

# Factors associated with nutrition label use among female college students applying the theory of planned behavior

Hyun Jeong Lim, Min Ju Kim and Kyung Won Kim<sup>§</sup>

Department of Food and Nutrition, Seoul Women's University, 621 Hwarangro, Nowon-gu, Seoul, 139-774, Korea

**BACKGROUND/OBJECTIVES:** Use of nutrition labels in food selection is recommended for consumers. The aim of this study is to examine factors, mainly beliefs explaining nutrition label use in female college students based on the Theory of Planned Behavior (TPB).

**SUBJECTS/METHODS:** The subjects were female college students from a university in Seoul, Korea. The survey questionnaire was composed of items examining general characteristics, nutrition label use, behavioral beliefs, normative beliefs, corresponding motivation to comply, and control beliefs. The subjects ( $n = 300$ ) responded to the questionnaire by self-report, and data from 275 students were analyzed using t-test or  $\chi^2$ -test.

**RESULTS:** The results showed that 37.8% of subjects were nutrition label users. Three out of 15 behavioral beliefs differed significantly by nutrition label use. Nutrition label users agreed more strongly on the benefits of using nutrition labels including 'comparing and selecting better foods' ( $P < 0.001$ ), 'selecting healthy foods' ( $P < 0.05$ ). The negative belief of 'annoying' was stronger in non-users than in users ( $P < 0.001$ ). Three out of 7 sources (parents, siblings, best friend) were important in nutrition label use. Twelve out of 15 control beliefs differed significantly by nutrition label use. These included beliefs regarding constraints of using nutrition labels (e.g., time, spending money for healthy foods) and lack of nutrition knowledge ( $P < 0.001$ ). Perceived confidence in understanding and applying the specifics of nutrition labels in food selection was also significantly related to nutrition label use ( $P < 0.001$ ).

**CONCLUSIONS:** This study found that the beliefs, especially control beliefs, suggested in the TPB were important in explaining nutrition label use. To promote nutrition label use, nutrition education might focus on increasing perceived control over constraints of using nutrition labels, acquiring skills for checking nutrition labels, as well as the benefits of using nutrition labels and receiving support from significant others for nutrition label use.

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## INTRODUCTION

Adequate nutrition behaviors during early adulthood are important for the long period of adulthood and disease prevention in midlife or later. College life is characterized by becoming independent, studying, extracurricular activities, part-time work on campus or outside, and preparation for the job. These influence the eating habits of female college students, characterized by skipping meals, not having a variety of foods, insufficient consumption of foods including fruits, vegetables or dairy foods, and frequent consumption of processed foods or convenience foods [1-3].

With the rapid development of the food industry, increases in nuclear families and seeking convenience in dietary life, processed foods and convenience foods are more readily available in our society. To help consumers choose foods sensibly, it is necessary to provide nutrition information on

processed foods or convenience foods. The nutrition label provides information regarding food products, including serving size, nutrient content in food products, and the percentage of daily values. In Korea, nutrition fact labeling was introduced in 1994 under the food sanitation act [4]. Reading nutrition labels was related to decisions in food selection, food purchasing behaviors, and practicing healthy eating behaviors (e.g., decreased consumption of energy or sodium) [5,6]. One study also reported that nutrition label users had lower prevalence of metabolic syndrome than those who did not use or did not have knowledge of nutrition labels [7]. Using nutrition labels will help consumers to choose or purchase foods sensibly and to practice desirable nutrition behaviors (e.g., eating adequate calorie or fat, etc.) accordingly. The results of the 2012 Korea National Health and Nutrition Examination Survey (KNHANES), however, revealed that only 31.7% of adults aged 19 and over read nutrition labels when they selected processed foods; those

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<sup>§</sup> Corresponding Author: Kyung Won Kim, Tel. 82-2-970-5647, Fax. 82-2-976-4049, E-mail. kwkim@swu.ac.kr

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who read nutrition labels was slightly higher (45.4%) in women aged 19-29 than adults aged 19 and over [8].

To promote nutrition label use in selecting or purchasing processed foods, investigation of factors explaining nutrition label use is needed. Studies on nutrition label use have focused on examining the status of nutrition label use, knowledge about and perceptions of using nutrition labels, food consumption, and eating habits [9-11]. Theory based research enables a systematic, comprehensive investigation of factors influencing nutrition behaviors. One of those theories, the Theory of Planned Behavior (TPB), provides a framework for understanding factors regarding nutrition behaviors because it covers diverse motivational factors (e.g., beliefs) influencing health or nutrition behaviors while using a small number of constructs.

