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Abstract: This study identifies and explores the key factors and issues that influence Taiwanese consumer behavior and preferences when it comes to the consumption of white shrimp. It aims to increase consumer confidence in, and purchase intention for, private-brand white shrimp and to develop marketing strategies and models for farmers who operate a self-produced, self-sold model. This study adopted the Alphabet theory and EKB modeling to obtain a holistic picture of white shrimp purchase behavior and consumer preferences. A semi-questionnaire was conducted with 921 consumers of white shrimp between November 2020 and March 2021, of which 787 questionnaires were valid and used in this study. Our study revealed the following noteworthy points. Freshness and drug residue are the two main concerns of white shrimp purchasers. The results of the consumer study show the existence of statistically significant differences between the defined segments in terms of general characteristics, consumption habits and behavior, and motivation for product awareness and purchase intention, as well as determination of the option of obtaining white shrimp for consumption. Our findings suggest that there is a significant correlation between product awareness and purchase intention. This has a number of practical implications for the self-produced, self-sold aquaculture farmer. In particular, it highlights the importance of the following: 1. establishing connection and trust by business model innovation, 2. improving product image and value, 3. providing product safety information to increase purchase intention and willingness to pay, and 4. developing production and sale plans in response to market demand.

**Keywords:** white shrimp; consumer behavior; consumer preferences; product awareness; purchase intention

**Key Contribution:** 1. A key challenge for white shrimp farmers with private brands is how to increase consumer confidence and purchase intention. 2. This study identifies that age, educational level, and monthly household income all have a significant influence on product awareness and purchase intention. 3. Food safety is a major motivating factor in the purchase of white shrimp in Taiwan, regardless of size or price. 4. Food certification and quality-test labeling are critical in increasing consumer trust in the quality and safety of white shrimp.

# 1. Introduction

With rapid economic development and the rise in per capita incomes, aquatic products have come to account for an increasingly high proportion of global consumption. These products include finfish, crustaceans, cephalopods, other mollusks, aquatic plants, algae, and other aquatic animals. Their importance for global food security and nutrition is increasingly recognized. They are unique and extremely diverse providers of essential omega-3 fatty acids and bioavailable micronutrients, supplying critical nutrients and improving overall health [1]. The United Nations Food and Agriculture Organization (FAO) indicates that the total global production of fisheries and aquaculture has significantly



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**Copyright:** © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https:// creativecommons.org/licenses/by/ 4.0/). increased over the past seven decades, rising from about 19 million tons in 1950 to about 178 million tons in 2020 [2]. However, there has been a slight decline in capture fisheries, with the 2020 figure falling 6.4 percent from its 2018 peak of 96 million tons. Aquaculture production, on the other hand, has expanded continuously since the late 1980s, and now contributes 88 million tons (49%) of the total production [2]. Aquaculture has thus become a major source of aquatic products in the market and has played a significant role in reducing the global supply–demand gap for aquatic food.

Despite its great diversity, aquaculture production is dominated by finfish at regional and global levels (Table 1). Crustaceans account for just under 10%, with white shrimp (Penaeus nnamei) accounting for 51.7% (5812.2 tons) of global farmed production in 2020 (Table 2). Shrimp sales account for about 15% of the global total, the highest among aquatic products [3]. They provide consumers with fresh and delicious tastes, but at a high price [4]. The sale and consumption of shrimp in Taiwan has grown rapidly in recent years, with four main species being farmed: white shrimp (Penaeus vannamei), giant tiger prawn (Penaeus monodon), giant river prawn (Macrobrachium rosenbergii), and kuruma prawn (Penaeus japonicus). Of these, white shrimp is the most important. Despite the high demand for white shrimp in the Taiwanese market, local production has declined significantly over the past decade, from a peak of 13,357 tons (worth NT\$ 2154.4 million) in 2012 to 9845 tons (worth NT\$ 2036.2 million) in 2021 (Figure 1). This is due to the spread of EHP (Enterocytozoon hepatopenaei) [5]. In response, the volume and value of imported white shrimp doubled between 2017 and 2020 (Figure 2) [6]. The major sources of imported white shrimp are South America (Honduras and Nicaragua) and Southeast Asia (Thailand and Malaysia) (Figure 3) [6].



Figure 1. The yield and value of white shrimp in Taiwan, 2012–2021.



Figure 2. The import quantity and value of white shrimp in Taiwan, 2017–2021.



