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Research article

A STUDY ON EATING HABITS, STRESS, ENDOCRINE DISRUPTOR EXPOSURE BEHAVIOUR AND PREMENSTRUAL SYNDROME IN FEMALE COLLEGE STUDENTS

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ABSTRACT

Premenstrual syndrome refers to a combination of physical, emotional, and behavioral symptoms that can interfere with daily life, which appear about 2 to 10 days before menstruation (the sulfur period after ovulation) and disappear just before or after menstruation. The purpose of this study is to investigate the relationship among the eating habits, stress, endocrine disruptor's exposure behavior and premenstrual syndrome of female college students. Data were collected from April 3 to April 20, 2019 using a structured questionnaire targeting 160 female college students who agreed to the purpose and procedure of the study. The collected data were analyzed for frequency, percentage, one way ANOVA, and Pearson correlation using the SPSS 25.0 program. As a result of the study, the average of female college students' eating habits, stress, endocrine disruptor exposure behavior and premenstrual syndrome were 2.51 points, 1.77 points, 2.72 points, and 2.08 points, respectively. As a result of the relationship analysis of the four research variables, premenstrual syndrome and dietary habits showed an inverse correlation ($r=-0.170$, $p=0.033$), and premenstrual syndrome and stress ($r=0.418$, $p<0.001$), Endocrine disruptors exposure behavior ($r=0.234$, $p=0.003$) showed a positive correlation. In addition, there was a negative correlation between eating habits and exposure behaviors of endocrine disruptors ($r=-0.393$, $p<0.001$), and there was a positive correlation between stress and endocrine disruptors exposure behavior ($r=0.229$, $p=0.001$).

KEYWORDS: Female college student, Eating habit, Stress, Premenstrual syndrome, Endocrine disruptor exposure behavior

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INTRODUCTION

Premenstrual syndrome refers to a combination of physical, emotional, and behavioral symptoms that can interfere with daily life, which appear about 2 to 10 days before menstruation (the sulfur period after ovulation) and disappear just before or after menstruation. More than 150-200 known symptoms are reported, and 80% of fertile women in Korea experience the premenstrual syndrome. About 5-10% of fertile women report the symptoms to be severe enough to interfere with their daily lives.[1,2] Symptoms were found to be severe by age, followed by female college students, middle-aged women, and high school students. The premenstrual syndrome (PMS) in female college students reduces academic efficiency and causes personal and social problems such as cheating, crimes or suicides in schools.[3,4] Factors influencing premenstrual syndrome (PMS) include health-related lifestyle habits such as exercise, smoking, drinking, sleeping time, excessive diet and nutrient intake, individual psychological and socio-cultural factors.

Looking at the dietary problems of Korean college students, unbalanced nutritional intake, lack of breakfast, snacks focused on calorie intake, excessive intake of dinner, irregular eating habits, unrestrained diet, and convenient dietary patterns are suggested. Since good nutrition in adolescence plays an important role in not only physical development, but also mental and emotional stability, a rational and nutritionally balanced diet is necessary. Nutritional imbalance and dietary problems are reported to have an effect on the occurrence of premenstrual syndrome in adolescent girls, and nutritional

Supplementation is suggested as the safest and most effective method for treating premenstrual syndrome. Also, the more severe the premenstrual syndrome, the more the appetite disappears or the appetite increases.