According to the TPB [12,13], the performance of a behavior is determined by one's intention to do it. A person's intention is determined by three factors: personal attitudes towards the behavior, subjective norms and perceived control over the behavior. This theory helps us to understand the causes of behavior by investigating salient information, which are the beliefs underlying the three factors. Attitudes towards the behavior are formed through beliefs regarding the consequences of a behavior (i.e., behavioral beliefs) and evaluation of those consequences. Subjective norms are influenced by normative beliefs regarding what significant others in one's environment think one should do and the motivation to comply with these significant others. Perceived behavioral control is formed through beliefs regarding skills or opportunities for the behavior (i.e., control beliefs) and perceived power of each control factor. The TPB has been used in explaining nutrition behaviors, such as dairy food consumption, adequate consumption of fruits and vegetables, family meal frequency, sugar-sweetened beverage consumption, and intentions to breastfeed [3,14-18].

As the importance of using nutrition labels has received attention, studies on nutrition label use have been conducted in recent decades [19-22]. However, most of these studies, have focused on examining the status of nutrition label use, knowledge and perceptions of using nutrition labels [19,20]. Relatively few studies have been conducted using theories to identify factors explaining nutrition label use [5,23]. The purpose of this study was to examine if factors, mainly beliefs based on the TPB, were important in explaining nutrition label use in female college students. In this study, female college students were chosen as the subjects, since they are entering the period of adulthood in the lifecycle, having independence in food choice and eating behaviors. They were more likely to consume and enjoy snacks than male college students [2]. In addition, nutrition behavior of young adult women, including female college students, is important because it will influence the food selection or nutrition behavior of future families as well as their food selection. Study findings will provide baseline data for development of nutrition education programs for promoting nutrition label use in female college students and young adult women.

## SUBJECTS AND METHODS

### Study design and subjects

This study used a cross-sectional survey design. A pilot-study using open-ended questions was completed with 10 college students in order to obtain information for development of items of the TPB. Subjects for the main survey were female college students, recruited from the university located in Seoul, Korea. Investigators explained the study, and those who were willing to participate in the survey provided written informed consent. Students were also informed that they could withdraw from the study if they were not willing to respond to the survey questionnaire. Self-reporting data were collected from 300 female college students in 2013. Excluding data of incomplete responses on nutrition label use or other major study variables ( $n = 15$ ) and majoring in food or nutrition ( $n = 10$ ), data from 275 students were used for statistical analysis. Those who majored in food or nutrition were excluded from data analysis, since this major (e.g., food or nutrition background) might influence nutrition label use and related beliefs. The completion rate was 91.7%. This study was approved by the Institutional Review Board of Seoul Women's University (IRB-2013A-2).

### Survey questionnaire

The survey questionnaire was developed using literature reviews and responses from the pilot study. Open-ended questions based on the TPB were used in the pilot study to examine advantages or disadvantages of nutrition label use, significant others influencing nutrition label use, and factors that make nutrition label use easy or difficult.

The survey questionnaire consisted of items for measurement of general characteristics, status of nutrition label use and factors (mainly beliefs) related to nutrition label use based on the TPB (Fig. 1). Nutrition label use was measured using an item if they read nutrition labels when selecting or purchasing processed foods or snacks. Based on the response on this item, subjects were categorized as nutrition label users (marked 'yes' on this item) or non-users (marked 'no' or 'don't know about nutrition label'). Further questions, such as nutrients for

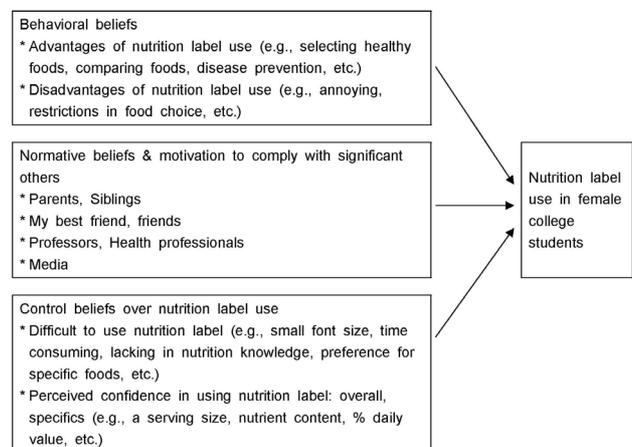


Fig. 1. Proposed factors related to nutrition label use applying the Theory of Planned Behavior

checking with interest and influence of reading nutrition labels on food selection, were asked only to the nutrition label users [8,24]. General characteristics included items such as age, height, weight, and grade.