Figure 3. Top ten countries from which Taiwan imported white shrimp, 2021.

	Africa	Americas	Asia	Europe	Oceania	World	Share of World Total (%)
Finfish	2236.5	2420.7	50,030	2673.7	100.7	57,461.1	46.9
Crustaceans	7.6	1266.1	9951.1	3.6	8.6	11,237	9.2
Mollusks	6	688.1	16,351.4	578.7	116.4	17,740.5	14.5
Other aquatic animals	0.06	0.37	1052.4	6.7	2.8	1062.3	0.9
Algae	104.1	25.3	34,916.3	21.8	10.1	35,077.6	28.6
Total aquaculture	2354.3	4400.5	112,300.7	3284.4	238.6	122,578.5	100

Table 1. Aquaculture production by region and by main species group in 2020 (thousand tons).

Table 2. World production of major species of farmed crustaceans (thousand tons).

	2010	2015	2020	Percentage of Total, 2020
White shrimp, Penaeus vannamei	2648.5	3803.6	5812.2	51.7%
Red swamp crawfish, Procambarus clarkii	599.3	723.1	2469	22%
Chinese mitten crab, Eriocheir sinensis	572.4	747.4	775.9	6.9%
Giant tiger prawn, Penaeus monodon	562.9	735.2	717.1	6.4%
Giant river prawn, Macrobrachium rosenbergii	193.1	202.5	294	2.6%
Indo-Pacific swamp crab, Scylla serrata	37.0	83.6	248.8	2.2%
Oriental river prawn, Macrobrachium nipponense	217.7	240.6	228.8	2%
Green mud crab, Scylla paramamosain	112.4	135.1	159.4	1.4%
Subtotal other species	538.5	447.9	531.8	4.7%
Total	5481.8	7118.9	11,237	100%

In the past, most white shrimp in Taiwan were directly purchased by shrimp dealers, who were thus able to control the purchase price [7]. However, the rise in online commerce platforms has changed consumer behavior and the pattern of the aquatic product market, and consumers now have diverse channels and sources for purchasing a variety of such products. In order to increase profits, a growing number of aquaculture producers have begun to sell white shrimp directly to consumers. Gradually, within the white shrimp aquaculture industry, a self-produced self-sold model of marketing has emerged, with direct delivery from the origin. This has led to an increase in the number of privately branded products on the market. However, in recent years, the issues of illegality and safety of aquatic food have aroused the concern of consumers. A key challenge for white shrimp farmers, therefore, is how to increase consumer confidence and purchase intention when it comes to private brands.

This study adopted the Alphabet theory [8,9] and EKB (Engel–Kollat–Blackwell) modeling [10] to obtain a holistic picture of white shrimp purchase behavior and consumer preferences. It analyzed the findings to identify the key factors and relationships that influence purchase behavior. It also aimed to reveal areas of interest which have not yet been well researched. This information can be used to develop marketing strategies and models to increase the sales of white shrimp farmers who operate a self-produced, self-sold model.

# 2. Literature Review

To better understand consumer preferences and purchase decisions, there has been a steady growth in the number of research studies over the past decade looking at the increasing demand for organic and locally produced aquatic products. This reflects the increasing importance and relevance of this research field [3,11–15]. Consumers' attitudes toward, and reasons for, purchasing locally produced aquatic products are varied. Some consider locally produced food more environmentally and eco-friendly, while others see it as fresher, safer, and healthier [9]. Given these different interests, information and consumer knowledge may influence preferences and translate into different purchase behavior. Previous studies have shown that demographic factors, habits, and contextual factors can all influence such behavior [8,15,16].

The Alphabet theory is a valuable framework which explains local food consumption by examining key factors and interactions. It can be used to identify interesting and previously undiscovered issues [9]. Ref. [8] merged the VBN theory [17] with the ABC theory [18] and added knowledge, information seeking, habits, and demographic data in order to better understand consumer preferences and motivations. The various relationships and interactions among elements in the Alphabet theory are presented in Figure 4.



Figure 4. Conceptual framework of Alphabet theory.

