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Depressive symptoms, eating habits, and dietary quality among young adults in Chungcheong, Korea

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ABSTRACT

BACKGROUND/OBJECTIVES: The prevalence of depression has increased globally, and depressive symptoms have been reported to lead to undesirable lifestyle choices, including poor eating behaviors. The aim of this study was to assess the severity of depressive symptoms in young adults and to investigate the differences in eating habits and dietary quality by the degree of these symptoms.

SUBJECTS/METHODS: This cross-sectional study included 497 young adults aged 19–39 yrs living in Chungcheong, Korea. Depressive symptoms were assessed using the Center for Epidemiologic Studies Depression (CES-D) scale, and eating habits and dietary quality were surveyed using questionnaires and nutrition quotient (NQ) for Korean adults.

RESULTS: The prevalence of depression in the participants was approximately 31.4%, based on a depressive symptom score of 16 on the CES-D scale, and the proportion of women was significantly higher than men. The depressed group considered food combinations and consumed snacks more frequently than the nondepressed group. No statistically significant differences were found in the total NQ score between the depressed and nondepressed groups; however, the moderation score was significantly lower in the depressed group for all participants and female participants.

CONCLUSION: We found that dietary quality, including snacking and moderation-related eating habits, varied with the degree of depressive symptoms in young adults. Further intervention studies are needed to clarify the association between dietary factors and depressive symptom.

Keywords: Depressive symptoms; eating habits; diet; young adult

INTRODUCTION

Depression is a disorder characterized by a loss of interest or motivation in life and feelings of depression, followed by activity withdrawal, cognitive and impulse control difficulties, and physical symptoms that eventually lead to a decline in daily functioning [1]. Depression has been reported to affect 5% of adults and approximately 3.8% of the total population, or approximately 280 million people, globally as of 2019 [2]. The prevalence of depression in all 15 Organization for Economic Co-operation and Development (OECD) countries ranged from 3.0–10.8% before the coronavirus pandemic (coronavirus disease 2019 [COVID-19])

to 10.0–36.8% in 2020 after COVID-19, with South Korea having the highest prevalence at 36.8% [3].

Countries around the world have experienced increased unemployment and lower incomes due to restrictions on social activities that were implemented to prevent the pandemic from spreading further, and these social factors contribute to poor mental health, which may have contributed to the increased prevalence of depression [4]. In particular, COVID-19 may have had a greater impact on young adults, the primary working-age demographic group, due to social and economic constraints, which may have contributed to their increased prevalence of depression among individuals in this group [4]. The prevalence of depression among Korean adults in 2020 was reported to be 8.3% in their 20s, 6.8% in their 30s, 4.9% in their 40s, 2.4% in their 50s, 4.3% in their 60s, and 5.3% in their 70s and older, with the highest prevalence among adults in their 20s and 30s [5].

Along with mental health issues, changes in daily routines due to COVID-19 have also impacted people's usual eating patterns, with increased consumption of high-calorie foods; increased use of delivery, convenience, and processed foods; and decreased consumption of vegetables and fruits [6]. Herle *et al*. [7] reported significantly greater odds of depressive symptoms among those who increased or decreased their dietary intake after COVID-19, suggesting that changes in dietary status due to COVID-19 are associated with the development of depressive symptoms.

Depressed mood is characterized by pessimistic and negative feelings and has been reported to lead to undesirable lifestyle choices and poor eating behaviors, impacting health [8,9]. Previous studies have reported eating problems associated with depressive symptoms, including skipping meals, eating inappropriate food groups, and engaging in emotional eating [10,11]. There are also reports of compounding problems with inappropriate eating behaviors that can occur with depressive symptoms, resulting in extreme eating behaviors to avoid or block awareness of depressive feelings [12]. These studies have suggested that anorexia due to depressive symptoms may lead to frequent meal skipping, which may reduce nutrient intake from meals, and that inappropriate food group consumption and increased intake of high-calorie foods due to emotional eating may lead to specific nutrient deficiencies or low nutrient density diets. Therefore, studies assessing dietary habits for individuals with depressive symptoms and suggesting appropriate dietary guidance for them are needed.

A study of 122 high school girls aged 15–18 found that higher levels of stress and depression were associated with more undesirable eating behaviors and attitudes, and higher levels of binge eating [13]. In addition, recent study of 345 middle-aged women reported that depression was negatively correlated with nutritional status, suggesting that depression may influence the consumption of unhealthy foods [14]. However, compared to adults in other age groups, adults in their 20s and 30s demonstrate socially concerning levels of mental health conditions, but research on young adults is limited.

The aims of this study were to assess the status of depressive symptoms in young adults, evaluate their eating habits and dietary quality, and examine differences in dietary status according to depressive symptoms degree. Therefore, depressive symptoms, eating habits, and dietary quality were evaluated and their associations were analyzed in adults in their 20s and 30s.

