

Research Article



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Conflict of Interest

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Dietary safety management competency for the sustainable health management of adolescents

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ABSTRACT

Purpose: The incidence of chronic diseases is increasing and the age of onset is decreasing in South Korea. Healthy eating habits to prevent chronic diseases are established in adolescence. This study verified the identified factors and dynamics that affect diet self-assessment for sustainable adolescent health and the prevention of chronic diseases.

Methods: Data were collected from 492 middle and high school students in South Korea from June to July 2018, and the participants answered a questionnaire on dietary safety management competency for sustainable health.

Results: The healthy dietary self-assessment scores of overweight/obese adolescents and adolescents who perceived their health as normal were significantly lower than those of other groups. Factor analysis verified the validity of the items that comprised each study area before a multiple regression analysis was used to investigate the factors affecting healthy dietary self-assessment. Sweet and salty diets, anxiety, food and nutrition knowledge, weight management knowledge, stress management, exercise, basic eating habits, and healthy eating habits significantly affected healthy dietary assessment among adolescents. A higher perception of one's health indicated a higher healthy dietary self-assessment, dietary safety knowledge, and health management practice scores ($p < 0.01$). Factors like healthy dietary self-assessment, food and nutrition knowledge, and weight management knowledge appear to have a significant correlation with other identified factors, except overeating. The adolescents' awareness, knowledge, and dietary safety practices influenced healthy dietary self-assessment, which can prevent chronic diseases and achieve sustainable health.

Conclusion: This study illustrated how the adolescents' awareness, knowledge, and practices of dietary safety influenced their healthy diet self-assessment. The results indicate that diet-based health management competency education relative to the adolescents' self-perception and weight levels should be implemented.

Keywords: adolescent; chronic disease; healthy diet; obesity

INTRODUCTION

The health, growth, and development of adolescents are highly dependent on their nutritional intake [1-3]. At present, adolescent diets remain poor due to over- or underconsumption of fat, sugar, dairy, fruits, and vegetables [4-6]. Specifically, 20.8% of

South Korean adolescents appear to be night eaters, demonstrating patterns of skipping breakfast and snacking instead, with a greater proportion of their energy intake obtained from fats and food from fewer food groups compared to non-night eaters [1]. Such poor diet choices leave both food-secure and food-insecure adolescents with micronutrient deficiency, particularly for vitamins A and C, and calcium [3].

Alongside poor diets among adolescents, the rise of adolescent obesity is primarily brought about by sedentary lifestyles and excessive food intake, a growing global phenomenon, compared to the persistent public health concern that is childhood obesity [7-9]. A similar report observed a 20.1% prevalence of obesity and overweight among middle and high school students in South Korea [10]. Left untreated, those with childhood obesity will likely suffer immediate and long-term consequences. Excessive adipose tissue in the body degrades immune functions and causes diabetes, cancer, and metabolic and cardiovascular diseases [11-14]. Amid these concerns, weight management education focusing on adolescent dietary education and the prevention of chronic diseases needs to be carried out more actively by middle schools and high schools.

Recent epidemiological studies on diet and chronic diseases focused on the relationship between diet quality and disease risk in adolescents [15], as well as the possible relationship between diets and diseases contracted in adulthood [16]. Health risk behaviors contribute to the leading causes of morbidity and mortality, namely chronic diseases and social problems of sedentary lifestyles and obesity [17]. As dietary risk factors are key contributors, there has been an increasing emphasis on understanding the influence of total diet quality and overall dietary patterns rather than singular aspects of consumption [18]. Understanding such influences is essential for adolescents as dietary patterns influence lifelong health [19].

The goals of the education plan are to prevent chronic diseases, including obesity, among individuals and groups, encouraging respect for their own and other people's lives and habits, and cultivating their self-directed management capability. While past studies developed several measures to assess the eating habits of adolescents, education on safety-oriented dietary practices necessitates evaluations to determine whether or not their diet helps prevent illness and promotes health care [20-23]. The evaluations would also examine the effects of diet safety awareness and knowledge, unhealthy diets, and health management practices on the diet self-assessment of adolescents according to their weight level and perceived health status. A standard need to be set as adolescent obesity continues to increase in Korea—a major cause of chronic disease among adolescents and adults. In a study by Kim [24], adolescents reported that the degree of interest in food safety differs according to obesity and health awareness, inferring that addressing adolescent obesity and awareness regarding their health condition should be a priority.