The EKB model was originally developed by Engel, Kollat, and Blackwell in 1968 to serve as a framework for organizing knowledge about consumer behavior. The model has been modified a number of times to improve its descriptive ability and to clarify the basic relationships between components and subcomponents. It enables researchers to make conclusions about consumer behavior and analyze the gap between consumers' perception and purchase behavior [10]. The EKB model consists of four sections, the main components and sub-components of which are as follows:

- Information input stage: the consumer obtains information from marketing sources (advertising or marketing activity) and searches external information (the Internet), both of which influence their decision-making process.
- Information processing stage: this refers to the consumer's exposure, attention, perception, acceptance, and retention of external information.
- Decision processing stages: these consist of five subcomponents—problem recognition, search for alternatives, alternate evaluation, purchase, and outcomes.
- Variables influencing the decision-making process: the individual characteristics as well as situational and environmental influences that affect all the stages of the decision-making process.

Since interactions between elements influence white shrimp purchase behavior and consumer preferences, this study adopted specific elements of each of these models to develop a holistic picture. In particular, the identification of underlying consumer behavior and preferences is critical for the improvement of marketing, communication, and policy making. With this in mind, five major research hypotheses (Figure 5) were put forward:

**Hypothesis 1.** *There is a significant difference in product awareness between demographic variables in white shrimp consumers.* 

**Hypothesis 2.** *There is a significant difference in purchase intention between demographic variables in white shrimp consumers.* 

**Hypothesis 3.** *There is a significant difference in product awareness between different consumption habits in white shrimp consumers.* 

**Hypothesis 4.** *There is a significant difference in purchase intention between different consumption habits in white shrimp consumers.* 

**Hypothesis 5.** *There is a significant correlation between product awareness and purchase intention for white shrimp.* 



Figure 5. Research hypothesis.

# 3. Methodology

## 3.1. Questionnaire Content

To encourage questionnaire participation and completion, avoid misunderstandings, and increase the accuracy of the results, a pre-prepared explanation of its purpose and context is recommended. This study duly prepared a self-administrated questionnaire to measure a variety of constructs in relation to consumers and white shrimp. These included socio-demographic variables, consumption behavior and habits, product knowledge and awareness, and purchase intention. The semi-structured questionnaires were pre-tested in a pilot study in September 2020. A total of 30 pre-test questionnaires were piloted and Cronbach's alpha for the whole questionnaire was 0.926. A semi-open question format was adopted with yes/no questions, single and multiple-choice questions, and questions with a five-point bipolar scale (Supplementary Material Questionnaire).

#### 3.2. Data Collection

Data were collected between November 2020 and March 2021. An efficient sampling plan should contact potential participants and provide useful and available information. In this study, convenience sampling was employed because it was both simple and allowed the researcher easy access to participants. The participants in the survey were all volunteers and came from different areas of Taiwan. They were recruited from the streets, local markets, schools, and the Internet. Selecting participants from different areas enables the consideration of heterogeneity in terms of consumption behavior and habits. The primary criterion for selecting subjects in this study was that they had experience in white shrimp consumption. In order to reduce desirability bias, the survey was conducted using a self-completion questionnaire. The elderly and those with low literacy were excluded. In the end, a total of 921 volunteers took part in the survey, and the data from 787 questionnaires were available for study. A total of 91 questionnaires were discarded due to missing, incomplete, or invalid responses.

### 3.3. Statistical Analysis

The collected data from the respondents were analyzed using SPSS 20.0 (IBM Corp., Armonk, NY, USA) as follows:

- The descriptive statistics of general characteristics, consumption habits and behavior, and motivation were analyzed based on frequency and percentage [3,15].
- In accordance with the general characteristics, differences in product awareness and purchase intention were analyzed using an independent *t* test and analysis of variance (ANOVA). The Scheffé test was used as a post hoc test [19,20].
- The correlation between product awareness and purchase intention was analyzed using Pearson's correlation coefficients. In order to reduce the probability of incorrectly rejecting the null hypothesis, the *p*-value was set at less than 0.05 [20].

Exploratory Factor Analysis was used to extract significant factors related to product awareness and purchase intention. These included product knowledge, product safety, price perception, product source, product value, and sale price.

- Product knowledge: consumers' awareness of specific information of product;
- Product safety: consumers' awareness of product to be safe;
- Price perception: consumers' perception of the price of product;
- Product source: consumers' perception of the original source of product influences their purchasing decision;
- Product value: consumers' perception of the trade-off between perceived benefit and perceived sacrifice influences their purchasing decision;
- Sale price: consumers' perception of the price of product that influences their purchasing decision.

