ORIGINAL PAPER

Mediating role of health literacy in self-care among female college students with menstrual symptoms: a cross-sectional study

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ABSTRACT

This study aimed to determine the mediating role of health literacy in self-care among female college students with menstrual symptoms. The participants were female students at Nagoya University who were aged ≥18 years, and 144 were included in the analysis. We used a questionnaire to investigate menstrual symptoms, self-care for menstruation, and their effect on daily life and health literacy. We defined high health literacy as scores equal to or above the median, and low health literacy as scores below the median, using the total score of the health literacy scale for female of reproductive age. In the high health literacy group, the intensity of menstrual pain and the Menstrual Distress Questionnaire score were significantly higher than those in the low health literacy group. The high health literacy group had significantly more regular menstrual cycles than the low health literacy group. The high health literacy group had a significantly higher rate of taking a contraceptive pill than the low health literacy group. The percentages of female students affected by menstrual symptoms during their academic studies and in non-physical leisure activities were significantly higher in the high health literacy group than in the low health literacy group. The high health literacy group also had significantly higher total self-care scores than the low health literacy group. Moreover, health literacy mediated the relationship between menstrual symptoms and self-care. These results suggest that health literacy is an important factor linking menstrual symptoms to self-care.

Keywords: health literacy, menstrual symptoms, self-care

Abbreviations:
eHEALS: eHealth Literacy Scale
HL: health literacy
MDQ: Menstrual Distress Questionnaire

INTRODUCTION

Menstrual distress symptoms include pain, water retention, autonomic reactions, mental distress, impaired concentration, behavioral changes, and arousal.[1] A study showed that 35.5% of female college students in Japan had their lives affected by menstrual symptoms.[2] Moreover, dysmenorrhea, which is included in menstrual-related symptoms, decreases quality of life and satisfaction with young female's academic performance.[3,4] Dysmenorrhea often leads to challenges in managing academic responsibilities at university because the pain can diminish concentration and productivity. Additionally, presenteeism caused by menstrual distress symptoms is recognized as a major issue.[5] These previous findings suggest that menstrual-related symptoms affect the lives of many female college students, which suggests that practicing self-care is important. The World Health Organization defines self-care as the ability of individuals, families, and communities to promote health, prevent disease, maintain health, and cope with illness and disability with or without the support of a health worker.[6] The most commonly used self-care strategies by female college students for managing primary dysmenorrhea include reducing physical activity (94.6%), and few seek medical advice for managing this condition (27.4%).[7] The primary dysmenorrhea consensus guideline[8] recommends continuous or extended use of combined hormonal contraceptives or regular exercise. Therefore, the self-care strategies used by female college students differ from those recommended in the guidelines. This difference suggests that the choice of self-care behaviors may be influenced by various factors including health literacy (HL).

HL is defined as the cognitive and social skills that determine the motivation and ability of individuals to gain access to, understand, and use information in ways that promote and maintain good health.[9] Yusefi et al[10] showed a positive correlation between HL and its dimensions with health-promoting behaviors. They suggested that improving HL in women can lead to a wide range of improvements in their status, including physical and mental health. Moreover, Japanese adults with lower HL levels are less likely to obtain the appropriate medical information.[11] However, women with high HL tend to take health-related actions, such as taking medicine or seeking medical services during menstrual abnormalities or premenstrual syndrome.[12] Additionally, a study showed a positive correlation between HL and academic performance.[13] Regarding the relationship between HL and menstrual symptoms in female college students, a study reported that the high HL group experienced stronger symptoms than the low HL group.[14] In this previous study, the authors believed that females in the high HL group were aware of their menstrual-related symptoms and sought solutions to alleviate them, which may have contributed to the increase in HL. However, to the best of our knowledge, no studies have investigated the role of HL as a mediator in the relationship between menstrual symptoms and self-care.

