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Research article

Path relationship of consumers' perceived susceptibility and severity of health problems with their purchase of buckwheat functional foods in China

Yixin Nong [a,b,e,**], Minjuan Zhao [c], Hsiaoping Chien [b,d,*]

[a] Fudan Postdoctoral Fellowships in Applied Economic Studies, Fudan University, Shanghai, 200433, China
[b] Graduate School of Agricultural and Life Sciences, University of Tokyo, Tokyo, 113-8657, Japan
[c] Northwest A&F University, 3 Taicheng Road, Yangling, 712100, China
[d] Japan International Research Center for Agricultural Sciences, Tsukuba, 305-8686, Japan
[e] Guangxi Beibu Gulf Bank Postdoctoral Innovation and Practice Base, Nanning, Guangxi, 530028, China

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ABSTRACT

Although the nutritional and health benefits of buckwheat foods have been widely discussed and evaluated, studies on consumer perceptions of the health benefits of buckwheat functional foods and how these perceived benefits influence their consumption are scarce. On the basis of the theory of planned behavior, this study aimed to explore consumers' purchase intention and behavior toward buckwheat functional foods while assessing the impact of their perceived susceptibility and severity of health concerns on the purchase decisions for such foods. Using data from 1077 participants collected in person from Southwest China, we compared the influencing factors between consumer groups based on whether they were aware of the nutritive and health benefits of buckwheat. The results indicated that, apart from consumers' perceived behavioral control, their perceived susceptibility and perceived severity of three selected common health problems, perceived value and efficacy of buckwheat, and subjective norms were strong predictors of consumers' purchase decisions. Moreover, perceived susceptibility and severity were effective antecedents of the perceived value and efficacy of buckwheat, respectively. Consumers aware of buckwheat's nutritive and health benefits of buckwheat were less affected by perceived efficacy. This study highlights that the higher the susceptibility to the three selected common health problems, the greater the internal and behavioral changes toward the purchase of buckwheat functional foods. These findings reveal factors affecting consumers' healthy eating beliefs, which can be beneficial for both policymakers and marketers in formulating healthy diet policies and strategies in developing countries.

1. Introduction

Inappropriate diet and unhealthy eating habits increase risk of diabetes, hypertension, and other non-communicable chronic health problems (Alhyas et al., 2011; Marsola, Carvalho-Ferreira, Cunha, Jaime, & da Cunha, 2021). It is necessary to adjust dietary patterns with foods that not only provide necessary nutrients but also promote disease prevention and physical and mental well-being (Roberts and Barnard, 2005; Siró et al., 2008). The Chinese proverb "Medicine and food have the same origin" is apt in this context, as it emphasizes maintaining a healthy body through food or a balanced diet. Functional foods play an outstanding role in achieving this as they offer scientifically proven benefits that lead to better health and well-being beyond what simple diet-required nutrients provide (Barauskaite et al., 2018). Consequently, a profound understanding of how consumers value the effects of functional foods and their relationship with consumers' health concerns and beliefs can benefit attempts to improve food choices (Siró et al., 2008).

As in the industrialized nations, the prevalence of obesity and other diet-related health problems is increasing in emerging developing nations, including China (Alhyas et al., 2011; Wang et al., 2007). To counteract the negative effects of these health problems and the declining well-being in China in the past decade, the government launched Healthy China blueprints (HC 2020 and HC 2030), which highlighted functional nutritive foods that citizens could incorporate into their diets, promote healthy eating habits, and prevent diseases (Hu et al., 2011; Tan et al., 2017). A nutrient-rich coarse grain and a valuable raw material for functional foods, common buckwheat (*Fagopyrum esculentum* Moench) combines health-promoting nutritional and medical value to reduce

* Corresponding author.
** Corresponding author.
E-mail addresses: nongyixin826@hotmail.com (Y. Nong), chienp@affrc.go.jp (H. Chien).

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hyperlipidemia, blood pressure, and diabetes because of its lower post-prandial blood glucose and insulin response (Guo and Xiong, 2013; Kreft, 2016). Additionally, Tartary (bitter) buckwheat (*F. tataricum* Gaertner) contains higher amounts of phenolic compounds, including rutin, orientin, and vitexin, as well as anti-hypertensive, anti-diabetic, and cholesterol-lowering properties (Luo et al., 2019). Responding to the traditional belief that food and medicine originate from the same source as well as consumers' desire for a balanced diet, traditional buckwheat products such as noodles, flour, and steamed buns, as well as novel products such as buckwheat bread, tea, wine, sprouts, and oatmeal, have entered the market, with demand for these growing rapidly. According to China's National Bureau of Statistics, the average annual growth rate of buckwheat sown area and output in China in the past five years were 2.4% and 3.25%, respectively.

Prior studies have found that consumers' attitudes toward a healthy lifestyle (Chen et al., 2018), including their perception of the value derived from functional foods (Bornkessel, Bröring (Onno) Omta and van Trijp, 2014; Huang et al., 2020), the risks of acquiring health problems (Nystrand and Olsen, 2020), and their descriptive normative susceptibility to peer influence, such as a substantial number of other people making similar choices (Barauskaite et al., 2018), affect people's choice of foods that offer health benefits. Their perception of the severity of health problems could also affect decisions on the functional foods they consume for disease prevention (Barauskaite et al., 2018; Conroy et al., 2021; Rosenstock, 1974). In addition, except for Huang et al. (2020), Yadav and Pathak (2017), and Guo et al. (2020), who focus on populous developing nations, prior studies have been conducted mainly in the context of developed countries. Based on the study by van der Heijden, te Molder, Jager, and Mulder (2021), who identified high prices and a lack of convenient channels as dominant purchase barriers in populous developing countries such as China and India, an in-depth exploration of consumers' attitudes toward healthier eating should be conducted. As the understanding of healthy dietary habits among Chinese consumers is limited (Hu et al., 2011; Wang et al., 2007), this study aimed to analyze the factors affecting consumers' healthy eating beliefs to help inform both policymakers and marketers in formulating healthy diet policies and strategies in China.