## 4. Results

# 4.1. Relationships between Product Awareness and Purchase Intention and General Demographic Characteristics

In this study, 44.6% of participants were male and 55.4% were female. Over half of the participants were aged 31–50 (31–40 = 26.7%; 41–50 = 24.7%). A total of 78.5% of the participants had a bachelor's, master's, or Ph.D. degree. Almost half of the participants lived in northern Taiwan. In terms of occupation, 27.3% were in the military/civil service/teaching, 19.2% were in the service industry, and 13.3% were in trading/finance/banking. A total of 61.5% of the participants were married, and 65.7% did not have children aged under 12. Almost a quarter of the participants (23.5%) claimed a monthly household income of over NT\$ 100,001 (Table 3). All the results of independence tests and one-way analysis of variance are shown in Table 3.

Regarding product awareness, this study found significant differences in product knowledge in terms of age (F = 8.426, p < 0.001), occupation (F = 4.896, p < 0.001), education (F = 6.467, p < 0.001), residence (F = 3.937, p < 0.05), marital status (t = 3.834, p < 0.01), and monthly household income (F = 2.258, p < 0.01). For product safety, there were significant differences in terms of age (F = 6.355, p < 0.001), education (F = 2.421, p < 0.01), and monthly household income (F = 2.773, p < 0.01). ANOVA revealed significant group differences in terms of age (F = 2.246, p < 0.01), education (F = 6.305, p < 0.001), residence (F = 3.474, p < 0.05), the number of children aged under 12 in a household (F = 12.218, p < 0.001), and monthly household income (F = 4.431, p < 0.001).

			Product Awareness						Purchase Intention					
Characteristic	Categories	n (%)	Product Knowledge		Product	Product Safety		Price Perception		Source	Product Value		Sale Price	
			t/F	Post Hoc	t/F	Post Hoc	t/F	Post Hoc	t/F	Post Hoc	t/F	Post Hoc	t/F	Post Hoc
Gender	male <sup>A</sup> female <sup>B</sup>	351 (44.6) 436 (55.4)	-2.390	ns	-2.329	ns	-1.973	ns	-2.251	ns	-2.705 **	B > A	-5.139	ns
Age	Under 20 <sup>A</sup> 21–30 <sup>B</sup> 31–40 <sup>C</sup> 41–50 <sup>D</sup> 51–60 <sup>E</sup> over 61 <sup>F</sup>	44 (5.6) 137 (17.4) 210 (26.7) 194 (24.7) 109 (13.9) 93 (11.8)	8.436 ***	B > A $C > A$ $D > A$ $E > A$ $F > A$	6.355 ***	C > A D > A	2.246 *	ns	3.888 **	B > A C > A D > A	6.882 ***	C > A D > A E > A	0.675	ns
Occupation	military/civil service/teacher <sup>A</sup> farming/fishing/husbandry <sup>B</sup> trading/finance/banking <sup>C</sup> industry/technical <sup>D</sup> service industry <sup>E</sup> homemaker <sup>F</sup> student <sup>G</sup> self-employed <sup>H</sup> retired <sup>I</sup> others <sup>J</sup>	$\begin{array}{c} 215 \ (27.3) \\ 23 \ (2.9) \\ 105 \ (13.3) \\ 58 \ (7.4) \\ 151 \ (19.2) \\ 79 \ (10.0) \\ 68 \ (8.6) \\ 32 \ (4.1) \\ 50 \ (6.4) \\ 5 \ (0.6) \end{array}$	4.896 ***	B > G C > G D > G E > G	1.569	ns	1.762	ns	1.922 *	ns	3.206 ***	B > G	3.007 **	ns
Education	primary or under <sup>A</sup> junior <sup>B</sup> senior (vocational) <sup>C</sup> college <sup>D</sup> university <sup>E</sup> MSc/Ph.D. <sup>F</sup>	3 (0.4) 19 (2.4) 147 (18.7) 153 (19.4) 324 (41.2) 141 (17.9)	6.467 ***	F > D F > E	2.421 *	F > E	6.305 ***	C > D C > E C > F	2.427 *	ns	5.319 ***	F > E	2.666 *	C > E

Table 3. Relationships between product awareness and purchase intention and general characteristics (N = 787) (USD 1 = NT\$ 27.899).

Table 3. Cont.

