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Prevalence of Dysmenorrhea and Its Correlating Lifestyle Factors in Japanese Female Junior High School Students

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Dysmenorrhea is a common menstrual disorder experienced by adolescents, and its major symptoms, including pain, adversely affect daily life and school performance. However, little epidemiologic evidence on dysmenorrhea in Japanese adolescents exists. This cross-sectional study aimed to determine the prevalence of and identify factors associated with dysmenorrhea in Japanese female junior high school students. Among 1,167 girls aged between 12 and 15 years, 1,018 participants completed a questionnaire that solicited information on age at menarche, menstruation, and lifestyle, as well as demographic characteristics. Dysmenorrhea was defined based on menstrual pain using a Visual Analog Scale (VAS), with moderate or severe (moderate-severe) dysmenorrhea, which adversely affects daily life, defined as VAS ≥ 4, and severe dysmenorrhea defined as VAS ≥ 7. The prevalence of moderate-severe dysmenorrhea was 476/1,018 (46.8%), and that of severe dysmenorrhea was 180/1,018 (17.7%). Higher chronological and gynecological ages (years after menarche) were significantly associated with a higher prevalence of dysmenorrhea regardless of severity (P for trend < 0.001). In addition, short sleeping hours (< 6/day) were associated with moderate-severe dysmenorrhea (OR = 3.05, 95%CI: 1.06-8.77), and sports activity levels were associated with severe dysmenorrhea (P for trend = 0.045). Our findings suggest that dysmenorrhea that adversely affects daily activities is highly prevalent, and may be associated with certain lifestyle factors in junior high school students. Health education teachers should be made aware of these facts, and appropriately care for those suffering from dysmenorrhea symptoms, absentees, and those experiencing difficulties in school life due to dysmenorrhea symptoms.

Keywords: adolescent; cross-sectional studies; dysmenorrheal; menstrual pain; prevalence
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Introduction

Menstrual disorders present a major health problem among adolescent girls because they influence not only future fertility, but also mental health and quality of life. Dysmenorrhea, defined by painful uterine cramps that precede and accompany menses (Sultan et al. 2012), is a common menstrual disorder experienced by adolescents. The etiology of primary dysmenorrhea includes an excess or imbalance in the amount of prostaglandin secretion from the endometrium during menstruation (Harada 2013). Major symptoms, including pain, adversely affect daily life and school performance. In fact, dysmenorrhea is the leading cause of recurrent short-term school absenteeism among female adolescents (Harel 2008).

Previous epidemiologic studies have reported high prevalence rates of dysmenorrhea that ranged between 43% and 91% in adolescent girls (Sultan et al. 2012). A number of studies have targeted young women, including older adolescents (i.e., high school students), as well as older women, but only a few studies have targeted younger adolescents, i.e., junior high school students (aged 12-15 years) (Ju et al. 2014). Although a nationwide survey of dysmenorrhea was previously conducted in Japan, the survey did not report on the prevalence of dysmenorrhea among teenagers (Osuga et al. 2005). Age at menarche has been decreasing over the last several decades, and the current mean menarcheal age in Japan is 12.2 years (Hinobayashi 2010). This highlights the importance of studies targeting dysmenorrhea in younger adolescents.

From a preventive perspective, risk factors for dysmenorrhea should be identified. Previous studies have shown that lifestyle factors, including physical activity and diet, are related to the condition in adolescents (French 2008; Harel 2008). These findings were based on high school and university students, however, and few studies

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have targeted younger adolescents.

This study aimed to determine the prevalence of and factors associated with dysmenorrhea in Japanese female junior high school students. The findings described herein should be useful for addressing dysmenorrhea and its related problems in school life.

Subjects and Methods

Participants and procedure

This was a cross-sectional study targeting female junior high school students in Ojiya City, Kawaguchi Town, Uonuma City, Minamiuonuma City, and Tokamachi City, in Niigata Prefecture, Japan, where there is a total of 29 junior high schools. We invited all 29 schools to participate, and 28 schools agreed. A total of 2,819 female students attended the 28 schools.