Extant research has focused on general functional foods, without targeting a specific food type (Barauskaite et al., 2018; Huang et al., 2020; Nystrand and Olsen, 2020). This study focuses on buckwheat functional foods because not only are these coarse grains easily available commercially in China, but also their health-promoting, nutritious properties and functionalities in disease prevention have been emphasized through both government promotional activities and commercial advertisements (Li and Zhang, 2001; Luo et al., 2019). In addition, although the nutritional and health benefits of buckwheat foods have been widely discussed and evaluated (Li and Zhang, 2001), studies on consumer perceptions of the health benefits of buckwheat functional foods and how these influence their consumption are scarce. In particular, people's perceived healthiness of the products (Bornkessel, Bröring (Onno) Omta and van Trijp, 2014) and their appraisal of their own capability to choose these foods (Barauskaite et al., 2018; Nystrand and Olsen, 2020) also motivate this study's intent to explore this topic. Additionally, given that Chinese consumers generally show poor trust in food production because of increasingly frequent food safety scandals (Conroy et al., 2021; Pei et al., 2011; Xu et al., 2020), choosing the buckwheat functional foods that require no high-tech ingredients and additives reflects not only consumers' acceptance of natural food without artificial chemicals but also their perception of buckwheat as a long-term therapy that resolves health problems while posing less danger to their health.

This study is the first to evaluate consumers' purchase decisions regarding buckwheat functional foods with respect to the health concerns in the Chinese context. First, based on the theory of planned behavior (TPB), a conceptual model was built to analyze the decision-making process that leads to such purchase decisions. Second, we estimated the effect of several new constructs associated with consumers' purchase intention (PI) and purchase behavior (PB) toward buckwheat, including their perceived value (PV) and perceived efficacy (PE), the antecedents of their perceived susceptibility (PSU) and perceived severity (PSE) of health issues, as well as perceived behavioral control (PBC) and subjective norms (SN). We clarify the relationship between these factors and purchase decisions. Third, we compared consumer group estimations based on their level of awareness of the nutritive value and health effects of buckwheat. Our study contributes to the existing literature by clarifying the effects of PSU and PSE in influencing PI and verifying new path relationships between them. In addition, differences between consumer groups with and without awareness of the nutritive value and health effects of buckwheat functional foods were identified.

2. Materials and methods

2.1. Data

The data were obtained from seven major cities in Sichuan and Guizhou in Southwest China, the main buckwheat cultivation areas and consumption provinces in the country. Thus, the consumers in these cities are familiar with various types of buckwheat functional foods, and are representative of the consumption of buckwheat products (Ruan et al., 2020). Before data collection, the researchers had the questionnaires designed according to established ethical guidelines and approved by Northwest A&F University in Yangling and the Japan International Research Center for Agricultural Sciences. During July and August 2018, an in-person survey was conducted in crowd-gathering places downtown, including city parks, outside supermarkets, and shopping malls, by trained students and experienced researchers. The purpose and content of the questionnaire were explained by the researcher to all respondents. Informed consent was obtained from all respondents, and the researchers ensured that the study complies with all ethical regulations. In the survey, buckwheat products included a wide range of commercial products (flour, bread, cake, noodles, and desserts). The respondents answered all questions voluntarily and were free to stop the survey at any time without providing any reason. A sample of 1159 consumer data was collected, and 1077 questionnaires were found valid.

2.2. Measures

The questionnaire had two sections. The first section comprised questions on eight constructs: perceived susceptibility (PSU), perceived severity (PSE), perceived value (PV), perceived efficacy (PE), subjective norms (SN), perceived behavioral control (PBC), purchase intention (PI), and purchase behavior (PB). The second section comprised five questions on the respondents' sociodemographic characteristics. Appendix 1 presents the 32 items used to measure the constructs. Hyperglycemia, dyslipidemia, and hypertension are the top three well-known health problems associated with eating habits and lifestyles in China, and were specifically defined in the questionnaire. A 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used to measure four items for each construct of PSU, PSE, PBE, and PR. PSU was measured against the top three health problems based on participants' current health conditions and diet (Akey et al., 2013).

The PSE measures the impact of the top three health problems on expenses, daily activities (such as walking and climbing stairs), lifespan, and the expected duration of the impact (Hu et al., 2011; Marsola et al., 2021). PV consists of three statements on the potential environmental and health benefits of buckwheat. As demonstrated by Nystrand and Olsen (2020), Hansen et al. (2018), and Armitage and Conner (2001), PE and PBC include three statements on the extent of the consumers' perception of their control over purchasing buckwheat. To assess SN, respondents were asked to rate how far family or friends' approval influenced their purchase decisions (Lim and An, 2021), and the influence of the rising health food consumption trend and government policy

(Guo et al., 2020). To estimate PI, consumers were asked about their intention to (i) buy buckwheat more frequently and in larger amounts, and (ii) recommend buckwheat to other people. PB deals with the greater variety and frequency of actual purchases (Nystrand and Olsen, 2020).