	Categories	n (%)	Product Awareness						Purchase Intention					
Characteristic			Product Knowledge		Product Safety		Price Perception		Product Source		Product Value		Sale Price	
			t/F	Post Hoc	t/F	Post Hoc	t/F	Post Hoc	t/F	Post Hoc	t/F	Post Hoc	t/F	Post Hoc
Residence	northern region <sup>A</sup> central region <sup>B</sup> southern region <sup>C</sup> eastern region <sup>D</sup> outlying islands <sup>E</sup>	214 (27.2) 152 (19.3) 393 (49.9) 19 (2.4) 9 (1.1)	3.937 *	C > B	3.242	ns	3.474 **	B > A	4.940 ***	C > A	7.157 ***	C > A	0.756	ns
Marital status	married <sup>A</sup> single <sup>B</sup>	484 (61.5) 303 (38.5)	3.834 **	A > B	2.703	ns	4.265	ns	2.794	ns	3.911 *	A > B	4.604	ns
The number of children aged under 12 in household	None <sup>A</sup> 1 <sup>B</sup> 2 <sup>C</sup> more than 3 <sup>D</sup>	517 (65.7) 131 (16.6) 120 (15.2) 19 (2.4)	2.303	ns	0.717	ns	12.218 ***	B > A C > A	3.764 *	ns	1.629	ns	4.549 **	B > A C > A
Monthly household income	under NT\$ 20,000 <sup>A</sup> NT\$ 20,001–NT\$ 40,000 <sup>B</sup> NT\$ 40,001–NT\$ 60,000 <sup>C</sup> NT\$ 60,001–NT\$ 80,000 <sup>D</sup> NT\$ 80,001–NT\$ 100,000 <sup>E</sup> over NT\$ 100,001 <sup>F</sup>	22 (2.8) 129 (16.4) 164 (20.8) 157 (19.9) 130 (16.5) 185 (23.5)	2.258 *	ns	2.773 *	D > A E > A F > A	4.431 ***	B > C B > E B > F	2.686	ns	1.633	ns	7.391 ***	B > C B > D B > E B > F

\* *p* < 0.05, \*\* *p* < 0.01, \*\*\* *p* < 0.001. ns: no significant difference. Superscript letters represent different groups of general characteristics.

Regarding purchase intention, this study found significant differences in product source in terms of age (F = 3.888, p < 0.01), occupation (F = 1.922, p < 0.05), education (F = 2.427, p < 0.05), residence (F = 4.940, p < 0.001), and the number of children aged under 12 in a household (F = 3.764, p < 0.05). For product value, there were significant differences in terms of gender (t = -2.705, p < 0.01), age (F = 6.882, p < 0.001), occupation (F = 3.206, p < 0.001), education (F = 5.319, p < 0.001), residence (F = 7.157, p < 0.001), and marital status (t = 3.911, p < 0.05). ANOVA revealed significant group differences in terms of occupation (F = 3.007, p < 0.01), education (F = 2.666, p < 0.05), the number of children aged under 12 in a household (F = 4.549, p < 0.01), and monthly household income (F = 7.391, p < 0.001).

# 4.2. Relationships between Product Awareness and Purchase Intention and Consumption Habits and Behavior

Table 4 shows the white shrimp purchasing and consumption habits of the participants. The highest self-catering frequency was 1–5 times/week (42.6%). Traditional markets (42.4%) and fresh supermarkets (23.9%) were the two most common places of consumption. The main reasons for purchasing white shrimp were convenience (30.1%), freshness (23.0%), and habituation (20.2%). A total of 34.4% of the participants stated that they purchased white shrimp monthly, and the most common expenditure was NT\$ 201–NT\$ 500 (56.3%). The consumers' main concerns were related to product safety, including freshness (41.6%) and drug residue (23.8%). White shrimp was often purchased during Lunar New Year (27.2%), on long weekends (18.5%), and at the Mid-Autumn Festival (17.8%). It is worth noting that almost half of the participants (44.1%) had no clear idea about the size of white shrimp. A total of 38.9% of the participants showed a preference for labeled or organic white shrimp. Just over a third (33.8%) thought that the sale price of labeled or organic white shrimp should be no different from other white shrimp products.