We distributed an anonymous self-administered questionnaire to the 2,819 students during classroom hours between October 2012 and March 2013 after the homeroom teacher or health education teacher explained the purpose of the study. It was emphasized that participation in the study was completely voluntary. Students returned the questionnaires in sealed envelopes to ensure confidentiality. Neither the questionnaire nor the envelope included any means of identification. Of the 2,819 students, 1,167 (41.4%) agreed to participate in the survey. Among these, the following students were excluded: 94 premenarcheal students, 7 students with incomplete demographic or menstrual information, and 13 students whose body mass index (BMI) exceeded ± 3 standard deviations (cutoff values of 11.9 and 27.7 kg/m^2) because extreme leanness or obesity may be associate with endocrine disorders. Of the remaining 1,053 students, 35 did not answer questions regarding pain, and thus were also excluded. Ultimately, data from 1,018 students were analyzed. The protocol for this study was approved by the Ethics Committee of Niigata University School of Medicine.

Questionnaire

The questionnaire solicited information on age, age at menarche, school year, height, weight, menstruation, and lifestyle. Regarding menstruation, students were asked to report the first and final dates of the last 3 consecutive menstruations, yielding a menstrual cycle and period. Students were also asked if they experienced any physical pain during the last 3 consecutive menstrual cycles, and evaluated degrees of pain using a Visual Analog Scale (VAS). VAS is a simple, validated method to record subjective estimates of pain intensity (McDowell and Newell 1996), and has been used in a number of dysmenorrhea studies. In the present study, dysmenorrhea was considered in terms of experiencing pain which makes activities of daily living difficult, and was defined as VAS ≥ 4, which has been used in several dysmenorrhea studies worldwide (Banikarim et al. 2000; Ortiz et al. 2009; Ozerdogan et al. 2009). Severe dysmenorrhea was defined as VAS ≥ 7 (Aubrun et al. 2003), which may require medical treatment (VAS 4-6 was considered moderate dysmenorrhea). In this paper, we use a term "moderate-severe dysmenorrhea" which means moderate or severe dysmenorrhea. Regarding lifestyle, the times of waking and going to bed were also reported, and the number of hours of sleep was calculated from this information. Habitual breakfast, lunch, and supper were classified as 1) everyday, 2) sometimes, and 3) none. Sports club activities (hours per week), excluding physical education classes at school, were reported as hours per day multiplied by frequency per week.

Statistical methods

Prevalence of dysmenorrhea was calculated, and compared according to levels of predictor variables by odds ratios (ORs) calculated with logistic regression analysis. In this analysis, BMI was divided into quartiles. With respect to "sports club activity," more than half of the students had zero hours, and thus this item was divided into four groups, i.e., the 0-hour-group and tertiles (low, medium, high) of those who partake in sports club activities. ORs, unadjusted and adjusted for gynecological age (years after menarche), were calculated with simple and multiple logistic regression analyses, respectively. A linear trend of ORs according to levels of predictors was tested by logistic regression analysis. SPSS (version 21, SPSS Inc., Chicago, IL, USA) was used for statistical analyses. $P < 0.05$ was considered statistically significant.

Results

Mean age, menarcheal age, height, weight, and BMI were 14.3 years (SD, 0.9), 12.1 years (SD, 1.0), 1.56 m (SD, 0.06), 47.5 kg (SD, 6.4), and 19.6 kg/m^2 (SD, 2.2), respectively. Mean gynecological age, menstrual cycle, and menstrual period were 2.3 years (SD, 1.2), 34.2 days (SD, 7.9), and 6.7 days (SD, 1.5), respectively. The prevalence of moderate-severe dysmenorrhea was 476/1,018 (46.8%), and that of severe dysmenorrhea was 180/1,018 (17.7%) (Table 1).

Regarding dietary habits, 931 (91.5%) students had breakfast every day, 69 (6.8%) had breakfast sometimes, and 18 (1.8%) did not have breakfast at all; all students ate lunch at school; and 983 (96.6%) students had supper every day, 29 (2.8%) had supper sometimes, and 6 (0.6%) did not have supper at all. Mean hours of sports club activities were 4.7 (SD, 6.6) per week, with 519 students (49.7%) having engaged in no such activity. Mean time of waking was 06:39 (SD, 45 min), mean bedtime was 23:09 (SD, 51 min), and mean hours of sleep was 7.5 (SD 0.8).

The prevalence and ORs of dysmenorrhea according to chronological age, gynecological age, menstrual cycle, and menstrual period are shown in Table 1. Higher chronological and gynecological ages were associated with a higher prevalence of dysmenorrhea, regardless of severity, but menstrual cycle length and menstrual period were not.