According to a survey by the Korean National Statistical Office, 64.5% of college students are under stress, and female college students experience more stress related to academic and family problems than male students. The recurring physical symptoms at the start of menstruation and the discomfort of decreased concentration is vulnerable to stress, suggesting that stress is a major related factor in premenstrual syndrome.[5,6,7] It affects the quality of life, physical, mental, and social health as well as health awareness.[8] Female college students have a relatively longer menstrual life than older women, and tend to tolerate their own premenstrual symptoms rather than seek treatment due to the prejudice against single women's visits to obstetrics. Therefore, it is more important for this age group to manage and study premenstrual symptoms.[9]

The endocrine disruptors are substances that interfere with the normal functioning of the endocrine system. The term endocrine disruptor is derived from the meaning that a chemical substance enters the body and acts like a hormone. It has a chemical structure similar to that of a hormone, so it interferes with normal hormone function and does not decompose and discharge. Because endocrine disruptors affect the hormonal system in the living body, even a very small amount can cause abnormalities in reproductive function, and the effects can be expressed in the

next generation. They are also called environmental hormones, the most common among them being bisphenols, polychlorinated biphenyls (PCB), dioxin from incinerators, alkyl phenols, plasticizers, and Styrofoam by-products such as styrene dimers and trimmers used in noodle cups.[10] Some substances are known to cause reproductive dysfunctions and deformities in wild animals or humans, and are reported to cause breast and reproductive organs cancers, endometriosis, uterine fibroma, and fibrous cytoplasm in the breast.[11] Endocrine disruptors are introduced into human body through various processes, such as with food that contains such substances or from food packaging containers, so they are related to dietary habits and can be considered as an influence factor for the premenstrual syndrome.[12] The endocrine disruptors are already deeply embedded in our lives, so it is quite difficult to fundamentally block them, and efforts should be made to minimize the exposure to them.

In this study, the eating habits, stress, endocrine disruptors, and premenstrual syndrome in female college students and the relationships between the four variables were investigated. It provides basic data for the development of health education programs that aim to help female college students alleviate discomfort during menstruation and form healthy habits.

The specific goals of this study are as follows:

1) Identify degree of the eating habits, stress, exposure to endocrine disruptors and premenstrual syndrome in the study participants.

2) Identify the differences in the eating habits, stress, endocrine disruptor's exposure behavior and premenstrual syndrome according to general characteristics for the study participants

3) Identify the relationships among the eating habits, stress, endocrine disruptor's exposure behavior and premenstrual syndrome.

MATERIAL AND METHODS

This study used a descriptive, cross-sectional design and self-reported questionnaire to identify the relationships between the exposure to endocrine disruptors and premenstrual syndrome among female college students. The subjects of this study were female students from three universities located in Busan who volunteered to participate after learning about the purposes and procedures of the study. In order to collect data, the researchers were required to prepare a structured questionnaire, explain the purpose and methods of the research to the students, and obtain a consent from the students who wanted to participate in the study. The data was collected from April 3 to April 20, 2019, and 157 cases out of a total of 160 cases were used for the final analysis, with three surveys being unclear.

The collected data was analyzed using IBM SPSS (IBM Corp., Armonk, NY, USA) Statistics for Window, version 25.0. The general characteristics of the participants were analyzed using descriptive statistics, and the degree of exposure to endocrine disruptors and premenstrual syndrome (PMS) were analyzed using the average and standard deviation. Differences in the eating habits, stress, endocrine disruptors, and premenstrual syndrome according to the general characteristics were analyzed with one-way ANOVA and independent t-test. The Pearson correlation analysis was performed to analyze the relationships among the four variables.

For the eating habits, the questionnaire provided by the public health center in Saha-gu, Busan was used (Nutritional Assessment, 2009). It consisted of 5 questions on regular eating habits, 11 questions on balanced eating habits, and 4 questions on diet and health, and a 5-point scale was used with 1 point for 'definitely not' and 5 points for 'very much'. The higher the score, the better the eating habits. In Hong Jong-Il's study, the reliability had the Cronbach's $\alpha = 0.722$, and in this study the Cronbach's $\alpha = 0.831$.

