

Article

Insect-Based Foods: A Preliminary Qualitative Study Exploring Factors Affecting Acceptance and New Product Development Ideas through Focus Groups

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Supplementary Materials

Product Name	Product Type	Flavours	Ingredients	Nutrient Composition	Packaging Sizes/Options	Price	Preparation	Advantages	Disadvantages	Supplier	Link to Website	Country
Eat For Future - 2 ZIRP Burger Patties	Burger Patties	n/a	*38% Ground Buffalo Worms -calcium alginate, rosemary extract), mushrooms, roasted onion (onion, sunflower oil), pea protein, water, spice salt (salt, spices), stabilizer: methylcellulose, parsley, flaxseed flour, caramel sugar, beetroot juice powder, smoke flavor, fermented rice flour sauce and onion juice (rice flour, onion juice concentrate, quinoa flour, salt).	*Per 100g patty = Energy: 660 kJ/159 kcal; Fat:8.8g (Saturated:3.8g); Carbohydrates:2.3g (Sugars:0.8g); Roughage:9.4g; Protein:13g; Salt:1.6g; Iron:3.6mg/24%; Calcium:256mg/32%; Zinc:2.6mg/26%	200g Box (each box contains 2 x 100g patties)	€4.99	1) Unpack patties and let them thaw for 10 minutes 2) Heat two tablespoons of vegetable oil in a coated pan 3) Place patties in the pan and fry over medium heat with regular turning for about 8-10 minutes until crispy-brown	*Ground insects (insect form not visible on the patty) *Can deliver in Ireland	Buffalo worms not yet authorised by the European Commission (EC)	ZIRP	Insects for cooking & snacking - ZIRP Insects	Austria
For Future - Oat Loaf Mix	Ready-made baking mix	Plain/classic	Oatmeal (71%), *buffalo worm flour (Alphitobius diaperinus) (12%), onion juice powder, carrots, garlic, parsnip, tomato flakes, sea salt, leek, beet sugar, peppers, black pepper, starch, smoked peppers, chill, rosemary oil.	*Per 100g = Energy: 1554 kJ/ 369 kcal; Fat:7.9g(saturated:1.3g); Carbohydrates:51.0g (sugars:6g); Protein:19g; Salt:1.5g	215g satchet	€5.90	*rapeseed oil, water & measuring cups needed Mix 250ml of warm water with the mix and let it soak for about 10 mins. Then form about 10-12 loaves from the mixture with damp hands and fry in a pan over low heat with rapeseed oil on both sides until golden brown. Drain on kitchen towel and serve. *Can be served with a yoghurt dip with fresh herbs & a crunchy salad	Insect form not visible Can deliver in Ireland	Buffalo worms not yet authorised by EC	ZIRP	Insects for cooking & snacking - ZIRP Insects	Austria
For Future - Pancake mix	Ready-made baking mix	Plain/classic	Spelt flour, beet sugar, starch, *buffalo worm flour (Alphitobius diaperinus) (7.1%), hemp seed flour, raising agents (sodium bicarbonates), acidifiers (potassium tartrates), salt.	*Per 100g = Energy:1494 kJ/ 353 kcal; Fat:2.6g (saturated:0.5g); Carbohydrates:68.0g (sugars:14.0g); Protein:13.0g; Salt:0.4g	295g satchet	€5.90	*Oat milk/water, rapeseed oil, apple cider vinegar, icing sugar & measuring cups needed Mix with 250ml oat milk (or cow's milk / water), 60ml rapeseed oil and 30ml apple cider vinegar in a bowl to a smooth dough. Heat rapeseed oil in a pan. Pour in about 2 tsp dough per pancake and bake over medium heat for about 30-40 seconds per side. Then sprinkle with icing sugar and enjoy.	Insect form not visible Can deliver in Ireland	Buffalo worms not yet authorised by EC	ZIRP	Insects for cooking & snacking - ZIRP Insects	Austria
For Future - Falafel mix	Ready-made baking mix	Classic	Chickpea flour, *buffalo worm flour (Alphitobius diaperinus) (8.6%), onion juice powder, sea salt, parsley, raising agents (sodium bicarbonate, pure wine stone), cumin, garlic powder, potato starch.	*Per 100g = Energy:1439 kJ/ 342 kcal; Fat:5.2g (saturated:0.9g); Carbohydrates:44.0g (sugars:4.1g); Protein:23.0g; Salt:4.4g	140g satchet	€5.90	*Water, olive oil, rapeseed oil & measuring cups needed Mix 150ml of boiling water and 1 tbsp olive oil with the ready mix. Allow the mixture to cool down and then form with damp hands into about teaspoons large loaves or balls. Bake/fry in plenty of oil (e.g rapeseed oil) until golden brown. Drain freshly baked falafel on kitchen roll and serve. *Can be served with hummus, olives, fresh flatbread & crunchy salad.	High-protein (>20% protein) Insect form not visible Can deliver in Ireland	Buffalo worms not yet authorised by EC	ZIRP	Insects for cooking & snacking - ZIRP Insects	Austria
For Future - Risotto mix	Ready made mix	Beetroot	Risotto rice (69%), beetroot juice powder (6.8%), potato starch, *buffalo worm flour (5.7%), salt, onion juice powder, carrots, leek, garlic, parsnip, thyme, caraway.	*Per 100g = Energy:1461 kJ/ 345 kcal; Fat:2.2g (saturated:0.5g); Carbohydrates:71.0g (sugars:4.4g); Protein:9.5g; Salt:3.4g	177g satchet	€5.90	*Onion, white wine, olive oil, vegetable broth or water needed Dice 1/2 onion and fry in a saucepan with oil until translucent. Add risotto mixture & fry briefly. Then it is best to deglaze with a little white wine. Once the smell of wine has disappeared, gradually add about 500ml of soup or water. Stir until the rice is soft but still firm to the bite. *2 tbsp Parmesan and a bit	Insect form not visible Can deliver in Ireland	Low in Protein (<12%) Buffalo worms not yet authorised by EC	ZIRP	Insects for cooking & snacking - ZIRP Insects	Austria