SUBJECTS AND METHODS

Subjects

The study was conducted on adults in their 20s and 30s in Chungcheong, Korea, who provided signed written informed consent. The survey was conducted between November 17, 2022 and June 9, 2023. As a cross-sectional study, the number of subjects was determined by calculating the sample size required at a 5% margin of error and 95% confidence level. The subjects were recruited from universities and companies of the province through off-site and on-site advertisements. The survey was self-administered and was completed after an interview with the researcher. Of the 539 participants, 42 were missing, and the final data of 497 participants were used for statistical analysis. This study was approved by the Institutional Review Board of Kongju National University (KNU_IRB_2022-104). In addition, all procedures were performed in accordance with relevant guidelines.

Assessment of depressive symptom levels

Levels of depressive symptoms were assessed using the screening questionnaire of the Center for Epidemiologic Studies Depression (CES-D) scale, which has been validated for reliability and validity in previous studies [15]. The CES-D consists of 20 items to assess depressive symptoms, focusing on depressive mood as experienced by the general population. All 20 items are scored on the frequency of feeling and behavior over the past week, with 0 for 1 day or less, 1 for 1–2 days, 2 for 3–4 days, and 3 for 5–7 days, and the 4 items of positive feeling are reverse scored. The total score is 60 points, with higher scores indicating higher levels of depressive symptoms. The cutoff point for the depression score to categorize the depressed and nondepressed groups was 16 points, which is the cutoff point used in community epidemiological surveys in Korea [15,16].

Questionnaire development and survey on general characteristics

The questionnaire used this study was finalized by adapting the items reported in previous studies [17-20] to the purpose of the present study and conducting a preliminary survey. The questionnaire consisted of the questions related to the general characteristics, eating habits, and dietary quality of the subjects. Among them, the general characteristics of the participants were assessed via questions regarding 6 variables: sex, age, physical characteristics (height, weight), occupation, residence type, and monthly income. Body mass index (BMI) was calculated dividing weight (kg) by the square of the height (m^2).

Evaluation of eating habits and dietary quality

Eating habits were assessed via questions regarding 5 variables: mealtime, frequency of eating out, consideration of food combinations at meals, frequency of snacking, and eating place. Overall dietary quality and nutritional status of the subjects were assessed using the nutrition quotient (NQ) for Korean adults developed by the Korean Nutrition Society [21,22]. The NQ consists of 18 items assessing 3 domains: balance, moderation, and practice. The balance domain was composed of 8 items regarding the consumption of vegetables, fruits, milk and dairy, fish, legumes, nuts, whole-grain and multigrain foods, and breakfast. The moderation domain consisted of 6 items regarding the consumption of red meat, processed meat, spicy and salty brothy foods, fast food, fatty breads and sweets, and the frequency of overeating and/or binge eating. The practice domain consists of 4 items on effort to eat healthily, reading nutrition labels, hand washing, and frequency of binge drinking (high-risk drinking). The NQ score was calculated by applying the itemized scores and weights proposed in the study by Yook *et al.* [22]. In addition, the assessment of NQ scores was based on the standardized percentile

distribution of national surveys. For the total NQ score, 68.5 to 100 was rated as 'high,' 52.7 to 68.5 as 'medium,' and 0 to 52.7 as 'low.' For the domain scores, balance was scored 55.8 to 100 being 'high' and 0 to 30.9 being 'low'; moderation was scored 85.3 to 100 being 'high' and 0 to 66.1 being 'low'; and practice was scored 74.5 to 100 being 'high' and 0 to 51.8 being 'low.'

Statistical analysis

Means and SDs were calculated for continuous variables, and frequencies were calculated for noncontinuous variables. The CES-D scale showed good reliability in our participants (Cronbach's α = 0.883). Differences between the $\geq$ 16 (depressed group) and < 16 (nondepressed group) groups were verified using the χ^2 test and Fisher's exact test for noncontinuous variables and the unpaired t-test for continuous variables. Statistical analysis was performed using SAS version 9.4 (SAS Institute Inc., Cary, NC, USA), and significance was tested at the P < 0.05.

RESULTS

Depressive symptom levels

The depressive symptom scores for each CES-D are shown in **Table 1**. Of the 20 items, "I felt I was just as good as other people" and "I felt hopeful about the future" had the highest depressive symptom scores, at 1.63 and 1.63, respectively, out of 3. The average depression score for all subjects was 12.78 out of 60. Women scored significantly higher than men on 13 of the 20 questions, with an overall score of 14.36 for women compared to 11.18 for men (P < 0.001). The percentages of men in the depressed group based on depression scores of 16, 21, and 25 were 59 (23.98%), 28 (11.38%), and 13 (5.28%), respectively, and 97 (38.65%), 53 (21.12%), and 26 (10.36%) for women, respectively, which were significantly higher than those for men (P < 0.01) (**Fig. 1**).