Items for assessment of beliefs regarding nutrition label use (i.e., behavioral beliefs) were developed based on responses from pilot study and previous studies [24,25]. These included health and nutritional benefits (e.g., selecting healthy foods, not having foods high in fat or sodium, disease prevention, calorie control, and obesity prevention), practical benefits (e.g., making me eat adequate amount of foods, comparison of foods in food selection, helping others to select good foods), and disadvantages of nutrition label use (e.g., not eating favorite foods, spending time for food selection, cost, restrictions in food choices). These items were measured on a 5-point scale from 'strongly disagree' (1) to 'strongly agree' (5) to indicate the strength of these beliefs. Total score for beliefs regarding nutrition label use was defined as the summated score of the 15 behavioral beliefs, while coding reversely the score on the items regarding disadvantages of nutrition label use. The higher total score indicated having more favorable attitudes toward nutrition label use. The Cronbach's alpha was 0.60.

Results from the pilot study and literature review [16,24] showed that seven types of people or influences were regarded as having normative pressure related to nutrition label use. These included parents, siblings, my best friend (i.e., very close friend), friends (i.e., friends in general), professors, health professionals (e.g., doctors, dietitians), and mass media (e.g., TV, newspapers). Items for normative beliefs were measured on a 5-point scale from 'strongly disagree' (1) to 'strongly agree' (5). The corresponding motivation to comply with each significant other was measured on a 5-point scale from 'not at all' (1) to 'very much' (5). There was also a response category (coded as 0) for subjects to check if each significant other did not apply to the subjects. The subjective normative items were defined as the product of each normative belief and corresponding motivation to comply with each significant other. The higher total score indicated that subjects perceived more subjective norms from significant others regarding nutrition label use. The Cronbach's alpha (normative belief X motivation to comply) was 0.84, which was considered quite acceptable.

Items for assessment of control beliefs were developed using literature review [24,25] and responses from the pilot study. Fifteen items were used to measure control beliefs. Perceived constraints of using nutrition labels included items such as 'small font size in nutrition label', 'lacking in nutrition knowledge', 'the tendency to eat impulsively', 'making me spend more time on grocery shopping', 'when I do grocery shopping with others (e.g., friends)', and 'preference for particular foods'. In addition, the perceived confidence in understanding and applying the specifics of nutrition labels (e.g., serving size, nutrients, nutrient content, and %daily value) in food selection was assessed. These items were rated on a 5-point scale from 'strongly disagree' (1) to 'strongly agree' (5), or from 'very difficult' (1) to 'very easy' (5) depending on the items. Total score for control beliefs was defined as the summated score of 15 control beliefs, while coding reversely the score on items regarding the perceived constraints of nutrition label use. A higher total score for control

beliefs indicated perceiving more control over using nutrition labels. The Cronbach's alpha was 0.82, which was considered acceptable.

### Statistical analysis

Data of 275 female college students were analyzed using SPSS (PASW Statistics 18.0; SPSS Inc., Chicago, IL, USA). Descriptive statistics, including frequency, mean, and standard deviation, were calculated. Subjects were categorized according to the two groups by nutrition label use. Nutrition label users were those who read nutrition labels when selecting or purchasing processed foods-snacks. Non-user group included those who did not read nutrition labels when selecting or purchasing processed foods-snacks or those who did not know about nutrition labels. T-test or chi-square test was used to determine whether there were significant differences in factors, including behavioral beliefs, normative beliefs and motivation to comply component, control beliefs, as in the TPB. A level of  $P < 0.05$  was considered significant for the statistical tests.

## RESULTS

### General characteristics of subjects by nutrition label use

General characteristics of subjects are presented in Table 1. Subjects in this study were categorized as nutrition label users ( $n = 104$ , 37.8%) and non-users ( $n = 171$ , 62.2%). The mean age of subjects was 20.6 years. The mean height and weight was 162.4 cm and 52.6 kg. No significant differences in age, mean height, and weight were observed between nutrition label users and non-users (Table 1).