While any self-assessment will result in some degree of error because of the respondents' subjective interpretation, self-assessment and management capacity are necessary to encourage sustainable dietary management among the youth. Additionally, it can be a resource for developing a healthy dietary education and self-directed health management and materials. This study verified identified factors affecting healthy dietary self-assessment among adolescents according to their weight levels and self-perceived health status to strengthen self-directed and sustainable dietary-based health care capacity. The study also identified the relationship between healthy dietary self-assessment, dietary safety awareness, dietary safety knowledge, unhealthy dietary management, and health management practices.

METHODS

Research participants

The study enlisted students from 4 middle schools and 4 high schools in South Korea as study participants through random sampling in 3 provinces (Seoul-Gyeonggi, Gangwon, and Daegu-Gyeongbuk areas) from June to July 2018. Students who were unable to answer the questionnaire due to absences caused by illnesses or injuries were excluded from the study. G*Power (version 3.1.9.3; Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany) analyzed 347 people with a median of 0.25, a significance level of 0.05, and a verification power of 95%. After factoring the participant dropout rate and excluding surveys with missing data, 400–500 samples were calculated, and 492 of the 516 surveys were analyzed. There are 256 male (52.0%) and 236 female (48.0%) students, 210 of which were middle school (42.7%), and 282 were high school (57.3%) students comprised the final survey data. The Daegu University Institutional Review Board approved all procedures for the selection of participants (1040621-201804-HR-020-02).

Research contents

The study used existing research to develop the first questionnaire, serving as the basis for the competence concept, related awareness, knowledge, habits, practices, and evaluation for dietary-based health management [24-27]. A 5-point Likert scale (1 for strongly disagree to 5 for strongly agree) graded each item in the questionnaire. Health status awareness was measured in 4 stages (very healthy, healthy, average, and weak), factoring height (cm) and weight (kg) to measure body mass index (BMI). The study utilized a modified questionnaire to suit the current study objectives, and 2 experienced home economics educators verified the content's appropriateness. Each subject's obesity was evaluated based on the 2017 South Korea children and adolescent growth chart by the Korea Centers for Disease Control and Prevention [28]. According to the Korean Society for the Study of Obesity, adolescents are overweight if their BMI is over the 85th percentile, and those below the 5th percentile are underweight [29].

Five areas comprised the study contents: healthy dietary self-assessment, dietary safety awareness, dietary safety knowledge, unhealthy dietary, and health management practices. The study used the Varimax rotation method for factor analysis, obtaining a minimum Kaiser-Meyer-Olkin measure of 0.7, a minimum loading value of 0.6, and a minimum Cronbach's α value of 0.6.

Healthy dietary self-assessment

Factor analysis of the subject's present healthy dietary self-assessment was extracted as one factor (Cronbach's $\alpha = 0.90$). The healthy dietary self-assessment scale consisted of 7 items evaluating the current diet's impact on chronic illnesses:

- I have healthy eating habits.
- I think that my dietary's nutrition content is well balanced.
- I think that my diet helps prevent diabetes.
- I think that my diet helps improve my immune system.
- I think that my diet helps my weight management (obesity prevention).
- I think that my diet helps prevent cancer.
- I think that my diet helps prevent hypertension and hyperlipidemia.

Dietary safety awareness

Three subgroups comprised dietary safety awareness: sweet and salty diets, disease susceptibility, and anxiety, and each subgroup comprised 5 items with eigenvalues of 1 or above. Items exploring the effects of sweet and salty eating habits, food additives, and obesity on chronic diseases comprised the sweet and salty diets and disease susceptibility scales, respectively. Items related to anxiety while eating made up the dietary safety anxiety scale. Based on the factor analysis results, the subjects were aware of the effects of each classification. Those with knowledge of sweet and salty diets were aware of its risks to obesity, diabetes, and cancer; subjects with dietary safety awareness were knowledgeable of the dangers of food additives. Additionally, subjects displayed an awareness of major food safety issues such as pesticides and heavy metals. The total variance expressed by these 3 factors was 59.69%, and the Cronbach's α coefficients were 0.80 or higher, showing the questionnaire items' high level of reliability.

Dietary safety knowledge

Two subgroups comprised the dietary safety knowledge category: food and nutrition knowledge, and weight management knowledge. The food and nutrition knowledge scale consisted of 7 items regarding food and nutrition in health management. In comparison, 5 items on low weight and obesity constituted the weight management knowledge scale with eigenvalues of 1 or above. Factor analysis results reveal that the subjects utilize their knowledge for each classification. Those with food and nutrition knowledge were able to recognize, read, analyze, judge, and distinguish food- and nutrition-related information. Similarly, those possessing weight management knowledge understood the relationship between energy intake and weight. The total variance expressed by these 2 factors was 57.26%, and the Cronbach's α coefficients were 0.82 or higher, which also showed the questionnaire items' high level of reliability.