2.3. Theoretical basis

2.3.1. Theory of planned behavior (TPB)

TPB (Ajzen, 1991) is among the most popular social-psychological models for understanding and predicting human behavior, and it has been applied widely in various fields (Barauskaite et al., 2018; Lim and An, 2021; Nystrand and Olsen, 2020; Yadav and Pathak, 2017). The theory has been used to explain the purchasing behavior for functional healthy foods, including the measurement of detailed perceptions and verification of the influence of mediating factors (Ajzen, 2016; Huang et al., 2020; Nystrand and Olsen, 2020). We assume that behavior can be predicted by intention and that intention is determined by three latent constructs: attitudes, SN, and PBC regarding behavior. *Attitudes* represent an individual's positive or negative evaluation of the behavior (Contini et al., 2020; Dorce et al., 2021; Fan et al., 2015) including the perceived benefits or PV of the potential behavioral impact (Dorce et al., 2021; Huang et al., 2020; Li et al., 2020). *SN* is the degree to which people value an important person's approval or disapproval; it is also influenced by perceived social pressure to act in a certain way (Ajzen, 2016; Lim and An, 2021). *PBC* describes the degree to which consumers perceive their ability to perform the behavior, which influences both PI and PB.

On the basis of the TPB model, many extant studies have explored consumers' decision-making on functional healthy foods by reconceptualizing the theory's three major constructs and enriching variables, such as *self-efficacy* (Lim and An, 2021; Nystrand and Olsen, 2020; Yadav and Pathak, 2017). TPB was used to develop our conceptual framework to understand and predict consumers' PI and PB toward buckwheat (see Figure 1). The framework depicts the structure of the hypotheses tested in this study. First, we assume that the stronger the behavioral intention, the higher the possibility of practice (Ajzen, 1991). As healthy eating behavior is significantly influenced by behavioral intention (Conner et al., 2002), we posit the following hypothesis:

H1. The intention to purchase buckwheat is positively related to PB.

2.3.2. Perceived value (PV)

Value associated with nutrition and health benefits (Huang et al., 2020; Hunter et al., 2019), health concerns and lifestyle (Nystrand and Olsen, 2020), and well-being (Lim and An, 2021) positively influences PI toward healthy functional food. Moreover, using the best–worst scaling method, Lusk and Briggeman (2009) demonstrated that value associated with nutrition, health, and food safety significantly affects consumers' food choices and consumption. On the basis of prior research that demonstrated the naturalness, environmental concerns, and nutritional value of buckwheat (Giménez-Bastida and Zieliński, 2015; Zhang et al., 2012), value associated with the environment, health, and the potential disease prevention effect of buckwheat was included in the PV construct.

Barauskaite et al. (2018) reported a strong positive association between conspicuous consumption and susceptibility to functional food distinctiveness by evaluating self-reported functional food purchase rates. Similarly, Kumar and Smith (2018) confirmed that health consciousness is a significant predictor of the intention to purchase healthy local food. Consumers' awareness of the functional properties of food and concerns about being overweight were found to be associated with believability and purchase intent toward functional food in Australia (Hunter et al., 2019). Although susceptibility and concerns associated with the nutritive value of functional foods have been discussed in prior studies, such studies rarely refer directly to the top three health problems. Considering buckwheat's nutritive value in preventing these problems, and that its medical benefits have been emphasized in the commercial market in China, consumers' PSU and PSE for the top three health problems were assumed to be associated with the PV of buckwheat. Hence, the following hypotheses are proposed:

H2. PV is positively related to PI for buckwheat.

H2a. PSU is positively related to the PV of buckwheat.

H2b. PSE is positively related to the PV of buckwheat.

2.3.3. Perceived efficacy (PE) and perceived behavioral control (PBC)

PBC influences people's intentions and the actual performance of a given behavior. Terry and O'Leary (1995) demonstrated that separate measures for PE and PBC should be employed in the TPB model. PE is associated with the assessment of internal constraints (Nystrand and Olsen, 2020; Zeweld et al., 2017), while PBC considers the controllability associated with external constraints along with behavior, such as lack of availability or higher sale price (Dorce et al., 2021). Although the concept of PBC can be similar to the notion of self-efficacy (Ajzen, 1991), it is necessary to differentiate a person's perceived control of external and internal constraints (Nystrand and Olsen, 2020). The PBC of the controllable external situation was empirically associated with