With respect to grades, 34.2% of subjects were freshmen, followed by sophomores (29.4%), seniors (20.0%), and juniors (16.4%). The percentage of freshmen in non-users (39.2%) was slightly higher than that in nutrition label users (26.0%), however, the distribution of grades was not statistically different by nutrition label use (Table 1).

When nutrition label users were asked about nutrients for checking, 67.4% indicated that they were interested in calories, followed by fat (6.5%), cholesterol (6.5%), saturated fat (5.5%), carbohydrate/sugars (5.5%), trans fat (4.3%), and sodium (3.3%). The majority of nutrition label users (85.6%) also indicated that

**Table 1.** General characteristic of subjects by nutrition label use

Variables	Total (n = 275)	Nutrition label use		t or $\chi^2$
		Users (n = 104)	Non-users (n = 171)	
Age (yrs)	20.6 ± 1.7 <sup>1)</sup>	20.8 ± 1.8	20.4 ± 1.6	1.9 <sup>3)</sup>
Height (cm)	162.4 ± 4.9	162.4 ± 4.3	162.5 ± 5.2	-0.1
Weight (kg)	52.6 ± 6.6	53.1 ± 6.2	52.2 ± 6.9	1.0
Grade				
Freshmen	94 (34.2) <sup>2)</sup>	27 (26.0)	67 (39.2)	5.5
Sophomores	81 (29.4)	34 (32.7)	47 (27.5)	
Juniors	45 (16.4)	21 (20.2)	24 (14.0)	
Seniors	55 (20.0)	22 (21.1)	33 (19.3)	
Total	275 (100.0)	104 (100.0)	171 (100.0)	

<sup>1)</sup> Mean ± SD

<sup>2)</sup> n (%)

<sup>3)</sup>  $\chi^2$  value by  $\chi^2$ -test or t value by t-test

**Table 2.** Nutrients for checking and influence of reading nutrition labels on food selection in nutrition label users

Variables	n (%)
Nutrient for checking <sup>1)</sup>	
Calorie	62 (67.4)
Carbohydrate/Sugars	5 (5.5)
Fat	6 (6.5)
Saturated fat	5 (5.5)
Trans fat	4 (4.3)
Cholesterol	6 (6.5)
Sodium	3 (3.2)
Others	1 (1.1)
Total	92 (100.0)
Influence of reading nutrition label on food selection	
Yes	89 (85.6)
No	15 (14.4)
Total	104 (100.0)

<sup>1)</sup> Number of subjects who did not respond to this variable: 12

reading nutrition labels influences their food selection (Table 2).

#### Behavioral beliefs by nutrition label use

Results regarding behavioral beliefs by nutrition label use are shown in Table 3. Total score for behavioral beliefs (possible score: 15-75), measured by 15 items, was 49.2 (65.6 out of 100). Total score for behavioral beliefs was significantly higher in nutrition label users than in non-users (50.3 vs 48.5,  $P < 0.01$ ), suggesting that nutrition label users, compared to non-users, showed more favorable attitudes regarding use of nutrition labels.

**Table 3.** Behavioral beliefs by nutrition label use

Variables	Total (n = 275)	Nutrition label use		t
		Users (n = 104)	Non-users (n = 171)	
If I were to use nutrition label in selecting/purchasing processed foods/snacks, it would ...				
1. Make me select healthy foods <sup>1)</sup>	3.9 ± 0.7 <sup>2)</sup>	4.0 ± 0.7	3.8 ± 0.6	2.1* <sup>3)</sup>
2. Help others (e.g., family members, friends) to select good foods	3.7 ± 0.7	3.8 ± 0.7	3.6 ± 0.7	1.9
3. Make me compare foods and select better foods	4.1 ± 0.6	4.2 ± 0.6	4.0 ± 0.6	3.5***
4. Help me not to have foods high in fat or sodium	3.6 ± 0.8	3.8 ± 0.8	3.6 ± 0.8	1.9
5. Make me eat adequate amount of foods (serving size)	3.1 ± 0.9	3.2 ± 0.9	3.0 ± 0.9	1.9
6. Make me select foods high in vitamins or calcium	3.6 ± 0.8	3.6 ± 0.7	3.7 ± 0.8	-0.7
7. Help me to prevent diseases (e.g., hypertension, diabetes mellitus)	4.0 ± 0.8	3.9 ± 0.8	4.0 ± 0.8	-1.2
8. Be good for calorie control and obesity prevention	4.1 ± 0.7	4.0 ± 0.7	4.1 ± 0.7	-0.6
9. Give the strict image to significant others	3.0 ± 0.9	3.0 ± 1.0	3.1 ± 0.9	-0.8
10. Make me spend much time on purchasing foods	3.8 ± 0.9	3.8 ± 0.9	3.7 ± 0.9	0.4
11. Make me spend money on purchasing foods	3.2 ± 1.0	3.2 ± 0.9	3.2 ± 1.0	-0.3
12. Make me not to eat my favorite foods	3.0 ± 1.0	3.1 ± 1.0	3.0 ± 1.0	0.6
13. Be annoying	3.2 ± 1.0	2.8 ± 1.0	3.5 ± 0.9	-6.5***
14. Make me not to choose a delicious snack	3.1 ± 1.0	3.1 ± 0.9	3.2 ± 1.0	-0.7
15. Reduce the number of processed foods that I can have	3.5 ± 1.0	3.5 ± 1.0	3.6 ± 1.0	-0.9
Total score <sup>4)</sup>	49.2 ± 5.1	50.3 ± 5.5	48.5 ± 4.6	2.9**

