ความสัมพันธ์ระหว่างความรอบรู้ด้านฉลากโภชนาการและพฤติกรรมการใช้ข้อมูลบนฉลากโภชนาการในการบริโภคผลิตภัณฑ์อาหารของนักศึกษาชั้นปีที่ 1 วิทยาลัยการสาธารณสุขสิรินธร จังหวัดขอนแก่น

Associations between Nutrition Label Literacy and Label Information Applications among First-year Students at Sirindhorn College of Public Health, Khon Kaen, Thailand

นิพนธ์ต้นฉบับ

Original Article

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บทคัดย่อ

วัตถุประสงค์: เพื่อศึกษาความรอบรู้ด้านฉลากโภชนาการ พฤติกรรมการใช้ข้อมูลบนฉลากโภชนาการในการเลือกซื้อเลือกบริโภคผลิตภัณฑ์อาหารและความสัมพันธ์ระหว่างความรอบรู้ด้านฉลากโภชนาการกับพฤติกรรมการใช้ข้อมูลบนฉลากโภชนาการ **วิธีการศึกษา:** การศึกษาเชิงวิเคราะห์แบบภาคตัดขวาง มีกลุ่มตัวอย่างคือ นักศึกษาชั้นปีที่ 1 วิทยาลัยการสาธารณสุขสิรินธร จังหวัดขอนแก่น จำนวน 124 คน ด้วยการสุ่มอย่างง่าย เก็บข้อมูลโดยใช้แบบทดสอบและแบบสอบถาม วิเคราะห์ข้อมูลโดยใช้สถิติเชิงพรรณนา ได้แก่ ความถี่ ร้อยละ ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน ค่ามัธยฐาน ค่าพิสัยระหว่างควอไทล์ และสถิติ Chi-square test **ผลการศึกษา:** ความรอบรู้ด้านการประเมินข้อมูลฉลากโภชนาการ ด้านการตัดสินใจเลือกปฏิบัติและด้านการเข้าถึงข้อมูลฉลากโภชนาการอยู่ในระดับสูง (ร้อยละ 73.39, 72.58 และ 68.55 ตามลำดับ) ส่วนความรอบรู้ด้านความเข้าใจฉลากโภชนาการอยู่ในระดับปานกลาง (ร้อยละ 60.48) ส่วนพฤติกรรมการใช้ข้อมูลบนฉลากโภชนาการอยู่ในระดับปานกลาง (ร้อยละ 53.23) ความรอบรู้ด้านการเข้าถึง ด้านการประเมินและด้านการตัดสินใจเลือกปฏิบัติสัมพันธ์กับพฤติกรรมการใช้ข้อมูลบนฉลากโภชนาการอย่างมีนัยสำคัญทางสถิติ (*P*-value = 0.001, < 0.001 และ < 0.001 ตามลำดับ) ส่วนด้านความเข้าใจฉลากโภชนาการไม่สัมพันธ์กับพฤติกรรมการใช้ข้อมูลบนฉลากโภชนาการ **สรุป:** ความรอบรู้ด้านการเข้าถึง ด้านการประเมินและด้านการตัดสินใจเลือกปฏิบัติของนักศึกษา มีความสัมพันธ์กับพฤติกรรมการใช้ข้อมูลบนฉลากโภชนาการ

คำสำคัญ: ความรอบรู้, ฉลากโภชนาการ, พฤติกรรมการใช้ข้อมูลบนฉลากโภชนาการ, การเลือกซื้อเลือกบริโภคผลิตภัณฑ์อาหาร

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Abstract

Objective: To determine the level of nutrition label literacy, behaviors of applying information from nutrition labels for consuming and buying products, and the relationships between nutrition label literacy and the behaviors of applying information from nutrition labels for consuming and buying products. **Method:** In this cross-sectional analytical research, 124 1st year students at Sirindhorn College of Public Health, Khon Kaen, Thailand, were selected randomly. Participants were tested for understanding and asked to rate their opinions on literacy of nutrition labels and behavior of applying nutrition label information. Data were analyzed by using frequency, percentage, mean, standard deviation, median, interquartile range (IQR) and Chi-square Test. **Results:** 73.39% of the participants had a high level of the appraisal of nutrition labeling information and 72.58% had a high level of decision-making. 68.55% had a high-level accessibility of nutrition label information, 60.5% had a moderate level of understanding about nutrition labeling. Moreover, 53.23% showed moderate level of applying information. The behavior of using food label information was significantly associated with access to nutrition label information, appraisal of nutrition label information and decision making in purchasing food products (*P*-value = 0.001, < 0.001, and < 0.001, respectively). Understanding about nutrition labeling had no association with the behavior. **Conclusion:** Access to nutrition label information, appraisal of nutrition label information and decision-making literacy were significantly associated with the behavior of using food label information.