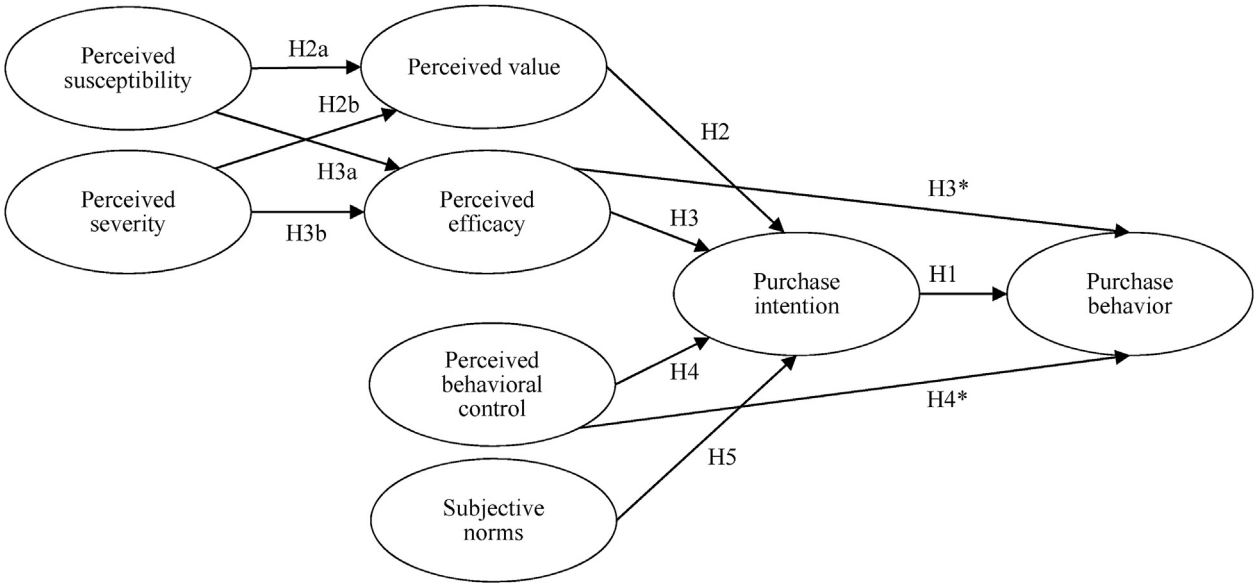

Figure 1. Conceptual model of consumers' purchase decisions on buckwheat.

behavioral intention and actual behavior (Ajzen, 2016; Armitage and Conner, 2001), while a person's appraisal of their ability to perform behavior-perceived efficacy should have a great impact on behavioral intention (Nystrand and Olsen, 2020; Terry & O'Leary, 1995). Self-appraisal has also been suggested as a mediating factor in perceptions toward healthy eating decisions (Caplan and Schooler, 2007; McCarthy et al., 2017), which can be influenced by an individual's perceived potential risk and concerns (Contini et al., 2020). In this study, PE was proposed as a distinctive predictor of PI and PB for buckwheat, which is associated with PSU and PSE in the top three health problems. Accordingly, the following hypotheses are proposed.

H3. PE is positively related to consumers' intention to buy buckwheat.

H3*. PE is positively related to the PB regarding buckwheat.

H3a. PSU is positively related to the PE of buckwheat.

H3b. PSE is positively related to the PE of buckwheat.

H4. PBC is positively related to the intention to purchase buckwheat.

H4*. PBC is positively related to the PB regarding buckwheat.

2.3.4. Subjective norms (SN)

Previous research has found that consumers' intentions of purchasing food are affected by social influences from family members and acquaintances (Contini et al., 2020; Yadav and Pathak, 2017), social consumption trends (Kumar and Smith, 2018), and government publicity (Zeweld et al., 2017). Based on meta-analyses, Armitage and Conner (2001) found that SN had an inconsistent effect on behavioral intention and weak predictability; in contrast, McEachan et al. (2011) found that SN was more strongly associated with intention. In the case of healthy and organic foods, social connections and pressures exert a greater impact on consumption decisions, emphasizing the significance of SN (Dorce et al., 2021; Nystrand and Olsen, 2020; Yadav and Pathak, 2017). Hence, following TPB, this study investigated the relationship between SN and consumers' PI and posited the final hypothesis.

H5. SN is positively related to consumers' intention to purchase buckwheat.

2.3.5. Analysis

The data from the questionnaire survey were analyzed using the Statistical Package for the Social Sciences (SPSS) (23.0) and Amos (24.0). Frequency distribution, percentage, mean, and standard deviation of the respondents were used to describe the data. We conducted a confirmatory factor analysis (CFA) to check the reliability and validity of the items and constructs, evaluated the model fit, and tested the hypotheses using structural equation modeling (SEM). Based on the SEM results, a comprehensive evaluation of the proposed model and the path relationships between the constructs was obtained (Li et al., 2020; Yadav and Pathak, 2017). Finally, the study conducted a SEM multi-group analysis to compare estimations between two consumer groups, who were aware and unaware of the potential nutritive value and health effects of buckwheat.

3. Results

3.1. Descriptive statistics

The demographic characteristics of the 1077 participants are presented in Table 1. Nearly half (48.7%) of the participants were younger than 35 and 23.4% were older than 55. The share of female respondents was 55.5%, as women are primarily responsible for daily food shopping in the sampled areas. Most respondents had completed high school (74.6%), including 60% who had obtained a junior college or bachelor's degree or higher. Less than half of the respondents (43.7%) had an average annual income of more than 50,000 CNY—the average annual urban income in the sampled areas—while 6.3% had less than 10,000 CNY. Finally, 73% and 66% of the respondents were respectively aware of the nutritive value and health effect of buckwheat.

Table 1. Demographic profile of the sample (n = 1077).

Characteristics	Frequency	Percentage
Age		
18–25	232	21.50
26–35	293	27.20
36–45	145	13.50
46–55	155	14.40
55–88	252	23.40
Gender		
Male	479	44.50
Female	598	55.50
Education level		
Middle school and below	274	25.50
High school	157	14.60
Junior college	215	20.00
Bachelor	349	32.40
Master and above	82	7.60
Annual income (10,000 yuan)		
Less than 1	68	6.30
From 1 to 3	239	22.20
From 3 to 5	298	27.70
More than 5	472	43.70

1 US $ = 6.496 yuan.

3.2. Measurement model

First, CFA was conducted to check the reliability and validity of the items. Model fit and hypothesis tests were then evaluated on the basis of the proposed structural model. As evident from Table 2, the results revealed high reliability and validity for the items in each construct. Cronbach's α and composite reliability (CR) were higher than the threshold of 0.7, verifying the reliability of each latent variable. Convergent and discriminant validity were also assessed using standardized factor loading and average variance extracted (AVE). One item measuring PBC ("It is easy for me to purchase buckwheat products from convenience stores and supermarkets") was omitted because of a low factor loading of 0.405. The remaining standardized factor loading values exceeded the recommended cut-off value of 0.6, indicating the high explanatory power of its latent variable. High AVE values also indicate strong convergent validity for all measurement items. The AVE square root value of each latent variable was higher than its correlation coefficient with the other variables (Table 3), further supporting discriminant validity. Overall, these results validate the measurement model.