The prevalence and ORs of moderate-severe dysmenorrhea (VAS ≥ 4) according to levels of predictor variables are shown in Table 2. Having breakfast less frequently tended to be associated with moderate-severe dysmenorrhea with marginal significance (adjusted P for trend = 0.088), but having supper was not (data not shown in Table 2). Bedtime tended to be associated with dysmenorrhea (adjusted P for trend = 0.094), and the < 6-hour-sleep group had a significantly higher prevalence of dysmenorrhea (OR = 3.05) than the ≥ 8-hour-sleep group (reference group).

The prevalence and ORs of severe dysmenorrhea (VAS ≥ 7) according to levels of predictor variables are shown in Table 3. Higher levels of sports club activities were significantly associated with a lower prevalence of severe dysmenorrhea (adjusted P for trend = 0.045), with

Table 1. Prevalence and odds ratios (ORs) of dysmenorrhea according to age and menstrual characteristics (n = 1,018).

	Prevalence of dysmenorrhea[a] (%)	Odds ratio (95% CI)	Prevalence of severe dysmenorrhea[b] (%)	Odds ratio (95% CI)
Age (years)		P for trend < 0.001		P for trend < 0.001
12	24/76 (31.6)	1 (reference)	6/76 (7.9)	1 (reference)
13	128/324 (39.5)	1.42 (0.83-2.41)	39/324 (12.0)	1.60 (0.65-3.92)
14	170/338 (50.3)	2.19 (1.29-3.72)	66/338 (19.5)	2.83 (1.18-6.80)
15	154/280 (55.0)	2.65 (1.55-4.54)	69/280 (24.6)	3.82 (1.59-9.17)
Subtotal	476/1,018		180/1,018	
Gynecological age (years since menarche)		P for trend < 0.001		P for trend < 0.001
< 1	40/149 (26.8)	1 (reference)	8/149 (5.4)	1 (reference)
1	119/282 (42.2)	1.99 (1.29-3.07)	40/282 (14.2)	2.91 (1.33-6.40)
2	126/251 (50.2)	2.75 (1.77-4.26)	51/251 (20.3)	4.49 (2.07-9.76)
3	119/207 (57.5)	3.69 (2.34-5.81)	48/207 (23.2)	5.32 (2.43-11.63)
≥ 4	62/100 (62.0)	4.45 (2.58-7.65)	29/100 (29.0)	7.20 (3.13-16.56)
Subtotal	466/989		176/989	
Menstrual cycle length*	P for trend = 0.550	P for trend = 0.332		
< 25 days	17/48 (35.4)	1 (reference)	9/48 (18.8)	1 (reference)
25-38 days	356/738 (48.2)	1.70 (0.92-3.12)	135/738 (18.0)	0.97 (0.46-2.05)
≥ 39 days	49/108 (45.4)	1.51 (0.75-3.06)	15/108 (13.9)	0.70 (0.28-1.73)
Subtotal	422/894		159/894	
Menstrual period*		P = 0.648		P = 0.377
1-2 days	–	–	–	–
3-7 days	297/645 (46.0)	1 (reference)	110/645 (17.1)	1 (reference)
≥ 8 days	117/245 (47.8)	1.07 (0.80-1.4)	48/245 (19.6)	1.19 (0.81-1.73)
Subtotal	414/890		158/890	

Subtotal numbers of participants vary due to missing values in the questionnaire.
*Classified according to the definition set forth by the Japan Society of Obstetrics and Gynecology.
[a]VAS ≥ 4.
[b]VAS ≥ 7.

the highest activity group having a significantly lower prevalence (OR = 0.59) than the "zero" activity group (reference group).

Discussion

To our knowledge, this is the first epidemiologic study on dysmenorrhea to specifically target female junior high school students (aged 12-15 years), i.e., early-stage adolescents. Dysmenorrhea in this study was defined as experiencing moderate-severe menstrual pain, which adversely affects daily activities. Although a number of epidemiologic studies on dysmenorrhea have been conducted, most did not evaluate the degree of menstrual pain, but rather included all menstrual pain (including mild pain), which resulted in very high prevalence rates of dysmenorrhea (Sultan et al. 2012). Indeed, if we were to include any degree of menstrual pain, the prevalence of dysmenorrhea in our study would have been 72.8%. In our view, moderate-severe menstrual pain requires relief and prevention, and thus we focused on dysmenorrhea associated with moderate-severe menstrual pain.