Keywords: literacy, nutrition labels, behavior of applying nutrition label information, consuming and buying food products

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Introduction

Nowadays, technology has become more advanced. Economic, social, and environmental changes are rapidly evolving. The food industry has also expanded to produce food to meet the needs of consumers. There is an increasing variety of food production contributing to changes in consumption behavior.[1,2] For example, customers choose to eat outside, fast food, ready meals, and more ready-to-cook food, because of convenience and quickness.[3] According to a study by National Statistical Office[4] , eating outside and consumption of such foods as fast food, ready meals, ready-to-cook food and frozen food have increased in popularity due to their convenience and quickness. It is found that happiness when eating is a focus for Thai people. They consider their preferences, food taste, appetite, and hygiene more important

than nutritional value. These influence the people's health conditions especially the incidence of obesity and various chronic non-communicable diseases. This behavior may be due to a lack of knowledge of the amount of nutrients in each food, such as the amount of sugar, sodium, and calories that exceed the body's needs. Displaying information on nutrition fact labels is a method that manufacturers communicate nutritional facts to consumers so that it can be used for making consumption choices. Explaining the nutritional value of food is another way to aid consumers in choosing consumption choices that match their need and are suitable for their own nutritional conditions.

Today, nutrition fact labels are displayed in both simplified and full versions. However, these labels are too detailed, difficult to understand and small. The Ministry of Public Health, therefore, issues a regulation in improving nutrition fact labels to be understandable more easily. It has been modified to comply with the Guideline Daily Amounts (GDA) which requires that some ready-to-eat foods display the number of calories, sugar, fat and sodium on the front of the package. This is to make the facts visible, readable, and easily understandable for consumers.[5] Health Literacy is the ability and skill to access knowledge and understanding of health. It can lead to communication with others to increase expertise and the ability to manage one's own health conditions. It can aid in decision making for one's good health when facing health and personal challenges.[6] That is why health literacy is in focus in many countries around the world especially developed countries especially in nutrition labeling. Hence, consumers' knowledge, understanding and awareness about facts on nutrition labels is essential to indicate if consumption choices are healthy. These skills help determine the right proportion of food that is suitable to one's health and to choose appropriate food. According to a study on knowledge and understanding of front-of-pack labeling of the Thai population, it is found that consumers could read nutrition labels but most of them failed to understand the meaning.[7] Additionally, Thai consumers could not compare the appropriate level of nutrition in comparison with the maximum amount consumed, making them unable to use the information in choosing nutritious food correctly.[7] From a research on the perception and use of information on food labels among students Sirindhorn College of Public Health, Chonburi Province in 2014, it discovered that the majority of students had a moderate level of interest in understanding the information on food labels, and the use of such information on purchasing and consumption choices.[2] Most of them were interested the most in information about the expiration date, price and FDA mark when considering buying and choosing consumption choices.[2]

Sirindhorn College of Public Health Khon Kaen is an educational institution that provides teaching and learning courses in public health. After graduation, graduates will be responsible in health promotion, surveillance, prevention and control, rehabilitation, primary care, environmental health, occupational health and safety and consumer protection. The consumer protection field focuses on food products and food safety in the community. Therefore, students should understand nutrition facts labels and use the knowledge to apply in choosing nutritious food properly. Additionally, they should be a good role model in health as well as be able to pass on the knowledge to people in the community. Therefore, there was a need to understand how these students know and understand about nutrition facts labels and their behavior of using information on nutrition labels. Such competence in the practice of healthcare providers is also required by the concept provided by the Department of Health, Ministry of Public Health.[8]

The conceptual framework of the study had four key components. First, the understanding was the ability to understand information on nutrition labels. Second, accessibility was the ability to seek, search, and obtain information about health literacy with the information on nutrition labels. Third, appraisal was the ability to explain, interpret, screen, and evaluate information on nutrition labels gained from accessibility. Fourth, practice was the ability to communicate and use information on nutrition labels in making decisions about purchasing and consuming food products. These were considered factors that are related to the behavior of using information on nutrition labels in choosing food products, teaching about nutrition and understanding about the correct nutrition labels for preparing qualified public health personnel.