3.3. Structural model

From the evaluation of the measurement model, the structural model was estimated. As presented in Table 4, the goodness-of-fit indices of the proposed model showed an adequate fit to the data. The SEM estimations are shown in Figure 2. First, the regression paths of PI (Std β= 0.360***) with PB were positive and significant, as well as that of PV (Std β= 0.254***) with PI, thereby supporting H1 and H2. Health benefits are perceived as an attractive and strong stimulation of consumers' intentions of purchasing functional foods (Huang et al., 2020). Two factors, PSU (Std β= 0.097***) and PSE (Std β= 0.190***), were found to be significant in explaining PV, supporting H2a and H2b. Compared with PSU, higher consumer PSE was positively related to their buckwheat PV. PSU (Std β= 0.254***) was proven to be an ascendant of PE. The association between PSE (Std β= 0.066) and PE was not significant; hence,

Table 2. Measurement model: Reliability and validity.

Latent variables	Items	Factor loading	SMC	Cronbach's α	C.R	AVE
Perceived susceptibility (PSU)	PSU1	0.848***	0.719	0.935	0.936	0.786
	PSU2	0.846***	0.715			
	PSU3	0.917***	0.840			
	PSU4	0.932***	0.868			
Perceived severity (PSE)	PSE1	0.827***	0.684	0.942	0.942	0.802
	PSE2	0.876***	0.768			
	PSE3	0.938***	0.880			
	PSE4	0.936***	0.876			
Perceived value (PV)	PV1	0.797***	0.633	0.925	0.929	0.767
	PV2	0.952***	0.906			
	PV3	0.937***	0.877			
	PV4	0.803***	0.646			
Perceived efficacy (PE)	PE1	0.904***	0.812	0.903	0.908	0.768
	PE2	0.921***	0.859			
	PE3	0.800***	0.633			
Perceived behavioral control (PBC)	PBC1	0.900***	0.826	0.700	0.703	0.535
	PBC2	0.892***	0.786			
Subjective norms (SN)	SN1	0.748***	0.599	0.893	0.900	0.754
	SN2	0.956***	0.915			
	SN3	0.884***	0.781			
Purchase intention (PI)	PI1	0.831***	0.691	0.930	0.914	0.785
	PI2	0.897***	0.805			
	PI3	0.919***	0.844			
Purchase behavior (PB)	PB1	0.939***	0.881	0.965	0.958	0.883
	PB2	0.941***	0.885			
	PB3	0.939***	0.909			

*** Significant at $p < 0.001$.

H3b was not supported. Furthermore, the results showed that PE was a stronger predictor of PI (Std β= 0.460***) and PB (Std β= 0.379***) than PV, thus supporting H3 and H3*. As shown in Figure 2, the direction of the relationship between PBC, PI, and PB was not significant; hence, H4 and H4* were not supported. H5 was also verified, as the path coefficient of SN was positive and significant (Std. β= 0.330***) in influencing PI.

Overall, the model explains 40.5% and 40.7% of the variance in consumers' PI and PB of buckwheat, respectively. Taken together, PSU and PSE explained 9.5% and 5.1% of the variance in the PV and PE, respectively. PE had the highest predictive power for PI, followed by SN and PV. In addition, PSU had a stronger impact on PE, whereas PSE worked significantly on PV.

3.4. Multiple group analysis results

The comparison between the awareness of the two groups regarding buckwheat's nutritive value and health effects, particularly the medical function, was explored using the structural weights model. The standardized coefficients and critical ratio of difference (CRD) are shown in Tables 5 and 6. The goodness-of-fit indices of the model reflected a good match, and the nested model comparison showed a significant difference between the two groups.

As presented in Table 5, the path coefficient of PV to PI of the aware group (Std β= 0.294***) was higher than that of the non-aware group (Std β= 0.150***). The absolute values of CRD from PV to PI, PE to PI, and PBC to PI were higher than the threshold value of 1.96, indicating that these path coefficients were significantly different between the two groups (M. Li et al., 2020). These results imply that PV and PE played a significant role in affecting the PI of the aware group, while the unaware group was highly influenced by PE. Regarding the two antecedents of PV, both PSU (Std β= 0.087***) and PSE (Std β= 0.286*) were significant for the aware group. Only PSE (Std β= 0.193) was significant for the non-aware group, and the coefficient value was smaller than that of the aware group. These results indicate that for consumers in the aware group, both PSU and PSE of the top three health problems significantly and positively improved PV. Likewise, the SN construct was found to be significantly related to PI, with a greater impact on the aware group. The coefficient of PE to PI was higher in the non-aware group (Std β= 0.628***) than in the aware group (Std β= 0.353***), indicating that consumers in the non-aware group were more affected by their PE. PSU was significantly associated with PE in both groups.

Comparisons of the groups' awareness of the health effects of buckwheat are presented in Table 6. The absolute value of CRD from PE to PI and SN to PI was higher than the threshold value of 1.96, indicating that SN was significantly more effective in the aware group than in the unaware group. Similar to the results shown in Table 5, PSE was significantly related to PV, particularly in the aware group. However, the PI and PB of the non-aware group were more influenced by PE. These comparisons further confirm the importance of PV and SN in affecting the decision to purchase buckwheat in the aware group and the significant impact of PE on the non-aware group. Furthermore, the association between awareness of buckwheat's nutritive value and health effects and health concerns should not be neglected.