Table 1. Depressive symptom score using CES-D of the subjects

Variables	All subjects (n = 497)	Men (n = 246)	Women (n = 251)	t-value (P)
I was bothered by things that usually don't bother me.	0.90 ± 0.90	0.82 ± 0.88	0.97 ± 0.91	−1.83 (0.068)
I did not feel like eating; my appetite was poor.	0.39 ± 0.69	0.39 ± 0.71	0.39 ± 0.67	−0.00 (0.998)
I felt that I could not shake off the blues even with help from my family or friends.	0.34 ± 0.69	0.26 ± 0.60	0.42 ± 0.75	−2.65 (0.008)
I felt I was just as good as other people.[1]	1.63 ± 1.01	1.51 ± 1.07	1.75 ± 0.94	−2.67 (0.008)
I had trouble keeping my mind on what was doing.	0.67 ± 0.83	0.54 ± 0.75	0.79 ± 0.88	−3.33 (0.001)
I felt depressed.	0.48 ± 0.76	0.37 ± 0.67	0.59 ± 0.82	−3.32 (0.001)
I felt that everything I did was an effort.	0.68 ± 0.88	0.57 ± 0.80	0.78 ± 0.94	−2.72 (0.007)
I felt hopeful about the future.[1]	1.63 ± 0.99	1.51 ± 1.01	1.75 ± 0.94	−2.74 (0.006)
I thought my life had been a failure.	0.19 ± 0.51	0.18 ± 0.52	0.21 ± 0.49	−0.62 (0.534)
I felt fearful.	0.36 ± 0.70	0.22 ± 0.55	0.50 ± 0.80	−4.54 (< 0.001)
My sleep was restless.	0.76 ± 0.92	0.64 ± 0.85	0.87 ± 0.98	−2.85 (0.005)
I was happy.[1]	1.26 ± 0.96	1.17 ± 0.96	1.35 ± 0.95	−2.05 (0.041)
I talked less than usual.	0.51 ± 0.78	0.48 ± 0.78	0.53 ± 0.78	−0.78 (0.438)
I felt lonely.	0.26 ± 0.60	0.22 ± 0.57	0.29 ± 0.63	−1.26 (0.210)
People were unfriendly.	0.22 ± 0.55	0.22 ± 0.57	0.23 ± 0.52	−0.24 (0.812)
I enjoyed life.[1]	1.34 ± 0.93	1.23 ± 0.92	1.45 ± 0.94	−2.63 (0.009)
I had crying spells.	0.19 ± 0.50	0.09 ± 0.37	0.28 ± 0.58	−4.45 (< 0.001)
I felt sad.	0.32 ± 0.60	0.22 ± 0.48	0.43 ± 0.69	−3.97 (< 0.001)
I felt that people dislike me.	0.18 ± 0.47	0.15 ± 0.44	0.21 ± 0.51	−1.43 (0.153)
I could not get starting something.	0.48 ± 0.78	0.39 ± 0.72	0.57 ± 0.82	−2.53 (0.012)
Total score	12.78 ± 8.56	11.18 ± 8.04	14.36 ± 8.78	−4.21 (< 0.001)

Values are presented as mean ± SD. Score by frequency a week: 0 point for less than 1 day, 1 point for 1–2 days, 2 points for 3–4 days, and 3 points for 5–7 days.
The Cronbach's α of the CES-D scale for the participants was 0.883.
CES-D, Center for Epidemiologic Studies Depression.
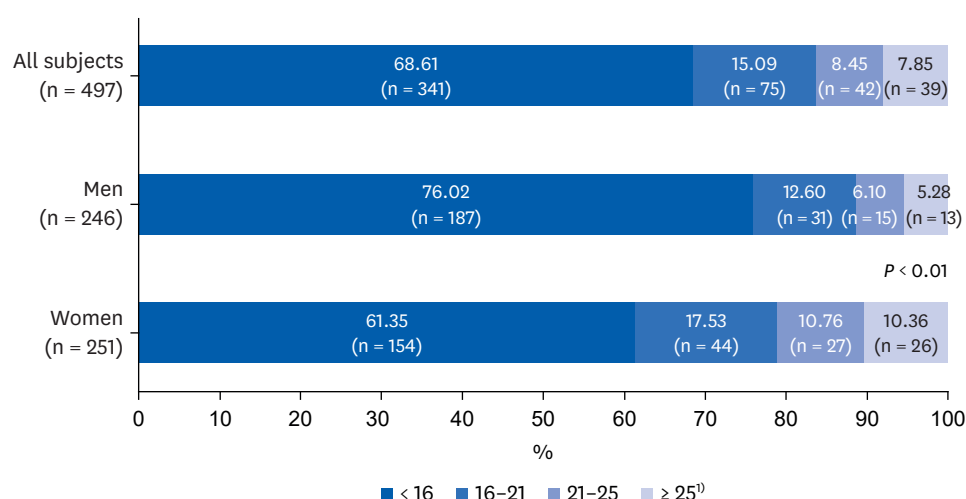[1]Positive items were scored reversely.

