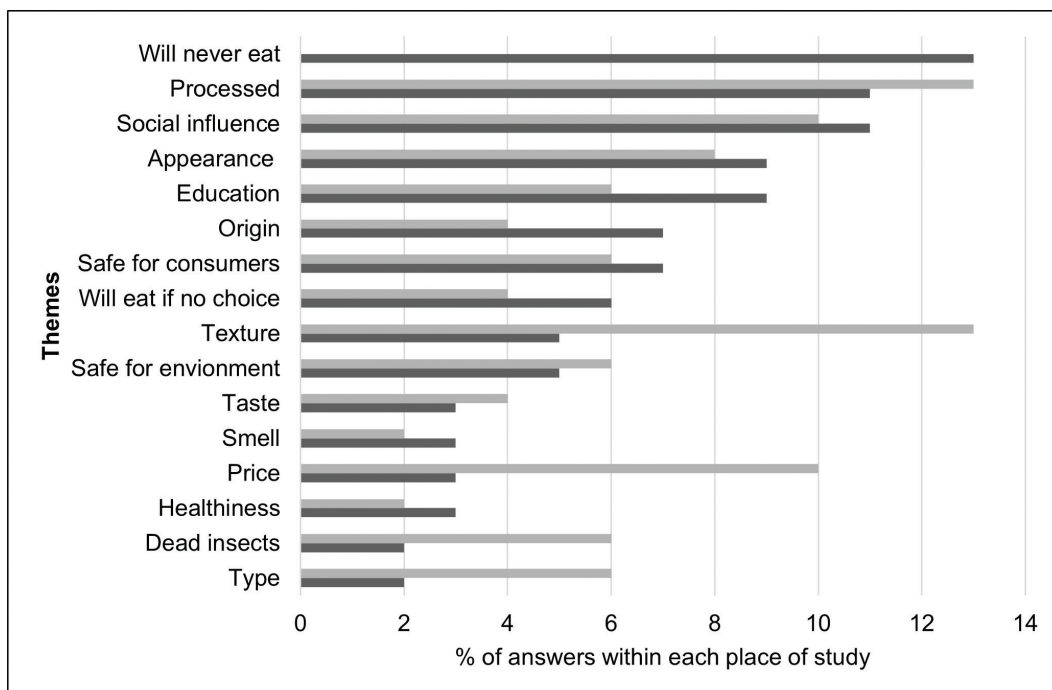


Figure 4. Other factors that could influence the willingness of participants in France (■) and Ireland (■) to consume insects as revealed from the analysis of the open-ended question “are there any other factors that would influence your decision to consume insects?”, and percentage of each theme within each group.

not be willing to consume insects due to feelings of disgust or because they are reluctant to try them under any condition as seen in Figure 2.

In addition, food neophobia and food disgust had a significant effect on the willingness to consume insects after knowing the regulatory framework (see Supplementary Table S3). These findings agree with previous findings of researchers who explored acceptance of entomophagy in other countries (Hartmann & Siegrist, 2016; La Barbera *et al.*, 2018; Lombardi *et al.*, 2019; Ribeiro *et al.*, 2022) showing that food neophobia and food disgust significantly affected willingness to consume insects in general regardless of the country. For example, Hartmann *et al.* (2015) found that the impact of food neophobia on willingness to consume insects was equally high in Germany and China in spite of the fact that Chinese participants were more willing to consume insects compared to German participants. Other studies have reported that the effect of food neophobia on the willingness to consume insect-based products was product-dependent and depended on the visibility of the insects (Ruby *et al.*, 2015; Kröger *et al.*, 2022). However, in the current study, food neophobia and disgust had a significant effect on the willingness to consume insect-containing foods with all the different product characteristics tested (Supplementary Table S4).

