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Research Article

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Exploring factors of nutrition teachers' intentions for sustainable dietary education in South Korea: an application of the theory of planned behavior

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Conflict of interest
There are no financial or other issues that might lead to conflict of interest.

ABSTRACT

Objectives: The purpose of this study was to investigate the perception of nutrition teachers and the factors influencing their intention toward sustainable dietary education utilizing the theory of planned behavior (TPB).
Methods: The self-administered online survey was completed by nutrition teachers in Jeollanam-do, South Korea. A total of 151 valid questionnaires were analyzed. Factor analysis and multiple regressions were employed to test the research model.
Results: The study findings demonstrated that all TPB variables significantly influenced the sustainable dietary educational intention, with the degree of influence ranking as follows: external perceived behavioral control (β = 0.417), attitude (β = 0.240), internal perceived behavioral control (β = 0.207), and subjective norms (β = 0.181). For external perceived behavioral control, nutrition teachers and elementary schools exhibited higher levels compared to dietitians and middle/high schools, respectively. The participants in sustainable dietary education training programs exhibited a higher level of internal perceived behavioral control compared to those who did not participate. The highest perception levels were reported for attitude (4.26), followed by subjective norms (4.02), internal perceived behavioral control (3.67), and external perceived behavioral control (3.20).
Conclusions: This study affirmed that the TPB variables elucidated the sustainable dietary educational intentions of nutrition teachers. The significant impacts of external and internal perceived behavioral control, attitude, and subjective norms on educational intentions were confirmed. Consequently, proactive support from schools and governments is essential to enhance the facilitating factors and mitigate the barriers toward sustainable dietary education in schools.

Keywords: sustainable dietary education; nutrition teacher; theory of planned behavior; internal perceived behavioral control; external perceived behavioral control

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Data Availability
The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

INTRODUCTION

The international community faces a multitude of interconnected challenges related to the economy, society, and environment. Since the Industrial Revolution, rapid economic and societal growth has enriched human life. However, this progress has come at a cost: a concurrent environmental and ecological crisis. The Intergovernmental Panel on Climate Change's 2023 Climate Change Report [1] highlights the severity of the situation. Global annual mean temperature has risen by 1.09°C compared to pre-industrial levels, and projections indicate a 1.5°C increase by the mid-2030s if current trends persist. Alongside rising temperatures, we are witnessing rapid increases in sea surface temperature and sea levels. Extreme weather events, such as simultaneous heat waves, heavy rain, droughts, and tropical cyclones, are becoming increasingly common around the world.

Recognizing the need for a holistic approach to economic, social, and environmental issues, UNESCO spearheaded discussions that led to the global adoption of sustainability as a guiding principle. This principle now informs a wide range of policies, including dietary policies aimed at overcoming the challenges we face [2]. Examples of such policies include France's Le programme National pour l'alimentation, the United Kingdom's Food 2030, New York City's NYC Food Policy, and Canada's Regional Food System Strategy for Vancouver. All these initiatives emphasize dietary education that reflects sustainability principles [3]. In line with this global shift, the Korean Government has also embraced sustainable dietary education. In 2020, the Ministry of Agriculture, Food and Rural Affairs announced the promotion of sustainable diets through the 3rd ('20-'24) Basic Plan for Dietary Education [4].

The concept of sustainable diets has evolved beyond its previous emphasis solely on health (nutrition). It now encompasses diets that promote a range of social values across the entire food chain, incorporating considerations not only of health but also of environmental sustainability and responsible practices in food selection, storage, preparation, consumption, and waste management [4,5]. Reviewing prior research on sustainable dietary education shows that it encompasses the domains of environment, health, and society.-In the environmental domain, studies by Kwon & Lee [6] and Oh *et al.* [7] demonstrated the positive impact of education programs on children's environmentally friendly attitudes and their sustainable dietary competence. Kwon & Lee [6] used gardening activities, while Oh *et al.* [7] utilized food mileage and plant factory education programs. In the health domain, studies by Kim *et al.* [8] and Han & Lee [9] developed programs focusing on vegetables and reducing sugar consumption, respectively. These programs validated positive changes in nutrition knowledge and dietary patterns among elementary school students. For the society domain, Yoo & Kim [10] demonstrated the positive effects of character education activities based on a green diet on preschoolers' awareness of life respect, community consciousness, and responsible behavior. Woo & Lee's study [11] developed a sensory education textbook and teaching guidebook to improve children's preference for traditional foods, aiming to inherit traditional food culture. They found that education using these materials positively affected student's knowledge, table manners, and preference for traditional foods.

Building on a growing body of research on sustainable dietary education, this approach is now being implemented nationwide. In Seoul, it is known as "green school meals," while Jeollanam-do uses the term "low-carbon green meals" [12]. These programs involve low-carbon school meals, which include Pesco (pescatarian) diets excluding beef but including fish, eggs, and other animal products. Despite the different names used in each region, they

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share a common goal of environmental sustainability, health, and society. The increasing adoption of sustainable dietary programs in various regions highlights the pivotal role of nutrition teachers responsible for imparting this sustainable dietary education. According to Article 8 of the Enforcement Decree of the School Meals Act [13], nutrition teachers are responsible for guiding students on dietary life, providing nutritional information and consultations, and educating the next generation on practicing sustainable dietary habits.