Figure S1. An illustrative screenshot [sample](#) (first page) of the EU market screening conducted for the insect-based foods that could be delivered in Ireland. The market screening was conducted in five countries where companies that deliver to Ireland could be found.

Table S1. Questions used in the protocol of the current study.

Focus Group Discussion		
1.	Let us perhaps start by going around the table and introducing ourselves. Telling us your name, your favourite food and what makes it your favourite food. We could start with you...	
2.	Prior to this discussion, has anyone of you ever heard of the eating of insects or foods containing them?	
3.	For those who have heard: Have you eaten them before?	
4.	If yes (How was your experience?).	
5.	If no (Was there a reason that made you not to try them?)	
6.	What do you think about the idea of eating insects? (opinions)	
7.	And would you consume insects?	
8.	If yes (how would you consume them?)	
9.	If they don't understand the question (In what form or in which products would you be willing to consume them?).	
<p><i>*Note: If the participants answer this question indirectly in their response to question 2, you do not have to ask this question.</i></p> <p><i>*Moderator brings out the trays with all tasting samples and puts them in front of each participant along with the scoring sheets, a pencil and water. 'This is an optional tasting session. In front of you are samples of some of the insect-based products available on the online market. Insect-based foods are not yet available in Ireland. In front/next to each sample is the name of that product. You are welcome to taste any product that you would like to taste. You can taste more than one or all the products but, in this case, we ask that you cleanse your pallet with some water before tasting the next product. For each product tasted, I ask that you score it on the scoring sheet that we gave you. You do not have to taste any products that you do not want to even if it's all of them. For each product you are not willing to taste however, we ask that you record the reasons for your decision on the sheet of paper we gave you (you will find it after the scoring sheets when you flip over: demonstrate).</i></p>		
10.	From all these products, which one did you like the most? Why?	
11.	Which one did you like the least? Why?	
12.	Are there any products that you did not taste? What were your reasons?	
<p><i>*The moderator hands out the printout with different insect-based products available (give to the two participants on either ends and say 'Could you please take one and pass?'). After everyone has gotten one: "On the page you now have are the different insect-based products available. None of them are from Ireland but they are accessible online. I will go through them briefly with you' (The moderator then goes through each item on the page).</i></p> <p><i>Just to show you how some of them look like in their original packaging, here they are. (You put them all on the table in front of the participants in batches: start with whole/plain insects and the flavoured ones then insect flour and products made with insect flour. "Feel free to touch them and take a closer look at them".</i></p>		
13.	Apart from all these insect-based products on the screen or in front of you, which are the only ones available on the market for now (in other countries), would you like to see any other products developed with insects or components from insects?	
<p><i>*I have a very short questionnaire here that I will just ask you to fill up. But before that, do you have any general comments regarding this focus group?</i></p>		
Pen and Paper Questionnaire		
1.	How old are you?	18–29
		30–39
		40–49
		50–59
		60 and above
2.	What is your gender?	Male
		Female
		Other