This study explored for the first time whether information on the regulatory framework would affect willingness to consume insects. As seen from the findings in Table 3, more participants were willing to consume insects after being informed about the regulatory framework compared to those who were willing before being informed. It could have been that this information assured participants of the safety of insects since safety concerns were raised by some participants as one of the reasons for their unwillingness to consume insects (see Figure 2) similar to what was found by Kane & Dermiki (2021). This provision of information on the regulatory framework resulted in more male consumers being willing to consume insects compared to female consumers, confirming the gender effect on acceptance of entomophagy in line with other published literature (Verbeke, 2015; Bartkiewicz, 2017; Sogari *et al.*, 2019; Kulma *et al.*, 2020; Kane & Dermiki, 2021). Although most of the studies showing the effect of gender were exploring willingness for the first time, a study by Barsics *et al.* (2017) found that providing information about entomophagy to participants had a positive impact on male participants' overall liking of insect-based bread and not on the female participants (Barsics *et al.*, 2017). The regulatory framework informs consumers how a particular insect species is safe for human consumption. This information could have reduced the level of food disgust often associated with the rejection of unsafe food (Rozin & Fallon, 1987) among male participants in this study. The current study also found that men were more willing to consume insect-containing foods

with all the different product characteristics tested, which is different from other studies that reported an effect of gender only when insects are visible and not when they are invisible (Lammers *et al.*, 2019; Orsi *et al.*, 2019).

Significantly more participants in France were willing to try insects after knowing the regulatory framework compared to participants in Ireland. Since participants from both countries were concerned about the safety of the insects as seen in Figure 2, this effect of country of study could have been because more participants in France had a positive opinion towards entomophagy in the first place as seen in Table 1. Country of study also influenced the willingness to consume insects based on the different product characteristics with participants from France being more willing to consume insects if they were tasty or disguised in a different product. This is echoed by the comments made by French participants on being unwilling to consume insects if not processed but only if they were 'prepared', 'transformed' and 'cooked in a wholesome meal'. Another explanation for the effect of the country of study on the willingness to consume insects could be the fact that more participants in Ireland followed a specific diet that could have affected their opinion about insects. Besides, vegans and vegetarians would not be willing to consume insects as these are considered animals (Elorinne *et al.*, 2019). This is further confirmed by the findings in Figure 2 where participants in Ireland mentioned that they were 'just not willing to consume insects' because of ethical concerns associated with the 'animal welfare' and because of the 'diet they followed'.

Yet another reason that could explain the differences in willingness to consume insects between the two groups was the fact that the students in the two countries were enrolled in different courses. Based on the descriptive statistics presented in Table 1, significantly more participants from France were enrolled in Engineering courses and these were significantly more willing to consume insects compared to participants from Ireland who were enrolled in Social Science and Business courses. This connection could also explain why participants from France were significantly more willing to consume insects if they are tasty or disguised in another product (same finding to that of Engineering students, results not shown). While participants' field of study affected their willingness to consume insects after knowing the regulatory framework and based on the different product characteristics, their level of study had no effect. This finding corroborated the findings of Menozzi *et al.* (2017) and Kane & Dermiki (2021) who found students' field of study to have a significant impact on their entomophagy acceptance. Since an innovative mindset is essential for engineering (García-Peñalvo & Colomo-Palacios, 2015) as well as food and nutrition (Lobefaro *et al.*, 2021) fields, the possibility that students enrolled in these courses are exposed to the concept of entomophagy through their studies could

explain the reason they were more willing to consume insects. Although in previous studies, level of education was found to affect the willingness to consume insects (Szendrő *et al.*, 2020), this was not the case in the current study where most participants had at least third-level education.

The age of the participants did not have any significant effect on most aspects of their willingness to consume insects except under marketing- and nutritional-related product characteristics. For instance, participants older than 30 yr old were more willing to consume insects if they were packed in an appealing packet, if they were produced and sold by a well-known food company and if they were nutritious. Brand (Bontemps *et al.*, 2008), packaging (Fernqvist *et al.*, 2015) and nutritional value (FAO, 2021) are factors that have been linked to increased costs of food products, so it could be possible that price might not have been an issue for the older participants in this study though further research would be needed to confirm this. A study conducted by Kane & Dermiki (2021) on Irish students revealed older participants to be more willing to consume insects instead of meat compared to the younger ones. However, there is a disharmony in past studies regarding their reports on the effect of age on the willingness to consume insects (Alhujaili *et al.*, 2023). While some researchers reported no effect of age (Rumpold & Langen, 2019; Schäufele *et al.*, 2019), most studies found younger consumers to be more willing to consume insects (Verbeke, 2015; Laureati *et al.*, 2016; Wilkinson *et al.*, 2018; Sogari *et al.*, 2019; Kulma *et al.*, 2020) as these were more aware of the sustainability benefits associated with entomophagy compared to older consumers (Sogari *et al.*, 2019). Yet other studies conducted in countries with an entomophagy culture found older consumers being more willing to consume insects as these were linked with a more entomophagy experience than younger consumers (Payne, 2015; Liu *et al.*, 2019). This disharmony in findings possibly points to the need for further research to be conducted to ascertain the effect of age in various countries. Therefore, future studies could focus on more than two age groups and explore a more representative sample of the population in France and Ireland.