However, previous studies exploring sustainable practices by job domains [14,15] have revealed that the education domain lags behind others. Additionally, research on the implementation of green school meals in Seoul found that the majority of nutrition teachers did not actively engage in educational aspects [16]. Given that the actual performance of sustainable dietary education in school settings has been reported to be low, it is crucial to identify measures that can increase the adoption of sustainable dietary education. To remove barriers and strengthen facilitations, we need to investigate the key factors that predict and explain the educational behaviors of nutrition teachers.

The theory of planned behavior (TPB), developed by Ajzen (1991) [17], is a widely used framework for predicting and explaining human behavior. It posits that intentions guide our actions, and these intentions are shaped by three key factors: attitudes toward behavior, subjective norms, and perceived behavioral control (PBC). The TPB has been applied across various research fields [18-21] demonstrating particular effectiveness in explaining consumer behavior related to sustainable food choices and dietary habits [21]. However, no prior studies have utilized the TPB to specifically understand the behaviors of nutrition teachers regarding sustainable dietary practices. This research gap highlights the need for an empirical study in this area.

Furthermore, researchers have emphasized the necessity of extending the TPB model to encompass external factors that shape individual characteristics and behaviors, thereby enhancing its explanatory power [22]. PBC is a core construct within the TPB that reflects an individual's subjective perception of their ability to control the resources and skills necessary for a specific behavior [17]. Subsequent research has differentiated PBC into internal PBC (IPBC) and external PBC (EPBC). Kidwell & Jewell [22] demonstrated that the expanded TPB model incorporating this distinction between IPBC and EPBC offered greater explanatory power compared to the original TPB model with a singular PBC construct.

Significantly, no prior studies investigating the educational behavior of nutrition teachers using the TPB framework have employed the expanded model with separate IPBC and EPBC constructs. The existing body of research on nutrition teachers' educational practices suggests that their intention to engage in educational practices is not solely influenced by their confidence and abilities, but is also contingent upon external environmental conditions or constraints [23]. Hence, the adoption of the expanded TPB model, delineating between IPBC and EPBC, offers promising prospects for achieving a more profound understanding of the educational behaviors exhibited by nutrition teachers.

First, this study aims to assess the current level of awareness about sustainable dietary education among nutrition teachers based on the TPB framework. This assessment will then be used to investigate the factors influencing their intention to implement sustainable dietary education practices. Second, the study aims to demonstrate the potential of expanding the TPB model for understanding the educational behavior of nutrition teachers. This will

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be achieved by dividing the core TPB construct of PBC into IPBC and EPBC. Furthermore, this study seeks to establish baseline data that can be used to activate sustainable dietary education initiatives.

METHODS

Ethics statement

This study was approved by the Institutional Review Board of Sunchon National University (IRB No. 1040173-202307-HR-020-02).

1. Study sample and duration

To investigate factors influencing nutrition teachers' intention to deliver sustainable dietary education, an online survey was conducted from September 13 to October 7, 2023, among elementary, middle and high school teachers in Jeollanam-do, South Korea. We contacted the Jeollanam-do Nutrition Teachers Association for recruitment and administered a survey provided by the Korean Social Science Data Center. Out of 657 teachers contacted, 152 (23.1% response rate) volunteered to participate and provided informed consent. After excluding incomplete responses, 151 questionnaires were included in the final analysis.

2. Study contents and methodology

1) Study model and variables

This study model explains that attitude, subjective norms, IPBC, and EPBC for sustainable dietary education affect nutrition teachers' intentions to teach (**Figure 1**). Among the variables composing the model, the first variable (attitude) refers to an individual's positive or negative evaluation of the consequences of performing a specific behavior. In simpler terms, someone with a favorable attitude towards sustainable dietary education is more likely to believe that teaching it will lead to positive outcomes. Conversely, someone with a negative attitude might believe it will lead to negative outcomes. Second, subjective norms represent an individual's perception of their reference group's (e.g., family, friends, and colleagues) approval or disapproval of performing a certain behavior. Stronger perceived support from a reference group increases the likelihood of an individual performing the behavior. Third, PBC reflects a person's subjective judgement about their ability to perform a specific behavior effectively. This study further divides PBC into 2 categories based on previous studies [18,22-25]. IPBC refers

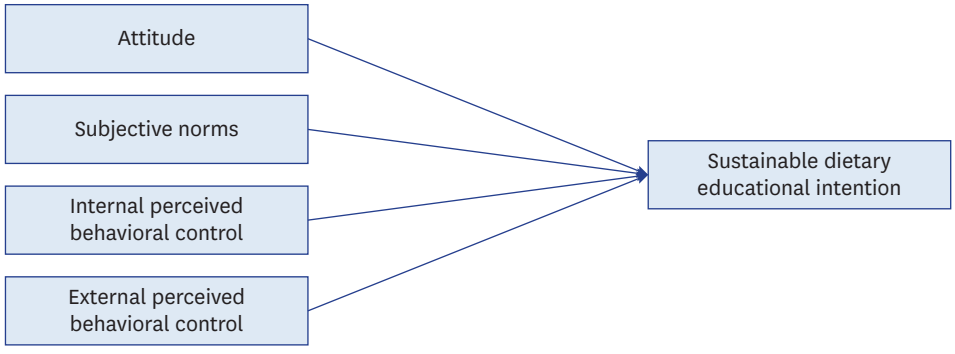

Fig. 1. Research model.