Therefore, this study aimed to determine the role of HL as a mediator in the relationship between menstrual symptoms and self-care related to menstruation in female college students. By clarifying this mediation effect, we aim to contribute to a deeper understanding of how HL facilitates self-care practices and to provide insights for future educational interventions that promote self-care related to menstrual symptoms.

MATERIALS AND METHODS

Ethics approval and consent to participate

The research ethics committee of Nagoya University Graduate School of Medicine approved the study (institutional review board [IRB] approval number: 23-508), and all subjects provided written informed consent before participation. This study met the guidelines of the Declaration

of Helsinki.

Participants

This cross-sectional study was performed from 9 June to 8 July, 2023. The inclusion criteria were female students at Nagoya University and an age ≥18 years. The exclusion criterion was students who had more than 90 days of amenorrhea. The participants were recruited using a bulletin board at Nagoya University. Some of the participants were selected using a convenience sampling method where no conflict of interest arose.

Measurements

We recorded the participants' characteristics, such as age, height, weight, academic major (medical vs non-medical), history of gynecological disease, intensity of menstrual pain (Numerical Rating Scale), frequency of menstrual pain, menstrual cycle, use of a contraceptive pill, gynecological consultation history, and application of menstrual management.

Menstrual symptoms were assessed by the Japanese version of the Menstrual Distress Questionnaire (MDQ). The MDQ consists of 54 questions on a 4-point scale. This scale was developed by Moos,[15] and the reliability and validity of the Japanese version has been verified by Akiyama and Kayashima.[16] The MDQ scores were summed, and we used the total score as an assessment of menstrual symptoms. A high MDQ score indicated that the participant was suffering from menstrual symptoms.

The severity of premenstrual syndrome symptoms was assessed using the Japanese Daily Records of Severity of Problems short-form version. This tool consists of 8 questions (4 items about psychological symptoms and 4 items about physical symptoms). All items are scored on a scale of 1 (not at all) to 6 (extreme). The reliability and validity on this scale has been verified by Ikeda et al.[17] The items were summed to calculate the total score.

We used the Self-Care Scale for Young Females with Dysmenorrhea as reported by Yamamoto.[18] This scale consists of 23 items and 6 factors. The 6 factors are as follows: (1) perception of self-efficacy; (2) intention to improve menstrual pain; (3) self-care that can be achieved by making lifestyle changes; (4) self-care using medicine; (5) expected level of burden needed to improve menstrual pain, and (6) feelings about self-care treatment. This scale uses the 5-step Likert scale, from the selections "It is very true" to "It is not true at all." The reliability and validity of this scale have been verified.[18] The scores were summed, and we used the total score as an assessment of self-care for menstrual symptoms. A high score indicated that the participant was able to perform self-care for menstrual symptoms.

We investigated whether menstrual symptoms affected the students' daily lives during the menstrual period, using the postmenstrual period as a baseline for comparison. We examined 4 items, namely (1) academic studies, (2) physical leisure activities, (3) non-physical leisure activities, and (4) part-time jobs. All items were scored on a scale of 1 (not at all) to 4 (extreme).

We evaluated HL specific to females using the health literacy scale for female of reproductive age. We also used the Japanese eHealth Literacy Scale (eHEALS) to evaluate ehealth literacy, which is defined as the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem. Each scale evaluates HL from a different perspective.[19]

In the health literacy scale for female of reproductive age, we included the following 3 categories: (1) female's choices and practices related to health information; (2) self-care during menstruation, and (3) knowledge of the female body. The original scale includes a fourth category of sexual health discussions with partners, but we excluded it because it is not directly related to menstruation. The reliability and validity of this scale have been verified by Kawata et al.[20]

These items were assessed on a 4-point sale of 1 (disagree) to 4 (agree).