Ireland is a country with a strong farming background, but the current study showed no significant effect of farming background on the willingness to consume insects from all aspects tested, possibly due to the small number of participants in this study who had a farming background. Similarly, a recent study on indirect entomophagy conducted among consumers and farmers in Ireland reported no significant differences between these two groups regarding their willingness to consume foods from animals fed with insect-based feed though these findings could also not be generalised due to sample size restrictions (Ranga *et al.*, 2023). Therefore, a representative sample of the population including those with and those without a farming background

in the two countries (France and Ireland) is suggested to be investigated.

The motives behind participants' usual food choices seeped into their view of entomophagy. Taste was the most important food choice motive of participants from both countries; it was also the product characteristic under which all participants were most willing to consume insects. This is similar to what was reported by Herbert & Beacom (2021), Reed *et al.* (2021) and Kane & Dermiki (2021) where taste was the most powerful factor in convincing students to consume insects, interestingly more powerful than the nutritional and environmental benefits of insects (Herbert & Beacom, 2021). Nevertheless, the taste of insects could only influence participants in the current study who were not following any specific diet to consume them. It could be assumed that those following a specific diet would need a more convincing reason than the taste of a product, to step outside their usual diet. In this study, nonetheless, the food choice motives associated with health and environmental benefits of food products were also found to positively influence willingness to consume insects, which were also mentioned among the other reasons they would consume insects as seen in Figure 4. While taste was the most important insect-based product characteristic considered by participants in this study, other researchers have found that for those who have not consumed insects before, willingness to try insects depends on taste expectation rather than on actual taste (Cicatiello *et al.*, 2016; Alhujaili *et al.*, 2023) and only after their first experience can one continue to consume insects based on the actual taste experience (House, 2016; Herbert & Beacom, 2021). Therefore, it may be that since providing information on the regulatory framework also increased entomophagy acceptance as shown in the current study, intervention strategies aimed at informing consumers of the recent updates in this framework along with the health and environmental benefits of entomophagy could encourage consumers to have their actual taste experience when presented with an opportunity. Moreover, since insects have been generally perceived as unappealing (Baker *et al.*, 2016), and unfamiliar (Tan *et al.*, 2015) in countries without an entomophagy culture, this could explain why those who gave importance to the appealing, familiarity or culture and tradition in making food choices in this study were less willing to consume insects.

Echoing the findings of past studies (Balzan *et al.*, 2016; Kane & Dermiki, 2021; Ribeiro *et al.*, 2022), participants in the current study were mostly unwilling to consume insects if they were visible ('whole') in their usual form and preferred if they were not visible but rather fully incorporated/disguised in other foods. Tan *et al.* (2015), however, reported that although some consumers preferred visible insects to chocolate-coated ones, those who had little or no previous experience with entomophagy preferred if the insects were not visible. This

could explain why French and Irish participants in this study generally preferred insects as food when they are not visible as only about a third of them had previous experience with entomophagy.

Regardless of the country of study, the positive effect of previous knowledge on the willingness to consume insects for the first time or after knowing the regulatory framework corroborates the findings of other researchers in the field as shown in the recent review by Kröger *et al.* (2022). Previous experience also resulted in a higher willingness to consume insects under the different product characteristics tested. This could be explained by the fact that exposure can increase familiarity and decrease food neophobia and disgust, that negatively affect willingness to consume insects. Therefore, the more studies are conducted to determine entomophagy acceptance among consumers, perhaps the more the concept could become familiar to them, indirectly. This is especially true for those experimental studies that allow participants to taste insect-based food.