Unhealthy dietary habits

Knowing that the subjects were exposed to various eating habits—eating out, sweet and salty foods, high fat and fast-food diets, night snacking and overeating—perceived unhealthy dietary habits were divided into poor eating and overeating habits. The poor eating habits scale consisted of 6 items on food that are likely to cause obesity or health problems; the overeating habits scale consisted of 2 items, frequent overeating and binge eating, with eigenvalues of 1 or above. Factor analysis results show that adolescents had perceptions of different diet behaviors, with eating harmful food and binge eating as having the highest awareness. The total variance expressed by 2 factors was 56.77%, and the Cronbach's α coefficient was 0.63 or higher, showing the questionnaire items' significant level of reliability.

Health management practices

Regarding the management of stress, exercise, hygiene, and basic and healthy eating habits, each scale had 3 to 5 items directly related to the eigenvalues of 1 or above. Stress management had 5 items on relationship management and psychological control. Exercise management had 3 items about obesity prevention and health care, basic eating habits had 4 items about routine diet, and hygiene management had 4 items about food poisoning prevention. The healthy eating habits scale consisted of 3 items on improving one's health. Factor analysis shows that stress, exercise, and diet management are the top 3 perceptions of good health among adolescents, with an awareness of eating colorful vegetables as the highest. The total variance expressed by these 3 factors was 57.06%, and the Cronbach's α coefficients were at least 0.61, showing the questionnaire items' significant level of reliability.

Statistical analysis

SPSS Statistics (ver. 24.0; IBM Inc., Armonk, NY, USA) analyzed the collected data. Frequency, percentage, and crossover were analyzed to find the weight level distribution according to the health status of the participant. One-way analysis of variance tested the significance at the $p < 0.05$ level, and the Ryan-Einot-Gabriel-Welsch F procedure determined the difference in dietary factors according to obesity and health status perception. Mean value and multiple regression analysis then investigated the correlation between factors.

RESULTS

Underweight adolescents are individuals whose BMI was below the 5th percentile relative to sex and height based on the 2017 adolescent growth chart of South Korea [28]. Overweight/obese (OW/OB) adolescents are individuals whose BMI was over the 85th percentile, and the other study participants who did not fall in either of the former categories were considered normal in weight [29]. Among the randomly sampled participants, 159 (32.3%) perceived themselves as very healthy, and 201 (40.9%) as healthy (**Table 1**). The percentage of students with high health awareness was higher in the normal weight group, compared to that from the underweight and OW/OB groups ($p < 0.01$).

Dietary-based health management factor scores according to obesity and perceived health status

Table 2 shows the mean scores of the healthy dietary self-assessment and the health management competence factors evaluation. The OW/OB group showed a lower score for healthy dietary self-assessment and a higher score for overeating habits compared with other groups ($p < 0.05$). Meanwhile, the underweight group showed a lower score for exercise compared with the normal weight group ($p < 0.05$). Respondents from the healthiest group showed a higher score in their self-assessment of a healthy dietary, dietary safety knowledge, and health management practices than the averagely healthy group ($p < 0.01$). Based on the results, these factors affected the health status and perception of adolescents, implying the need for an active implementation of dietary safety-focused sustainable health education for adolescents with low health awareness.

Correlation between dietary-based health management factors

Table 3 shows the correlation between the healthy dietary self-assessment of the participants and other factors. Healthy dietary self-assessment and food and nutrition knowledge showed significant correlations with all factors, except for overeating habits ($p < 0.05$) and showed a negative correlation with poor eating habits ($p < 0.01$). Weight management knowledge and stress management and exercise factors yielded similar results, except for dietary safety anxiety and overeating. Adolescents surveyed were aware that overeating or poor eating habits increase the risk of chronic diseases.

Table 1. Weight and perceived health status of the study respondents

Factor	Total	Very healthy	Healthy	Average	Weak	χ^2 value
Total	492 (100.0)	159 (32.3)	201 (40.9)	111 (22.6)	21 (4.3)	18.02**
Underweight	59 (12.0)	11 (18.6)	24 (40.7)	17 (28.8)	7 (11.9)	
Normal weight	311 (63.2)	112 (36.0)	129 (41.5)	62 (19.9)	8 (2.6)	
OW/OB	122 (24.8)	36 (29.5)	48 (39.3)	32 (26.2)	6 (4.9)	

Values are presented as number (%).