This study aimed to determine the level of nutrition label literacy, behaviors of applying information from nutrition labels for consuming and buying products, and the relationships between nutrition label literacy and the behaviors of applying information from nutrition labels for consuming and buying products among the first-year students at Sirindhorn College of Public Health, Khon Kaen. It was hypothesized that the

nutrition label literacy (understanding, accessibility, evaluation and decision-making skills) was significantly associated with the behaviors of applying the information.

Methods

This cross-sectional analytical study was conducted among the first-year students at Sirindhorn College of Public Health, Khon Kaen, Thailand. Sample size was estimated by using the equation of Daniel[9], $n = NZ^2\alpha/2\ p(1-p) / [\ Nd^2 + Z^2\alpha/2\ p(1-p)]$, where n = sample size, N = 187 students of the first-year at Sirindhorn College of Public Health, Khon Kaen in the academic year 2020 as the study population, Z = 1.96 for a type I error of 5% and two-sided test, p = proportion of students who recognize and use of information on food labels overall as 62.8% (or p = 0.628).[2] With an absolute error (d) of 0.05, a sample size of 124 participants was required. Participants were selected by a simple random sampling technique with a quota proportional to the number of students in each academic program.

Research instruments

In this research, a questionnaire with 3 sections was used. In the **first section**, demographic characteristics were collected including sex, age, and academic program. The **second section** asked about nutrition label literacy which is divided into 4 parts.

In **Part 1**, 12 questions were used to test the understanding/knowledge on nutrition labeling. A score of 1 point was given for a correct answer, and zero for an incorrect one. With the total score of 0 – 12 points, understanding level could be categorized based on Bloom cut-off point.[10] Understanding was classified into low, moderate, and high levels (0 – 4, 5 – 8, and 9 - 12 points, respectively). In **part 2**, 5 questions asked about accessibility to nutrition label information. In **part 3**, 5 questions asked about nutrition label evaluation. In **part 4**, 5 questions evaluated decision-making about nutrition labeling. The response for parts 3 – 4 was a 5-point rating scale ranging from 0-never, to 1-sometimes, 2-often, 3- always, and 4-every time. With the total score of 0 – 20 points, nutrition label literacy level could be categorized based on Class width[11] as low, moderate, and high (0 – 7, 8 – 13 and 14 - 20 points, respectively).

In the **last section**, 10 questions were used to ask about behaviors of using food label information. Response was a 5-point rating scale ranging from 0-never, to 1-sometimes, 2-often, 3-always, and 4-every time. With the total score of 0 – 40 points, the behavior level could be categorized based on Class width[11] as low, moderate, and high (0 - 13, 14 - 26 and 27 - 40 points, respectively).

Research instruments quality assurance

The questions of test and questionnaire were examined for content validity by three experts in public health and consumer protection. Content validity was warranted with content validity indices of between 0.67 and 1.00. Internal consistency reliability was tested in 30 students with characteristics comparable to the prospective participants. Questions to test understanding/knowledge had a borderline internal consistency reliability with an Kruder-Richardson coefficient of 0.69 with indices of difficulty of between 0.42 and 0.67. Questions on nutrition label literacy and behaviors had high internal consistency reliability with Cronbach's alpha coefficients of 0.94 and 0.81, respectively.

Participant ethical protection and data collection procedure

The study protocol was approved by the Ethics Committee for Human Study, Sirindhorn college of Public Health, Khon Kaen. (Approval number: SCPHKKIRB ST020). In the data collection process, participants were informed about the study's objectives and process. The voluntary nature of the study was elaborated so participants could participate voluntarily and withdraw from the study at any time with no consequences. Participants' information and answers were secured and presented as summary.