This study had a number of strengths and limitations. One of the limitations was the small sample size ($N = 183$) and therefore results of this study could not be generalised for all students studying in France and Ireland. However, these results could guide future studies exploring willingness to consume insects among this group of consumers and expand this to the general population of these countries. Another limitation of this study was the use of relatively new scales such as the single item for the food choice motives and the items from the food disgust. Yet, the qualitative data collected in the form of open-ended questions added validity to the study scales used, since they confirmed the importance of disgust, food neophobia and neophilia among the participants in the two countries. We also recommend that future studies exploring entomophagy acceptance among students in France and Ireland use other scales on food neophobia and disgust not used in this study (e.g., the Food Technology Neophobia Scale by Cox & Evans (2008), the disgust subscale of the Entomophagy Attitude Questionnaire by La Barbera *et al.* (2020) and the Insect Phobia Scale by Moruzzo *et al.* (2021)) for a different perspective and comparison purposes.

On the other hand, the current study had a number of strengths. For example, this was the first study that compared student participants from France and Ireland, aiming to fill the gap in the literature of cross-cultural studies. The findings were confirmed by other single country studies. Another strength was that this is the first study that explored the effect information on the regulatory framework might have on the willingness to consume insects. Moreover, future studies could explore the willingness to consume the different insect species being approved in the European Union among students in France and Ireland since other studies have found

willingness to vary depending on the type of insect species (Tuccillo *et al.*, 2020; Alhujaili *et al.*, 2023).

Conclusions

The aim of this study was to determine the factors affecting the willingness of students studying in France and Ireland to consume insects for the first time, after having information on the regulatory framework, and based on different product characteristics. The factors investigated in this study (country of study, gender, age, level and field of study, farming background, diet, previous knowledge and experience, food neophobia, food disgust and food choice motives) affected willingness to consume insects differently depending on the aspect tested. Overall, those most willing to consume insects were students in France, male, enrolled in engineering courses, not following a specific diet, more concerned about taste, the environment and health and less about familiarity, culture, religion and traditions. Moreover, knowing information on the regulatory framework increases willingness to consume insects in general.

The findings of this study can guide education and marketing strategies as more insect species are being approved in Europe as novel foods. These strategies need to be country-specific, taking into consideration the food choice motives of people living in each country. Finally, this study focused on hypothetical conditions under which the two populations were asked about their willingness to consume insects, which is an important step towards product development; however, future studies should explore the willingness to consume insect-containing foods through tasting sessions.

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Conflict of interest

The authors declare no conflict of interest.

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Supplementary material

Supplementary Table S1: Mean scores of the items of food neophobia and food neophilia (items have not been reversed) and food disgust for participants in France and in Ireland

Scale	Item	France	Ireland	Significance
		Mean \pm s.d.	Mean \pm s.d.	
Neophilia	I am constantly sampling new and different foods	2.85 \pm 1.061	3.40 \pm 1.109	***
Neophobia	I don't trust new foods	2.20 \pm 1.004	2.16 \pm 1.119	
Neophobia	If I don't know what a food is, I won't try it	1.98 \pm 1.129	2.53 \pm 1.340	*
Neophilia	I like foods from different cultures	4.41 \pm 0.845	4.26 \pm 0.951	
Neophilia	At dinner parties, I will try new foods	4.03 \pm 0.954	4.16 \pm 0.974	
Neophobia	I am afraid to eat things I have never had before	2.27 \pm 1.190	2.34 \pm 1.282	
Neophilia	I will eat almost anything	3.48 \pm 1.251	3.11 \pm 1.405	
Disgust	There is a maggot in the cherry I want to eat	3.34 \pm 1.249	3.96 \pm 1.195	***
Disgust	There is a little snail in the salad I want to eat	2.83 \pm 1.403	3.09 \pm 1.425	
Disgust	There is a worm in my apple	3.42 \pm 1.241	3.48 \pm 1.302	

In bold: the highest significant figure within each test (comparing the two countries).

* = $P < 0.05$, *** = $P < 0.001$.