OW/OB, overweight/obese.

** $p < 0.01$.

Table 2. Dietary safety and health management practices according to weight levels and perceived health status

Factors	Weight levels				Perceived health status				
	Underweight (n = 59)	Normal weight (n = 311)	OW/OB (n = 122)	F	Very healthy (n = 159)	Healthy (n = 201)	Average (n = 111)	Weak (n = 21)	F
Healthy dietary self-assessment	3.49 ± 0.77 ^a	3.30 ± 0.75 ^a	2.97 ± 0.72 ^b	12.01 ^{***}	3.43 ± 0.80 ^a	3.27 ± 0.68 ^a	2.92 ± 0.68 ^b	3.19 ± 1.03 ^{ab}	10.72 ^{***}
Dietary safety awareness									
Sweet and salty diets	3.80 ± 0.73	3.90 ± 0.70	3.83 ± 0.81	0.60	3.95 ± 0.81	3.83 ± 0.68	3.85 ± 0.71	3.80 ± 0.76	1.00
Disease susceptibility	3.41 ± 0.78	3.42 ± 0.68	3.29 ± 0.87	1.34	3.48 ± 3.80	3.29 ± 0.69	3.42 ± 0.74	3.44 ± 0.85	2.09
Anxiety	2.75 ± 0.89	2.75 ± 0.80	2.71 ± 0.79	0.09	2.68 ± 0.90	2.73 ± 0.76	2.83 ± 0.76	2.71 ± 0.83	0.75
Dietary safety knowledge									
Food and nutrition knowledge	3.29 ± 0.85	3.20 ± 0.69	3.19 ± 0.67	0.42	3.39 ± 0.78 ^a	3.14 ± 0.64 ^b	3.11 ± 0.63 ^b	3.06 ± 0.99 ^b	5.23 ^{**}
Weight management knowledge	3.49 ± 0.77	3.57 ± 0.68	3.58 ± 0.73	0.32	3.72 ± 0.77 ^a	3.48 ± 0.61 ^b	3.49 ± 0.65 ^b	3.46 ± 1.07 ^b	4.24 ^{**}
Mean	3.37 ± 0.76	3.35 ± 0.63	3.35 ± 0.62	0.03	3.53 ± 0.69 ^a	3.28 ± 0.55 ^b	3.27 ± 0.59 ^b	3.23 ± 1.00 ^b	5.81 ^{**}
Unhealthy dietary habits (reverse)									
Poor eating habits management	3.22 ± 0.92	3.19 ± 0.70	3.02 ± 0.82	2.27	3.26 ± 0.81	3.12 ± 0.73	3.07 ± 0.69	3.08 ± 0.97	1.69
Overeating habits management	2.42 ± 0.99 ^b	2.52 ± 0.94 ^b	2.75 ± 0.92 ^a	3.32 [*]	2.69 ± 1.02	2.54 ± 0.89	2.49 ± 0.94	2.36 ± 0.81	1.50
Mean	3.02 ± 0.82	3.02 ± 0.65	2.95 ± 0.74	0.41	3.11 ± 0.73	2.97 ± 0.69	2.92 ± 0.63	2.90 ± 0.78	2.13
Health management practices									
Stress management	3.64 ± 0.81	3.78 ± 0.77	3.62 ± 0.77	2.42	3.96 ± 0.75 ^a	3.71 ± 0.66 ^b	3.49 ± 0.91 ^c	3.37 ± 0.74 ^c	10.49 ^{***}
Exercise	2.88 ± 1.09 ^b	3.31 ± 1.03 ^a	3.17 ± 0.98 ^{ab}	4.61 [*]	3.62 ± 1.04 ^a	3.16 ± 0.99 ^b	2.91 ± 0.90 ^b	2.48 ± 1.00 ^c	16.74 ^{**}
Basic eating habits	3.69 ± 0.72	3.61 ± 0.77	3.52 ± 0.72	1.20	3.76 ± 0.80 ^a	3.56 ± 0.70 ^b	3.47 ± 0.72 ^b	3.36 ± 0.91 ^b	4.65 ^{**}
Hygiene	3.96 ± 0.63	3.90 ± 0.65	3.82 ± 0.61	1.05	4.02 ± 0.68 ^a	3.82 ± 0.61 ^b	3.79 ± 0.63 ^b	4.04 ± 0.46 ^a	4.35 ^{**}
Healthy eating habits	3.46 ± 0.93	3.46 ± 0.75	3.40 ± 0.80	0.31	3.66 ± 0.81 ^a	3.42 ± 0.77 ^b	3.18 ± 0.72 ^c	3.56 ± 0.77 ^{ab}	8.52 ^{***}
Mean	3.59 ± 0.58	3.67 ± 0.53	3.55 ± 0.52	2.31	3.86 ± 0.55 ^a	3.59 ± 0.48 ^b	3.44 ± 0.51 ^c	3.38 ± 0.48 ^c	17.81 ^{***}