Each item in the eHEALS uses a 5-point Likert scale to answer each question, with response options ranging from 1 (strongly disagree) to 5 (strongly agree). The reliability and validity of this scale have been verified by Mitsutake et al.[21]

In this study, the data were collected using a paper-based or web-based questionnaire using Google Forms (Alphabet, Mountain View, CA, USA). The response time was approximately 15 minutes, and there were no reports of fatigue or stress related to taking the questionnaire.

Analysis

We used the total score of the health literacy scale for female of reproductive age as the HL level. Respondents who reported HL scores equal to or greater than the median score were considered to have high HL, while those with scores lower than the median score were considered to have low HL. The distribution of continuous data was evaluated using the Shapiro–Wilk test. Normality distributed variables, such as height, body mass index, the HL total score, and the self-care total score, were compared by the t-test. Skewed data, such as age, weight, intensity of menstrual pain, and the total score of the eHEALS, were analyzed by the Mann–Whiteney U test. Categorical data, such as the academic major, frequency of menstrual pain, effects of menstrual symptoms on daily life, menstrual cycle, taking a contraceptive pill, gynecological consultation history, and application of menstrual management, were compared with the results of Pearson's chi-square test.

Data analyses were performed with EZR (Saitama Medical Center, Jichi Medical University, Japan). EZR is a modified version of R commander designed to add statistical functions frequently used in biostatistics. Differences were considered statistically significant at $p<0.05$.

SPSS 29.0 software (IBM Corp, Armonk, NY, USA) was used for a mediation analysis. We used the bootstrapping procedure in SPSS PROCESS macro4.0 to test for mediating effects and chose model 4. In this model, the MDQ score was the independent variable, self-care was the dependent variable, and HL was the mediating variable. With 5000 bootstrapping resamples, the direct, indirect, and total effects were estimated using a 95% bias-corrected confidence interval (CI). The effect was considered statistically significant if zero was not included in the 95% CI.

RESULTS

We assessed 250 female college students in Nagoya University for eligibility. A total of 190 female college students agreed to participate in this study. Three females were excluded because of having amenorrhea for more than 90 days. Furthermore, participants with no responses (n=28) and incomplete responses (n=15) were excluded, resulting in a final sample size of 144 for the analysis (Fig. 1).
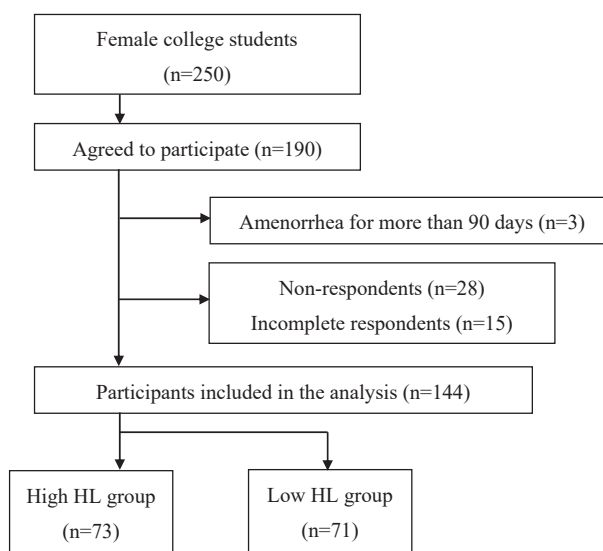
Fig. 1 Flowchart of the participants

HL: health literacy

A sample size of 144 had a post hoc power of 100% for linear multiple regression with a significance level of p<0.05.

In the total HL score of females in reproductive age, the mean score was 56 (standard deviation = 8.5) and the median was 56. The high HL group had a significantly higher score of intensity of menstrual pain (p=0.03), higher total score of HL in females of reproductive age (p<0.01), and higher total score of the eHEALS (p<0.01) than the low HL group (Table 1). The high HL group also had a significantly higher proportion of respondents with a regular menstrual cycle than the low HL group (p=0.03). The high HL group had a significantly higher percentage of taking a contraceptive pill than the low HL group (14% vs 3%, p=0.04).