Supplementary Table S2: Comparison of the items of food neophobia and food disgust between the ones who are willing to try insects for the first-time vs the ones who are not willing

If no, would you be willing to eat?	Yes (N = 59)	No (N = 61)	Total (N = 120)	Significance
	Mean \pm s.d.	Mean \pm s.d.	Mean \pm s.d.	
I am constantly sampling new and different foods	3.15 \pm 0.96	2.7 \pm 1.16	2.93 \pm 1.09	*
I don't trust new foods	1.92 \pm 0.77	2.7 \pm 1.19	2.32 \pm 1.08	***
If I don't know what a food is, I won't try it	1.85 \pm 1.01	2.8 \pm 1.35	2.33 \pm 1.28	***
I like foods from different cultures	4.34 \pm 0.84	4.05 \pm 1.10	4.19 \pm 0.99	
At dinner parties, I will try new foods	4.19 \pm 0.88	3.77 \pm 1.10	3.98 \pm 1.02	***
I am afraid to eat things I have never had before	2.00 \pm 1.16	2.97 \pm 1.15	2.49 \pm 1.25	***
I will eat almost anything	3.68 \pm 1.17	2.52 \pm 1.22	3.09 \pm 1.32	*
There is a maggot in the cherry I want to eat	3.27 \pm 1.19	4.18 \pm 1.10	3.73 \pm 1.23	***
There is a little snail in the salad I want to eat	2.36 \pm 1.20	3.74 \pm 1.31	3.06 \pm 1.43	***
There is a worm in my apple	3.12 \pm 1.13	4.05 \pm 1.13	3.59 \pm 1.22	***

Comparison is conducted using the Mann–Whitney U test.

In bold: the highest significant figure within each test (comparing Yes vs. No).

* = $P < 0.05$, *** = $P < 0.001$.

Supplementary Table S3: Comparison of the items of food neophobia and food disgust between the ones who are willing to try insects after knowing about the regulatory framework vs. the ones who are not willing

	Yes (120)	No (63)	Total (183)	Significance
	Mean \pm s.d.	Mean \pm s.d.	Mean \pm s.d.	
I don't trust new foods	1.97 \pm 0.89	2.60 \pm 1.19	2.19 \pm 1.05	**
I am constantly sampling new and different foods	3.33 \pm 1.03	2.65 \pm 1.14	3.09 \pm 1.11	***
If I don't know what a food is, I won't try it	1.92 \pm 1.11	2.79 \pm 1.31	2.22 \pm 1.25	***
I like foods from different cultures	4.43 \pm 0.73	4.17 \pm 1.13	4.34 \pm 0.89	
At dinner parties, I will try new foods	4.21 \pm 0.89	3.86 \pm 1.06	4.09 \pm 0.96	*
I am afraid to eat things I have never had before	1.93 \pm 1.07	3.00 \pm 1.22	2.30 \pm 1.23	***
I will eat almost anything	3.72 \pm 1.18	2.56 \pm 1.27	3.32 \pm 1.33	***
There is a maggot in the cherry I want to eat	3.31 \pm 1.25	4.19 \pm 1.07	3.61 \pm 1.26	***
There is a little snail in the salad I want to eat	2.46 \pm 1.27	3.86 \pm 1.22	2.94 \pm 1.41	***
There is a worm in my apple	3.07 \pm 1.21	4.16 \pm 1.03	3.44 \pm 1.26	***

Comparison between the two groups is conducted using the Mann–Whitney *U* test.

In bold: the highest significant figure within each test (comparing Yes vs. No).

* = $P < 0.05$, ** = $P < 0.01$, *** = $P < 0.001$.

Supplementary Table S4: Effect of food neophobia, neophilia and disgust on the factors under which insects could be consumed determined with a Spearman's correlation (correlation coefficient)