4. Discussion

This study explored the PI and PB of buckwheat functional foods for 1077 consumers in southwest China using an extended TPB model. We proposed a conceptual model incorporating the PSU and PSE of the top three health problems and the PV, PE, PBC, and SN of buckwheat. Except for PBC, all constructs were found to be significant in the proposed model. Our findings add to the understanding of the predictors of buckwheat consumption and path relationships, as PSU and PSE are strongly relevant to the PV and PE of purchasing buckwheat. Moreover, the explanatory factors for buckwheat in the awareness of nutritive value and health effects groups were different, and consumers in the awareness group were highly influenced by PV and SN relative to PE.

This study yielded several key findings. First, it revealed the diverse impacts of PSU and PSE on consumers' buckwheat purchase decisions.

Table 3. Results of the discriminant validity test.

Latent variables	PSU	PSE	PV	PE	PBC	SN	PI	PB
PSU	**0.887**							
PSE	0.424***	**0.896**						
PV	0.204**	0.295***	**0.876**					
PE	0.218***	0.146	0.058*	**0.806**				
PBC	0.103**	0.156***	0.050	0.030	**0.731**			
SN	0.158***	0.164***	0.057	0.041	0.442***	**0.868**		
PI	0.199	0.188	0.297***	0.486***	0.122	0.341***	**0.886**	
PB	0.155	0.124	0.129	0.554***	0.063	0.142	0.545***	**0.939**

The square roots of the AVEs are bold elements. *, **, *** Significant at p< 5%, <1% and <0.1%, respectively.

Table 4. Path relationship among the constructs.

Hypotheses	Std β	Std. error	t-value	Result
(H1) Purchase intention (PI) →Purchase behavior (PB)	0.360***	0.041	11.285	Supported
(H2) Perceived value (PV) → Purchase intention (PI)	0.254***	0.036	7.926	Supported
(H2a) Perceived susceptibility (PSU) → Perceived value (PV)	0.097***	0.022	2.802	Supported
(H2b) Perceived severity (PSE) → Perceived value (PV)	0.254***	0.028	7.240	Supported
(H3a) Perceived susceptibility (PSU) → Perceived efficacy (PE)	0.190***	0.032	5.284	Supported
(H3b) Perceived severity (PSE) → Perceived efficacy (PE)	0.066	0.038	1.848	Not supported
(H3) Perceived efficacy (PE) → Purchase intention (PI)	0.460***	0.030	12.771	Supported
(H3*) Perceived efficacy (PE) →Purchase behavior (PB)	0.379***	0.040	10.110	Supported
(H4) Perceived behavioral control (PBC) → Purchase intention (PI)	-0.050	0.030	-1.565	Not supported
(H4*) Perceived behavioral control (PBC) →Purchase behavior (PB)	0.008	0.035	0.260	Not supported
(H5) Subjective norms (SN) → Purchase intention (PI)	0.330***	0.030	9.277	Supported

CMIN/DF = 4.186, RMSEA = 0.067, CFI = 0.949, IFI = 9.949, TLI = 0.941, NFI = 9.939, PNFI = 0.815, PGFI = 0.823.
*** Significant at p < 0.1%.

Higher consumer PSE was found to be linked with PV of buckwheat functional food choices. The reason could be that prevention measures, including diet change and healthy functional food, are often communicated with the severity of the health problems. In contrast, susceptibility to the top three health problems was positively related to PE among consumers. Consumers paying more attention to their susceptibility implemented sound practices more frequently (Wang et al., 2021). These results clarify the effects of PSU and PSE, and verify new path relationships between them, which help advance understanding of why consumers are more determined to change their behavior to healthy eating when they are more aware of disease susceptibility, rather than just the seriousness of the diseases.

Second, the results confirmed that PV is a positive and significant predictor of PI, which is consistent with prior research on functional foods (Huang et al., 2020). The estimates in Table 2 also show that the factor "buckwheat products are beneficial for both my health and my family's health" is more significant than environmental factors. As stated in an empirical study on organic food consumption by Dorce et al. (2021), perceived health benefits largely explain consumers' attitudes. Additionally, the group differences analysis in Tables 5 and 6 further verified that, although the effects of general health benefits were stronger than reducing specific disease risk, targeting specific types of disease might work better for consumers interested in particular health benefits (Huang et al., 2020). Thus, buckwheat's nutritive and health value in improving well-being and preventing diseases is of critical importance to the consumers and should be prominently identified on the product label.

Third, internal and external controls had different impacts on consumers' decision to purchase buckwheat based on the PE and PBC estimates, which is congruent with a previous study conducted in Norway by Nystrand and Olsen (2020). As suggested by the meta-analysis by Williams and Rhodes (2016), the robust predictive capability of efficacy should be further explored, together with its motivational antecedents. Our findings further verified the positive influence of PE, particularly for consumers in the unaware groups (as shown in Tables 5 and 6). Contini et al. (2020) also reported that consumer purchase behavior was not always constrained by monetary resources; thus, business strategies based on quality are more effective than those based on price. Regarding dietary behavior, self-efficacy was found to be more strongly related to PI than to PBC (Armitage and Conner, 2001). However, it was surprising that PBC had no significant impact on either PI or PB for buckwheat, indicating that consumers' purchase decisions were not constrained by external factors. This is because, with the vigorous development of