Values are presented as mean ± SD.

OW/OB, overweight/obese.

^{*}p < 0.05; ^{**}p < 0.01; ^{***}p < 0.001.

^{a,b,c}Means in the same column with different superscripts are significantly different from the result of the Ryan-Einot-Gabriel-Welsch F test.

Table 3. Correlation analysis among variables

Factors	1	2	3	4	5	6	7	8	9	10	11	12	13
Healthy dietary self-assessment	1.000												
Sweet and salty diets	0.104 [*]	1.000											
Disease susceptibility	0.193 ^{**}	0.617 ^{**}	1.000										
Anxiety	0.193 ^{**}	0.146 ^{**}	0.279 ^{**}	1.000									
Food and nutrition knowledge	0.496 ^{**}	0.205 ^{**}	0.284 ^{**}	0.212 ^{**}	1.000								
Weight management knowledge	0.372 ^{**}	0.349 ^{**}	0.393 ^{**}	0.163 ^{**}	0.635 ^{**}	1.000							
Poor eating habits	-0.137 ^{**}	0.033	0.039	-0.067	-0.100 [*]	-0.033	1.000						
Overeating habits	-0.059	0.128 ^{**}	0.103 [*]	0.058	0.065	0.037	0.382 ^{**}	1.000					
Stress management	0.335 ^{**}	0.302 ^{**}	0.242 ^{**}	0.116 ^{**}	0.376 ^{**}	0.429 ^{**}	0.003	-0.035	1.000				
Exercise	0.329 ^{**}	0.165 ^{**}	0.201 ^{**}	0.126 ^{**}	0.317 ^{**}	0.270 ^{**}	0.047	0.041	0.285 ^{**}	1.000			
Basic eating habits	0.383 ^{**}	0.177 ^{**}	0.167 ^{**}	0.070	0.418 ^{**}	0.410 ^{**}	0.011	-0.051	0.366 ^{**}	0.287 ^{**}	1.000		
Hygiene	0.266 ^{**}	0.261 ^{**}	0.137 ^{**}	0.077	0.474 ^{**}	0.379 ^{**}	-0.021	-0.060	0.355 ^{**}	0.208 ^{**}	0.283 ^{**}	1.000	
Healthy eating habits	0.452 ^{**}	0.176 ^{**}	0.168 ^{**}	0.063	0.429 ^{**}	0.373 ^{**}	-0.194 ^{**}	-0.020	0.317 ^{**}	0.224 ^{**}	0.460 ^{**}	0.284 ^{**}	1.000

1: Healthy dietary self-assessment, 2: Sweet and salty diets, 3: Disease susceptibility, 4: Anxiety, 5: Food and nutrition knowledge, 6: Weight management knowledge, 7: Poor eating habits, 8: Overeating habits, 9: Stress management, 10: Exercise, 11: Basic eating habits, 12: Hygiene, 13: Healthy eating habits.

^{*}p < 0.05; ^{**}p < 0.01.

Effect of dietary factors on the current dietary safety assessment

Table 4 shows the stepwise multiple regressions by the participants' weight level and health status groups, and each group showed several key differences in factors affecting healthy dietary self-assessment. The normal weight group considered weight management

Table 4. Multiple regressions on dietary assessment for preventing chronic disease

