

Exploring consumers' willingness to pay for handmade plant-based desserts

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Abstract

Due to the increase in environmental consciousness in recent years, the plant-based food market has grown significantly, especially in Germany. Additionally, COVID-19 pandemic has impacted eating habits, leading to an increase in the consumption of desserts and handmade preparations. Based on these trends and changes in consumer behavior, this paper aimed to identify the willingness to pay [WTP] for handmade plant-based desserts compared to other variations, and to identify the main factors that impact WTP. A quantitative approach was employed through an online survey to 409 individuals living in Germany. Results showed that the handmade plant-based cupcake variation had the highest WTP. A profile analysis revealed that mainly women, aged 18 to 34 years old, with a high educational level, are willing to pay more for handmade plant-based desserts. These findings can enable companies in this market to better price and target their products, adapting their marketing strategies.

Keywords: willingness to pay; pricing; food; segmentation.

Introduction

Global warming is a well-known phenomenon, widely discussed and defined as the increase of average temperature on Earth. One of the main causes of this is greenhouse gas emissions, such as carbon dioxide and methane (Florides and Christodoulides, 2009; Kerr, 2007; Milich, 1999). An efficient way to decrease those emissions is by reducing the consumption of animal-based products in favor of a plant-based diet, as lifecycle emissions from plant-based foods are only half of those from animal-based ones. The plant-based food category encompasses foods in their natural form, such as vegetables, legumes, and nuts, as well as products made with alternatives to meat, dairy, and eggs. Examples include pea or wheat-based meats, soy and coconut yogurts, and other products like desserts and snacks that contain an alternative to an ingredient of animal origin (Beacom et al., 2021; Xu et al., 2021).

Due to the increase of environmental consciousness in the past years, the plant-based food market has grown significantly. It is forecasted that by 2030, sales of meat and dairy substitutes will outpace those of traditional animal products. According to market research conducted by the Good Food Institute Europe (2022), the leading country in the plant-based food market is Germany, with an increase in sales of 42% between 2020 and 2022. The research also shows that one of the fastest-growing categories was dessert, being attributed to the rise in dessert consumption overall, usually associated with a potential behavioral response to environmental stress.

The recent COVID-19 pandemic has increased stress and anxiety for many adults, and several research studies indicate that the pandemic is associated with changes in self-reported eating habits. Individuals reported higher consumption of sweets, desserts, and salty snacks (Bloomberg Intelligence, 2021; Pfefferbaum and North, 2020; Sadler et al., 2021). However, this behavior is also influenced by other factors, including cultural, social, personal, and psychological aspects. In marketing, a key indicator of consumer behavior is the willingness to pay [WTP]. WTP is similarly influenced by these factors, adding layers to the complexity of understanding consumer behavior (Shogren et al., 1994; Anderson et al., 1993; Balderjahn, 2003; Kotler and Armstrong, 2023).

Prior literature has explored the consumers' WTP for plant-based food, mainly meat and dairy substitutes (Kurawadwala, 2021; Wang et al., 2022). Some have explored WTP for handmade food and handmade products (Blare et al., 2020; Frizzo et al., 2020), as well as consumer behavior for comfort plant-based food (Batista et al., 2023). However, no prior literature was found reporting WTP for handmade plant-based desserts specifically. Following the recent changes in consumer behavior, we aimed to identify the WTP for handmade plant-based desserts compared to other variations, and to identify the main factors that impact this WTP.

Theoretical Background

Greenhouse emissions and food

Many sectors contribute to greenhouse emissions, as electricity and heat generation, transportation, manufacturing and construction, and agriculture. Among these, agriculture is the leading contributor to methane emissions, which can have up to twenty times more impact on global warming compared to CO₂. Most of this methane comes from livestock, as they produce methane through their digestive processes, known as enteric fermentation. Furthermore, the increased land use and change, such as deforestation, for livestock farming and cultivation of their food, are great contributors for greenhouse emissions (Milich, 1999; Ritchie et al., 2024). Beacom et al. (2021) state

that a highly effective strategy for mitigating greenhouse gas emissions is to shift consumption away from animal-based products and towards a plant-based diet. This approach is particularly impactful because the lifecycle emissions of plant-based foods are only half those of their animal-based counterparts.