Fig. 1. Distribution of the subjects by depressive symptom score.
P-value indicate a significant difference between men and women by χ^2 test.
[1)]Depressive symptom scores by the Center for Epidemiologic Studies Depression (CES-D) scale.

General characteristics according to depressive symptom levels

The general characteristics of the participants according to their depressive symptoms are shown in **Table 2**. The average age was 27.00 yrs in the depressed group and 27.40 yrs in the nondepressed group, with no significant difference. Height was significantly lower in the depressed group (166.44 cm) than in the nondepressed group (168.73 cm) ($P < 0.01$), but weight and BMI were not significantly different between the depressed and nondepressed groups.

Eating habits according to depressive symptom levels

Table 3 shows the participants' eating habits according to their level of depressive symptoms. In terms of food combinations, the depressed group of subjects had the highest proportion of people who sometimes considered (50.00%) and were not interested (35.90%) in food combinations, while the nondepressed group had the highest proportion of people who were not interested (49.27%), showing a significant difference ($P < 0.05$). Among all the participants, the daily frequency of snaking in the depressed group was the highest (36.54%), while the frequency of 1–2 times per week (31.67%) was the highest in the nondepressed group ($P < 0.001$). In addition, the depressed group of women consumed snacks daily (41.24%) and 3–4 times a week (37.11%), while the nondepressed group consumed snacks 3–4 times a week (29.87%) and daily (29.22%), which was a significant difference ($P < 0.05$).

NQ scores according to depressive symptom levels

The NQ scores of the subjects according to their level of depressive symptoms are shown in **Table 4**. The total NQ score for all subjects was 45.32 out of 100, and there was no significant difference between the depressed and nondepressed groups. The scores for each domain were 25.11 for balance, 57.06 for moderation, and 51.66 for practice. The moderation score was significantly lower in the depressed group than in the nondepressed group for all subjects (54.01 vs. 58.46, $P < 0.01$) and for women (54.17 vs. 60.14, $P < 0.01$). In addition, in all subjects and women, the depressed group had a higher proportion of low grade and the nondepressed group had a higher proportion of medium and high grades, a significant difference ($P < 0.05$).

Table 2. General characteristics of the subjects according to depressive symptom score