Data analysis

Descriptive statistics including frequency with percentage, mean with standard deviation (SD), and median with interquartile range (IQR) were used to summarize demographic characteristics and study variables. Chi-square test was used to determine the relationships between the levels of nutrition label literacy and levels of behaviors. Statistical significance was set at a type I error of 5%. All statistical analyses were performed using MS Excel.

Results

Of the 124 participants, most were female (91.16%) and under 20 years old (91.16%). They were 19.07 years old by average with a range of 18 – 35 years. The majority were enrolled in the Bachelor of Public Health Program in Community Public Health and Diploma of Public Health (Pharmacy Technique) (26.61% for both) (Table 1).

Table 1 Demographic characteristics of the participants (N = 124).

Characteristics	N	%
Sex		
Male	11	8.84
Female	113	91.16
Age (years), mean = 19.07 ± 1.75, median = 19, range = 18 – 35.		
< 20	113	91.16
≥ 20	11	8.84
Academic program		
Bachelor of Public Health Program (Community Public Health)	33	26.61
Bachelor of Public Health Program (Dental Health)	30	24.19
Diploma of Emergency Medical Operation Program	28	22.58
Diploma of Public Health (Pharmacy Technician)	33	26.61

For the understanding/knowledge about nutrition labels, the question with the highest correct answers was “nutrition information is a description of the type and amount of nutrients contained in a product” (97.58%), followed by “a label that indicates energy, sugar, fat, and sodium is a nutrition facts label” (93.55%), and “if you want to know that food provides the amount of energy and how much nutrients are there, see Nutritional value per serving” (91.94%). Items with the least correct responses were “the key ingredient shown on the nutrition label includes detailed information about the product, method of use, consumption method, recommendations,” (18.55%) and “nutrition information shows general information such as product name, date, month, year of manufacture, place of production” (24.19%) (Table 2).

All aspects of literacy were considered as “always” not “every time” by the majority of participants (Table 3). For **the access to nutrition label** information, the item most commonly practiced at “always” was “The nutrition labels were easily searchable via the Internet” (35.48%), followed by “when you want to know about nutrition labeling information, you can do your own research through various channels” (33.87%) (Table 3). The least practiced aspect was “When seeking information about nutrition labeling, you can choose to study from educational institutions, teachers, students, friends” (21.77%) followed by “Pay attention to additional information on nutrition labels when they do not understand or doubt” (24.19%).

Table 2 The understanding/knowledge about nutrition labeling (N = 124).

Item	Correct response	
	n	%
1. Nutrition information shows in detail the type and amount of nutrients contained in the product.	121	97.58
2. Nutrition information shows general information such as product name, date, month, year of manufacture, place of manufacture.	30	24.19
3. Labels that indicate energy, sugar, fat, sodium are nutritional labels.	116	93.55
4. Nutritional value per serving refers to the energy and nutrients that the body receives per serving.	110	88.71
5. If the container is large, it should be consumed all at once by looking at the number of servings per container.	77	62.10
6. If you want to know how much energy food provides and how much nutrients are there, see “nutritional value per serving.”	114	91.94
7. To find out what percentage of the recommended daily intake of calcium is, see “Percent of Daily Recommended.”	111	89.52
8. If the label states "Number of servings per pack: 8", it means that if consuming all packets at once, 8 times more energy and nutrients than what is stated on the label will be received.	62	50.00
9. Key ingredients shown on nutrition labels include detailed information on the product, instructions for use, method of consumption, and recommendations.	23	18.55
10. Nutritional labeling only applies to snack foods.	85	68.55
11. Thai Recommended Daily Intakes or Thai RDI means the recommended daily intake of nutrients for Thai people aged 10 years and over.	40	32.26
12. Nutrition labels help you choose the right product for your body condition or sickness.	113	91.13

Regarding **the assessment of nutrition label information**, the most common practice was “You assess food products based on data on nutrition labels by looking at the amount of sugar, sodium, cholesterol“ (33.06%) followed by “You check the information on the nutrition label before purchasing or choosing to consume” (29.84%) and “you check the information on the nutrition label to confirm your own understanding” (29.03%) (Table 3). The least common practice was “You assess by observing the overall of nutrients proportion (e.g., carbohydrates, proteins, fats) compared to the nutritional conditions you should receive” (19.35%).