\*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$

<sup>1)</sup> Each item was measured using 5-point scales from 'strongly disagree' (1) to 'strongly agree' (5).

<sup>2)</sup> Mean ± SD

<sup>3)</sup> t value by t-test

<sup>4)</sup> Total score of 15 items (possible score: 15-75). To calculate the total score, the items from 9 to 15 were scored reversely.

Three out of 15 behavioral beliefs were significantly related to nutrition label use (Table 3). More specifically, nutrition label users, compared to non-users, scored significantly higher on beliefs regarding the benefits of using nutrition labels, such as 'making me compare foods and select better foods' ( $P < 0.001$ ) and 'making me select healthy foods' ( $P < 0.05$ ). Negative behavioral beliefs, 'using nutrition label is annoying', differed significantly between nutrition label users and non-users (mean score: 2.8 in users, 3.5 in non-users,  $P < 0.001$ ), suggesting that nutrition label users perceived less strongly that this belief is a disadvantage of using nutrition labels than non-users (Table 3).

#### Normative beliefs and motivation to comply by nutrition label use

Table 4 shows results regarding normative beliefs and motivation to comply component by nutrition label use. Total score for normative belief and motivation to comply (possible score: 0-175), measured by seven pairs of items, was 75.1 (42.9 out of 100). Total score for normative beliefs and motivation to comply differed significantly between nutrition label users and non-users (79.7 vs 72.2,  $P < 0.05$ ), indicating that nutrition label users perceived more influence from significant others regarding use of nutrition labels than non-users (Table 4).

Three out of seven pairs of normative belief and motivation to comply were significantly related to nutrition label use. More specifically, expectation and motivation to comply with parents ( $P < 0.01$ ), sisters-brothers ( $P < 0.05$ ) and my best friend ( $P < 0.05$ ) were important in influencing the subject's nutrition label use (Table 4).

#### Control beliefs by nutrition label use

Results regarding control beliefs are shown in Table 5. Total

**Table 4.** Normative beliefs and Motivation to comply by nutrition label use

Variables	Total (n = 275)	Nutrition label use		t
		Users (n = 104)	Non-users (n = 171)	
Normative belief <sup>1)</sup> X Motivation to comply <sup>2)</sup>				
1. Parents	11.3 ± 5.5 <sup>3)</sup>	12.5 ± 5.8	10.6 ± 5.2	3.0** <sup>4)</sup>
2. Sisters-Brothers	9.3 ± 6.0	10.5 ± 6.3	8.5 ± 5.7	2.6*
3. My best friend	8.8 ± 4.5	9.6 ± 4.6	8.4 ± 4.5	2.1*
4. Friends	8.2 ± 3.9	8.8 ± 4.3	7.8 ± 3.6	1.9
5. Professors	10.3 ± 5.8	10.7 ± 5.8	10.1 ± 5.8	0.9
6. Health professionals (e.g., doctors, dietitians)	15.2 ± 5.7	15.2 ± 5.7	15.2 ± 5.7	0.0
7. Mass media (e.g. TV, newspapers)	12.1 ± 5.1	12.4 ± 4.8	12.0 ± 5.2	0.7
Total score <sup>5)</sup>	75.1 ± 26.3	79.7 ± 27.7	72.2 ± 25.1	2.3*