Plant-based food and Willingness to Pay

Plant-based foods are defined as any product containing no ingredients of animal origin (Xu et al., 2021). Environmental changes, including pandemics, undoubtedly affect consumer behavior. COVID-19 pandemic has been related with prioritization of handmade preparations and fresh food. A reason for this increase during this period can be linked to the tradition of baking together and spending time with the family. The resurgence of these traditions during the pandemic has had a positive impact on the handmade food market. Handmade food, often seen as unique with superior sensory quality, can trigger nostalgic sentiments, evoking these cherished family bonding moments (Bracale and Vaccaro, 2020; Bravo et al., 2014; Rodrigues et al., 2021).

WTP, which represents the maximum amount an individual is willing to spend to obtain a product or service, seems to be sensitive to trends such as plant-based food. Studies show that managers consider the knowledge of WTP to be a cornerstone of marketing strategies and essential for developing an optimal pricing strategy (Anderson et al., 1993; Balderjahn, 2003). Prior academic work has investigated consumer willingness to pay for plant-based foods, primarily focusing on substitutes for meat and dairy products (Kurawadwala, 2021; Wang et al., 2022). Other studies have explored WTP in the context of handmade goods and artisanal products (Frizzo et al., 2020). While one piece of research has examined consumer behavior concerning plant-based comfort foods (Batista et al., 2023), there remains a gap in the literature regarding WTP specifically for handmade, plant-based desserts.

Method

The research was conducted using quantitative research. For primary data collection, a structured survey was used. The target population for this research comprised residents in Germany, regardless of their nationality. The survey was performed in an online questionnaire in English and in German using Google Forms.

Survey was designed based on previous research about WTP for plant-based and sustainable food, based on Kurawadwala (2021), Sgroi et al. (2023), and Laukkanen (2021). The first part contained socio-demographic questions, followed by exploratory questions about current diet and frequency of dessert consumption. The second part asked about the consumption of desserts based on different compositions (traditional vs. plant-based) and preparation methods (mass-produced vs. handmade), as well as the willingness to buy them, using Likert scale. The same scale was also used to explore the respondents' perceptions of handmade and plant-based desserts. The survey concluded with key questions about WTP, where respondents were asked about the maximum price they would pay for a dessert based on its composition and preparation method.

Data collection was carried out anonymously from July to August, 2024. The survey was shared via WhatsApp and LinkedIn. It was also published on SurveyCircle and SurveySwap. Based on a population of approximately 84,700,000 inhabitants in Germany, the aim was to collect 385 responses. The non-probability convenience sampling method was used to collect the responses. To organize and analyze the data, descriptive statistics tests were conducted. Additionally, Pearson's correlation analysis was used to test the correlation between variables.

Results and Discussion

We collected a total of 414 responses. Five participants were excluded from the analysis due to incomplete WTP (Willingness to Pay) data, resulting in a final sample of 409 valid responses. The sociodemographic data for these participants are presented in Table 1.

Table 1. Socio-demographic data

Gender	N	%
Female	246	60.1
Male	157	38.4
Non-binary	4	1.0
Prefer not to say	2	0.5
Age	N	%
18-24 years	104	25.4
25-34 years	167	40.8
35-44 years	82	20.0
45-54 years	32	7.8
55-64 years	18	4.4
65 years or older	6	1.5
Highest level of education	N	%
Primary school	1	0.2
Secondary level I (e.g., Hauptschule, Realschule)	8	2.0
Secondary level II (e.g., High school, Gesamtschule, Gymnasium)	64	15.6
Vocational school or technical college	24	5.9
Bachelor's degree	174	42.5
Advanced degree (Diplom, Master's degree, PhD, MBA, etc.)	138	33.7
Annual household gross income	N	%
Under €25,000	121	29.6
€25,000-€49,999	59	14.4
€50,000-€74,999	58	14.2
€75,000-€99,999	42	10.3
€100,000-€149,999	62	15.2
€150,000-€199,999	15	3.7
€200,000 or more	15	3.7
Prefer not to say	37	9.0

Source: Original research results

The majority of the respondents were female (60.1%), aged between 25 and 34 years (40.8%), with a Bachelor's degree (42.5%), and with an annual household gross income of under 25,000€ (29.6%). The survey also explored the participants' diet and frequency of dessert consumption, the results are displayed in Table 2.