	I would eat insects: if they were whole		I would eat insects: if they were disguised in another product that I like		I would eat insects: if they were tasty		I would eat insects: if they were nutritious		I would eat insects: if they were produced and sold by a well-known food company		I would eat insects: if they were packed in an appealing packet		I would eat insects: if they were widely available (in my usual grocery store)	
	France	Ireland	France	Ireland	France	Ireland	France	Ireland	France	Ireland	France	Ireland	France	Ireland
Neophilia	0.268**	0.259*	0.189	0.13	0.166	0.209	0.342**	0.155	0.234*	0.182	0.301**	0.232*	0.358**	0.200
	new and different foods													
Neophobia	-0.286**	-0.251*	-0.343**	-0.265*	-0.281**	-0.256*	-0.380**	-0.206	-0.295**	-0.241*	-0.383**	-0.284*	-0.371**	-0.272*
Neophobia	-0.231*	-0.240*	-0.264**	-0.260*	-0.296**	-0.318**	-0.365**	-0.259*	-0.263**	-0.197	-0.214*	-0.269*	-0.315**	-0.294**
	food is, I won't try it													
Neophilia	0.202*	0.14	0.142	0.068	0.153	0.182	0.189	0.171	0.176	0.113	0.167	0.089	0.248*	0.075
	cultures													
Neophilia	0.375**	0.06	0.233*	0.028	0.342**	0.18	0.309**	0.141	0.299**	0.198	0.353**	0.112	0.385**	0.151
	try new foods													
Neophobia	-0.350**	-0.451**	-0.212*	-0.449**	-0.328**	-0.490**	-0.363**	-0.433**	-0.345**	-0.434**	-0.290**	-0.514**	-0.428**	-0.480**
	I am afraid to eat things I have never had before													
Neophilia	0.441**	0.258*	0.313**	0.308**	0.363**	0.462**	0.523**	0.368**	0.527**	0.340**	0.468**	0.382**	0.580**	0.374**
Disgust	-0.320**	-0.342**	-0.171	-0.185	-0.285**	-0.179	-0.360**	-0.138	-0.278**	-0.103	-0.318**	-0.132	-0.395**	-0.191
	There is a maggot in the cherry I want to eat													
Disgust	-0.332**	-0.370**	-0.314**	-0.395**	-0.346**	-0.401**	-0.406**	-0.417**	-0.374**	-0.303**	-0.306**	-0.340**	-0.405**	-0.353**
	There is a little snail in the salad I want to eat													
Disgust	-0.284**	-0.331**	-0.167	-0.322**	-0.312**	-0.345**	-0.339**	-0.369**	-0.289**	-0.273*	-259**	-0.328**	-0.359**	-0.349**
	There is a worm in my apple													

In bold: statistically significant figures.
* = $P < 0.05$, ** = $P < 0.01$.

Supplementary Table S5: Effect of food choice motives on the factors under which insects could be consumed determined using Spearman's correlation (correlation coefficient rho)

Food choice motives	Conditions under which insects could be consumed													
	If they are whole		If they were disguised in another product that I like		If they were tasty		If they were nutritious		If they were produced and sold by a well-known food company		If they were packed in an appealing packet		If they were widely available (in my usual grocery store)	
	Ireland	France	Ireland	France	Ireland	France	Ireland	France	Ireland	France	Ireland	France	Ireland	France
It looks appealing	0.176	0.071	0.103	0.120	0.128	0.063	0.133	0.274**	0.139	0.200*	0.199	0.072	0.182	0.193
It tastes good	-0.033	-0.105	-0.261*	-0.099	-0.161	-0.230*	-0.106	-0.029	-0.153	-0.101	-0.104	-0.075	-0.128	-0.101
It is animal friendly	0.007	-0.103	0.000	-0.154	0.084	-0.087	0.092	-0.196*	0.115	0.018	0.061	0.041	0.060	-0.090
It has no preservatives	-0.232*	-0.037	-0.065	-0.025	-0.053	0.018	-0.075	-0.213*	-0.084	-0.161	-0.079	-0.070	-0.058	-0.146
It is familiar	0.234*	0.179	0.159	0.163	0.210	0.098	0.184	0.176	0.126	0.049	0.162	0.072	0.166	0.204*
It fits in with my religion/tradition/culture	0.081	0.073	0.223*	0.102	0.156	0.118	0.099	0.273*	0.059	0.124	0.062	0.192	0.144	0.175
It is convenient	0.012	0.009	-0.046	0.122	-0.134	-0.027	-0.054	0.077	0.043	-0.008	0.018	-0.077	0.004	-0.028
It is healthy	-0.122	0.019	-0.063	-0.125	-0.136	-0.069	-0.250*	-0.240*	-0.146	-0.119	-0.192	-0.163	-0.199	-0.134
It has good price	-0.080	-0.064	-0.081	0.131	-0.151	0.090	-0.091	0.057	-0.190	0.131	-0.194	0.081	-0.175	0.045
It is environmentally friendly	-0.096	-0.208*	-0.084	-0.327**	-0.089	-0.136	-0.047	-0.344**	-0.058	-0.185	-0.074	-0.173	-0.068	-0.329**

In bold: statistically significant figures.
* = $P < 0.05$, ** = $P < 0.01$.