\*  $P < 0.05$ , \*\*  $P < 0.01$ <sup>1)</sup> Each item was measured using 5-point scales from 'strongly disagree' (1) to 'strongly agree' (5). There was a response category of 'not applicable' (0) if each significant other did not apply to the subjects.<sup>2)</sup> Each item was measured using 5-point scales from 'not at all' (1) to 'very much' (5). There was a response category of 'not applicable' (0) if each significant other did not apply to the subjects.<sup>3)</sup> Mean ± SD. Possible score: 0-25. The score on each item was calculated by multiplying each normative belief and corresponding motivation to comply.<sup>4)</sup> t value by t-test<sup>5)</sup> Possible score: 0-175. Total score was calculated by multiplying the score on each normative belief and corresponding motivation to comply and summing up these scores.**Table 5.** Control beliefs by nutrition label use

Variables	Total (n = 275)	Nutrition label use		t
		Users (n = 104)	Non-users (n = 171)	
It's difficult to use nutrition label in selecting/purchasing foods/snacks because of ...				
1. Small font size in nutrition label <sup>1)</sup>	3.5 ± 0.9 <sup>3)</sup>	3.4 ± 0.9	3.6 ± 0.9	-1.9 <sup>4)</sup>
2. Lacking in knowledge about nutrition label	3.6 ± 1.0	3.2 ± 1.1	3.8 ± 0.8	-5.3***
3. Lacking in nutrition knowledge (e.g., role of nutrients, nutrients and health)	3.6 ± 0.9	3.2 ± 1.0	3.8 ± 0.8	-4.6***
4. The tendency to eat impulsively	3.7 ± 1.0	3.5 ± 1.0	3.8 ± 0.9	-2.3*
5. Making me spend more time on grocery shopping	3.3 ± 1.0	2.8 ± 1.0	3.6 ± 0.9	-7.1***
6. making me select expensive foods	2.9 ± 1.0	2.6 ± 0.9	3.1 ± 1.0	-3.7***
7. Shopping foods with others (e.g., friends)	3.2 ± 1.0	3.2 ± 1.0	3.3 ± 1.0	-0.9
8. Placing nutrition label in back of the food package	3.4 ± 1.0	3.3 ± 1.0	3.4 ± 1.0	-1.3
9. Preference for specific foods	3.4 ± 0.9	3.2 ± 1.0	3.5 ± 0.8	-2.8**
10. I can read nutrition label and select foods because I have interest in health and nutrition	3.4 ± 0.8	3.8 ± 0.7	3.2 ± 0.8	5.9***
How difficult or easy is it to do the followings in selecting/purchasing foods?				
11. I read nutrition labels <sup>2)</sup>	2.8 ± 0.8	3.2 ± 0.8	2.6 ± 0.8	5.9***
12. I understand the meaning of serving size on nutrition label	3.1 ± 0.9	3.4 ± 0.9	3.0 ± 0.8	3.9***
13. I understand the nutrients on nutrition label (e.g., calorie, fat, etc.)	3.2 ± 0.9	3.6 ± 0.8	2.9 ± 0.8	6.3***
14. I understand the nutrient content per serving size on nutrition label (e.g., calorie 400kcal, fat 10g, etc.)	2.9 ± 1.0	3.2 ± 1.0	2.7 ± 0.9	4.0***
15. I understand the % daily values of nutrients on nutrition label	2.7 ± 1.0	3.0 ± 1.0	2.5 ± 0.9	4.6***
Total Score <sup>5)</sup>	41.7 ± 7.5	46.0 ± 8.0	39.1 ± 5.9	7.6***

\*  $P < 0.05$ , \*\*  $P < 0.01$ , \*\*\*  $P < 0.001$ <sup>1)</sup> Each item was measured using 5-point scales from 'strongly disagree' (1) to 'strongly agree' (5).<sup>2)</sup> Each item was measured using 5-point scales ranging from 'very difficult' (1) to 'very easy' (5).<sup>3)</sup> Mean ± SD<sup>4)</sup> t value by t-test<sup>5)</sup> Total score of 15 items (possible score: 15-75). To calculate the total score, the items from 1 to 9 were scored reversely.

score for control beliefs (possible score: 15-75), measured by 15 items, was 41.7 (55.6 out of 100). Total score for control beliefs was significantly higher in nutrition label users than in non-users (46.0 vs 39.1,  $P < 0.001$ ).