Table 2. Current diet and dessert consumption

Current diet	N	%
Omnivore	266	65.0
Pescatarian	17	4.2
Vegetarian	55	13.4
Vegan	13	3.2
Flexitarian	58	14.2
Frequency of dessert consumption	N	%
Every day	98	24.0
2-3 times per week	171	41.8
Once a week	83	20.3
1-2 times a month	51	12.5
Never	6	1.5
Ever consumed handmade traditional dessert	N	%
Yes	381	93.2
No	9	2.2
I don't know	19	4.6
Ever consumed mass-produced plant-based dessert	N	%
Yes	294	71.9
No	64	15.6
I don't know	51	12.5
Ever consumed handmade plant-based dessert	N	%
Yes	275	67.2
No	73	17.8
I don't know	61	14.9

Source: Original research results

Most of the respondents follow an omnivore diet without any restriction (65%), consume dessert 2-3 times per week (41.8%), and has already consumed handmade traditional dessert (93.2%), mass-produced plant-based dessert (71.9%), and handmade plant-based dessert (67.2%). Participants were also asked about their likelihood of purchasing desserts, based on different compositions. The results are shown in Table 3.

Table 3. Purchase likelihood of different variations of desserts (%)

Dessert	1	2	3	4	5	Mean	Standard deviation
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Mass-produced traditional	10.0	16.9	19.1	27.1	26.9	3.44	1.31
Handmade traditional	4.9	7.1	14.2	28.6	45.2	4.02	1.15
Mass-produced plant-based	11.2	16.1	31.8	24.0	16.9	3.19	1.22
Handmade plant-based	6.8	11.7	24.0	27.1	30.3	3.62	1.22

Source: Original research results

The highest likelihood of purchasing is for the handmaid desserts, whereas the traditional ones lead the way with a mean of 4.02. The dessert with the least likelihood is the mass-produced plant-based, with a mean of 3.19. For both traditional and plant-based desserts, the likelihood of purchase is higher when they are handmade. The delta between mass-produced and handmade is 0.58 for traditional desserts and 0.43 for plant-based ones, slightly indicating a greater influence of the handmade aspect on traditional desserts. These results are in line with previous studies showing that consumers are still reluctant to buy plant-based food, due to concerns usually related to taste, texture, and lack of willingness to change their diet (Beacom et al., 2021). Participants were also asked about their dessert perceptions, where they needed to rate their level of agreement with certain statements using the Likert scale, where 1 means completely disagree and 5 means completely agree. The results can be found in Table 4.

Table 4. Dessert perception (%)

Statement	1	2	3	4	5	Mean	Standard deviation
1. Handmade desserts taste better than mass-produced ones	1.0	2.7	13.2	28.1	55.0	4.33	0.88
2. Handmade desserts have a higher quality than mass-produced ones	0.7	2.7	9.3	29.1	58.2	4.41	0.82
3. I prefer to consume handmade dessert than mass-produced ones	0.7	4.2	15.4	24.2	55.5	4.30	0.93
4. Plant-based desserts are more sustainable	2.9	10.3	31.5	29.6	25.7	3.65	1.06
5. Plant-based desserts are healthier than traditional ones	9.5	18.3	38.4	21.8	12.0	3.08	1.12
6. Plant-based desserts taste as good as traditional ones	8.1	18.1	35.2	23.7	14.9	3.19	1.14

7. Plant-based desserts offer good variety into my diet	8.8	14.4	30.8	28.6	17.4	3.31	1.18
8. My family and friends think I should eat plant-based desserts	40.8	19.8	29.1	7.1	3.2	2.12	1.12
9. I feel social pressure to consume more plant-based alternatives	40.3	21.5	21.5	11.7	4.9	2.19	1.22
10. It is completely up to me what foods I purchase	1.5	3.7	8.6	21.6	65.0	4.45	0.90

Source: Original research results

The numbers indicate stronger agreement for statements 1, 2, and 3, representing a positive perception for handmade desserts, which goes in line with the results for their likelihood of purchasing and with similar studies, where participants also perceived handmade food with better taste and higher quality, with preference over mass-produced food (Bravo et al., 2014; Rivaroli et al., 2020). When it comes to plant-based desserts there is a neutral perception, with the means hovering between 3.08 and 3.65, with the highest being attributed to sustainability, also supporting previous studies showing that plant-based food still needs to win over more consumers (Beacom et al., 2021). Research also showed that the participants do not feel pressure for eating more plant-based alternatives from their family nor the society, which reflects previous research, where non-consumers of plant-based food reported not perceiving societal pressure to consume more of it (Carfora et al., 2022). There is also a high level of agreement for purchasing decision, showing that the respondents make their own decisions when it comes to what food to buy.