Table 1 Participants' characteristics

	All (n=144)	Low HL group (n=71)	High HL group (n=73)	p
Age (years)	20 (18–23)	20 (18–23)	20 (18–22)	0.83[a]
Height (cm)	158±5.2	158±5.3	158±5.0	0.43[b]
Weight (kg)	50 (39–65)	50 (39–65)	50 (40–60)	0.74[a]
Body mass index (kg/m^2)	20.0±1.8	20.0±1.84	20.0±1.73	0.92[b]
Academic major				
Medical	107 (74)	54 (38)	53 (37)	0.78[c]
Non-medical	37 (26)	17 (12)	20 (14)	
History of gynecological disease				
Yes	2 (1)	1 (1)	1 (1)	1[c]
Intensity of menstrual pain	4 (0–10)	4 (0–8)	5 (0–10)	0.03[a]

Frequency of menstrual pain				
Every time	65 (45)	24 (17)	41 (28)	0.59[c]
Sometimes	45 (31)	27 (19)	18 (13)	
Few	28 (19)	16 (11)	12 (8)	
Not at all	6 (4)	4 (3)	2 (1)	
Menstrual cycle				
≤24 days	6 (4)	3 (2)	3 (2)	0.03[c]
25 to 38 days	110 (76)	48 (33)	62 (43)	
≥39 days	4 (3)	1 (1)	3 (2)	
Irregular	19 (13)	15 (10)	4 (3)	
Not aware/do not understand	5 (3)	4 (3)	1 (1)	
Taking a contraceptive pill				
Yes	12 (8)	2 (1)	10 (7)	0.04[c]
Gynecological examination history				
Yes	54 (38)	22 (15)	32 (22)	0.16[c]
Application of menstrual management				
Yes	78 (54)	35 (24)	43 (30)	0.32[c]
HL score	56±8.6	49±5.3	63±5.3	<0.01[b]
eHEALS score	26 (9–39)	25 (9–32)	28 (12–39)	<0.01[b]

Data are presented as the median (range) n (%), or mean ± standard deviation.
eHEALS: eHealth literacy scale
HL: health literacy
[a]Analyzed using the Mann–Whiteney U-test for comparisons between the low and high HL groups; [b]analyzed using the t-test for comparisons between the two groups; [c]analyzed using the chi-square test for comparisons between the two groups.

The high HL group had significantly higher scores in the MDQ (p<0.01), a higher total score of the Daily Records of Severity of Problems short-form (p=0.04), and higher psychological symptoms scores of the Daily Records of Severity of Problems short-form (p=0.04) than the low HL group (Table 2). The percentage of respondents whose menstrual symptoms affected academic studies and non-physical leisure activities was significantly higher in the high HL group than in the low-HL group (p<0.05 and p<0.01, respectively). Additionally, the high HL group had a significantly higher self-care total score than the low HL group (p<0.01).

A multiple regression analysis was constructed using self-care as the dependent variable (Table 3). No multicollinearity was observed among the independent variables included in the model (Variance Inflation Factor <10). The MDQ, frequency of menstrual pain, application of menstrual management, taking a contraceptive pill, HL, and eHEALS were the independent variables. The overall model fit was assessed using the F-test, which indicated a significant relationship between the dependent variable and the independent variables (adjusted R-squared=0.30, F=11.0, p<0.01). Among the independent variables, HL had a significant positive effect on self-care (β=0.22, p=0.01). Similarly, the frequency of menstrual pain showed a significant positive effect on self-care (β=0.22, p<0.01).