Twelve out of 15 control beliefs showed statistically significant relation to nutrition label use (Table 5). Perceived control beliefs such as 'checking nutrition label makes me spend more time

on grocery shopping' ( $P < 0.001$ ), 'lacking in knowledge about nutrition label' ( $P < 0.001$ ), 'lacking in nutrition knowledge (e.g., role of nutrients, nutrients and health,  $P < 0.001$ ), 'making me select expensive foods' ( $P < 0.001$ ), 'preference for specific foods' ( $P < 0.01$ ) and 'the tendency to eat impulsively' ( $P < 0.05$ ) differed significantly between nutrition label users and non-users. Nutrition label users, compared to non-users, felt signifi-

cantly more control over these constraints. In addition, nutrition label users perceived more confidence in 'reading nutrition labels' ( $P < 0.001$ ). More specifically, nutrition label users and non-users differed significantly in terms of perceived confidence in 'understanding the nutrients on nutrition label (e.g., calorie, fat, etc.) in food selection' ( $P < 0.001$ ), 'understanding the % daily value of nutrients on nutrition label in food selection' ( $P < 0.001$ ), 'understanding the nutrient content per serving size on nutrition label (e.g., calorie 400 kcal, fat 10g, etc.) in food selection' ( $P < 0.001$ ), and 'understanding the meaning of serving size on nutrition label in food selection' ( $P < 0.001$ ). Nutrition label users scored significantly higher on perceived control over the specifics of checking nutrition label than non-users (Table 5).

## DISCUSSION

This study focused on examining motivational beliefs associated with nutrition label use based on the TPB. The percentage of nutrition label users (37.8%) in the current study was lower than that reported in the previous studies [8,10]. Results of the 2012 KNHANES [8] showed that 45.5% of women aged 19-29 years were nutrition label users. A study with female college students [10] also reported that 47.3% used nutrition labels in purchasing processed foods. In a survey with adults in their twenties, approximately 43% had recognition of nutrition labels [9]. In contrast, a study regarding the stages of change found that only 31.6% were nutrition label users (action or maintenance stage) while two-thirds of subjects were in the preaction stages (precontemplation, contemplation, or preparation stage) [26]. Among the general characteristics examined in this study, subject's grade seemed to differ slightly by nutrition label use, although it did not reach statistical significance. Nutrition label users were more likely to be juniors and seniors than freshmen and sophomores.

About two-thirds of nutrition label users responded that they were interested in reading the calorie information in nutrition labels. Other nutrients of interest were fat, cholesterol, saturated fat, and carbohydrate/sugars. Interest in calorie or fat information might reflect the fact that young adult women are highly interested in weight control and accordingly want to reduce the intake of energy or fat. Similar to the current study, results of the 2012 KNHANES showed that adults aged 19-29 had interest in calorie (62.5%), fat (saturated fat, trans fat, cholesterol), and sodium information on nutrition labels [8]. In the current study, 85.6% of subjects mentioned that reading nutrition labels influenced their food selection. This finding indicates that checking nutrition labels influences the decision to select healthy foods, suggesting the need for nutrition education regarding nutrition label use. The response that nutrition label use influenced food selection was slightly higher than that reported in the 2012 KNHANES (78.6% of women aged 19-29) [8].

Nutrition label users showed significantly favorable beliefs toward use of nutrition labels in food selection compared with non-users (possible score: 15- 75, 50.3 vs 48.5,  $P < 0.01$ ). Among the behavioral beliefs, nutritional benefits were motivators for using nutrition labels. Nutrition label users, compared to non-

users, felt more strongly regarding the immediate advantages of checking nutrition labels, such as 'comparing foods and selecting better foods' and 'selecting healthy foods'. In contrast, belief strength regarding long-term benefits (e.g. disease prevention) did not differ between the two groups. These results suggested that nutrition education for nutrition label use should focus on the short-term, immediate benefits rather than the long-term, distant benefits for young adult women. Similarly, a study with college students reported that reasons for reading nutrition labels were mainly 'for checking the nutrient content', 'for weight control', 'to compare products or processed foods', and 'for health' [1,22]. Another study reported that expectation for nutrition or health benefits based on food labeling had an impact on the attitudes and intention to purchase products [5]. A previous study found that young adults, compared to middle-aged adults, had lower perception regarding food, nutrition, and health, suggesting a relatively low level of interest in health among young adults [27]. In one study, nutrition label users perceived the importance of checking nutrition labels more strongly than non-users and nutrition label use showed positive correlation with diet quality [26]. Among seven negative beliefs regarding nutrition label use, non-users, compared to users, agreed more strongly on the item 'checking nutrition label is annoying'. Similarly, previous studies found that reasons for not using nutrition labels were 'habit' and 'annoying' [10,22]. Thus, nutrition education might focus on skills for more efficient use of nutrition information on labels based on one's health concerns.