		Prefer not to say
3.	What is the highest level of education you have achieved so far?	Secondary education Third level education Post-graduate (Master's/PhD)
4.	What is/was your field of studies?	Open-ended
5.	Rate how much you would agree with the following statements:	Strongly disagree Somewhat disagree Neither agree nor disagree Somewhat agree
	#I am constantly sampling new and different foods	
	#I don't trust new foods	
	#If I don't know what a food is, I won't try it	
	#I like foods from different cultures	
	#At dinner parties, I will try new foods	Strongly agree
	#I am afraid to eat things I have never had before	
	#I will eat almost anything	
6.	Please feel free to leave any comments below regarding your experience today or the study itself.	Open-ended

Table S2. The extent to which participants (N=17) liked/disliked the insect-based foods tasted based on their overall liking scores.

Insect-Based Product	The extent to which Participants Liked/Disliked the Insect-Based Product Tasted (%) ¹					N/A ²
	Dislike Very Much	Dislike Somewhat	Neutral	Like Somewhat	Like Very Much	
Yellow mealworms	0.0	17.6	5.9	35.3	17.6	23.6
Migratory locusts	11.8	11.8	17.6	17.6	5.9	35.3
House crickets	11.8	5.9	5.9	23.5	35.3	17.6
Pasta	5.9	29.4	29.4	29.4	5.9	0.0
Crackers	0.0	23.6	5.9	17.6	52.9	0.0
Chips	0.0	5.9	5.9	17.6	70.6	0.0
Spread	0.0	5.9	11.7	41.2	41.2	0.0
Protein bar	5.9	5.9	23.5	29.4	35.3	0.0

¹The values shown represent the percentage of participants in each category. ²Participants who did not taste the respective insect-based products.

Table S3. The extent to which participants (N = 17) were willing to buy the insect-based foods tasted.

Insect-Based Product	The extent to which Participants were Willing to Buy the Insect-Based Product Tasted (%) ¹					Participants Who were not Willing to Taste
	Very Much Unwilling	Somewhat Unwilling	Neutral	Somewhat Willing	Very Much Willing	
Yellow mealworms	11.8	5.8	11.8	47.0	0.0	23.6
Migratory locusts	17.6	5.9	17.6	11.8	11.8	35.3
House crickets	23.5	5.9	11.8	11.8	29.4	17.6
Pasta	17.6	29.4	5.9	29.4	17.7	0.0
Crackers	11.8	11.8	11.8	17.6	47.0	0.0
Chips	0.0	11.8	0.0	29.4	58.8	0.0
Spread	5.9	5.9	23.5	35.3	29.4	0.0
Protein bar	17.6	5.9	23.6	17.6	35.3	0.0

¹All values shown represent the percentage of participants in each category.