

IMPACT OF COVID-19 PANDEMIC ON WILLINGNESS TO CONSUME INSECT-BASED FOOD PRODUCTS IN CATALONIA

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Abstract: Edible insects are among the novel sustainable sources of protein in the West. The impact of COVID-19 on the willingness to consume (WTC) jam and yogurt enriched with insect ingredients was analyzed. A questionnaire was applied using the Qualtrics© consumer panel. The multinomial logit (MNL) model was used to analyze the determinant factors affecting consumers' WTC the insect-based products. Results showed that the outbreak of COVID-19 caused a significant decrease in the WTC. Consumers who strictly followed the regulations during the confinement and are well informed about symptoms were more likely to reject the consumption of the insect-based products. Both before and during the lockdown, results showed that young and employed consumers, with low-income level, who consider the environmental impact of their food choices are prone to consume the products with insect protein. Findings also revealed that the COVID-19 outbreak decreased the heterogeneity of WTC between males and females.

Keywords: consumer acceptance, COVID-19, edible insects, food, sustainability

1. Introduction

Companies in Europe started launching food and drinks with insects in 2014 and the number of products has significantly increased since 2018 (Mintel, 2021). Insects are considered a sustainable source of protein compared to conventional animal protein sources such as beef, pork, and chicken (Orsi et al., 2019). The products include whole insects as the main or only ingredient or insects processed into powder as an “invisible” minor ingredient. Even though insects have interesting environmental and nutritional benefits, the edible insect sector in Europe struggles with low consumer acceptance (Gere et al., 2017; Orsi et al., 2019). The recent outbreak of the COVID-19 pandemic could also lead to increased rejection of these unusual foods of animal origin. Two new insect-based novel products are explored: strawberry jam and Greek-type natural yogurt. The main objectives of this research are to investigate whether the outbreak of COVID-19 will have an impact on consumers' WTC the two insect-based products and to understand the factors affecting the WTC.

2. Materials and Methods

2.1. Data collection and sampling method

Data was collected in Catalonia (Spain) from two waves using Qualtrics© platform and its consumer online panel. The first wave of data was collected from 799 participants between January and February 2020 before the COVID-19 lockdown in Catalonia. The second wave of data was collected from another 481 participants between 21 May and 2 June 2020 during the COVID-19 lockdown in Catalonia.

2.2. Questionnaire design

The semi-structured questionnaire consisted of three blocks. The first part included questions about consumers' socio-demographics. The expected willingness to consume (WTC) question of strawberry jam and natural yogurt enriched with insect protein constituted the second part. The last part was related to consumption and purchasing behaviors. Several questions were introduced: the food purchase place and consumers' relative importance of the different product attributes (price, origin, quality, convenience, nutritional value, and ecological value when buying food). The questionnaire administered during the lockdown included additional questions related to the COVID-19 situation.

2.3. WTC insect-based products

Respondents had to choose their willingness to consume from a five categorical alternatives scale (yes, probably yes, do not know, probably no, and no).

An example of the question is presented below:

The increasing demand for the consumption of meat as a source of protein is compromising the sustainability of the systems of animal production. Products enriched with insect proteins are currently appearing on the Spanish market as an environmentally sustainable source of protein compared to protein of other animal origins. Would you be willing to consume enriched food products with insect protein if their organoleptic characteristics remain unaltered (taste, color, and odor)?

2.4. The Multinomial Logit (MNL) model

In order to analyze the determinant factors affecting the consumers' WTC, the multinomial logit (MNL) model was applied. The dependent variable was the WTC variable which was grouped into three categories: *positive WTC* (yes), *uncertain WTC* (probably yes, do not know, probably no), and *negative WTC* (no). The independent variables included in the MNL were the socioeconomic variables and the consumers' behavior variables. The model is constructed separately for positive and uncertain WTC after choosing negative WTC as the reference category.

3. Results

3.1. WTC before and during lockdown

The WTC the insect-based products during COVID-19 is significantly less than before COVID-19 as can be seen in Table 1 (P<0.01). During COVID-19, the percentage of participants prone to consume decreased by an average of 5.80% for both products and increased by an average of 12.35% for those reluctant to consume.

Table 1: Willingness to consume insect-based strawberry jam and yogurt before and during lockdown

Product	Event	Positive WTC	Uncertain WTC	Negative WTC	Chi-Square Value	p Value
Strawberry Jam	Before lockdown	13.4%	59.9%	26.7%	25.89	0.00
	During lockdown	8.5%	51.8%	39.7%		
Yogurt	Before lockdown	15.8%	58.2%	26.0%	27.43	0.00
	During lockdown	9.1%	52.2%	38.7%		

3.2. Factors affecting WTC before and during COVID-19

The MNL models were estimated twice, before the COVID-19 lockdown and during the COVID-19 lockdown. Only the results related to the MNL model of insect-based yogurt will be presented (Table 2 and Table 3).