This study found that nutrition label users, compared with their counterparts, perceived more pressure to use nutrition labels from parents, siblings, and one's best friend. However, the influence of health professionals, professors, and mass media was not significantly different between the two groups. This finding suggests that informal groups such as family members and friends are important sources to influence the use of nutrition labels in samples of young adult women. Previous studies using the TPB have suggested somewhat inconsistent results regarding the influence of significant others, partly supporting the results of the current study [3,14-16]. Subjective norms were found to be related to family meal frequency, and fruit and vegetable intake after the intervention [15,16], while other studies did not find an association between subjective norms and nutrition behaviors [3,14].

In this study, nutrition label users showed significantly higher perceived control beliefs than non-users (possible score: 15-75, 46.0 vs. 39.1,  $P < 0.001$ ). In addition, most of the control beliefs examined were significantly related to nutrition label use. These results indicated the importance of perceived confidence in performing the behavior, as suggested in the TPB [12]. In the current study, control beliefs were measured in terms of perceived confidence in overcoming specific constraints or barriers to use of nutrition labels, and perceived confidence in understanding and using nutrition labels in food selection. Non-users, compared to users, perceived the constraints in using nutrition labels more strongly, such as 'spending more time on grocery shopping' and 'paying more money in selecting foods (i.e., more cost for healthy foods)' as a result of checking nutrition labels. In addition, the study results indicated that

internal sources of control (e.g., one's knowledge level, the tendency to eat impulsively) rather than external sources (e.g., small font size, placing nutrition label on the back of the food package) were the factors differentiating nutrition label users from non-users. Perceived constraints such as 'small font size' and 'back-of pack nutrition labeling', cannot be solved by an individual's efforts, thus these control beliefs might not be different between the two groups. However, these constraints might be improved through policy or environmental changes to promote nutrition label use. Contrary to this study, previous studies reported that 'the font size in nutrition label is too small to read', and 'nutrition label is too complex to use' were reasons for not using nutrition labels [10,22].

This study also found that perceived confidence in understanding the specifics of nutrition labels and selecting foods accordingly was significantly related to nutrition label use ( $P < 0.001$ ). The study finding is consistent with the previous finding that self-efficacy to reduce fat intake was related to nutrition label use [28]. The study population is young adult women attending college, thus, nutrition education regarding the specifics of nutrition labels and teaching skills in selection of foods based on nutrition labels would be effective in helping young adult women to select foods using nutrition labels. Similar to the current study, several previous studies applying the TPB suggested that perception of control was a significant factor in influencing nutrition behaviors including dairy food consumption, fruit and vegetable consumption, having family meals frequently, breakfast consumption, and safe food handling [3,14,16,28-30]. The study findings implied that methods to increase the perception of control over using nutrition labels should be incorporated in nutrition education.

The limitation of this study is that study results are based on a convenience sample of female college students who agreed to participate in the study in Seoul, Korea. Thus, the findings might not be generalized to different groups of young women.

In summary, this study suggested that factors, including behavioral, normative, and control beliefs need to be considered in development of nutrition education for promoting nutrition label use in female college students. Most of all, nutrition education might focus on increasing perceived control over nutrition label use. Specifically, nutrition education planning is needed in order to help young adult women to attain clear knowledge regarding nutrition labels (e.g., the meaning of a serving size, nutrient content, % daily value, etc.) and to apply knowledge of nutrition labels in selection of healthy snacks or purchasing processed foods. The perception of control over the constraints of using nutrition labels might be strengthened by providing methods to reduce the barriers (e.g., time, cost, preference for specific foods), such as reading information on the nutrient of concern, comparing prices of similar products, and recognizing the value on health. In addition, nutrition educators might include strategies to address the short-term benefits rather than long-term benefits of using nutrition labels (e.g., comparing and selecting better foods, selecting healthy foods vs. disease prevention) as well as reducing the perceived disadvantages of nutrition label use (e.g., it is annoying). Finally, informal groups, such as parents, siblings, and one's best friend

might be considered as appropriate channels to promote nutrition label use in food selection for this population.

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