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to an individual's perception of their own internal resources, knowledge, and confidence, whereas EPBC captures an individual's perception of how external environmental conditions or available resources might influence their ability to perform the behavior [22,24].

2) Development of the questionnaire

This survey questionnaire was developed based on previous studies on sustainable activities, nutritional education [14-16,23,26], and the application of the TPB to nutrition teachers [14,17,18,22,24,25].

The questionnaire underwent revisions and additions based on insights from a preliminary survey and interviews with 2 nutrition education experts and ten elementary school nutrition teachers in Jeollanam-do. For example, we modified the wording in the attitude domain to address redundancy in terms of expressing 'enjoyable' and 'joyful.' Additionally, the subjective norm domain was expanded to include separate items for other nutrition teachers, colleagues (principals/general teachers), and kitchen staffs. Also, questions related to perceived difficulties in delivering sustainable dietary education within the IPBC (teaching skill) and EPBC (opportunity to teach, time, place, budget, and standardized educational material) sections were added.

To ensure conceptual clarity on sustainable dietary education, the definition was explained in the initial survey and interviews. This allowed us to confirm that nutrition teachers agreed with the definition and fully understood the concept. The validated definition was presented at the beginning of the final questionnaire: 'dietary education reflecting not only health but also environment and society throughout all food-related courses.'

Furthermore, to avoid confusion with previous health-focused nutrition education, we informed participants that the scope of sustainable dietary education in this study was limited to 'face-to-face education' with students. This excludes indirect education methods such as school meal bulletin boards, websites, and school correspondence.

Following these modifications and additions, the questionnaire was administered to a second preliminary survey group of 33 nutrition teachers from elementary and middle/high schools in Jeollanam-do. After this pilot testing, the final questionnaire was confirmed.

3) Questionnaire items

The questionnaire consisted of 2 main categories. The first category, focusing on the subject's general characteristics, comprised 9 items. These items gathered information about the participants, including their sex, age, educational attainment, occupation, school level, number of students per meal, number of meals served per day, frequency of sustainable dietary education lectures delivered, and participation in relevant training programs.

The second category explored factors affecting intentions to deliver sustainable dietary education. This section drew upon previously established TPB-based questionnaires [14] and incorporated additional items informed by the first and second preliminary surveys. It included 5 items related to attitude [14], 4 items on subjective norms [14,15], 5 items assessing IPBC [14,18,23], 5 items on EPBC [14,15,18,23,26], and 3 items measuring intention to deliver sustainable dietary education [14]. All questionnaire items in this section used a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

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3. Statistical analysis

Data analysis was conducted using IBM SPSS Statistics 21 (IBM Corporation, Armonk, NY, USA). Subjects' general characteristics were presented as frequency and percentages.

To assess the validity of the 19 items measuring factors affecting nutrition teachers' intentions to deliver sustainable dietary education, exploratory factor analysis (EFA) with Varimax rotation was employed to identify potential underlying factors. Internal consistency across all study variables was evaluated using reliability analysis.

Descriptive statistics were used to calculate means and standard deviations for the TPB variables after establishing their validity and reliability. Multiple regression analysis was then performed to examine the influence of each variable on intentions to deliver sustainable dietary education. Furthermore, an independent samples t-test was conducted to compare groups exhibiting differences in the levels of IPBC and EPBC among the TPB variables. The significance level for all analyses was set to 0.05.

RESULTS

1. Subject's general characteristics

Table 1 shows the subjects' general characteristics. The majority of respondents (n = 150, 99.3%) were female, with only 1 male participant (0.7%). In terms of age distribution, 76

Table 1. General characteristics of the participants (n = 151)

Variables	Description	Frequency
Individual		
Sex	Male	1 (0.7)
	Female	150 (99.3)
Age (year)	≤ 29	22 (14.6)
	30–39	22 (14.6)
	40–49	31 (20.5)
	≥ 50	76 (50.3)
Educational attainment	2-year college	7 (4.6)
	4-year university	71 (47.0)
	Graduate school	73 (48.4)
Occupation	Nutrition teacher	122 (80.8)
	Dietitian	29 (19.2)
School		
School level	Elementary school	104 (68.9)
	Middle/high school	47 (31.1)
Number of students(per meal)	≤ 99	50 (33.1)
	100–299	44 (29.1)
	300–499	21 (13.9)
	≥ 500	36 (23.9)
Number of meals served (per day)	1	124 (82.1)
	≥ 2	27 (17.9)
Sustainable dietary education		
Frequency of sustainable dietary education lectures delivered (per year)	≤ 5	63 (41.7)
	6–10	38 (25.2)
	11–15	20 (13.2)
	16–20	16 (10.6)
	≥ 21	14 (9.3)
Participation in training programs	Participant	99 (65.6)
	Non-participant	52 (34.4)

n (%).

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respondents (50.3%) were aged 50 or above, followed by 31 (20.5%) in their 40s, 22 (14.6%) in their 30s, and another 22 (14.6%) aged 29 or younger. Notably, those in their 40s and 50s comprised over 70% of the sample.