We retrieved articles documenting the prevalence of moderate-severe dysmenorrhea in younger adolescents, diagnosed by methods that evaluated the degree of menstrual pain (Banikarim et al. 2000; Agarwal and Venkat 2009; Eryilmaz et al. 2010; Parker et al. 2010; Rigon et al. 2012; Pitangui et al. 2013) (Table 4). The prevalence of moderate-severe dysmenorrhea reported in these studies ranged from 49% to 75%. The prevalence in our study population was 46.8%, which is lower than the rates reported in these previous reports, and could be attributed to our younger study population.

The prevalence of dysmenorrhea increased with age (31.6% for 12-year-olds, 39.5% for 13-year-olds, 50.3% in 14-year-olds, and 55% in 15-year-olds; Table 1). This is comparable to data reported by Agarwal and Venkat (2009), which reported prevalences of 43.6%, 47.2%, 62.7%, and 62.4%, respectively. These data collectively suggest that the prevalence of dysmenorrhea steeply increases in girls in the junior high school age group. We also found that the prevalence of dysmenorrhea is more strongly associated with gynecological age than chronological age (Table 1).

Table 2. Prevalence and odds ratios (ORs) of moderate-severe dysmenorrhea (VAS ≥ 4) according to levels of predictor variables (n = 1,018).

	n	Patients	Prevalence (%)	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)
BMI (kg/m^2)				P for trend = 0.043	P for trend = 0.779
Quartile 1 (< 18.0)	221	93	42.1	1 (reference)	1 (reference)
Quartile 2 (≥ 18.0, < 19.0)	199	94	47.2	1.23 (0.84-1.81)	0.94 (0.62-1.42)
Quartile 3 (≥ 19.0, < 21.0)	301	142	47.2	1.23 (0.87-1.74)	0.91 (0.62-1.34)
Quartile 4 (≥ 21.0)	240	125	52.1	1.50 (1.04-2.16)	0.94 (0.62-1.34)
Breakfast				P for trend = 0.039	P for trend = 0.088
Eat every day	931	426	45.8	1 (reference)	1 (reference)
Eat sometimes	69	39	56.5	1.54 (0.94-2.52)	1.32 (0.79-2.21)
Do not eat	18	11	61.1	1.86 (0.72-4.85)	2.07 (0.73-5.89)
Sports club activity (hours/week)†				P for trend = 0.013	P for trend = 0.513
None	519	258	49.7	1 (reference)	1 (reference)
Low (> 0, < 5.4)	149	73	49.0	0.97 (0.68-1.40)	1.05 (0.72-1.54)
Medium (≥ 5.4, < 10.7)	152	66	43.4	0.78 (0.54-1.12)	1.00 (0.68-1.47)
High (≥ 10.7)	198	79	39.9	0.67 (0.48-0.94)	0.85 (0.60-1.22)
Bedtime				P for trend = 0.002	P for trend = 0.094
-23:00	750	332	44.3	1 (reference)	1 (reference)
23:01-24:00	223	114	51.1	1.32 (0.98-1.78)	1.13 (0.83-1.55)
24:01-	44	29	65.9	2.43 (1.28-4.61)	1.82 (0.94-3.51)
Time of waking				P for trend = 0.140	P for trend = 0.573
-6:00	446	195	43.7	1 (reference)	1 (reference)
6:01-7:00	556	274	49.3	1.25 (0.97-1.61)	1.14 (0.88-1.48)
7:01-	13	5	38.5	0.80 (0.26-2.50)	0.49 (0.14-1.72)
Hours of sleep (/day)				P for trend = 0.040	P for trend = 0.377
< 6	20	15	75.0	3.86 (1.38-10.79)	3.05 (1.06-8.77)
≥ 6, < 7	110	50	45.5	1.07 (0.71-1.63)	0.85 (0.55-1.32)
≥ 7, < 8	416	205	49.3	1.25 (0.96-1.63)	1.29 (0.99-1.70)
≥ 8	471	206	43.7	1 (reference)	1 (reference)

*Adjusted for gynecological age (years since menarche).
†Activity levels > 0 were divided into tertiles.