The stress survey was developed by Kim & Lee (1996), and a questionnaire modified and supplemented by Bae (2002) was used. The questionnaire had a total of 27 questions with 7 questions on domestic stress, 6 questions on friend-related stress, 3 questions on social and economic stress such as household income or lack of pocket money, and 4 questions on appearance. A 4-point scale was used, with 1 point assigned to "never", and 4 points to "always". The higher the score, the higher the stress. A total score of 54 points or less with an average of 2 points or less was classified as having no stress, and a score of 55 or more higher than the average of 2 was classified as having stress. The internal consistency reliability of this study has the Cronbach's α=0.876. In the previous study, the Cronbach's α=0.876, and in this study the Cronbach's α= 0.909.

The exposure behavior to endocrine disruptors was measured using behavioral tools for reducing exposure to environmental hormones developed by Kim Mi-ra and Kim Hyo-Jung. The scale consists of 23-item questionnaire scored using a Likert scale ranging from 1 (never) to 5 (always). All questions, except for the questions 17 and 22, were reversed, and the higher scores indicated more exposure to the endocrine disruptors. Exposure to endocrine disruptors was classified as a high risk for 5 and 4 points (70 to 115 points), medium risk for 3 points (47 to 69 points), and low risk for 1 and 2 points (23 to 46 points). The Cronbach's α for this study was 0.778.

The MDQ (Menstrual Discomfort Questionnaire) developed by Moss (1968) was used. The MDQ is a questionnaire that classifies premenstrual symptoms and indicates 47 negative symptoms that can measure severity. Pain (6 questions), concentration (8 questions), behavior change (5 questions), autonomic reaction (4 questions), water retention (5 questions), negative effect (8 questions), arousal (5 questions), and control (6 questions) make up a total of 47 questions in 8 areas (Table 1). The symptoms were classified as "Not at all" 1 point, "Not weak" 2 points, "There are symptoms, but they do not disrupt normal life" 3 points, "They interfere with normal life." 4 points, and 'is not active.' 5 points. A higher score indicated severe level of the premenstrual symptom. The risk for the premenstrual syndrome was classified as low for 1 to 94 points, medium for 95 to 141 points, and high for 142 points or more. The Cronbach's α for this study was .971.

Table 1. Menstrual Distress Questionnaire

Subarea	Symptoms	Number of item
pain	muscle stiffness, headache, cramps, backache, fatigue, general aches	6
concentration	lowered motor coordination, insomnia, forgetfulness, confusion, difficulty concentrating, distractible, accidents, lowered judge-	8

	ment	
behavior change	take naps, stay in bad, stay at home, avoid social activities, decreased efficiency, lowered school or work performance	5
autonomic reaction	dizziness faintness, cold sweats, nausea, vomiting, hot flashes	4
water retention,	swelling, skin disorders, painful breast, weight gain, diarrhea	5
negative affect,	crying, loneliness, restlessness, irritability, mood swings, depression, tension	8
arousal	affectionate, orderliness, excitement, feelings of well-being, bursts of energy	5
control	chest pains, ringing in the ears, feeling of suffocation heart pounding, numbness, blind spots	6
	Total	47

RESULTS

General and menstrual related characteristics

Table 2 shows the general characteristics and subjects related to menstruation.

The average age of the subjects was 21.44 years old, followed by 50 in the first grade (31.8%), 45 in the fourth grade (28.7%), 48 in the second grade (30.6%), and 14 in the third grade (8.9%). The average age at menarche was 13.3 years old, and the period of menstrual cycle was the highest with 94 (60.5%) on the 25th to 35th days, the least with 4 days (2.5%) on the 36th day, and the duration of menstruation was 122 with 4-6th days (77.0%), 26 (16.0%) over 7 days, and 6 (4.0%) within 3 days. 121 people (77%) answered that they do not take medicine when asked if they take pain medications during menstruation.