Educational attainment also revealed a concentration at the graduate level, with 73 respondents (48.4%) holding graduate degrees. This was followed by 4-year college degrees (n = 71, 47.0%) and 2-year college degrees (n = 7, 4.6%). The majority of participants were nutrition teachers (n = 122, 80.8%) compared to dietitians (n = 29, 19.2%).

Regarding school level, 104 respondents (68.9%) worked in elementary schools, while 47 (31.1%) worked in middle/high schools. Elementary schools employed over half of the participating nutrition professionals. The number of students per lunch period varied. Fifty respondents (33.1%) reported serving fewer than 100 students, followed by 44 (29.1%) serving 100 to less than 300 students, 21 (13.9%) serving 300 to less than 500 students, and 36 (23.9%) serving 500 or more students.

The frequency of sustainable dietary education lectures also differed. The annual frequency of education operations was highest at 5 times or less, with 63 individuals (41.7%). Following this, 38 individuals (25.2%) reported conducting operations 6 to 10 times annually, while 20 individuals (13.2%) reported 11 to 15 times, 16 individuals (10.6%) reported 16 to 20 times, and 14 individuals (9.3%) reported conducting operations more than 21 times annually. Finally, participation in relevant training programs revealed that over 60% of respondents (n = 99, 65.6%) had participated, while 52 (34.4%) had not.

2. Analysis of validity and reliability of the study model

Table 2 presents the analysis of the study model's validity and reliability. To assess model validity, EFA was conducted on the composite variables. Three items with factor loadings below 0.4 were removed, and the analysis was rerun.-It was verified that the collected data

Table 2. Exploratory factor analysis of the theory of planned behavior variables

Variables		Perception	Factor loading	Eigen value	Variance (%)
I think it is _____ to carry out sustainable dietary education at school (α = 0.916).				7.614	47.859
A1	rewarding	4.40 ± 0.92	0.865		
A2	wise	4.32 ± 1.04	0.840		
A3	exciting	4.11 ± 1.03	0.816		
A4	useful	4.52 ± 0.82	0.807		
A5	enjoyable	3.96 ± 1.08	0.805		
_____ would want me to carry out sustainable dietary education (α = 0.898).				1.343	8.391
SN1	Kitchen staffs	3.75 ± 1.18	0.832		
SN2	Other nutrition teachers and dietitians	4.17 ± 1.01	0.788		
SN3	Students and their parents	3.97 ± 1.06	0.786		
SN4	My colleagues (principals/general teacher)	4.18 ± 0.90	0.771		
I have a _____ of sustainable dietary education (α = 0.892).				1.126	7.038
IPBC1	knowledge	3.66 ± 1.05	0.865		
IPBC2	teaching skill	3.48 ± 1.17	0.839		
IPBC3	confidence	3.87 ± 1.02	0.719		
I have a _____ of sustainable dietary education (α = 0.887).				2.375	14.844
EPBC1	place (classroom, cooking room)	3.46 ± 1.45	0.866		
EPBC2	time	3.51 ± 1.48	0.854		
EPBC3	budget (cost of making educational material)	2.78 ± 1.62	0.777		
EPBC4	standardized educational material	3.05 ± 1.58	0.687		
Total variance					77.862

Mean ± SD.
A, attitude; SN, subjective norms; IPBC, internal perceived behavioral control; EPBC, external perceived behavioral control.

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were appropriate for factor analysis, with the measure of sampling adequacy of 0.876, and Bartlett sphericity test of χ^2 = 1,873.664 (df = 120) and P = 0.001 (P < 0.05).

Four factors were extracted, and based on previous studies [14,17,18,22,24,25], they were named attitude, subjective norms, IPBC, and EPBC, respectively. Factor loadings (the correlations between the extracted factors and each variable) ranged from 0.687 and 0.866. The explanatory power of the entire factor model was relatively high, accounting for 77.86% of the variance.

The internal consistency reliability of the study model was also examined. Cronbach's alpha coefficient for each factor ranged from 0.887 to 0.916, indicating high internal consistency reliability across all factors.

3. Perception level of attitude, subjective norms, IPBC, and EPBC for sustainable dietary education

Table 2 shows the perception levels of factors affecting intentions to deliver sustainable dietary education. This table presents the perception levels of nutrition teachers regarding attitude, subjective norms, IPBC, and EPBC toward sustainable dietary education.

The mean score for all variables combined was 3.78 points. Breaking down the scores by domain, attitudes had the highest mean score (4.26), followed by subjective norms (4.02), IPBC (3.67), and EPBC (3.20).

Within the attitude domain, 'useful' (4.52) received the highest score, followed by 'rewarding' (4.40), 'wise' (4.32), 'exciting' (4.11), and 'enjoyable' (3.96). Since all items had mean scores above 3.90, it can be concluded that nutrition teachers generally held favorable attitudes toward sustainable dietary education.

In the subjective norm domain, 'my colleagues (principals/general teachers)' (4.18) had the highest score, followed by 'other nutrition teachers' (4.17), 'students and their parents' (3.97), and 'kitchen staffs' (3.75). This indicates a generally high level of perceived support, although kitchen staffs received slightly lower scores than the other groups.

The IPBC domain revealed that 'confidence' (3.87) was perceived as the strongest factor, followed by 'knowledge' (3.66), and 'teaching skill' (3.48). These scores were lower than those observed in the attitude and subjective norm domains.