Independent variables	Weight level						Perceived health status							
	Underweight (R ² = 0.25, F = 2.51 [†])		Normal weight (R ² = 0.39, F = 16.44 ^{***})		OW/OB (R ² = 0.39, F = 7.05 ^{***})		Very healthy (R ² = 0.26, F = 5.11 ^{**})		Healthy (R ² = 0.35, F = 9.56 ^{***})		Average (R ² = 0.38, F = 6.41 ^{***})		Weak (R ² = 0.49, F = 2.53)	
	β	t	β	t	β	t	β	t	β	t	β	t	β	t
Dietary safety awareness														
Sweet and salty diets	-0.14	-0.93	-0.09	-1.83	-0.05	-0.62	-0.11	-1.34	0.01	0.13	-0.20	-2.35 [*]	-0.45	-1.55
Disease susceptibility	0.03	0.21	0.10	1.97	-0.12	-1.41	0.03	0.32	0.08	1.14	-0.02	-0.22	0.43	1.21
Anxiety	0.08	0.56	0.08	1.65	0.16	2.06 [*]	0.01	0.13	0.13	2.18 [*]	0.24	2.82 ^{**}	0.43	1.30
Dietary safety knowledge														
Food and nutrition knowledge	0.21	1.19	0.115	1.88	0.30	3.51 ^{**}	0.23	2.27 [*]	0.24	3.32 ^{**}	0.08	0.80	0.10	0.24
Weight knowledge	0.19	1.34	0.12	2.116 [*]	0.09	0.99	0.05	0.53	0.10	1.42	0.20	1.92	0.26	0.95
Unhealthy dietary habits														
Poor eating habits	-0.05	-0.33	-0.13	-2.68 ^{**}	-0.05	-0.57	-0.06	-0.78	-0.04	-1.08	-0.17	-1.89	-0.20	-0.84
Overeating habits	0.00	0.01	-0.02	-0.43	-0.08	-0.98	-0.08	-1.05	-0.07	-1.08	0.04	0.48	-0.29	-1.00
Health management practices														
Stress management	0.18	1.26	0.19	3.59 ^{***}	0.16	1.83	0.17	2.07 [*]	0.03	0.48	0.25	2.94 ^{**}	0.25	1.03
Exercise	0.12	0.97	0.18	3.61 ^{***}	0.38	4.87 ^{***}	0.10	1.22	0.18	2.84 ^{**}	0.21	2.44 [*]	0.16	0.62
Basic eating habits	0.14	0.96	0.27	5.33 ^{***}	-0.05	-0.64	0.22	2.67 ^{**}	0.21	3.24 ^{**}	0.14	1.61	-0.05	-0.16
Hygiene	0.06	0.39	0.08	1.49	-0.04	-0.40	0.18	2.07 [*]	0.03	0.46	-0.11	-1.26	-0.23	-0.59
Healthy eating habits	0.25	1.59	0.30	5.74 ^{***}	0.25	3.01 ^{**}	0.17	2.04 [*]	0.30	4.89 ^{***}	0.21	2.29 [*]	-0.04	-0.70

Dependent variables: healthy dietary self-assessment.

OW/OB, overweight/obese.

[†]p < 0.05; ^{*}p < 0.01; ^{**}p < 0.001.

knowledge, poor eating habits, stress management, basic eating habits, and healthy eating habits as important factors of a healthy dietary (p < 0.05). The underweight group did not focus on these factors, while the OW/OB group considered anxiety, food and nutrition knowledge, exercise, and healthy eating habits as important factors (p < 0.05).

For the very healthy group, food and nutrition knowledge, stress management, basic eating habits, hygiene, and healthy eating habits were significant variables (p < 0.05). In comparison, the significant variables of the healthy group were dietary safety anxiety, food and nutrition knowledge, exercise, basic eating habits, and healthy eating habits (p < 0.05). However, the averagely healthy group was not aware of the dangers of sweet and salty diets, poor eating and overeating, and the importance of dietary safety knowledge, basic eating habits, and hygiene management (p < 0.05).

Sustainable health management model focused on dietary safety and competency

The study utilized regression analysis to examine the factors that influence the healthy dietary evaluation of adolescents for sustainable health management. **Fig. 1** illustrates the relationship between adolescent health (dependent variable), dietary safety management (independent variable), and dietary-based health management capacity (mediator variable). The dietary safety-based health-management competency model included dietary safety awareness and knowledge, unhealthy dietary management, and health management practices. Sweet and salty diets, dietary safety anxiety, food and nutrition knowledge, weight management knowledge, stress management, exercise, basic eating habits, and healthy eating habits factors are major mediators in predicting the healthy dietary self-assessment of adolescents (p < 0.05). On the other hand, unhealthy dietary factors did not affect healthy dietary self-assessment—adolescents did not consider poor and overeating habits increased the risk of chronic diseases (R² = 0.35, p < 0.001).