Characteristic	Categories	n (%)
	none	68 (8.6)
	1–5 times	335 (42.6)
Frequency of self-catering per week	6–10 times	207 (26.3)
Frequency of self-catering per week	11~15 times	95 (12.1)
	more than 16 times	82 (10.4)
	traditional market	538 (42.4)
	fresh supermarket	304 (23.9)
	warehouse retailing	197 (15.5)
Consumption place of white shrimp	wholesale fish market	106 (8.3)
	e-commerce platform	16 (1.3)
	white shrimp farmer	79 (6.2)
	others	30 (2.4)
	convenience	419 (30.1)
	habituation	281 (20.2)
	cheap	173 (12.4)
Reasons for purchasing white shrimp	freshness	320 (23.0)
in these places	hygienic quality	77 (5.5)
	quality assurance	98 (7.0)
	good service	13 (0.9)
	others	11 (0.8)
	daily	9 (1.1)
	weekly	136 (17.3)
Consumption frequency of	monthly	271 (34.4)
Consumption frequency of	quarterly	151 (19.2)
white shrimp	half yearly	88 (11.2)
	annually	27 (3.4)
	others	105 (13.3)

Table 4. Descriptive statistics of consumption habits (N = 787) (USD 1 = NT\$ 27.899).

Characteristic	Categories	n (%)
	under NT\$ 200	95 (12.1)
	NT\$ 201-NT\$ 500	443 (56.3)
Average expenditure on white shrimp	NT\$ 501-NT\$ 1000	202 (25.7)
per time	NT\$ 1001-NT\$ 2000	37 (4.7)
	over NT\$ 2001	10 (1.3)
	I have no idea about size	347 (44.1)
Purchasa siza of white shrimp	10–20 shrimps/600 g	196 (24.9)
i urchase size of white similip	21–30 shrimps/600 g	185 (23.5)
	31–40 shrimps/600 g	59 (7.5)
	none	94 (11.9)
	shell off shrimp	51 (6.5)
primary concern about purchasing	allergy to shrimp	95 (12.1)
white shrimp	high cholesterol	36 (4.6)
	freshness	327 (41.6)
	drug residue	184 (23.4)
	none	181 (11.8)
	long weekends	283 (18.5)
	Lunar New Year	416 (27.2)
	Ching Ming Festival	59 (3.9)
	Mother's Day	94 (6.1)
Purchasing white shrimp during	Dragon Boat Festival	58 (3.8)
specific holidays or festivals	Chung Yuan Festival	47 (3.1)
	Father's Day	42 (2.7)
	Mid-Autumn Festival	273 (17.8)
	National Day	18 (1.2)
	Christmas	23 (1.5)
	others	36 (2.4)
preferences for labeled or organic	yes	306 (38.9)
white shrimp	no	112 (14.2)
white stimp	not sure	369 (46.9)
	same price	266 (33.8)
	less than NT\$ 20	126 (16.0)
Willingness to pay more for labeled or	NT\$ 21–40	173 (22.0)
organic white shrimp	NT\$ 41-60	90 (11.4)
organic write sump	NT\$ 61–80	36 (4.6)
	NT\$ 81–100	53 (6.7)
	over NT\$ 101	43 (5.5)

Table 4. Cont.

Regarding product awareness, ANOVA (Table 5) revealed that, based on consumption frequency, there were significant differences among participants in terms of product knowledge (F = 2.177, p < 0.05), product safety (F = 3.808, p < 0.001), and price perception (F = 3.784, p < 0.001). However, based on the frequency of self-catering, the only significant difference was in price perception (F = 3.226, p < 0.05).

Turning to purchase intention, Table 5 shows that, based on consumption frequency, there were significant differences among respondents in terms of product source (F = 2.827, p < 0.001), product value (F = 3.185, p < 0.001), and sale price (F = 4.480, p < 0.001). For the frequency of self-catering, the significant differences were in product value (F = 2.831, p < 0.05) and sale price (F = 3.510, p < 0.001).

		Product Awareness							Purchase Intention					
Characteristic	<b>Categories</b>	Produ Knowle	ıct edge	Produc	t Safety	Pric Percep	e tion	Proc Sou	luct rce	Produ Valu	ıct e	Sale	Price	
		F	Post Hoc	F	Post Hoc	F	Post Hoc	F	Post Hoc	F	Post Hoc	F	Post Hoc	
Frequency of self- catering per week	None <sup>A</sup> 1–5 times <sup>B</sup> 6–10 times <sup>C</sup> 11~15 times <sup>D</sup> more than 16 times <sup>E</sup>	0.972	ns	0.347	ns	3.226 *	ns	2.201	ns	2.831 *	ns	3.510 ***	B > E C > E	
Consumption frequency of white shrimp	Daily <sup>A</sup> Weekly <sup>B</sup> Monthly <sup>C</sup> Quarterly <sup>D</sup> Half yearly <sup>E</sup> Annually <sup>F</sup> Others <sup>G</sup>	2.177 *	ns	3.808 ***	C > A D > A	3.784 ***	ns	2.827 ***	ns	3.185 ***	ns	4.480 ***	C > D C > E C > G	

**Table 5.** Relationships between product awareness and purchase intention and consumption habits (N = 787).

\* p < 0.05, \*\*\* p < 0.001. ns: no significant difference. Superscript letters represent different groups of consumption habits.