Table 3. Regression analysis for factors influencing educational intention

Variables	Unstandardized B	SE	Standardized β	t
(Constant)	−0.141	0.267		−0.528
A	0.288	0.066	0.240	4.365***
SN	0.202	0.069	0.181	2.927*
IPBC	0.214	0.064	0.207	3.331**
EPBC	0.319	0.047	0.417	6.867***
F		81.105		
P-value		< 0.001		
Adjusted R^2		0.681		
Durbin-Watson		1.977		

A, attitude; SN, subjective norms; IPBC, internal perceived behavioral control; EPBC, external perceived behavioral control.
*P < 0.05, **P < 0.01, ***P < 0.001 by multiple regression analysis.

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Finally, the EPBC domain had the lowest overall score among the four variables, with 'time' (3.51) receiving the highest rating. Following this were 'place' (3.46), 'standardized educational material' (3.05), and 'budget' (2.78). The item 'budget' had the lowest score across the entire study.

4. Factors affecting intentions of delivering sustainable dietary education

The results of a multiple regression analysis conducted to examine factors influencing nutrition teachers' intentions to deliver sustainable dietary education, as measured by the TPB variables, are shown in **Table 3**.

The results indicate that the regression model is statistically significant (F = 81.105, $P < 0.001$), explaining 68.1% of the variance in intentions (adjusted $R^2 = 0.681$). Multicollinearity diagnostics confirmed no issues with the model, as all composite variables had tolerance values greater than or equal to 0.5 and variance inflation factors less than 1.9. Additionally, the Durbin-Watson statistic (1.977) close to 2 suggests no significant autocorrelation among the error terms, further supporting the model's appropriateness.

Multiple regression analysis revealed that EPBC had the strongest influence (β = 0.417, $P < 0.001$) on nutrition teachers' intentions to deliver sustainable dietary education. EPBC refers to the teachers' perceived level of control over external factors necessary for delivering this type of education, such as place (classrooms, cooking rooms), time availability, budget (cost of materials), and access to standardized educational materials. The analysis suggests that improvements in EPBC would significantly increase intentions to deliver sustainable dietary education.

Attitudes (β = 0.240, $P < 0.001$) were the second most influential variable. This study defined attitudes as an individual's favorableness towards practicing sustainable dietary education. The results showed a positive correlation, indicating teachers with more positive attitudes were more likely to deliver such education.

IPBC (β = 0.207, $P < 0.01$) was the third most influential factor. IPBC refers to the teachers' perceived control over the internal factors needed for delivering this education, such as knowledge, teaching skill, and confidence. The analysis suggests that improvements in IPBC would also significantly increase intentions to deliver sustainable dietary education.

Subjective norms (β = 0.181, $P < 0.05$) were the last influential variable. Subjective norms refer to the perceived influence of others on an individual's behavior. This study included other nutrition teachers, kitchen staffs, colleagues (principals/general teachers), and students/parents as items of subjective norms. The results showed a positive correlation, suggesting that higher perceived social pressure from these groups translated to increased intentions to deliver sustainable dietary education.

Table 4. Internal perceived behavioral control by general characteristics of the participants

Variables	IPBC
Participation in training programs	
Participant	3.79 ± 0.98
Non-participant	3.45 ± 0.95
t-value	2.036*

Mean ± SD.
IPBC, internal perceived behavioral control.
*$P < 0.05$ by independent samples t-test.

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Table 5. External perceived behavioral control by general characteristics of the participants

Variables	EPBC
Occupation	
Nutrition teacher	3.36 ± 1.26
Dietitian	2.54 ± 1.43
t-value	3.046*
School level	
Elementary school	3.45 ± 1.27
Middle/high school	2.65 ± 1.31
t-value	3.561***
Number of meals served (per day)	
1	3.32 ± 1.30
≥ 2	2.67 ± 1.35
t-value	2.338*

Mean ± SD.
EPBC, external perceived behavioral control.
*$P < 0.05$, ***$P < 0.001$ by independent samples t-test.

All variables composing the study model exhibited statistically significant positive correlations with intentions of delivering sustainable dietary education.

5. Difference in PBC by general characteristics of respondents

We further analyzed potential differences in PBC based on the respondents' general characteristics (**Tables 4** and **5**). A statistically significant difference was observed in IPBC between those who participated in the relevant training program (mean score: 3.45) and those who did not (mean score: 3.45, t = 2.036, $P < 0.05$).

Significant differences in EPBC were also found based on occupation (t = 3.046, $P < 0.05$), school level (t = 3.561, $P < 0.001$), and the number of meals served per day (t = 2.338, $P < 0.05$). Nutrition teachers (mean score: 3.36) reported higher EPBC compared to dietitians (mean score: 2.54). Additionally, elementary school teachers (mean score: 3.45) had higher EPBC compared to middle/high school teachers (mean score: 2.65). Finally, respondents working in schools with one meal per day reported a significantly higher level of EPBC (mean score: 3.32) compared to those working in schools with two or more meals per day (mean score: 2.67).