Chan et al. (2009) reported similar results, finding that the prevalence of dysmenorrhea in girls in Hong Kong continued to increase from gynecological ages 1 to 7.

Sports club activity levels were found to be inversely associated with the prevalence of severe dysmenorrhea (P for trend = 0.045). Exercise is generally expected to relieve the symptoms of dysmenorrhea. One plausible explanation is that aerobic exercises work by shunting blood flow away from the viscera, resulting in less congestion of blood in the pelvic area during the menstrual phase (Daley 2008). A number of observational and intervention studies have demonstrated the effectiveness of exercise in alleviating dysmenorrhea. However, an association between physical activity levels and dysmenorrhea has yet to be established (Daley 2008). In observational studies specifically targeting adolescents, the association is less likely (Wilson et al. 1984; Teperi and Rimpelä 1989; Lee et al. 2006; Blakey et al. 2010). In contrast to these studies, we found that sports activity levels were associated with severe dysmenorrhea, although they were not associated with overall dysmenorrhea. This finding has implications in that exercise may relieve severe menstrual pain.

We also found that short sleeping hours (< 6 hours) (OR = 3.05) and staying up late at night (P for trend = 0.094, marginal significance) were associated with the prevalence of dysmenorrhea. Gagua et al. (2012) reported similar results, in which shortened sleeping time was associated with primary dysmenorrhea in adolescents. Sleep affects the onset of puberty by altering the pattern of melatonin secretion (Crowley et al. 2007). In this context, short sleeping time or a late bedtime may affect dysmenorrhea and its symptoms. However, caution should be exercised when considering causality. Indeed, dysmenorrhea itself might obstruct normal sleep. Given the cross-sectional

Table 3. Prevalence and odds ratios (ORs) of severe dysmenorrhea (VAS ≥ 7) according to levels of predictor variables (n = 1,018).

	n	Patients	Prevalence (%)	Unadjusted OR (95% CI)	Adjusted OR* OR (95% CI)
BMI (kg/m^2)				P for trend = 0.148	P for trend = 0.448
Quartile 1 (< 18.0)	221	34	15.4	1 (reference)	1 (reference)
Quartile 2 (≥ 18.0, < 19.0)	199	34	17.1	1.13 (0.67-1.91)	0.76 (0.43-1.33)
Quartile 3 (≥ 19.0, < 21.0)	301	59	19.6	1.34 (0.84-2.13)	0.91 (0.55-1.51)
Quartile 4 (≥ 21.0)	240	48	20.0	1.38 (0.85-2.23)	0.70 (0.39-1.24)
Breakfast				P for trend = 0.056	P for trend = 0.135
Eat every day	931	158	17.0	1 (reference)	1 (reference)
Eat sometimes	69	17	24.6	1.60 (0.90-2.84)	1.48 (0.81-2.70)
Do not eat	18	5	27.8	1.88 (0.66-5.35)	1.69 (0.52-5.50)
Sports club activity (hours/week)†				P for trend < 0.001	P for trend = 0.045
Zero	519	111	21.4	1 (reference)	1 (reference)
Low (> 0, < 5.4)	149	27	18.1	0.81 (0.51-1.30)	0.86 (0.53-1.40)
Medium (≥ 5.4, < 10.7)	152	21	13.8	0.59 (0.36-0.98)	0.83 (0.49-1.41)
High (≥ 10.7)	198	21	10.6	0.44 (0.27-0.72)	0.59 (0.35-0.99)
Bedtime				P for trend = 0.033	P for trend = 0.455
-23:00	750	123	16.4	1 (reference)	1 (reference)
23:01-24:00	223	43	19.3	1.22 (0.83-1.79)	1.02 (0.68-1.52)
24:01-	44	13	29.5	2.14 (1.09-4.20)	1.44 (0.70-2.96)
Time of waking				P for trend = 0.035	P for trend = 0.136
-6:00	446	66	14.8	1 (reference)	1 (reference)
6:01-7:00	556	110	19.8	1.42 (1.02-1.98)	1.34 (0.95-1.90)
7:01-	13	3	23.1	1.73 (0.46-6.44)	0.88 (0.18-4.34)
Hours of sleep (/day)				P for trend = 0.755	P for trend = 0.315
< 6	20	6	30.0	1.95 (0.73-5.21)	1.33 (0.46-3.87)
≥ 6, < 7	110	19	17.3	0.95 (0.55-1.64)	0.73 (0.41-1.29)
≥ 7, < 8	416	70	16.8	0.92 (0.65-1.30)	0.92 (0.65-1.31)
≥ 8	471	85	18.0	1 (reference)	1 (reference)

*Adjusted for gynecological age (years since menarche).
†Activity levels > 0 were divided into tertiles.