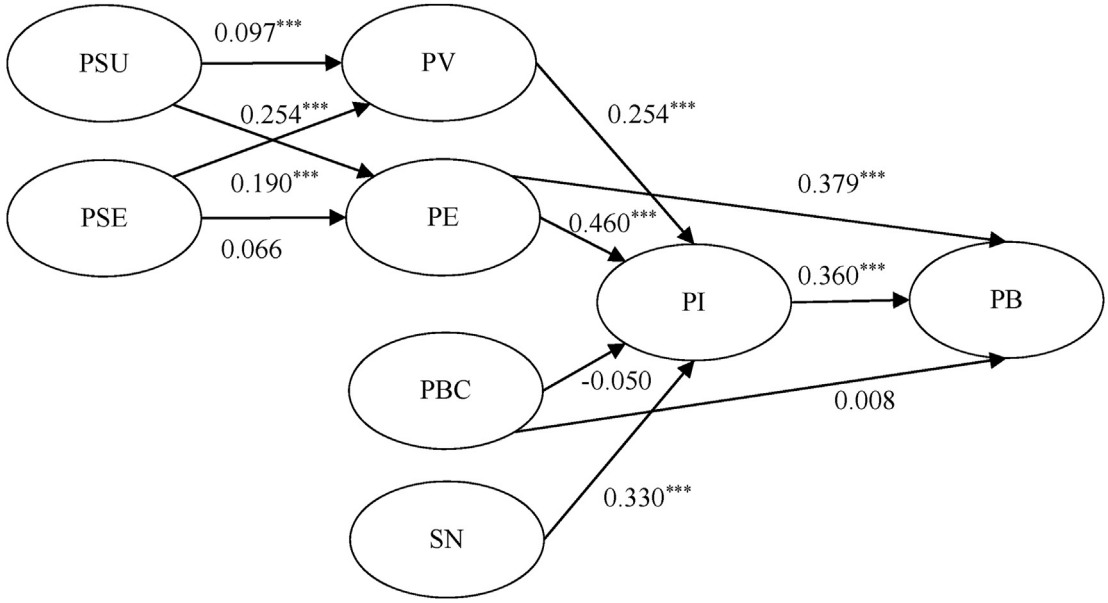

Figure 2. Results of SEM with standardized coefficients. *Note: CMIN/DF = 4.186, RMSEA = 0.067, CFI = 0.949, IFI = 9.949, TLI = 0.941, NFI = 9.939, PNFI = 0.815, PGFI = 0.823; *** Significant at p < 0.1%.*

Table 5. Path relationship among two nutritive value awareness groups.

Path relationship	Aware of nutritive value		Non-aware of nutritive value		CRD
	Std β	t-value	Std β	t-value	
PI→PB	0.345***	9.586	0.410***	5.671	0.521
PV→PI	0.294***	7.690	0.150**	2.596	-2.213**
PSU→PV	0.087***	2.106	0.087	1.346	-0.900
PSE→PV	0.286*	6.741	0.193**	2.957	0.118
PE→PI	0.353***	8.420	0.628***	9.224	3.583***
PE→PB	0.393***	9.445	0.318***	3.818	-0.994
PSU→PE	0.198***	4.608	0.158*	2.351	0.336
PSE→PE	0.061	1.440	0.086	1.288	-0.416
PBC→PI	0.009	0.234	-0.136*	-2.364	-2.101**
PBC→PB	0.016	0.472	0.025	0.486	0.115
SN→PI	0.353***	8.198	0.293***	4.374	-0.355

CMIN/DF = 3.952, RMSEA = 0.053, CFI = 0.939, IFI = 0.939, TLI = 0.930, PNFI = 0.798, PGFI = 0.815.
*, **, *** Significant at p < 5%, <1% and <0.1%, respectively.

e-commerce in China, consumers can easily search for relevant information about buckwheat functional foods, such as their nutritive and health effects, and accessible sale channels (Conroy et al., 2021).

Fourth, SN was found to exert a strong influence on consumers' intent to purchase buckwheat. The impact of social connections and publicity pressure is particularly salient for a healthy diet, and its predictive power for food consumption has been widely studied (Dorce et al., 2021; Kumar and Smith, 2018; Lim and An, 2021). The trend of healthy eating and extensive publicity have drawn attention to buckwheat products while enhancing consumers' PI (Lim and An, 2021). In developing countries with a limited understanding of healthy diets, commercial and government publicity are critical in broadening information sources to improve consumers' understanding of healthy functional foods (Fan et al., 2015; Huang et al., 2020; Nystrand and Olsen, 2020). Although Chinese consumers show relatively low trust in the functions and safety of functional foods (Huang et al., 2020; Nystrand and Olsen, 2020), the estimates in Tables 5 and 6 indicate that SN is beneficial for marketing buckwheat functional foods, particularly for aware groups, indicating the strong influence of social pressures and government publicity.

The comparisons between the groups' awareness of nutritive value and health effects revealed interesting results, in which PV and SN had a stronger impact on buckwheat purchase decisions in the aware groups.

Table 6. Path relationship among two groups of health effects awareness.

Path relationship	Aware of health effects		Non-aware of health effects		CRD
	Std β	t-value	Std β	t-value	
PI→PB	0.351***	8.574	0.356***	6.747	-0.007
PV→PI	0.242***	5.816	0.251***	5.189	-0.009
PSU→PV	0.050	1.149	0.137*	2.442	-1.482
PSE→PV	0.281***	6.208	0.197***	3.520	1.432
PE→PI	0.329***	6.833	0.598***	11.292	3.414***
PE→PB	0.359***	7.407	0.411***	6.879	0.326
PSU→PE	0.149***	3.208	0.220***	3.843	-0.174
PSE→PE	0.061	1.322	0.053	0.936	1.444
PBC→PI	-0.005	-0.126	-0.096*	-2.087	-1.500
PBC→PB	0.010	0.248	0.005	0.109	-0.082
SN→PI	0.426***	8.494	0.192***	3.856	-3.675***

CMIN/DF = 3.826, RMSEA = 0.051, CFI = 0.940, IFI = 0.940, TLI = 0.931, PNFI = 0.799, PGFI = 0.816.
*, **, *** Significant at p < 5%, <1% and <0.1%, respectively.