Table 2. General and Menstrual related Characteristics (N=157)

Characteristics	Category	N(%) or Mean(±SD)
age		21.44 ±3.65
	≤ 20	47(29.7)
	≥ 21	111(70.3)
grade	1st	50(31.8)
	2nd	48(30.6)
	3rd	14(8.9)
	4th	45(28.7)
menarche Age		13.29±1.297
menstrual cycle	≤24days	13(8.3)
	25~35days	94(60.5)
	≥36days	4(2.5)
	Irregular	44(28.7)
menstrual Period	≤3days	6(4.0)
	4~6days	122(77.0)
	≥7days	26(16.0)
	etc.	3(3.0)
use of analgesics	Yes	36(22.9)
	No	121(77.1)

Mean scores for the eating habits, stress, endocrine disruptor exposure behavior and premenstrual syndrome.

The average scores for eating habits, stress, exposure to endocrine disruptors, and premenstrual syndrome were 2.51 points, 1.77 points, 2.72 points, and 2.08 points, respectively.

In the case of endocrine disruptors, we have 3.28 in the high-risk group, 2.59 in the normal group, and 1.95 in the low-risk group. The average score for the premenstrual syndrome was 2.08 points, and the behavioral change was the highest at 2.70 points by sub-area, followed by negative emotion 2.57 points, pollination 2.23 points, pain 2.14 points, concentration 1.96 points, autonomous response 1.76 points, and control 1.57 points. And the arousal was the lowest with 1.49 points (Table 3).

Among the 23 items of exposure behavior of endocrine disruptors, the top five items with a high score for exposure behavior were 'I use shampoo when I wash my hair', 'A lot of detergents are used when washing dishes', 'I often eat fast food-like hamburgers and pizza', 'I often eat cup laymen on Styrofoam', 'I often drink commercial drinking water' (Table 4).

Table 3. Mean Score of Endocrine Disruptor Exposure Behavior and Premenstrual Syndrome (N=157)

Variables	N (%)	Mean±SD	Minimum Value	Maximum Value
eating habit		2.51±.54	1.25	3.90
stress		1.77±.44	0.96	3.00
endocrine disruptor exposure behavior		2.72±.43	1.83	3.78
high(≥ 70 score)	40(25.5)	3.28±.21	3.04	3.78
medium(47~69 score)	107(68.2)	2.59±.27	2.04	3.00
low(≤ 46 score)	10(3.3)	1.95±.04	1.83	2.00
premenstrual syndrome		2.08±.76	1.00	4.23
pain		2.14±.86	1.00	4.50
concentration		1.96±.94	1.00	4.88
change of behavior		2.70±1.18	1.00	5.00
autonomic reaction		1.76±.94	1.00	5.00
water retention		2.23±.93	1.00	4.80
negative affect		2.57±1.15	1.00	5.00
arousal		1.49±.68	1.00	5.00
control		1.57±.72	1.00	4.17

Table4. Mean Score by Item for endocrine disruptor exposure behaviors.

Items	Mean±SD
When cooking cup ramen, heat in a microwave oven	1.90±1.16
Fruits and vegetables are eaten without peeling	2.34±1.15
I often eat warm cans of vending machines	1.53±.75
Hair product spray is often used	1.59±.88
Merdury-containing waste batteries are disposed of with normal garbage	1.66±.93
I often use air freshener in my house or car	2.20±1.15
I often use plastic bowls when warming food in a microwave	2.20±1.15
Use a wrap when warming food in a microwave oven	2.28±1.19

I use many plastic meal tools	2.32±1.10
I often eat hot food in plastic bowls	2.26±1.08
I often drink commercial drinking water	3.12±1.15
I use spray insecticides to catch bug	2.52±1.18
Use food packing wraps when keeping food	3.01±1.15
when storing food in a refrigerator, place it in a plastic bowl	2.82±1.20
A lot of detergents are used when washing dishes	3.59±.96
I enjoy eating imported fruits such as bananas and oranges	3.05±1.07
I enjoy eating organic vegetables and fruits at home	2.58±1.10
I prefer bleached tissue rather than unbleached tissue paper	2.94±0.96
I often eat fast food-like hamburgers and pizza	3.41±1.00
I often drink coffee and sports drinks in cans	3.09±1.20
I often eat cup lamyeon on Styrofoam	3.20±1.19
I wear dry-clean clothes after drying with enough wind	2.50±1.06
I use shampoo when I wash my hair	4.75±0.61

Differences in the endocrine disruptor exposure behavior and premenstrual syndrome according to general and menstrual related characteristics.