Regarding **the decision-making of nutrition labeling information**, the most common practice was “If you have to buy food for a diabetes patient, you'll consider the nutrition label by looking at the sugar content as choosing criteria” (33.87%) followed by “In purchasing food, you use the nutrition label to make a decision to buy” (32.25%), “In choosing to food choices, you buy foods that are appropriate for your health conditions based on information listed on the nutrition label” (25.80%). The least practice was “If you want to add vitamins to your body, you read the vitamin content in the nutrition label box of the product to compare the vitamin content before making a decision to buy a product that meets the needs” (23.39%) (Table 3).

Table 3 Accessibility, evaluation and decision-making of nutrition labeling information (N = 124).

Item	N (%)				
	every time	always	often	sometimes	never
The accessibility of nutrition label information					
1. You can easily find nutrition label information via the internet.	44 (35.48)	55 (44.35)	22 (17.74)	2 (1.61)	1 (0.81)
2. When you want to know about nutrition label information, you can choose to study from educational institutions, teachers, students, and friends.	27 (21.77)	58 (46.77)	29 (23.38)	8 (6.45)	2 (1.61)
3. When you want to know about nutrition label information, you can research it yourself through various channels.	42 (33.87)	52 (41.93)	25 (20.16)	5 (4.03)	0 (0)
4. You pay attention to additional information on nutrition labels when you do not understand or have doubts.	30 (24.19)	53 (42.74)	32 (25.80)	9 (7.25)	0 (0)
5. You can ask people who know, consult the media, read books to confirm your understanding about nutrition labels.	35 (28.22)	52 (41.93)	32 (25.80)	5 (4.03)	0 (0)
The assessment/appraisal of nutrition labeling information					
1. You evaluate food products based on the information on the nutrition label, by observing the amount of sugar, sodium, cholesterol.	41 (33.06)	61 (49.93)	20 (16.13)	1 (0.81)	1 (0.81)
2. You check the information on the nutrition label before buying and choosing to consume.	37 (29.84)	61 (49.18)	22 (17.74)	3 (2.42)	1 (0.81)
3. You check the information on the nutrition label to confirm your own understanding by searching for more information.	36 (29.03)	59 (47.58)	25 (20.16)	3 (2.42)	1 (0.81)
4. When choosing food, you will use different nutrients (e.g., protein, calcium, fat) as selection criteria.	29 (23.39)	57 (45.97)	32 (25.81)	4 (3.23)	2 (1.61)
5. You assess by observing the overall of nutrients proportion (e.g., carbohydrates, proteins, fats) compared to the nutritional conditions you should receive.	24 (19.35)	56 (45.16)	39 (31.45)	3 (2.42)	2 (1.61)
The decision-making of nutrition labeling information					
1. If you want to know your daily calcium intake, you can look at the text on the nutrition label to make a purchase decision.	32 (25.80)	60 (48.39)	29 (23.38)	1 (0.81)	2 (1.61)
2. If you want to add vitamins to your body, you read the vitamin content in the nutrition label of the product to compare the vitamin content before deciding to buy a product that meets your needs.	29 (23.39)	60 (48.39)	33 (26.62)	1 (0.81)	1 (0.81)
3. In food purchase, you use nutrition labels to make purchasing decisions.	40 (32.25)	56 (45.16)	23 (18.55)	4 (3.22)	1 (0.81)
4. If you have to buy food for a diabetes patient, you look at the sugar content in the nutrition label as a criterion for purchasing.	42 (33.87)	55 (44.35)	23 (18.55)	4 (3.23)	0 (0)
5. In food purchase, you choose food that are appropriate for your health condition based on information listed on the nutrition label.	32 (25.80)	63 (50.80)	26 (20.96)	2 (1.61)	1 (0.81)

When literacy scores were categorized into levels, most participants had a high level of literacy in the assessment/appraisal of nutrition label information, decision-making of nutrition labeling information, and access to nutrition label information (73.39%, 72.58% and 68.55%, respectively). However, most participants had a moderate level of understanding/knowledge of nutrition labeling (60.48%) (Table 4).

Table 4 Nutritional label literacy level (N = 124).