DISCUSSION

This study aimed to establish foundational data for promoting sustainable dietary education by exploring factors influencing nutrition teachers' intentions to deliver such education, based on the TPB. Analyses revealed that a majority of respondents in Jeollanam-do delivered sustainable dietary education '0–5 times or less per year,' indicating a relatively low frequency of such practice. This finding aligns with previous studies on the implementation of sustainable dietary education [14-16].

The low performance of education by nutrition teachers has been a persistent problem since the introduction of the Nutrition Teacher System in 2006 [14-16]. These challenges encompass various factors such as 'work overload,' 'insufficient educational resources,' and 'systemic issues (e.g., not designated as regular class sessions) [16,23,26]. Therefore, specific measures are needed to increase the delivery of sustainable dietary education.

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This study emphasizes the distinction between IPBC and EPBC within the TPB model. Traditionally, Ajzen [25] conceptualized PBC as a single construct encompassing both internal and external factors. Internal factors included skills, knowledge, background, and willpower, while external factors included access to support, time, and cost. Building upon this concept, Bang & Kim [18] divided PBC into IPBC and EPBC in their study of tourist behavior.

In contrast, previous TPB research on educational behavior among general teachers has typically treated PBC as a single domain [27,28]. However, unlike general teachers, nutrition teachers have the dual responsibility of providing meal services and delivering education. Moreover, they often lack the institutional support structures commonly available in traditional classrooms, such as regular teaching schedules and standardized textbooks. Given these distinct circumstances, we argue that an expanded TPB model, differentiating between IPBC and EPBC, is essential for comprehending the specific barriers that impede nutrition teachers from delivering education. Furthermore, Jong's study [23] found significant differences in the levels of internal and external factors hindering nutrition teachers from delivering educational behavior. Therefore, this study holds significance by demonstrating the need for the expanded TPB model, separating PBC into IPBC and EPBC, when investigating the educational behavior of nutrition teachers.

Our analysis based on the study model confirmed that all major variables were significantly associated with nutrition teachers' intention to provide sustainable dietary education. Among these variables, EPBC had the strongest influence. A high level of EPBC signifies that a nutrition teacher perceives greater control over external resources, which in turn strengthens intentions to deliver education and ultimately leads to its implementation. Despite its significant influence, the nutrition teacher's overall perception of EPBC was the lowest among all the variables. Similarly, Jong's study [23] which explored factors affecting intentions to deliver nutrition education found that external challenges, such as 'work overload' (55.6%), 'not included in the regular class session and insufficient materials' (26.2%), and 'time constraints for delivering education' (13.5%) were significantly higher than in internal factors like 'lack of knowledge and confidence of nutrition teachers' (3.2%). This confirms that the greater barrier posed by external factors in delivering education compared to internal factors.

While Jong's study [23] focused on pre-existing nutrition education emphasizing health, this study examined sustainable dietary education, encompassing broader concepts and scope that include environment, health, and society domains. Despite the expanded curriculum and content of dietary education reflecting current trends, both studies reveal the consistent challenge of insufficient external resources for teachers to effectively deliver education. This suggests that the current external resource system remains inadequate to support educational activities among nutrition teachers.

The role of the nutrition teacher in delivering sustainable dietary education is crucial, but individual efforts alone are insufficient. Therefore, alongside content development and curriculum refinement for sustainable dietary education, active support through external resources is necessary at national, community, and school levels to empower nutrition teachers to deliver education effectively.

Since EPBC is the most influential factor for intentions to deliver education, the study further investigated differences in EPBC based on subject characteristics to identify additional measures for strengthening it. First, nutrition teachers reported a higher level of EPBC

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compared to dietitians. This finding aligns with Lee's study [15], which demonstrated significantly higher self-assessment scores among full-time nutrition teachers compared to part-time dietitians. Part-time dietitians, not formally classified as teachers, may perceived less responsibility and duty toward delivering nutrition education [29]. Therefore, efforts to improve attitudes and perceptions of part-time dietitians regarding sustainable dietary education, along with systemic support, are also necessary.

Second, nutrition teachers in elementary schools had higher EPBC compared to those in middle/high schools. This aligns with Yu's study [29], which found the lowest performance level of nutritional education in high schools, possibly due to students' focus on academic and college entrance exams. Therefore, active support for expanding the implementation of sustainable dietary education in middle/high schools is needed.

Third, the level of EPBC was higher among those working in schools providing one meal per day compared to those with 2 or more meals. This suggests that a higher meal frequency (increased workload) translates to a lower perceived level of control over resources needed for delivering education. Therefore, establishing realistic measures and plans to improve the level of EPBC is crucial, such as reducing workload and intensity for nutrition teachers, and potentially increasing the number of nutrition teachers on staff.

Attitude emerged as the second most influential factor in intentions to deliver education in this study. A significant positive association was found between attitudes and intentions, suggesting that nutrition teachers with more positive attitudes toward sustainable dietary education are more likely to deliver such education. Similarly, Oh's study [27] found that elementary school teachers' attitudes had the strongest positive influence on intentions to improve mathematics instruction. These findings suggest that regardless of whether they are nutrition teachers or general teachers, positive attitudes toward education are generally linked with stronger intentions to deliver that education.

This study found that current nutrition teachers generally held positive attitudes toward sustainable dietary education. We believe this may be related to the actual practice of such education. While most respondents reported delivering sustainable dietary education '0 to 5 times' per year, a significant portion delivered education more frequently. This engagement with education delivery may contribute somewhat to the positive attitudes observed among the teachers.