In the end, participants were asked about their WTP for a unit of cupcake based on its ingredients and preparation method, with the options of mass-produced traditional, handmade traditional, mass-produced plant-based, and handmade plant-based. Among the responses, 17 respondents assigned a WTP of €0.00 (zero) for one or two variations, indicating that they wouldn't be willing to purchase those versions. Specifically, 3 assigned zero to both mass-produced versions (traditional and plant-based), 5 to the mass-produced plant-based version, 7 to both plant-based versions (mass-produced and handmade), and 2 to both traditional versions (mass-produced and handmade). The descriptive results of the WTP input are displayed in Table 5.

Table 5. Consumers' willingness to pay [WTP] for different cupcake variations

Cupcake	Mean	Median	Mode	Range	Standard deviation
Mass-produced traditional	1.93€	1.85€	2.00€	0.00 – 10.00€	1.19
Handmade traditional	3.18€	3.00€	2.00€	0.00 – 15.00€	1.76
Mass-produced plant-based	2.06€	2.00€	2.00€	0.00 – 15.00€	1.35

Source: Original research results

The results of the mean show a higher WTP for the handmade variations, supporting the evidence from previous studies. For the traditional cupcake, the delta between mass-produced and handmade variations is 1.25€, and for the plant-based cupcake, the delta is 1.17€. In other words, respondents would be willing to pay almost 65% more for a handmade version of a traditional cupcake and almost 57% more for a handmade version of a plant-based cupcake. When comparing the mass-produced variations, there is a slightly higher WTP for plant-based, with a delta of 0.13€ (or almost 7%), and a similar result, but with a lower difference, is found when comparing both handmade variations, with a delta 0.05€ (or 1.6%).

These results can indicate that the plant-based aspect have slightly more influence on the WTP for the mass-produced versions than on the handmade ones. These findings support previous research that found that premium price is usually associated with the perception of high quality and health benefits (Yu et al., 2022). As shown in Table 4, most participants perceive handmade dessert with higher quality, which can justify the highest WTP. But also, a significant number of participants perceive plant-based food as more sustainable and healthier than traditional ones, which can explain the higher WTP compared to traditional ones.

Pearson’s correlation analysis was conducted to identify the variables that influence WTP. All the qualitative responses were transformed in dummy variables to have a better representation and output. Among all variables, only six of them had statistical relevance (p-value < 0.05), all the others did not, therefore are not shown in the results. The results of the regression are displayed in Table 6.

Table 6. Pearson’s correlation test for willingness to pay [WTP] for handmade plant-based cupcake

Parameter	Value	Error	t	p-value	[2.5%	97.5%]
Gender: Male	-0.7796	0.18037	-4.3225	0.00002	-1.1342	-0.4250
	6		7		4	7
Consumed handmade traditional: I don't know	0.93642	0.41529	2.25482	0.02468	0.12000	1.75284
Income: 75,000€-99,999€ per year	0.95088	0.28223	3.36922	0.00083	0.39606	1.50571
It is completely up to me what foods I purchase	-0.2197	0.09794	-2.2438	0.02539	-0.4132	-0.0272
	7		4		3	2
Handmade desserts have a higher quality than mass-produced ones	0.22539	0.11233	2.00656	0.04547	0.00457	0.44622

Purchase likelihood of handmade plant-based desserts 0.30657 0.07304 4.19717 0.00003 0.16298 0.45017

Source: Original research results

The test shows the six variables that influence the WTP for handmade plant-based cupcake, where the highest correlation is with male gender (p-value = 0.00002) with a negative effect, followed by the likelihood to buy handmade plant-based desserts (p-value = 0.00003), and the income range of 75,000€ to 99,999€ per year (p-value = 0.00083). The regression model has R² value of 0.15, explaining only 15% of the influence on the WTP, showing great limitation. Due to this limitation, a further profile analysis was conducted. The sample included all participants willing to pay more than the average WTP of 3.23€ for a handmade plant-based cupcake. This group, known as high payers and the focus of this research, resulted in a sample size of N=174. Their data are displayed in Table 7, and their WTP in Table 8.