Nutritional label literacy	N (%) by level		
	High	Moderate	Low
The understanding about nutrition labeling	48 (38.71)	75 (60.48)	1 (0.81)
The accessibility of nutrition label information	85 (68.55)	37 (29.84)	2 (1.61)
The assessment/appraisal of nutrition labeling information	91 (73.39)	32 (25.81)	1 (0.81)
The decision-making of nutrition labeling information	90 (72.58)	33 (26.61)	1 (0.81)

For the behavior of using information on nutrition labels, the most practiced behavior as “always” was “buying food products with nutrition labels” (40.32%) followed by “reading nutrition labels before purchasing food products” (29.83%) and “comparing the nutrients of food products among brands before purchasing” (28.22%). The least practiced ones were “not reading the information on the nutrition label because it is difficult to understand” (12.9%) followed by “not reading nutrition labels, because of wasted time” (14.51%) and “not reading the nutrition label because it was useless for consumption” (16.12%) (Table 5).

Table 5 The behavior of using information on nutrition labels (N = 124).

Item	N (%)				
	every time	always	often	sometimes	never
1. You buy food products that provide nutrition labels.	50 (40.32)	57 (46.96)	15 (12.09)	0 (0)	2 (1.61)
2. You read the nutrition label before purchasing food products.	37 (29.83)	56 (45.16)	28 (22.58)	1 (0.81)	2 (1.61)
3. You compare nutrients of different brands before purchasing.	35 (28.22)	56 (45.16)	27 (21.77)	5 (4.03)	1 (0.81)
4. You buy food products by looking at the energy received.	28 (22.58)	64 (51.61)	29 (23.39)	2 (1.61)	1 (0.81)
5. You don't read nutrition labels because it is not useful for consumption.	20 (16.12)	21 (16.93)	30 (24.19)	38 (30.64)	15 (12.09)
6. You don't read the information on the nutrition label because it is difficult to understand.	23 (18.54)	22 (17.74)	30 (24.19)	33 (26.61)	16 (12.90)
7. You use nutrition labels as a media to educate about purchasing food product.	26 (20.96)	59 (47.58)	31 (25.00)	7 (5.64)	1 (0.81)
8. You read the number of servings on the nutrition label to know the amount of consumption unit you will get after finishing eating.	26 (20.96)	54 (43.54)	31 (25.00)	11 (8.87)	2 (1.61)
9. You avoid buying food products with high sugar content, when compared to the recommended daily dosage percentage.	32 (25.80)	45 (36.29)	35 (28.22)	10 (8.06)	2 (1.61)
10. You don't read nutrition labels. because it wastes time.	29 (23.38)	23 (18.54)	26 (20.96)	28 (22.58)	18 (14.51)

The majority of the participants had a moderate level of behavior (53.23%) while only 1.61% had a low level (Table 6).

Table 6 Levels of behavior of using information on nutrition labels (N = 124).

Level of behaviors	n	%
High (≥ 27 points)	56	45.16
Moderate (14 - 26 points)	66	53.23
Low (< 14 points)	2	1.61
Median (IQR) = 26 (5.75), range = 12 – 40 points.		

In terms of **the associations**, participants with a high level of accessibility to nutrition label information were 4.12 times more likely to have a high level of behavior of using information on nutrition labels in purchasing and choosing food products (OR = 4.12; 95% CI = 1.75 to 9.73, *P*-value = 0.001). Similarly, those with a high level of assessment/appraisal was 5.49 times more likely to have a high level of behavior (OR = 5.49; 95% CI = 2.07 to 14.57, *P*-value < 0.001) and those with a high level of decision-making was 24.00 times more likely to have a high level of behavior (OR = 24.00; 95% CI = 5.42 to 106.43, P-value < 0.001). However, understanding/knowledge about nutrition labeling had no association with the behavior (Table 7)

Table 7 Relationships between health literacy and behavior of using information on nutrition labels in purchasing and consuming food products (N = 124).

Health literacy of nutrition labeling	Behavior, N (%) by levels		Odds ratio	95% Confidence interval of odds ratio	*P*-value*
	Low and moderate	High			
Understanding/knowledge					
High level	24 (50.00)	24 (50.00)	1.37	0.66 to 2.84	0.460
Low & moderate level	44 (57.33)	32 (42.67)			
Accessing					
High level	38 (44.70)	47 (55.30)	4.12	1.75 to 9.73	0.001
Low & moderate level	30 (75.68)	9 (24.32)			
Assessment/Appraisal					
High level	41 (45.05)	50 (54.95)	5.49	2.07 to 14.57	< 0.001
Low & moderate level	27 (81.25)	6 (18.75)			
Decision-making					
High level	36 (40.00)	54 (60.00)	24.00	5.42 to 106.43	< 0.001
Low & moderate level	32 (93.94)	2 (6.06)			

* Chi-square test.