There was no statistically significant difference in the endocrine disruptor exposure behavior according to the general characteristics of the subjects and the menstrual-related characteristics, and in the case of the premenstrual syndrome, there was a statistically significant difference in the presence or absence of analgesics (t=2.243, p=0.026) (Table 5).

Table5. Differences in Research Variables According to General Characteristics (N=157)

		Endocrine Disruptor Exposure Behavior		Premenstrual Syndrome	
		M±SD	F(p) /t(p)	M±SD	F(p)/ t(p)
age	≤ 20	2.70±.39	-0.400 (0.689)	1.98± 0.70	-0.970 (0.333)
	≥ 21	2.73±0.45		2.11± 0.79	
grade	1st	2.74±0.39	0.097 (0.962)	2.06±0.74	0.409 (0.747)
	2nd	2.72±0.44		2.07±0.81	
	3rd	2.76±0.46		1.89± 0.73	
	4th	2.70±0.47		2.14± 0.76	
menstrual cycle	24↓	2.57±0.51	1.202 (0.311)	2.26± 0.98	0.619 (0.604)
	25-35	2.72±0.42		2.09± 0.73	
	36↑	2.50±0.72		1.80± 0.77	
	irregular	2.79±0.42		1.99± 0.78	
menstrual Period	3↓	2.50±0.66	1.261 (0.986)	1.77± 0.77	0.986 (0.401)
	4-6	2.73±0.41		2.04± 0.74	
	7	2.70±0.46		2.26± 0.78	
	irregular	3.10±0.43		2.29± 1.45	
medication	yes	2.79±0.47	1.065 (0.289)	2.32± 0.80	2.243 (0.026)
	no	2.70±0.42		2.00± 0.74	

Differences in the eating habits and stress according to general and menstrual related characteristics

There was no statistically significant difference in the stress according to the general characteristics of the subjects and the menstrual-related characteristics, and in the case of the eating habit, there was a statistically significant differences according to grades. First grade than the grade 3 showed good eating habit (F=3.144, p=0.027) (Table 6).

Table 6. Differences in Research Variables according to General Characteristics (N=157)

		Eating Habit		Stress	
		M±SD	F(p) /t(p)	M±SD	F(p)/ t(p)
age	≤ 20	2.63±0.49	1.849 (0.057)	1.70± 0.35	-1.477 (0.142)
	≥ 21	2.46±0.55		1.87± 0.47	
grade	1st	2.57±0.51	3.144 (0.027)	1.69±0.35	1.241 (0.297)
	2nd	2.39±0.52		1.82± 0.52	
	3rd	2.25±0.46		1.69± 0.36	
	4th	2.51±0.54		1.84± 0.46	
menstrual cycle	24↓	2.65±0.63	1.645 (0.181)	1.71± 0.47	0.126 (0.945)
	25-35	2.52±0.50		1.77± 0.43	
	36↑	2.93±0.46		1.82± 0.41	
	irregular	2.41±0.59		1.79± 0.47	
menstrual Period	3↓	2.75±0.66	0.874 (0.456)	1.77± 0.77	0.113 (0.952)
	4-6	2.52±0.56		2.04± 0.74	
	7	2.45±0.40		2.26± 0.78	
	irregular	2.18±0.50		2.29± 1.45	
medication	yes	2.47±0.56	-0.441 (0.660))	1.87± 0.39	1.516 (0.132)
	no	2.52±0.53		1.74± 0.45	

Relationships among the eating habits, stress, endocrine disruptor exposure behavior and premenstrual syndrome.