Characteristics	All subjects (n = 497)				Men (n = 246)				Women (n = 251)			
	Total	Nondepressed (n = 341)	Depressed (n = 156)	χ² (t)-value (P)	Total	Nondepressed (n = 187)	Depressed (n = 59)	χ² (t)-value (P)	Total	Nondepressed (n = 154)	Depressed (n = 97)	χ² (t)-value (P)
Age (yrs)	27.27 ± 6.47	27.40 ± 6.44	27.00 ± 6.54	0.63 (0.527)	27.43 ± 6.43	27.32 ± 6.31	27.80 ± 6.86	−0.50 (0.618)	27.11 ± 6.51	27.49 ± 6.62	26.52 ± 6.33	1.16 (0.248)
Height (cm)	168.01 ± 8.57	168.73 ± 8.60	166.44 ± 8.32	2.79 (0.005)	174.52 ± 5.93	174.54 ± 5.89	174.47 ± 6.10	0.08 (0.935)	161.63 ± 5.56	161.68 ± 5.56	161.55 ± 5.06	0.19 (0.848)
Weight (kg)	67.20 ± 14.63	67.53 ± 14.25	66.50 ± 15.47	0.73 (0.467)	75.08 ± 12.54	74.53 ± 12.34	76.82 ± 13.13	−1.22 (0.224)	59.49 ± 11.54	59.02 ± 11.54	60.22 ± 13.30	−0.76 (0.451)
BMI (kg/m²)	23.65 ± 4.06	23.57 ± 3.86	23.84 ± 4.47	−0.65 (0.516)	24.59 ± 3.58	24.24 ± 3.57	25.15 ± 3.59	−1.38 (0.170)	22.72 ± 4.30	22.53 ± 3.96	23.03 ± 4.78	−0.87 (0.387)
Residence type				4.26 (0.235)[1]				3.13 (0.372)[1]				4.10 (0.251)[1]
With family	186 (37.42)	137 (40.18)	49 (31.41)		87 (35.37)	71 (37.97)	16 (27.12)		99 (39.44)	66 (42.86)	33 (34.02)	
Alone	174 (35.01)	117 (34.31)	57 (36.54)		83 (33.74)	60 (32.09)	23 (39.98)		91 (36.25)	57 (37.01)	34 (35.05)	
Dormitory	133 (26.76)	84 (24.63)	49 (31.41)		74 (30.08)	54 (28.88)	20 (33.90)		59 (23.51)	30 (19.48)	29 (29.90)	
Others	4 (0.80)	3 (0.88)	1 (0.64)		2 (0.81)	2 (1.07)	0 (0.00)		2 (0.80)	1 (0.65)	1 (1.03)	
Job				1.94 (0.747)				0.87 (0.760)				1.48 (0.829)
Profession	43 (8.65)	31 (9.09)	12 (7.69)		20 (8.13)	15 (8.02)	5 (8.47)		23 (9.16)	16 (10.39)	7 (7.22)	
Technician	41 (8.25)	31 (9.09)	10 (6.41)		38 (15.45)	29 (15.51)	9 (15.25)		3 (1.20)	2 (1.30)	1 (1.03)	
Service	67 (13.48)	46 (13.49)	21 (13.46)		15 (6.10)	12 (6.42)	3 (5.08)		52 (20.72)	34 (13.55)	18 (18.56)	
Student	274 (55.13)	187 (54.84)	87 (55.77)		136 (55.28)	106 (56.68)	30 (50.85)		138 (54.98)	81 (52.60)	57 (58.76)	
Others	72 (14.49)	46 (13.49)	26 (16.67)		37 (15.04)	25 (13.37)	12 (20.34)		35 (13.94)	21 (13.64)	14 (14.43)	
Income (10,000 won/month)				0.78 (0.677)				0.51 (0.773)				1.22 (0.543)
< 50	162 (32.60)	107 (31.38)	55 (35.26)		74 (30.1)	57 (30.48)	17 (28.81)		88 (35.06)	50 (32.47)	38 (39.18)	
50–200	139 (27.97)	98 (28.74)	41 (26.28)		69 (28.1)	54 (28.88)	15 (25.42)		70 (27.89)	44 (28.57)	26 (26.80)	
≥ 200	196 (39.44)	136 (39.88)	60 (38.46)		103 (41.9)	76 (40.64)	27 (45.76)		93 (37.05)	60 (38.96)	33 (34.02)	

Values are presented as mean ± SD or number (%). The depression score used to categorize the nondepressed and depressed groups is 16 points.
BMI, body mass index.
[1]Fisher's exact test.

DISCUSSION

Depressive symptoms can lead to inappropriate dietary and lifestyle behaviors, which may result in nutrient deficiencies or imbalances in dietary intake. In this study, we assessed depressive symptom levels in young adults in their 20s and 30s and found that the average depressive symptom score was 12.8, compared to 11.2 for men and 14.4 for women. In a study by Kim et al. [23], depressive symptom scores according to the CES-D were 14.6 for men and 15.9 for women in their 20s and 13.8 for men and 14.6 for women in their 30s. In addition, the scores were 5.5 for individuals in their 20s and 5.1 for those in their 30s [24], 10.3 for those in their 20s and 9.5 for those in their 30s for Korean adult men [25], and 13.3 for men and 16.5 for women among college students [20]. The depressive symptom scores reported in previous studies were similar to those in our study, ranging from 10–15, with some variation by region, sex, and time. These are shown that the depressive symptom level of the subjects, a young adult in his 20s and 30s, is not high enough to be of concern.

A depressive symptom score of 16 or higher, as assessed by the CES-D, is considered clinically significant psychological distress and is used as the cutoff point for selecting the depression group [26]. The prevalence of depression in this study was 31.4% among all the participants, with a prevalence of 24.0% among males and 38.7% among females. Oh et al. [24], who assessed the prevalence of depression based on a CES-D score of 16, reported that 11.0%. Kim et al. [25] reported a prevalence of depressive symptoms of 14.1% in men in their 20s and 10.3% in their 30s, and Park et al. [20] reported a prevalence of 31.6% in college students. These studies showed that the prevalence of depression as assessed by the CES-D prior to 2019 was less than 30%, but since 2020, it has increased to more than 30%, suggesting that depression in adults in their 20s and 30s has increased in recent years. Choi [1] reported a significant increase in the prevalence of depression among Korean adults before and after COVID-19, suggesting that COVID-19 had a direct impact on mental and psychological health. Further studies should analyze the factors that lead to depressive symptoms in young adults to prevent and manage depressive symptoms.