Therefore, promoting the value and effectiveness of positive attitudes through workshops or campaigns that showcase successful cases of sustainable dietary education programs is essential. Additionally, efforts to maintain and reinforce positive attitudes among nutrition teachers toward sustainable dietary education are necessary.

IPBC emerged as the third most influential factor affecting intentions to deliver education. A higher level of IPBC signifies that an individual perceives greater control over their internal resources, ultimately leading to stronger intentions to deliver education and ultimately its implementation. This interpretation highlights the importance of nutrition teachers' perceived control over their internal resources for effectively delivering sustainable dietary education.

To improve IPBC, developing and expanding workshops and training programs related to sustainable dietary education is crucial. Our study found that participants in relevant training

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programs had significantly higher levels of IPBC compared to non-participants, emphasizing the need for active collaboration among various stakeholders to develop and expand such programs. Therefore, active collaboration is required among various stakeholders, including metropolitan and provincial education offices, local universities, training institutions, relevant associations, and the Korean Dietetic Association, to develop and expand workshops and training programs related to sustainable dietary training.

Subjective norms, which refer to the perceived influence of others on an individual's behavior, emerged as the fourth and final factor affecting intentions to deliver education. A significant positive association was found between subjective norms and intentions, indicating that a higher level of perceived social pressure translates to stronger intentions to deliver education. This finding differs from Chung's study [14], which identified subjective norms as the most influential factor in nutrition teachers' desire to implement sustainable dietary education. It is important to note that Chung's study [14] examined the comprehensive scope of sustainable practices for nutrition teachers, encompassing duties like purchasing, menu planning, operations, waste management, education, and promotion/management. In contrast, our study focused solely on the educational aspect of sustainable dietary practices, which is just one component of a nutrition teacher's responsibilities.

These differing results suggest that the level of subject norms may vary depending on the specific work scope of nutrition teachers. Nevertheless, despite the observed difference in degree, subjective norms remain a significant factor influencing intentions to deliver sustainable dietary education. Therefore, it is crucial to cultivate positive subjective norms among nutrition teachers by fostering active interest, support, and cooperation from those around them, including other nutrition teachers, kitchen staffs, colleagues (principals and general teachers), and students/parents.

This study has some limitations. While this study focused on exploring the intentions of nutrition teachers to deliver sustainable dietary education, it did not directly assess their actual performance in delivering such education. Future research should address this gap by examining the actual delivery of sustainable dietary education as a dependent variable. Additionally, the study's sample was limited to Jeollanam-do and exhibited an unequal sex distribution, warranting future studies with a more balanced representation and a broader nationwide sample. Future studies should investigate whether sustainable dietary education is being conducted in a balanced manner across all domains, including environment, health, and society.

Despite these limitations, this study is significant for several reasons. It is the first to investigate the comprehensive scope of sustainable dietary education practices in Jeollanam-do, an area where prior research on this topic is lacking. Additionally, this study contributes to the theoretical foundation by employing TPB framework to understand nutrition teachers' perceptions and intentions regarding sustainable dietary education. It also offers strategies to activate dietary education programs and suggests the potential for expanding TPB research among nutrition teachers by differentiating PBC into IPBC and EPBC. Overall, the findings from this study can inform the development of policies and systems to support sustainable dietary education initiatives.

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CONCLUSIONS

This study was conducted to provide foundational data for activating sustainable dietary education by exploring individual motivational factors influencing the intention of nutrition teachers in Jeollanam-do Province, South Korea, based on the TPB framework. These findings suggest that improvements in nutrition teachers' attitudes, subjective norms, internal perceived behavioral control, and external perceived behavioral control regarding sustainable dietary education would lead to a positive increase in their intentions to deliver such education. However, it was noted that nutrition teachers' actual perceptions of external perceived behavioral control, the most influential factor on educational intention, were relatively low. We anticipate that this study will contribute to promoting sustainable dietary education by strengthening facilitating factors and addressing barriers identified in this study.