Table 7. High payers' socio-demographic data and current diet

Gender	N	%
Female	125	71.8
Male	46	26.4
Non-binary	2	1.1
Prefer not to say	1	0.6
Age	N	%
18-24 years	48	27.6
25-34 years	79	45.4
35-44 years	28	16.1
45-54 years	13	7.5
55-64 years	4	2.3
65 years or older	2	1.1
Highest level of education	N	%
Primary school	1	0.6
Secondary level I (e.g., Hauptschule, Realschule)	4	2.3
Secondary level II (e.g., High school, Gesamtschule, Gymnasium)	25	14.4
Vocational school or technical college	8	4.6
Bachelor's degree	75	43.1
Advanced degree (Diplom, Master's degree, PhD, MBA, etc.)	61	35.1
Annual household gross income	N	%
Under €25,000	48	27.6
€25,000-€49,999	27	15.5
€50,000-€74,999	29	16.7

€75,000-€99,999	23	13.2
€100,000-€149,999	24	13.8
€150,000-€199,999	6	3.4
€200,000 or more	5	2.9
Prefer not to say	12	6.9
Current diet	N	%
Omnivore	103	59.2
Pescatarian	8	4.6
Vegetarian	24	13.8
Vegan	8	4.6
Flexitarian	31	17.8

Source: Original research results

Table 8. Willingness to pay [WTP] for high payers

Cupcake	Mean	Median	Mode	Range	Standard deviation
Mass-produced traditional	2.59€	1.80€	3.00€	1.99 – 10.00€	1.22
Handmade traditional	4.35€	3.00€	4.00€	2.99 – 15.00€	1.72
Mass-produced plant-based	2.96€	2.00€	3.00€	2.99 – 15.00€	1.47
Handmade plant-based	4.75€	3.00€	4.00€	3.49 – 20.00€	1.78

Source: Original research results

The analysis revealed a clear demographic profile. This group is predominantly women (71.8%) between the ages of 18 and 34 (73%), with a high level of education (78.2% hold a Bachelor's or Master's degree). This finding aligns with prior research indicating that women, younger people, and educated individuals are more inclined to consume plant-based foods and alternatives (Beardsworth and Bryman, 1999; Serdar and Phillips, 2011). The income level is well spread, with the lowest income bracket having the highest representation, which does not support previous studies showing that a higher income can lead to a higher WTP. Nonetheless, other research suggests that income level has no significant effect on WTP when it is related with environmentally friendly products and food, as environmental protection has become a global consensus, which could explain the survey results (Dunlap and Mertig, 1997; Flores and Carson, 1997; Fotopoulos and Krystallis, 2002; Lee, 2016).

We found that consumers willing to pay more for handmade plant-based desserts are not limited to those with a fully plant-based diet. A significant portion of these high-paying consumers are omnivores, vegetarians, or flexitarians, demonstrating a broader market for those looking to reduce their animal product consumption. This aligns with other studies showing consumers are open to plant-based alternatives for environmental reasons (Beacom et al., 2021). When analyzing WTP within this high-paying group, a general increase was observed across all dessert variations. The handmade plant-based option had a WTP 47% higher than the overall sample, while the handmade traditional had a WTP 37% higher. The plant-based aspect was particularly influential for this group, as the price difference between the two handmade variations

(€0.40) was eight times greater than for the entire sample. This indicates that the plant-based attribute has a stronger impact on their WTP.

These results can assist companies in this market to better price and target their products by adapting their marketing and advertising strategies. Given that the market for plant-based food is bound to grow, and Germany is leading this trend, it is of utmost relevance to study consumer behavior in the country. Considering both the change in eating habits due to the COVID-19 pandemic and the positive perception of handmade food, handmade plant-based desserts can become very attractive for companies to focus on, allowing them to leverage a premium price.

Conclusion

Responding to consumer trends influenced by environmental awareness and the COVID-19 pandemic, this study aimed to identify the WTP for handmade plant-based desserts and the factors affecting it. We found that the handmade aspect was the main driver of a higher WTP, with handmade plant-based cupcakes having the highest value. A key finding was the identification of a high-WTP segment—primarily women aged 18-34 with high education—for whom the plant-based attribute had a significantly greater influence. These results underscore the importance of customer segmentation for creating targeted marketing and pricing strategies, including the potential for a premium product line. Future research could build on these findings by conducting further statistical analyses, exploring different types of desserts, and performing cross-cultural studies to gain a more comprehensive understanding of WTP in this market segment.

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