Table 4. Previously reported prevalence of moderate-severe dysmenorrhea in adolescent girls.

Authors	Year of publication	Country	Subject age (years)	Sample size	Evaluation of dysmenorrhea	Prevalence (%)
Banikarim	2000	USA	14-17	706	VAS	75
Agarwal	2009	Singapore	12-19	5,561	Other	62
Eryilmaz	2010	Turkey	15-18	1,408	Facial pain rating scale*	49
Parker	2010	Australia	15-19	1,051	Numeric rating scale	70
Rigon	2012	Italy	13-21	4,892	Other	56
Pitangui	2013	Brazil	12-17	174	Numeric rating scale	66

VAS, visual analogue scale.
*"Even more" pain or higher is considered moderate-severe pain.

design of the current study, causality could not be determined, and this represents a limitation of the study.

The present study showed a tendency for participants who regularly skip breakfast to suffer from dysmenorrhea (P for trend = 0.088). This finding is consistent with that of Fujiwara and Nakata's (2010) study demonstrating that

female college students who skip breakfast have a significantly higher degree of dysmenorrheal symptoms than those who eat breakfast. In the present study, nearly 10% of participants did not eat breakfast every day. Skipping breakfast among teenagers has been on an increasing trend over the last decade (Ministry of Health, Labour and Welfare, Japan 2014), and is a growing health problem in adolescents. While the mechanisms underlying the adverse effects of skipping a meal are unclear, they may relate to the inadequate intake of certain foods. For example, many studies have reported that low intake of certain polyunsaturated fatty acids (Tokuyama and Nakamoto 2011; Hansen and Knudsen 2013), which have anti-inflammatory effects, may enhance pain. In addition, low intake of dairy products (Abdul-Razzak et al. 2010) and dietary fiber (Nagata et al. 2005) may relieve dysmenorrheal pain. Studies to identify dietary factors that affect dysmenorrheal pain are warranted.

The present study has several limitations. First, the study used a cross-sectional design, which cannot determine causal relationships. In the context of this study, for example, the identified risk factors may have been caused by dysmenorrhea symptoms. A longitudinal study should be conducted to address this issue. Second, the participation rate was not sufficiently high, and thus generalization of our results should be made with caution. For example, it is possible that girls without dysmenorrhea may not have been interested in participating in the study. These methodological limitations should be addressed in future studies. Finally, we could not differentiate between primary and secondary dysmenorrhea, although secondary dysmenorrhea in adolescence is considered rare (Proctor and Farquhar 2006; Harada 2013).

The present epidemiologic study of dysmenorrhea among Japanese adolescents yielded several new findings. The prevalence of moderate-severe dysmenorrhea in junior high school girls was as high as 46.8%, and increased with increasing gynecological age. In addition, sports activity levels, short sleeping hours, and skipping breakfast (marginal significance) were associated with dysmenorrhea in this population. In conclusion, dysmenorrhea which adversely affects daily activities is highly prevalent, and may be associated with lifestyle factors among female junior high school students. Junior high school teachers, especially those in charge of health education, should be made aware of these facts, and appropriately care for those suffering from dysmenorrhea symptoms, absentees, and those experiencing difficulties in school life due to the symptoms.

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Conflict of Interest

The authors declare no conflict of interest.

References

Abdul-Razzak, K.K., Ayoub, N.M., Abu-Taleb, A.A. & Obeidat, B.A. (2010) Influence of dietary intake of dairy products on dysmenorrhea. *J. Obstet. Gynaecol. Res.*, **36**, 377-383.

Agarwal, A. & Venkat, A. (2009) Questionnaire study on menstrual disorders in adolescent girls in Singapore. *J. Pediatr. Adolesc. Gynecol.*, **22**, 365-371.

Aubrun, F., Langeron, O., Quesnel, C., Coriat, P. & Riou, B. (2003) Relationships between measurement of pain using visual analog score and morphine requirements during postoperative intravenous morphine titration. *Anesthesiology*, **98**, 1415-1421.