When comparing eating behaviors by level of depressive symptoms, the depressed group was more likely to be concerned with food combinations and to snack daily than was the nondepressed group. Considering the combination of food in the diet is a healthy eating behavior that leads to

Table 3. Eating habits of the subjects according to depressive symptom score

Characteristics	All subjects (n = 497)				Men (n = 246)				Women (n = 251)			
	Total	Nondepressed (n = 341)	Depressed (n = 156)	χ² (t)-value (P)	Total	Nondepressed (n = 187)	Depressed (n = 59)	χ² (t)-value (P)	Total	Nondepressed (n = 154)	Depressed (n = 97)	χ² (t)-value (P)
Mealtime (min)				0.61 (0.735)				5.47 (0.065)				1.74 (0.419)
< 10	57 (11.47)	41 (12.02)	16 (10.26)		42 (17.07)	31 (16.58)	11 (18.64)		15 (5.98)	10 (6.49)	5 (5.15)	
10–20	303 (60.97)	209 (61.29)	94 (60.26)		163 (66.26)	119 (63.64)	44 (74.58)		140 (55.78)	90 (58.44)	50 (51.55)	
≥ 20	137 (27.57)	91 (26.69)	46 (29.49)		41 (16.67)	37 (19.79)	4 (6.70)		96 (38.25)	54 (35.06)	42 (43.30)	
Eating out frequency				9.56 (0.089)				7.25 (0.202)				6.75 (0.240)
≥ Once/day	63 (12.68)	37 (10.85)	26 (16.67)		29 (11.79)	20 (10.70)	9 (15.25)		34 (13.55)	17 (11.0)	17 (17.53)	
5–6/week	62 (12.47)	47 (13.78)	15 (9.62)		29 (11.79)	22 (11.76)	7 (11.86)		33 (13.15)	25 (16.20)	8 (8.25)	
3–4/week	134 (26.96)	83 (24.34)	51 (32.69)		66 (26.83)	44 (23.53)	22 (37.29)		68 (27.09)	39 (25.3)	29 (29.90)	
1–2/week	173 (34.81)	127 (37.24)	46 (29.49)		87 (35.37)	71 (37.97)	16 (27.12)		86 (34.26)	56 (36.4)	30 (30.93)	
1–3/month	48 (9.66)	34 (9.97)	14 (8.97)		21 (8.54)	18 (9.63)	3 (5.08)		27 (10.76)	16 (10.40)	11 (11.34)	
Rarely	17 (3.42)	13 (3.81)	4 (2.56)		14 (5.69)	12 (6.42)	2 (3.39)		3 (1.20)	1 (0.70)	2 (2.06)	
Consideration of food combinations at meal				8.69 (0.013)				5.90 (0.052)				2.45 (0.293)
Not interested	224 (45.07)	168 (49.27)	56 (35.90)		134 (54.47)	107 (57.20)	27 (45.76)		90 (35.86)	61 (39.61)	29 (29.90)	
Sometimes	221 (44.47)	143 (41.94)	78 (50.00)		89 (36.18)	67 (35.83)	22 (37.29)		132 (52.59)	76 (49.35)	56 (57.73)	
Always	52 (10.46)	30 (8.80)	22 (14.10)		23 (9.35)	13 (6.95)	10 (16.95)		29 (11.55)	17 (11.04)	12 (12.37)	
Snacking frequency				21.20 (< 0.001)				7.00 (0.072)				10.21 (0.017)
Every day	129 (25.96)	72 (21.11)	57 (36.54)		44 (17.89)	27 (14.44)	17 (28.81)		85 (33.86)	45 (29.22)	40 (41.24)	
3–4/week	148 (29.78)	96 (28.15)	52 (33.33)		66 (26.83)	50 (26.74)	16 (27.12)		82 (32.67)	46 (29.87)	36 (37.11)	
1–2/week	139 (27.97)	108 (31.67)	31 (19.87)		86 (34.96)	69 (36.90)	17 (28.81)		53 (21.12)	39 (25.32)	14 (14.43)	
Rarely	81 (16.30)	65 (19.06)	16 (10.26)		50 (20.33)	41 (21.93)	9 (15.25)		31 (12.35)	24 (15.58)	7 (7.22)	
Eating place				1.73 (0.629)				2.41 (0.491)				2.46 (0.484)
House	246 (49.50)	170 (49.85)	76 (48.72)		101 (41.06)	80 (42.78)	21 (35.59)		145 (57.77)	90 (58.44)	55 (56.70)	
Cafeteria	175 (35.21)	120 (35.19)	55 (35.26)		108 (43.90)	82 (43.85)	26 (44.07)		67 (26.69)	39 (26.68)	29 (29.90)	
Eat out	50 (10.06)	36 (10.56)	14 (8.97)		24 (9.76)	17 (9.09)	7 (11.96)		26 (10.46)	19 (12.34)	7 (7.22)	
Others	26 (5.23)	15 (4.40)	11 (7.05)		13 (5.28)	8 (4.28)	5 (8.47)		13 (5.18)	7 (4.55)	6 (5.19)	

Values are presented as number (%). The depression score used to categorize the nondepressed and depressed groups is 16 points.