Table 2 Comparison of menstrual-related symptoms, premenstrual syndrome symptoms, effects of menstrual symptoms on daily life, and self-care between the two HL groups

	All (n=144)	Low HL group (n=71)	High HL group (n=73)	p
MDQ total score	28 (0–111)	21 (1–99)	34 (0–111)	<0.01[a]
Daily Records of Severity of Problems total score	17 (8–46)	16 (8–41)	20 (8–46)	0.04[a]
Psychological symptoms	7 (3–22)	6 (3–18)	7 (4–22)	0.04[a]
Physical symptoms	10 (4–24)	9 (4–24)	11 (4–24)	0.10[a]
Effects of menstrual symptoms on daily life				
Academic studies[†]	107 (74)	47 (66)	60 (82)	<0.05[a]
Physical leisure activities[†]	99 (69)	45 (63)	54 (74)	0.21[a]
Non-physical leisure activities[†]	62 (43)	23 (32)	39 (53)	0.01[a]
Part-time jobs[†]	85 (59)	41 (58)	44 (60)	0.87[a]
Self-care total score	71±12	67±11	74±11	<0.01[b]

Data are presented as the median (range), n (%), or mean ± standard deviation.
HL: health literacy
MDQ: menstrual distress questionnaire
[†]Data show the number of respondents who answered "2–4"; [a]analyzed using the Mann–Whitney U-test for comparisons between the low and high HL groups; [b]analyzed using the t-test for comparisons between the two groups.

Table 3 Multiple regression analysis of self-care for menstruation

Variables	β	t	p	95% CI
MDQ	0.15	1.82	0.07	−0.006–0.142
Frequency of menstrual pain	0.22	2.75	0.01	0.802–4.921
Application of menstrual management	0.14	1.90	0.06	−0.132–6.718
Taking the contraceptive pill	0.12	1.60	0.11	−1.153–11.062
HL	0.22	2.58	0.01	0.069–0.526
eHEALS	0.13	1.60	0.11	0.060–0.561

eHEALS: eHealth literacy scale
HL: health literacy
MDQ: menstrual distress questionnaire
β: standardized coefficient
Adjusted R-squared = 0.30, F=11.04, p<0.01.

To investigate the mediating effect of HL, a bootstrap test with 5000 random samples was performed. There were significant effects of the MDQ on HL (path a, β=0.33) and HL on self-care (path b, β=0.33). The standardized coefficients of the total (path c) and direct effects (path c') of the MDQ on self-care were 0.39 and 0.28, respectively. The standardized coefficient of the indirect effect of the MDQ on self-care via HL (path a×b) was 0.11, and the 95% CI did not include zero, which indicated that the mediating effect was significant. HL partially mediated the relationship between MDQ and self-care, with a mediating effect of 28.1% of the total effect (Table 4). A path diagram of the mediating effect of HL is shown in Fig. 2.

Table 4 Results of the mediation analysis

Path a β (p)	Path b β (p)	Total effect (path c') β (p)	Direct effect (path c) β (p)	Indirect effect (path a×b) β (95% CI)	Percentage of the direct effect	Percentage of the indirect effect
0.33 (<0.01)	0.33 (<0.01)	0.39 (<0.01)	0.28 (<0.01)	0.11 (0.04–0.20)	71.9%	28.1%

β: standardized coefficient
CI: confidence interval
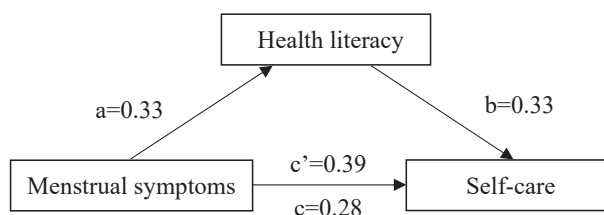
Fig. 2 Path diagram of the mediating effect of HL between menstrual symptoms and self-care
HL: health literacy

DISCUSSION

This study showed an association between HL and self-care related to menstruation among female college students and examined the mediating role of HL. We found that HL was positively associated with self-care and that HL mediated the relationship between menstrual distress and self-care. These findings indicate that HL specific to females is a key factor involved in self-care for menstrual symptoms.