Table 2: Factors affecting WTC insect-based yogurt before COVID-19 lockdown in Catalonia

	Positive WTC		Uncertain WTC	
	β	e^β	β	e^β
α_i	-1.27		1.91 ***	
Gender	1.06 ***	2.89	1.00 ***	2.72
Age	1.00 ***	2.72	0.28	1.32
Buying food online	0.70 **	2.02	0.50 **	1.65
Origin	-0.29 ***	0.75	-0.25 ***	0.78
Advertisements	0.21 ***	1.24	0.14 **	1.16
Ecological importance	2.20 ***	9.02	1.25 ***	3.48
Quality score	-0.27 ***	0.77	-0.24 ***	0.78
Employment status	0.63 **	1.87	0.34 *	1.41
Income	0.83 **	2.28	0.10	1.10
Education	0.54 **	1.71	-0.09	0.91

Table 3: affecting

McFadden R²: 0.113 / Classification accuracy rate.: 62.2%
based yogurt during COVID-19 lockdown in Catalonia

Factors WTC insect-

	Positive WTC		Uncertain WTC	
	β	e^β	β	e^β
α_i	-1.67		3.09 ***	
Gender	0.13	1.14	0.42 **	1.52
Age	1.49 ***	4.42	-0.09	0.91
Following restrictions	-0.25	0.78	-0.26 **	0.77
Cereal consumption	0.94 **	2.55	0.32	1.38
Children at home	0.34	1.41	0.44 *	1.55
Informed about symptoms	0.13	1.14	-0.29 ***	0.75
Income	1.40 **	4.06	-0.28	0.75
Ecological importance	0.85 **	2.35	0.16	1.17
Employment status	0.69 *	1.99	0.30	1.35
McFadden R ² : 0.100 / Classification accuracy rate.: 60.7%				

significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

The independent variables that are common between the two waves, before and during COVID-19 lockdown, are presented below:

Gender

Before lockdown, males compared to females are 2.89 times more likely to consume insect-based yogurt. However, during lockdown, COVID-19 had a homogenizing effect on gender where both males and females are unlikely to be willing to consume the product.

Age

Both before and during lockdown consumers belonging to the age group 18-39 years old compared to older consumers are more likely to consume yogurt enriched with insect protein (IP) with even increased heterogeneity during the lockdown (2.72 and 4.42 times respectively).

Ecological Importance

In both cases, consumers that give higher importance to the ecological attribute of food are more likely to consume yogurt enriched with IP (9.02 and 2.35 times respectively). However, during lockdown the effect size of the ecological attribute is reduced.

Employment status

In both cases, employed consumers are more likely to be willing to consume insect-based yogurt compared to unemployed consumers (1.87 and 1.99 times respectively).

Income

Consumers with a monthly income of 1000€ or less compared to those with a higher income are more likely to be willing to consume yogurt with insects in both events (2.28 and 4.06 times respectively).

The independent variables explaining heterogeneity before COVID-19 only are presented below:

Buying food online

Consumers that buy food online are 2.02 times more likely to be willing to consume yogurt enriched with insect protein.

Origin

On a scale from 1 to 7, with every one unit increase in the importance consumers give to origin when buying food, the odds of being willing to consume yogurt enriched with IP decreases 0.75 times.

Advertisements

Consumers that agree that advertisements are necessary are 1.24 times more willing to consume yogurt with IP.

Quality score

On a scale from 1 to 11, with every one unit increase in the relative importance that consumers give to the quality score associated with seasonal food, they are 0.77 times less likely to consume yogurt enriched with IP.

Education

Consumers with a university education compared to those with a lower level of education are 1.71 times more likely to consume insect-based yogurt.

The independent variables explaining heterogeneity during the COVID-19 lockdown only are presented below:

Following Restrictions/Informed about Symptoms

On a scale from 1 to 7, with every one unit increase in how strictly a participant is following restrictions to prevent the spread of COVID-19 and in the belief that muscle ache and body pain is a common symptom of COVID-19, the odds of rejecting the consumption of yogurt with IP increases by 0.77 and 0.75 times respectively.

Cereal consumption

Consumers that increased their cereal consumption during the pandemic are 2.55 times more likely to be willing to consume insect-based yogurt.

Children at home

Consumers with children up to 12 years old are 1.55 times less likely to be willing to reject the consumption of yogurt with insect protein.

4. Conclusion

The present study confirms that consumer acceptance of insect-based products in Catalonia (for example yogurt and jam enriched with insect protein) decreased significantly during the COVID-19 lockdown and that the gender effect was homogenized. The results also indicate that the image of insect consumption continues to be linked with low-quality and with countries of low income. Another important finding is that the COVID-19 pandemic has increased consumers' concerns about virus transmission and food safety risks associated with the consumption of insects. Hence, consumers need to be ensured that insect consumption is safe. Relevant information on product labels such as food safety certifications and the origin of insects should be considered to gain the trust of potential consumers.

In general, the outbreaks of infectious diseases, COVID-19 among them, have temporary consequences on consumer behavior after which regular consumption levels are resumed. This should be confirmed with longer-term research.

5. References

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