balanced nutrition. Furihata *et al.* [18] reported a greater incidence of depressive symptoms in subjects who had an unbalanced diet based on a self-assessment of their usual diet. Arusha and Biswas [26] reported that depressive symptom scores were significantly lower among those who self-reported balanced meals than among those who did not, but there was no significant association between balanced eating and depressive symptom scores. Previous studies have shown that lower levels of depressive symptoms are associated with favorable food combinations, which is different from the results of the present study. Previous studies, including our study, have used self-assessment of nutritional balance, which can be a limitation in objectively and equally comparing participants' eating habits and meal balance. It is also possible that the results of this study differed from those of previous studies because it was a cross-sectional study, and the depressed group did not include subjects with severe depressive symptoms. To verify the association between dietary balance and depressive symptoms, longitudinal studies with objective measures and subjects with varying levels of depression are required in the future.

Snacking is one of the most common eating behaviors associated with depressive symptoms, with frequent snackers reporting significantly more depressive symptoms than never snackers [18,19]. In this study, the depressed group had a higher rate of daily snacking than did the nondepressed group. It has been reported that snacking is often motivated by hunger, emotional emptiness, and habits rather than nutritional supplementation [27], and this purpose of snacking can involve choosing snack foods for palatability, increasing the consumption of sugary, salty, and fatty snacks [28]. In depressive symptoms, the consumption of palatable foods can reduce depressive feelings in the short term by moderating the reactivity of the pituitary-hypothalamic-adrenal axis and the cortisol stress response [29]. The physiological effects of snacking may be more sensitive in people with negative moods, so depressive symptoms may be dependent on snacking. However, frequent snacking can lead to excessive calorie intake

Table 4. NQ assessment of the subjects according to depressive symptom score

Characteristics	All subjects (n = 497)				Men (n = 246)				Women (n = 251)			
	Total	Nondepressed (n = 341)	Depressed (n = 156)	t/χ² value (P)	Total	Nondepressed (n = 187)	Depressed (n = 59)	t/χ² value (P)	Total	Nondepressed (n = 154)	Depressed (n = 97)	t/χ² value (P)
Balance	25.11 ± 13.92	25.45 ± 14.22	24.37 ± 13.26	0.81 (0.421)	24.63 ± 12.71	24.98 ± 13.03	23.53 ± 11.71	0.76 (0.448)	25.59 ± 15.02	26.04 ± 15.57	24.88 ± 14.16	0.59 (0.554)
Low	348 (70.02)	231 (67.74)	117 (75.00)	4.14 (0.126)	176 (71.54)	128 (68.45)	48 (81.36)	6.41 (0.024)[1]	172 (68.53)	103 (66.88)	69 (71.13)	0.51 (0.849)[1]
Medium	137 (27.57)	103 (30.21)	34 (21.79)		66 (26.83)	57 (30.48)	9 (15.25)		71 (28.29)	46 (29.87)	25 (25.77)	
High	12 (2.41)	7 (2.05)	5 (3.21)		4 (1.63)	2 (1.07)	2 (3.39)		8 (3.19)	5 (3.25)	3 (3.09)	
Moderation	57.06 ± 14.29	58.46 ± 14.43	54.01 ± 13.51	3.26 (0.001)	56.29 ± 14.11	57.09 ± 14.05	53.74 ± 14.10	1.60 (0.112)	57.83 ± 14.44	60.14 ± 14.74	54.17 ± 13.22	3.25 (0.001)
Low	368 (74.04)	241 (70.67)	127 (81.41)	8.92 (0.012)	188 (76.42)	141 (75.40)	47 (79.66)	1.21 (0.546)	180 (71.71)	100 (64.94)	80 (82.47)	10.90 (0.004)[1]
Medium	112 (22.54)	84 (24.63)	28 (17.95)		48 (19.51)	37 (19.79)	11 (18.64)		64 (25.50)	47 (30.52)	17 (17.53)	
High	17 (3.42)	16 (4.69)	1 (0.64)		10 (4.07)	9 (4.81)	1 (1.69)		7 (2.79)	7 (4.55)	0 (0.00)	
Practice	51.66 ± 17.83	51.14 ± 17.83	52.81 ± 15.57	-1.04 (0.299)	48.52 ± 17.83	47.87 ± 17.96	50.58 ± 14.10	-1.21 (0.230)	54.74 ± 18.04	55.11 ± 19.06	54.17 ± 16.36	0.40 (0.688)
Low	254 (51.11)	177 (51.91)	77 (49.36)	0.89 (0.641)	145 (58.94)	114 (60.96)	31 (52.54)	2.78 (0.249)	109 (43.43)	63 (40.91)	46 (47.42)	1.21 (0.545)
Medium	180 (36.22)	119 (34.90)	61 (39.10)		83 (33.74)	58 (31.02)	25 (42.37)		97 (38.65)	61 (39.61)	36 (37.11)	
High	63 (12.68)	45 (13.20)	18 (11.54)		18 (7.32)	15 (8.02)	3 (5.08)		45 (17.93)	30 (19.48)	15 (15.46)	
Total NQ	45.32 ± 10.91	45.63 ± 11.43	44.64 ± 9.66	1.00 (0.316)	43.69 ± 10.30	43.77 ± 10.84	43.41 ± 8.45	0.26 (0.794)	46.93 ± 11.26	47.90 ± 11.75	45.38 ± 10.30	1.73 (0.085)
Low	381 (76.66)	252 (73.90)	129 (82.69)	5.22 (0.074)	201 (81.71)	150 (80.21)	51 (86.44)	2.36 (0.450)[1]	180 (71.71)	102 (66.23)	78 (80.41)	5.91 (0.052)[1]
Medium	102 (20.52)	77 (22.58)	25 (16.03)		39 (15.85)	31 (16.58)	8 (13.56)		63 (25.10)	46 (29.87)	17 (17.53)	
High	14 (2.82)	12 (3.52)	2 (1.28)		6 (2.44)	6 (3.21)	0 (0.00)		8 (3.19)	6 (3.90)	2 (2.06)	