There was a statistically significant difference in the premenstrual syndrome according to the risk of exposure to endocrine disruptors (F=5.273, p=0.006). Excluding the autonomic reaction and arousal regions, pain (F=3.274, p=0.041), concentration (F=5.426, p=0.005), and change of behavior (F=3.726, p=0.026), water retention (F=5.801, p=0.004), negative affect (F=3.899, p=0.022), control (F=5.188, p=0.007) in the sub-regions of premenstrual syndrome had statistically significant differences (Table 7).

As a result of the relationship analysis of the four researched variables, premenstrual syndrome and eating habits showed an inverse correlation (r=-0.170, p=0.033), and premenstrual syndrome and stress (r=0.418, p<0.001), and endocrine disruptors exposure behavior(r=0.234, p=0.003) showed a positive correlation. In addition, there was a negative correlation between eating habits and exposure to endocrine disruptors (r=-0.393, p<0.001), and there was a positive correlation between stress and exposure to endocrine disruptors (r=0.259, p=0.001)(Table 8).

Table 7 Differences in Premenstrual Syndrome According to Risk of Endocrine disruptor exposure behavior

Premenstrual Syndrome	Endocrine Disruptor Exposure Behavior			F(p)
	High risk	Medium risk	Low risk	
	M±SD	M±SD	M±SD	
Pain	2.43±1.06	2.04±0.76	1.93±0.26	3.274(0.041)
Concentration	2.37±1.12	1.80±0.81	1.88±1.17	5.426(0.005)
change of behavior	3.13±1.23	2.56±1.13	2.42±1.25	3.726(0.026)
autonomic reaction	2.06±1.19	1.66±0.84	1.60±0.48	2.722(0.069)
water retention	2.60±0.86	2.13±0.86	1.66±0.73	5.801(0.004)
negative affect	3.01±1.24	2.42±1.07	2.45±1.29	3.899(0.022)
arousal	1.50±0.60	1.45±0.63	1.96±1.25	2.541(0.082)
control	1.87±0.93	1.47±0.60	1.33±0.56	5.188(0.007)
total	2.40±0.89	1.96±0.69	1.93±0.63	5.273(0.006)

Table 8. Relation of , Stress, Diet Habit, Endocrine Disruptor Exposure Behaviors and Premenstrual Syndrome (N=157)

	Eating Habit	Stress	endocrine disruptor exposure behavior	premenstrual syndrome
Eating habit	1	NA	NA	NA
stress	-0.148(0.065)	1	NA	NA
endocrine disruptor exposure behavior	-0.393(<0.001)	0.259(0.001)	1	NA
premenstrual syndrome	-0.170(0.033)	0.418(<0.001)	0.234(0.003)	1

DISCUSSION

The averages for female college students' eating habits, stress, behavior caused by an exposure to endocrine disruptors, and premenstrual syndrome were 2.51, 1.77, 2.72, and 2.08 points, respectively. The mean score for the behavior caused by an exposure to endocrine disruptors in this study was 2.72 on average, it is higher than 2.68 in Chun Suk-hee's study[11] for college students and lower than 3.22 in the Kim Mira and Kim Hyo-jeong's study[12] and 2.81 point in the study by Kim Min-ah,[10] which surveyed nursing students. This result was supported by Hong Jong-Il's study,[13] which reported that female college students had a significantly higher risk of disorders than female high school students ($X2=32.978$, $p<0.001$). This may be caused by an increased awareness of the environmental hormones, but the possibility of exposure to environmental hormones has increased due to lifestyle changes in modern society. Agrochemicals, dioxins, bisphenol A, alkyl phenols, phthalates, styrene, and other endocrine disruptors come deep into our lives through various foods, incinerators, furniture, electronic products, plastic containers, receipts, synthetic detergent ramen containers, etc. Therefore, it is time to be alert to these harmful substances. It is known that the endocrine disruptors affect the reproductive system, the thyroid gland, and the pituitary gland, thus acting like estrogen or acting as anti-estrogen and affecting genital health.[14]