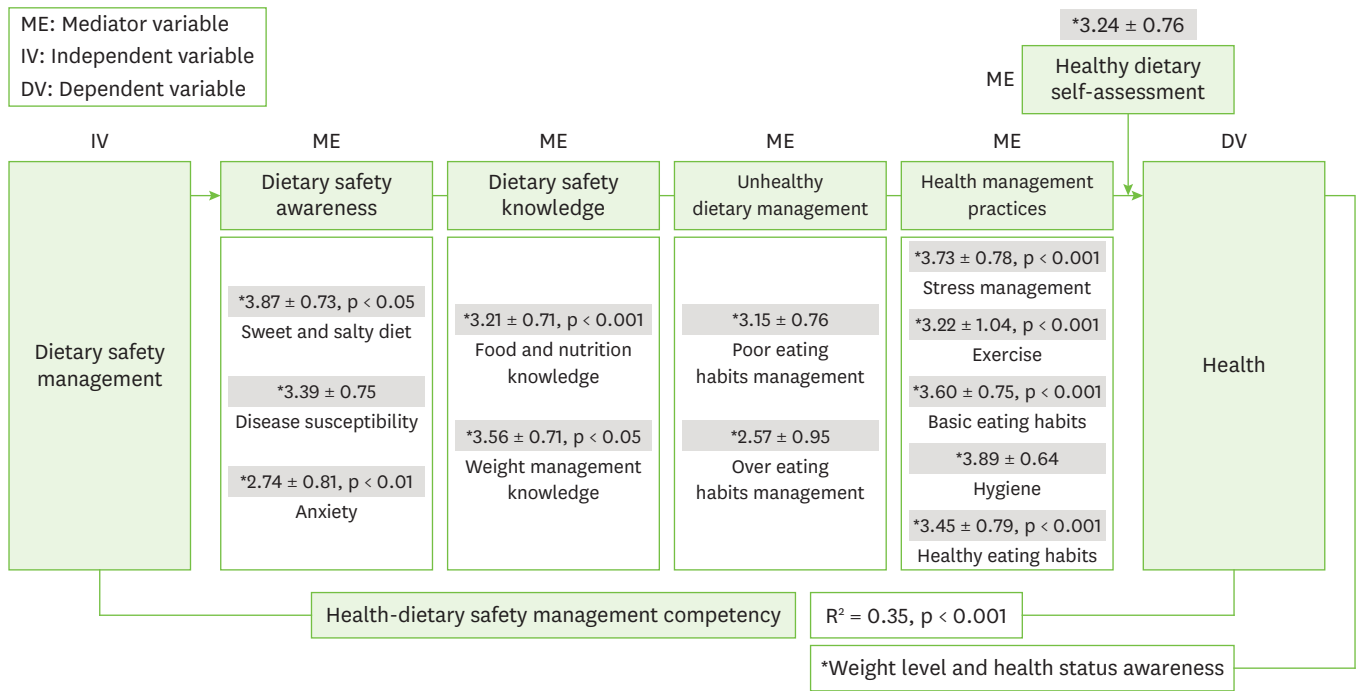


Fig. 1. Graphical view of the interaction status of the variables in the model.

This figure shows the relationship between adolescent health, dietary safety management, and dietary-based health management competency. *Values are presented as mean ± SD. 5-point Likert scale: 1-strongly disagree; 2-disagree; 3-neutral; 4- agree; 5-strongly agree. P and R² values are evaluated by regression analysis on healthy dietary self-assessment.

DISCUSSION

The results reveal a significant difference in the perception of health status according to weight level; the percentage of the normal weight group was significantly higher than that of the underweight and OW/OB groups. A healthy dietary self-assessment was significantly different according to weight levels and perceived health status, and healthy eating habits were significantly correlated with all factors, except anxiety and overeating habits. Factors such as sweet and salty diets, anxiety, food and nutrition knowledge, weight management knowledge, stress management, exercise, basic eating habits, and healthy eating habits have a significant effect on healthy dietary self-assessment. These results could indicate that South Korean adolescents need proactive education on the relationship between dietary safety, weight management, and chronic diseases. Kim [30] and Kim [31] emphasized dietary safety management competency and dietary independence competency for prevention and management of chronic diseases in cancer survivors and adults. In addition, Kim [32] emphasized healthy weight management and emotional management for sustainable health management of adolescents. Therefore, it is necessary to cultivate healthy dietary management competency for the prevention of chronic diseases in adolescence and to be able to actively practice it. In addition, more active dietary education should be implemented so that this practice can be continuously maintained throughout life.