Discussions and Conclusion

In this study, most students had a high level of literacy of nutrition labeling including accessibility, evaluation and decision-making skills. This could be attributable to the information on nutrition labels that has been checked before purchasing, use of nutrition labels to make informed purchasing decisions and easy access to nutrition label information by searching for more information via mobile phone and the Internet to confirm the correct understanding.

In terms of understanding or knowledge, most students, however, had a moderate level of understanding/knowledge. This finding is consistent with the results from a study of Tanpomiprated and Maopimpa which found that the majority of FDA-based volunteer primary school students had a moderate level of knowledge and understanding of nutrition labels.[12] Our finding is also consistent with Komwong et al which found that the majority of public health students had a moderate level of the interest in understanding information on food labels and using the information in purchasing and choosing consumption choices.[2] This could be that students check information on nutrition labels before purchasing, using nutrition labels to make informed purchasing decisions, having easy access to nutrition label information and searching for more information via the Internet to confirm the information.

The overall behavior of using information on nutrition labels for consuming and buying food products was at a moderate level. This finding is consistent with a study of Tanpoomprates and Maopimpa which found that the majority of FDA-based volunteer primary school students had a moderate level of nutrition labeling behaviors.[12] This could be because students usually follow such a practice by choosing to buy food products that provide nutrition labels, reading nutrition labels before purchasing food products and comparing the nutrients among brands before purchasing.

The access, appraisal and decision-making to nutrition label information had a relationship with the behavior of using information on nutrition labels in choosing to buy food products. It showed that students who are literate on accessing and appraisal of nutrition labels as well as on decision-making in consumption choices are more likely to the behavior of using information on nutrition labels in choosing to buy food products.

Regarding the understanding of nutrition labels, it was found that it has no relationship with the behavior of using the information on the nutrition label for consuming and buying food products since students are not aware of how to use information to make decisions. This is consistent with the conception of Grunert et al which states that understanding and utilization of nutrition labels are separate matters.[13] Consumers may understand nutrition but choose to ignore the information on the nutrition label due to other reasons to regarded as more important or influential in making purchase

decisions than nutritional value which is in accordance with the study of Tanpomiprated and Maopimpa.[12]

We found that knowledge of nutrition labeling was not related to nutrition labeling behavior. This is inconsistent with the results of a study by Thongkiaw and colleagues which found that understanding was positively correlated with utilization of GDA nutrition label information (r = 0.186).[14] This may be due to a consumer's limitation in reading nutrition labels or a lack of attention in the labels as they have been read in other purchases before. It may also relate to a different type of behavior in choosing food choices. Although they have good knowledge and understanding of nutrition labels, they choose not to follow practices. They may have been influenced by other factors such as time limit, price, environment, etc.

This study had certain limitations. The food products mentioned in questions were limited to general food, healthy food, ready-to-cook food, semi-finished food, dairy products, and beverages. Students could refer to other kinds of food based on their diverse experience and exposure. Those foods could have different label information. In addition, since most students did not know the amount of energy or nutrients, they should be getting each day, the assessment and decision making they expressed could be different otherwise. Last, this study was done only in the first year students. Findings could then be limited the first-year students.

Based on our findings, administrators, teachers, and related persons could develop campaigns, activities, and class materials to promote the understanding, literacy, and behavior of using information on nutrition labels in choosing food products in daily life. More studies on other factors affecting knowledge, literacy, and behavior of using nutrition labels should be conducted.

In conclusion, students in a public health college had a moderate understanding and behavior, and high levels of all three aspects of the literacy of using information on nutrition labels of food products (access to nutrition label information, appraisal of nutrition label information and decision making). Students with high levels of access to nutrition label information, appraisal of nutrition label information and decision making were significantly more likely to have a high level of behavior. The understanding or knowledge was however not associated with the behavior.

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