In this study, the median score of the health literacy scale for female of reproductive age was 56 points, which is slightly higher than that in previous studies of female medical students (median score, 53 points).[14] Majeed-Saidan et al reported that medical students sought gynecological treatments more frequently and used medications at a higher rate to alleviate symptoms than non-medical students.[22] Our study included medical students and non-medical students as participants and their HL scores were compared between faculties. However, no significant difference in HL scores was found between these 2 groups of students. Therefore, in contrast to previous studies, medical students and non-medical students had high HL.

The rate of taking a contraceptive pill was significantly higher in the high HL group than

in the low HL group. According to the United Nations, the rate of using a contraceptive pill in Japan is 2.9%, which includes use for contraception, and the rate of this pill specifically for alleviating menstrual symptoms is unclear.[23] In the gynecology clinical guidelines,[24] the use of low-dose estrogen–progestin combination therapy for functional dysmenorrhea is rated as Grade B. Individuals in the high HL group may have obtained information suggesting that taking a contraceptive pill can alleviate menstrual symptoms, which could have led to a higher proportion of users.

Regarding the association between HL and menstrual symptoms, we found that the high HL group showed stronger menstrual symptoms than the low HL group. A previous study that focused on medical students also reported a similar result to that in our study.[14] The participants in the high HL group were aware of their menstrual symptoms, and seeking solutions to alleviate these symptoms may have contributed to their higher HL.

In our study, a significantly higher proportion of respondents reported that menstrual symptoms affected their academic studies and non-physical activities in the HL group than in the low HL group. A meta-analysis[25] comprising 38 studies including 21,573 young women showed that the academic effect was significant, with 20.1% reporting absences from school or university because of dysmenorrhea (n=19, n=11,226, 95% CI 14.9–26.7), and 40.9% reporting negative effects on class performance or concentration (n=10, n=5,126, 95% CI 28.3–54.9). These results suggest the requirement for an educational environment that considers absences or early departures due to menstrual symptoms.

In this study, the multiple regression analysis showed that self-care was significantly affected by the frequency of menstrual pain and HL. These results indicate that effective self-care for menstruation requires emphasizing HL related to female-specific health information, rather than simply relying on information obtained from the internet. Additionally, the mediation analysis showed that HL significantly mediated the relationship between menstrual symptoms and self-care. These results indicate the effectiveness of improving HL. Previous research has suggested the importance of acquiring and using literacy related to symptoms and coping,[26] and our study supports this importance. Furthermore, these results suggest that improving HL in the school education environment is crucial for managing menstrual symptoms and promoting self-care. In particular, the implementation of comprehensive health education programs that include knowledge and coping strategies related to menstruation is essential. Evidence to support providing these programs was provided by a study on menstrual education for high school students, which reported a behavioral change in self-care practices among those experiencing menstrual pain.[27] In addition, improvements in university regulations and environments are also necessary. There have been positive developments, such as the Ministry of Education, Culture, Sports, Science and Technology (MEXT) stating in the guidelines for university entrance examinations that considerations should be made to ensure that applicants are not disadvantaged by the number of days they miss owing to menstrual-related symptoms. In the future, implementing flexible responses to absences and early departures due to menstrual symptoms, providing private rest spaces to ensure privacy, and establishing a system where medical consultation and support can be accessed when needed will be necessary.

This study has several limitations. First, the generalizability of this study is limited because of its small sample size and it was conducted at a single university. Second, this study adopted a cross-sectional study design. Therefore, causal relationships cannot be determined. Third, this study did not investigate the use of medications other than a contraceptive pill. Fourth, an examination of mediating factors other than HL in the relationship between menstrual symptoms and self-care was not conducted. Future surveys should investigate other medical choices and investigate other mediating factors in the relationship between HL and self-care.

In conclusion, this study shows that HL is positively associated with self-care, and HL mediates the association between MDQ and self-care. These results suggest that HL is an important factor linking menstrual symptoms to self-care.

ACKNOWLEDGMENTS

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