## 4.3. Correlations between Product Awareness and Purchase Intention

Table 6 shows clear and moderate correlations between product awareness and purchase intention. All six correlations were positive and significant at <0.05. Three exceeded r = 0.50. Product value correlated with product knowledge (r = 0.591) and product safety (r = 0.520), while sale price correlated with price perception (r = 0.524). While significant, these relationships are moderate in strength and in line with previous studies.

Table 6. Correlation between the variables in product awareness and purchase intention.

D 1 ( )	Purchase Intention								
Product Awareness –	Product Source	Product Value	Sale Price						
product knowledge	0.475 **	0.591 **	0.329 **						
product safety	0.475 **	0.520 **	0.179 **						
price perception	0.449 **	0.332 **	0.524 **						

\*\* p < 0.01.

# 5. Discussion

This study pinpoints the behavior and preferences of Taiwanese consumers when it comes to white shrimp. It investigates the possible influence of attributes that are missing in existing studies. We provide evidence and a holistic picture of consumer preferences and purchase behavior in Taiwan, a market which may have rather different characteristics to mature markets in other countries. Consistent with our hypotheses, consumers with different demographic variables and consumption habits showed different degrees of product awareness and purchase intention. There was also a significant correlation between product awareness and purchase intention. These results may have practical implications for the self-produced, self-sold aquaculture sector.

# 5.1. Establishing Connections and Trust between Producers and Consumers through Business Model Innovation

Despite a transformation in lifestyles and the rise in online shopping, most Taiwanese consumers still purchase aquatic products in traditional markets and supermarkets [21]. For consumers, traditional markets have the advantage of convenience and freshness, while supermarkets possibly have better environmental sanitation, product safety, and

quality [22]. However, the traditional marketing and sales model of aquatic products in Taiwan is particularly susceptible to the effect of information asymmetry, and this has a direct and serious impact on trade structure, price fluctuation, and the income of aqua farmers.

Although some aqua farmers plan to operate their own business and brands, the limited number of marketing channels and high operating costs present key challenges. Therefore, this study puts forward farmers markets, a rapidly emerging production–consumption pattern, as an alternative option. Farmer's markets tend to be concentrated in urban areas, which provides locally produced products with safety certification, as well as enables direct communication with consumers about product information and brand story. Farmer's markets have the advantages of traditional markets and supermarkets, but can also help establish an interactive trust relationship between aqua farmers and consumers.

## 5.2. Improving Product Image and Value

When it comes to aquatic products, there are significant safety issues. These include environmental pollution [22–24], inappropriate use of medication [25], and drug residues [26,27]. According to the results of a 2019 national drug residue program conducted by the Taiwan Food and Drug Administration, the total number of unqualified domestic aquatic products exceeds that of poultry and livestock. This study noted that nearly 40% of participants showed a preference for labeled or organic white shrimp. This finding is consistent with previous studies which have demonstrated a rise of health consciousness among consumers, and a preference for trusted, safe, and healthy aqua products [3,21,28].

These results highlight the importance of health and safety attributes in improving the product image and value of aqua products [3,29]. The Taiwanese certification labels (CAS, TAP, CAS Organic) and production traceability system can be used as a medium to convey health and safety information to consumers. This will reduce information asymmetry and encourage better self-discipline and responsibility among aqua farmers, leading to improved quality assurance and lower risks [30]. Improvements in the quality and safety of aqua products will help in the process of market segmentation and the targeting of customer groups. Promoting and disseminating aqua product information may raise product value and brand image and thus increase demand.

#### 5.3. Providing Product Safety Information to Increase Purchase Intention and Willingness to Pay

Our finding that an organic label or traceability information increases consumers' purchase intention is in line with the results of previous studies [31–35]. However, unlike previous studies [34,36,37], which found clear evidence that consumer willingness to pay increased for products with high quality, safety, and environmental friendliness, our study showed that over a third of the participants believe that the sale price of white shrimp with labels or traceability information should be no higher than that of other white shrimp. This implies that consumers do not think that the costs of food inspection and certification should be passed on. A consequence of this is that most dealers are unwilling to raise the purchase price of certified products, which in turn makes aquaculture farmers reluctant to participate in the traceability system or obtain relevant certification.