This indicates that improving consumers' understanding of buckwheat's specific functionalities of nutritional supplements and disease prevention is conducive to its consumption (Armitage and Conner, 2001; Huang et al., 2020; Nystrand and Olsen, 2020). In contrast, PE was more effective for consumers in the non-aware groups, indicating that their decisions were more influenced by internal controls, such as personal preferences (Contini et al., 2020).

The first limitation of this study is that as buckwheat is also a traditional daily food for some ethnic minorities in the mountainous areas of southwest China (Ruan et al., 2020), the current results should be generalized carefully to these consumers. This is because their preferences and acceptance levels for buckwheat food are possibly much higher than those of other consumers. Second, the two buckwheat species, common and Tartary, were not differentiated in the current study; further studies could distinguish between these two species to provide more precise insights for the promotion of marketing and health diet policies. For example, Tartary buckwheat could be more favorable for the three highly susceptible consumers. Thus, further studies are encouraged to enrich our understanding of consumers' PB regarding different types of buckwheat. Third, the extent to which purchasing behavior is influenced by the specific components and functions of functional foods should be explored in depth to understand the role of their health benefits and medical functions in improving dietary patterns in developing countries.

5. Conclusions

Considering the relatively limited awareness of healthy dietary patterns in China, this study evaluated purchase decisions among consumers in southwest China. In particular, it looked at buckwheat functional foods for healthy eating from the perspective of disease prevention. The estimations proved the high predictive power of PV, PE, and SN for consumers' intention to purchase buckwheat, and highlighted the importance of buckwheat's nutritional supplement functionalities. The results showed that, compared with PBC, PE was positive and significant in influencing both PI and PB. Moreover, the PSE of having the top three health problems was positively related to consumers' PV, whereas susceptibility was effective in increasing the PE of purchasing buckwheat products. Our study specifically highlights the group differences in path relationships and influencing factors between consumers' awareness of the nutritive value and health effects of buckwheat.

From the viewpoint of practical applications and policy implications, this study showed that improving consumers' understanding of the health benefits of buckwheat products, particularly their functionalities, would increase the likelihood of purchase, specifically among consumers aware of the nutritive and health properties of buckwheat. Additionally, general knowledge of health issues, such as the top three health problems, and their potential health impacts motivate consumers to adjust their diet patterns and improve their diet quality. Hence, social media and other networks should be utilized to widely publicize information related to these problems to enhance consumers' cognition of a healthy diet. Second, current studies imply that PSU highly affects the self-efficacy of purchasing buckwheat; therefore, enhancing the perception of nutritive and health effects in functional buckwheat products should be effective among consumers who are more susceptible to the top three health problems. To attract buckwheat consumers, diet information related to these problems should not be neglected, and social connections and communication should be used for the transmission of the benefits of healthy and functional foods and other health-related information. Third, considering the influence of PSE on consumers' PV of buckwheat and the stronger effects on the aware group, policymakers and marketers are encouraged to improve consumers' understanding of buckwheat's multiple properties with targeted communication campaigns that emphasize healthy diet and well-being, to help enhance awareness of potential top three chronic diseases morbidity.

Declarations

Author contribution statement

Yixin Nong: Conceived and designed the experiments; performed the experiments; analyzed and interpreted the data; wrote the paper.

Minjuan Zhao: Conceived and designed the experiments; performed the experiments; contributed reagents, materials, analysis tools or data.

Hsiaoping Chien: Conceived and designed the experiments; performed the experiments; contributed reagents, materials, analysis tools or data, wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

Appendix 1

Measurement items

Items	Description (translated from Chinese)
PSU1	I might have the top three health problems because of personal health conditions.
PSU2	Having the top three health problems will damage my health because of my health conditions.
PSU3	Without adjusting my diet, I am very likely to have the top three health problems in the future.
PSU4	Having the top three health problems will damage health because of inappropriate diet.
PSE1	The top three health problems will increase my expenditure.
PSE2	The top three health problems will influence my daily life.
PSE3	The top three health problems will influence my lifespan.
PSE4	The impact of the top three health problems will last for a long time.
PV1	I purchase buckwheat products because it is free from agricultural pollutants and I feel safe to buy them.
PV2	I purchase buckwheat products because it is beneficial for my health.
PV3	I purchase buckwheat products because it is beneficial for my family's health.
PV4	I purchase buckwheat products because it reduces the possibility of having the *top three* health problems.
PE1	I am confident that I would purchase buckwheat products regularly while people around me buy other products.
PE2	I am confident that I would purchase buckwheat products regularly even when other products are on sale.
PE3	I am confident that I would purchase buckwheat products regularly even when my family does not need it.
PBC1	I am confident I have enough resources (e.g. time, money, and opportunities) to purchase buckwheat products.
PBC2	I am confident it is not difficult for me to purchase buckwheat products.
PBC3	It is easy for me to purchase buckwheat products from convenience stores and supermarkets
SN1	It is important to me that my families and friends think I should buy buckwheat products.
SN2	It is important to me that more and more people purchase buckwheat products.
SN3	It is important to me that the national healthy diet policy encourages purchase of buckwheat products.
PI1	I will recommend to others to buy buckwheat products.
PI2	I will continue to buy buckwheat products.
PI3	I will buy buckwheat products more frequently.
PB1	I have been purchasing more buckwheat products.
PB2	I have been purchasing more varieties of buckwheat products.
PB3	I have been purchasing buckwheat products more frequently.

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