The average score for the premenstrual syndrome experienced by the subjects in this study was 2.08 points, compared to 2.67 points from Jung, Oh and Choi[15] using the same MDQ scale, and 2.75 points from Kim Hyun-young and Kim Sang-nam.[16] However it was higher than the score of 1.7, which was the result of Song et al.[17] In the sub-area, behavioral change was the highest with 2.70 points, and the arousal area was the lowest with 1.49 points, consistent with the findings of Choi, Lee, Ahn.[18] In the studies of Jung, Oh, Choi[15] and Song et al.,[17] the scores for the areas of pollination and pain were high, which is different from the results in this study. This is because the symptoms of the premenstrual syndrome are a very subjective, so it is thought that different results may appear in situations where it is difficult to ensure homogeneity between the study subjects and the study method. As a result of verifying the difference in premenstrual syndromes according to general characteristics and menstrual-related characteristics, there was a difference in the use of analgesics, and the group taking the medicine was found to experience more symptoms of premenstrual syndrome.

As a result of examining the relationship between the risks of premenstrual syndrome and eating habits, the premenstrual syndrome was severe in those who did not eat breakfast, and the risk of premenstrual syndrome was high in subjects who overeat, do not eat regularly, or eat out frequently. Similar to the results of this study, Lim found that those who binge eat when hungry had severe premenstrual syndrome.[19] Based on these findings, it is thought that the risk of the premenstrual syndrome will be lower if breakfast is not skipped and a balanced diet is maintained regularly.

Among the stress items, the premenstrual syndrome was more severe when the respondents were stressed by grades, excessive expectations of parents, or comparisons to the siblings. In addition, stress related to employment, entrance examinations, and economic factors was also found to affect the risk of the premenstrual syndrome. Sure, the majority of these stresses cannot be avoided during the growth process, but I think they need a positive attitude and active support from home, school, and society. In particular, since stress causes insufficient sleep or fatigue,[20] sufficient sleep and measures to relieve fatigue are required to relieve premenstrual syndrome.

As a result of examining the relationship between the exposure to endocrine disruptors and premenstrual syndrome, statistically significant differences in premenstrual syndrome depending on the exposure to endocrine disruptors were found. In addition, there was a significant positive correlation between the behavior caused by the exposure to endocrine disruptors and premenstrual syndrome. This was consistent with the findings of Hong Jong-il[13] who reported that the scores for the premenstrual syndrome increased as the scores for the exposure increased. It was found to support the results of Sung-hee Lee et al. who revealed that the behavior caused by the exposure to endocrine disruptors is a factor that influences the premenstrual syndrome in female college students.[21]

CONCLUSION

This study attempted to provide the basic data for the development of health education programs for the management of the PMS symptoms in female college students by examining the behavior caused by the exposure to endocrine disruptors in female college students and the degree of the premenstrual syndrome, and understanding the correlation between the variables. There were statistically significant differences in the premenstrual syndrome depending on the risk of an exposure to endocrine disruptors. In addition, there was a significant positive correlation between the exposure to endocrine disruptors and the premenstrual syndrome. Endocrine disruptors may pose a health threat to indi-

viduals or their offspring such as women's breast cancer, increased infertility and malformations, attention deficit, and increased number of children with learning disabilities. I think it is very important to remind female college students about the risks that endocrine disruptors pose to the endocrine system. Therefore, the premenstrual syndrome is a reproductive health problem that negatively affects daily life in women in their 20s, and it is necessary to include the importance of the endocrine disruptors to health education classes and to encourage reducing the exposures. Finally, since this study was conducted on female college students enrolled in universities in Busan, it cannot be concluded that the results will hold for young women in other regions. In addition, since the study was conducted in a retrospective self–report method, it is suggested that the research should include the observations during the menstrual cycle.

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