Our finding of a close relationship between product knowledge and purchase intention is entirely consistent with previous studies [38–40]. The results show that high-income consumers pay more attention to the quality and safety of white shrimp, while young, low-income, lower-educated consumers are more sensitive to price. This may partly explain why, for this latter group, knowledge about product awareness and food safety is insufficient, and why the issue of food safety does not significantly affect their willingness to buy.

Previous studies [41,42] have suggested that education about a fish-based diet is one of the most cost-effective interventions for communicating accurate information and knowledge to younger and inexperienced consumers and increasing their consumption of aquatic products. The promotion of a fish-based diet can both eliminate misconceptions about aquatic products and enhance the transparency of market information. This will increase the number of potential consumer groups in the future.

#### 5.4. Developing a Production and Sales Plan in Response to Market Demand

A better understanding of the specific characteristics (motivation, habits, and preferences) of key consumer groups will enhance competitiveness. Most Taiwanese are accustomed to cooking and enjoying sumptuous meals with their relatives during traditional festivals. The demand for, and consumption of, aquatic products increase during these "family gatherings" and "traditional festivals" [43]. This study therefore suggests that white shrimp farmers who operate a self-produced, self-sold model develop and adjust their overall production, marketing, and scheduling to coincide with these special festivals. Doing so will enable them to meet peak consumer demand and effectively raise profits by increasing sales and prices.

This study also recommends that, with improvements in freezing technology, farmers sell their products using quick freezing methods. In this respect, a key challenge will be to overcome the perception among Taiwanese consumers that frozen aquatic products are of inferior quality. Given our findings, we strongly suggest that farmers provide accurate information on the preservation of aquatic products in order to clear up misconceptions and close the knowledge gap. This will enable them to establish a self-brand image and avoid the significant costs of transporting live shrimp.

#### 6. Conclusions

This study reveals the purchase behavior and preferences of Taiwanese consumers when it comes to white shrimp and identifies key factors and relationships that have not been revealed in previous studies. It concludes that Taiwanese consumers typically buy white shrimp in traditional markets for reasons of habit and convenience, that the most common purchase frequency is once a month, and that the typical purchase is worth NT\$ 201–500. Custom and tradition mean that most consumers purchase white shrimp products during specific festivals, such as the Lunar New Year, long weekend holidays, and the Mid-Autumn Festival. The majority of the consumers do not know the exact quantity of white shrimp they purchase, but state "freshness" and "drug residues" as their priority considerations. Nearly 40% prefer white shrimp with a safety certification. On the other hand, almost half of the consumers (46.9%) may choose not to buy certified products due to their high price. Indeed, it is worth noting that over a third of consumers are unwilling to pay a higher price for certified or quality-tested white shrimp because they believe that quality assurance is something which farmers have a duty to provide.

This study reveals a number of important issues concerning the behavior and preferences of Taiwanese consumers when it comes to white shrimp. Firstly, it identifies the importance of understanding demographics. Age, educational level, and monthly household income were all found to have a significant impact on product awareness and purchase intention. The variables representing those over 20 of age, with a high level of education, or a high household income correlated positively with product knowledge and product safety. Self-produced, self-sold white shrimp farmers therefore need to consider the demographics and habits of potential consumers and adapt their marketing strategies accordingly. Secondly, this study shows that food safety is a major motivating factor in the purchase of white shrimp in Taiwan, regardless of size or price. Food certification and quality-test labeling are therefore critical in increasing consumer trust in the quality and safety of white shrimp. Thirdly, this study highlights the benefits of promoting product value by raising product awareness, building trust, deepening interaction with consumers, and increasing consumer willingness. To this end, we suggest that farmer's markets, a relatively new style of market in Taiwan, offer an excellent opportunity for aqua farmers to promote their products personally, increase product knowledge, and provide timely and relevant information about food quality and safety. This may also be of help in future

research on the influence of farmer's markets on consumer awareness and the consumption of aquatic products. Finally, this study encourages white shrimp farmers to develop an overall production and marketing plan and to adjust their production schedules to align with specific festivals. This will enable them to increase sales and prices as well as to boost profits.

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