Values are presented as mean ± SD or number (%).
NQ, nutrition quotient.
The depression score used to categorize the nondepressed and depressed groups is 16 points.
[1]Fisher's exact test.

and decrease the overall quality of meals, so instead of indulging in snacking to alleviate depressive symptoms, it is important to promote healthy eating habits based on eating a variety of foods.

It has been reported that snacking is associated with a variety of factors, including obesity degree, energy intake, and meal patterns [30-32]. In this study, when the snacking frequency was compared between non-obese and obese subjects according to the degree of depressive symptoms, both groups showed significantly higher snacking frequency in the depressed group (data not shown). These results suggest that the difference in snacking frequency based on depressive symptom severity is not influenced by obesity. However, energy intake was not investigated or evaluated in this study. Therefore, our interpretation of the difference in snacking frequency by depressive symptom severity may be limited due to the lack of investigation data on energy intake and failure to adjust for various factors that could influence snacking behavior. Future studies should consider a variety of factors to explain this association and clarify a causal relationship between them.

In this study, overall dietary quality was evaluated using the NQ for Korean adults, and the NQ score was 45.32 out of 100, indicating a low grade. This score was also lower than that reported in previous studies that evaluated adults aged 19–64 yrs [22,33], indicating that the dietary quality of young adults is undesirable. In our study, when comparing the NQ scores according to depressive symptoms, the depressed group had significantly lower moderation scores than did the nondepressed group for all subjects and for women, while there were no significant differences in the balance and practice factors.

The moderation factor consisted of 6 items about the consumption of red meat, processed meat, spicy and salty brothy foods, fast food, fatty breads and sweets, and the frequency of overeating and/ or binge eating [22]. Among the 6 moderation items, the frequency of overeating and/or binge eating was significantly higher in the depressed group than in the nondepressed group ($P < 0.01$) (data not shown). Khosravi et al. [34] reported that individuals with dietary patterns that included red and processed meats were more likely to have depressive symptoms, and Liu et al. [35] reported that a higher frequency of sweets and fast food consumption was associated with higher depressive symptom scores. In addition, it has been reported that the frequency of overeating and/or bingeing is associated with emotional eating, which manifests as depressive symptoms and increased fat intake [36]. In this study, the depressed group had a higher rate of frequent overeating and/ or binge eating than did the nondepressed group, resulting in a lower moderation score than that of the nondepressed group. These results suggest that dietary guidance should be provided to improve dietary quality by controlling impulsive eating behaviors

and guiding appropriate food choices according to depressive symptoms in young adults in their 20s and 30s.

This study has strengths in that depressive symptom severity was assessed in young adults, and significant the differences in eating behaviors and dietary quality by depressive symptom severity were observed in a population with an increasing prevalence of depression. The findings of this study suggest the importance of eating habits and dietary quality in the prevention and management of depression in young adults, and these results can be used as scientific evidence for the association between depressive symptom severity and dietary lifestyle choices. Nevertheless, this study has several limitations. Firstly, as a cross-sectional study, there may not be enough evidence to infer the association between depressive symptoms and eating habits. Secondly, the study participants were limited to those living in a few regions of South Korea, which may not be representative of young adults. Thirdly, the CES-D, which assesses the severity of depressive symptoms, is a self-report questionnaire, which may have limitations for the diagnosis of depression. Lastly, the participants in this study were relatively homogeneous, but we did not include and control for a variety of confounding factors. Future structured investigations including intervention studies are needed to clarify these associations.

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