REFERENCES

1. Intergovernmental Panel on Climate Change (IPCC). Climate change 2023: synthesis report [Internet]. IPCC; 2023 [updated 2023; cited 2023 Apr 4]. Available from: https://www.ipcc.ch/report/ar6/syr/downloads/report/IPCC_AR6_SYR_SPM.pdf.
2. Kang MJ, Lee SH, Kim YT, Lee SW. The development and application of ESD education program on sustainable development goals 1-4 area. Korean J Elementary Educ 2018; 29(1): 81-99. CROSSREF
3. Lee KA. Exploring the necessity and practical tasks of dietary education in food plans. J Korean Pract Arts Educ Res 2020; 26(1): 51-72. CROSSREF
4. Ministry of Agriculture, Food and Rural Affairs. 3rd ('20~'24) basic plan for dietary education [Internet]. Ministry of Agriculture, Food and Rural Affairs; 2020 [updated 2020 Jan; cited 2023 Nov 23]. Available from: https://www.mafra.go.kr/home/5109/subview.do?enc=Zm5jdDF8QEB8JTJGYmJzJTJGaG9tZSUyRjc-5MiUyRjU2MTg3MSUyRmFydGNsVmlldy5kbyUzRg%3D%3D.
5. Nam YM, Kana A, Yoon JH. Comparison of the sustainable dietary policy among countries - focusing on France, the UK, the USA, and Japan -. Korean J Community Living Sci 2019; 2019(4): 75-75.
6. Kwon HI, Lee YM. The effect of the gardening activity program for sustainable eating education on infants' sustainable eating capacity and environmentally friendly attitudes. Early Child Educ Res Rev 2023; 27(3): 101-127. CROSSREF
7. Oh YJ, Min JY, Ryu HW, Cho KS. Development and application of low-carbon environmental education program using food mileage and plant factory. J Korean Soc Environ Educ 2016; 29(4): 400-411. CROSSREF
8. Kim SR, Yu KH, Kim MJ, Ly SY. Effects of vegetable-focused nutrition education on improving nutrition knowledge and dietary habits in young Children. Korean J Hum Ecol 2023; 32(5): 665-678. CROSSREF
9. Han HM, Lee SS. A nutrition education program development and the application for the elementary students - focused on sugar intake education -. J Korean Pract Arts Educ 2008; 21(2): 111-131.
10. Yoo HR, Kim KS. The effect of character education activities based on green diet on children's perception of life respect, community spirit and caring behavior. J Korea Open Assoc Early Child Educ 2018; 23(6): 29-54.
11. Woo TJ, Lee KH. Development of a sensory education textbook and teaching guidebook for preference improvement toward traditional Korean foods in schoolchildren. Korean J Nutr 2011; 44(4): 303-311. CROSSREF
12. Jeollanamdo Office of Education. Basic plan for school meals [Internet]. Jeollanamdo Office of Education; 2023 [updated 2023 Jan 30; cited 2023 Dec 22]. Available from: https://www.jne.go.kr/sse/na/ntt/selectNttInfo.do?mi=794&bbsId=454&nttSn=5055200#none.
13. Ministry of Government Legislation. Enforcement degree of the school meals act [Internet]. Ministry of Government Legislation; 2023 [updated 2023 Apr 25; cited 2023 Dec]. Available from: https://www.law.go.kr/lsSc.do?menuId=1&subMenuId=15&query=%ED%95%99%EA%B5%90%EA%B8%89%EC%8B%9D%EB%B2%95%20%EC%8B%9C%ED%96%89%EB%A0%B9&dt=20201211#undefined.
14. Chung MJ. Factors influencing the sustainable practices in school food service operations - an application of the extended theory of the planned behavior model -. Korean J Food Nutr 2021; 34(2): 242-253. CROSSREF

https://doi.org/10.5720/kjcn.2024.29.2.114

15. Lee NY. Dietitians' self-evaluation and barriers to sustainable practices for school foodservice management - focused on Daejeon and Chungnam area -. Korean J Food Cook Sci 2017; 33(3): 342-352. CROSSREF
16. Park SH. Awareness and operation status about green meal service in school nutrition teachers at Seoul area [master's thesis]. Kookmin University; 2021.
17. Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process 1991; 50(2): 179-211. CROSSREF
18. Bang HW, Kim MJ. A study on application validity of the theory of planned behavior including perceived behavior control to the international tourism study. J Hosp Tour Stud 2020; 22(2): 35-48.
19. Kim WB, An JY, Um JB. A study of consumers' intentions to purchase alternative meats using the theory of planned behavior. J Agric Ext Community Dev 2023; 30(3): 143-155.
20. Liu AN, Lee SW, Hwang JY. Factors related to the short-term and long-term intentions of healthy eating among Chinese adults living in Shanghai and parts of Anhui Province of China using the theory of planned behavior. J Nutr Health 2022; 55(1): 188-199. CROSSREF
21. Shin EM, Kim KW. Psychosocial factors related to dairy product consumption among female university students in Daejeon. Korean J Community Nutr 2003; 8(6): 867-875.
22. Kidwell B, Jewell RD. An examination of perceived behavioral control: internal and external influences on intention. Psychol Mark 2003; 20(7): 625-642. CROSSREF
23. Jong HS. The relationship analysis of the actual condition of nutrition education, job satisfaction and teacher efficacy of nutrition teacher in Gangwon province [master's thesis]. Sangji University; 2019.
24. Armitage CJ, Conner M. Distinguishing perceptions of control from self-efficacy: predicting consumption of a low-fat diet using the theory of planned behavior. J Appl Soc Psychol 1999; 29(1): 72-90. CROSSREF
25. Ajzen I. Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. J Appl Soc Psychol 2002; 32(4): 665-683. CROSSREF
26. Park ES. Operation and training demand on dietary life education of nutrition teachers in Jeonbuk province. Korean J Hum Ecol 2014; 23(1): 149-161. CROSSREF
27. Oh YY. Understanding and predicting elementary teachers' intention to change in mathematics instruction. J Educ Res Math 2003; 13(3): 267-286.
28. Choi JS, Yim SY. Factors influencing primary school teachers' reading strategy instruction in social studies classes: applying the theory of planned behavior. J Korean Assn Learn Cent Curric Instr 2021; 21(3): 1031-1049. CROSSREF
29. Yu SY. School dietitian's job satisfaction, job importance and education needs at college level according to the school levels in Sejong [master's thesis]. Kongju National University; 2021.