The mean score of the overeating habits factor is significantly higher than that of other groups among the OW/OB students. Where adolescents perceived their health status as weak, the proportion of OW/OB students tended to increase. In other words, OW/OB students perceived that their eating habits did not help prevent chronic diseases. The study of Troop et

al. [33] corroborates these findings where events and problems acting as stressors triggered binge eating. According to Potochnick et al. [34], food insecurity among children had a positive unadjusted association with BMI. Based on the findings of Thunfors et al. [35], instruction and information may be necessary for helping overweight adolescents develop an interest in specific health behaviors and achieve their weight loss goals. Therefore, this study acknowledged weight management as a crucial health care factor for OW/OB students.

Adolescents need weight management education to generate interest in chronic health diseases caused by behavioral patterns. Among adolescents of normal weight, factors such as weight management knowledge, poor eating habits, stress management, exercise, basic eating habits, and healthy eating habits influenced their healthy dietary self-assessment significantly in this study. In comparison, dietary safety anxiety, food and nutrition knowledge, exercise, and healthy eating habits influenced OW/OB adolescents. The difference implies that while OW/OB adolescents perceive those factors as important, they do not necessarily give value to basic eating habits. With the nutritional quality of breakfast as the principal BMI and overweight predictors, dietary safety education for OW/OB adolescents should emphasize the importance of avoiding overeating and maintaining basic eating habits to help prevent the contraction of chronic diseases [36].

Adolescents who perceived themselves as very healthy had a higher score in dietary safety knowledge and health management practices than those of the other groups. Basic and healthy eating habits, along with dietary safety knowledge, are perceived as critical factors in health care among adolescents. A report by Hong [37] emphasized the necessity of restructuring knowledge so that students can digest such information properly during this period of growth while emphasizing the need for a firm foundation of competency-based school education. Therefore, adolescents need active weight management education to increase their dietary safety and health care knowledge and competency.

Given the study's results, adolescent health is dependent on maintaining a healthy weight and basic and healthy eating habits based on dietary safety awareness and knowledge. However, regression analysis showed no relationship between the factors affecting the self-assessment of healthy eating and dietary safety knowledge. A study by Kim [24] reported that food safety knowledge had no significant effect on the behavioral intention of adulterated food management. Therefore, health education for adolescents should focus on problem-solving competency rather than simple knowledge. As self-efficacy is related to healthy dietary patterns and fruit intake, education and awareness should be prioritized [38,39]. Foley et al. [40] also emphasized the importance of a home-based adolescent-led strategy for promoting healthy eating habits and physical activities.

Education on sustainable food safety management in adolescence is very effective in preventing diseases not only in adolescence but also in adulthood [16]. Adolescents with average awareness of their health condition, in particular, should be the focus for active education, as a reminder that avoiding sweet and salty diets is essential to preventing chronic diseases. In this study model, health-dietary management competency, based on dietary safety awareness and knowledge, unhealthy dietary management, and health care practice factors, influence the health of adolescents and may help strengthen the health care capacity of the youth. Recognizing the importance of diet in adolescence is essential, emphasizing basic and healthy dietary education to reduce unhealthy eating habits and sustainable dietary management competencies that can be maintained into adulthood.

Educating adolescents to cultivate their dietary safety competence is at the core of maintaining lifelong and sustainable health management capacity. Additionally, dietary safety education should be actively carried out, taking factors such as weight level and health status recognition into consideration. While the regression analyses suggested a health-dietary safety management competency model, the study derived the factors related to weight management and excluded chronic disease knowledge. Further studies could focus on factors related to sustainable weight management with chronic disease knowledge.

SUMMARY

Having sweet and salty diets, diet safety anxiety, knowledge on weight management and food and nutrition, stress and exercise management, basic eating habits, and healthy eating habits all significantly affected proper dietary assessment among adolescents. A more informed perception of one's health indicated higher healthy dietary self-assessment, dietary safety knowledge, and health management practice scores. This study illustrated how adolescents' awareness, knowledge, and practices of dietary safety influenced their healthy dietary self-assessment. Therefore, implementing a dietary-based health management competency education on dietary safety for adolescents should follow weight level and health condition self-perception. The findings in this study suggest 3 factors that affect adolescent dietary knowledge: emphasis on safety, sustainable chronic disease management education, and active implementation as a self-directed management competency. As this study examined sustainable health-dietary safety management strategies in adolescents, the study's implications can benefit health education curricula.

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