Banikarim, C., Chacko, M.R. & Kelder, S.H. (2000) Prevalence and impact of dysmenorrhea on Hispanic female adolescents. *Arch. Pediatr. Adolesc. Med.*, **154**, 1226-1229.

Blakey, H., Chisholm, C., Dear, F., Harris, B., Hartwell, R., Daley, A.J. & Jolly, K. (2010) Is exercise associated with primary dysmenorrhoea in young women? *BJOG*, **117**, 222-224.

Chan, S.S., Yiu, K.W., Yuen, P.M., Sahota, D.S. & Chung, T.K. (2009) Menstrual problems and health-seeking behaviour in Hong Kong Chinese girls. *Hong Kong Med. J.*, **15**, 18-23.

Crowley, S.J., Acebo, C. & Carskadon, M.A. (2007) Sleep, circadian rhythms, and delayed phase in adolescence. *Sleep Med.*, **8**, 602-612.

Daley, A.J. (2008) Exercise and primary dysmenorrhoea: a comprehensive and critical review of the literature. *Sports Med.*, **38**, 659-670.

Eryilmaz, G., Ozdemir, F. & Pasinlioglu, T. (2010) Dysmenorrhea prevalence among adolescents in eastern Turkey: its effects on school performance and relationships with family and friends. *J. Pediatr. Adolesc. Gynecol.*, **23**, 267-272.

French, L. (2008) Dysmenorrhea in adolescents: diagnosis and treatment. *Paediatr, Drugs*, **10**, 1-7.

Fujiwara, T. & Nakata, R. (2010) Skipping breakfast is associated with reproductive dysfunction in post-adolescent female college students. *Appetite*, **55**, 714-717.

Gagua, T., Tkeshelashvili, B. & Gagua, D. (2012) Primary dysmenorrhea: prevalence in adolescent population of Tbilisi, Georgia and risk factors. *J. Turk. Ger. Gynecol. Assoc.*, **13**, 162-168.

Hansen, S.O. & Knudsen, U.B. (2013) Endometriosis, dysmenorrhoea and diet. *Eur. J. Obstet. Gynecol. Reprod. Biol.*, **169**, 162-171.

Harada, T. (2013) Dysmenorrhea and endometriosis in young women. *Yonago Acta Med.*, **56**, 81-84.

Harel, Z. (2008) Dysmenorrhea in adolescents. *Ann. NY Acad. Sci.*, **1135**, 185-195.

Hinobayashi, T. (2010) Puberty and environment: an evolutionary developmental view. *Annu. Res. Rep.* (*The Foundation for Growth Science*), **33**, 229-232 (in Japanese).

Ju, H., Jones, M. & Mishra, G. (2014) The prevalence and risk factors of dysmenorrhea. *Epidemiol. Rev.*, **36**, 104-113.

Lee, L.K., Chen, P.C., Lee, K.K. & Kaur, J. (2006) Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore Med. J.*, **47**, 869-874.

McDowell, I. & Newell, C. (1996) *Measuring Health: A Guide to Rating Scales and Questionnaires*, 2nd ed., Oxford University Press, New York, NY.

Ministry of Health, Labour and Welfare, Japan (2014) *The National Health and Nutrition Survey in Japan, 2012*. Ministry of Health, Labour and Welfare, Tokyo, Japan (in Japanese).

Nagata, C., Hirokawa, K., Shimizu, N. & Shimizu, H. (2005) Associations of menstrual pain with intakes of soy, fat and dietary fiber in Japanese women. *Eur. J. Clin. Nutr.*, **59**, 88-92.

Ortiz, M.I., Rangel-Flores, E., Carrillo-Alarcón, L.C. & Veras-

Godoy, H.A. (2009) Prevalence and impact of primary dysmenorrhea among Mexican high school students. *Int. J. Gynaecol. Obstet.*, **107**, 240-243.

Osuga, Y., Hayashi, K., Kobayashi, Y., Toyokawa, S., Momoeda, M., Koga, K., Yoshino, O., Tsutsumi, O., Hoshiai, H., Terakawa, N. & Taketani, Y. (2005) Dysmenorrhea in Japanese women. *Int. J. Gynaecol. Obstet.*, **88**, 82-83.

Ozerdogan, N., Sayiner, D., Ayranci, U., Unsal, A. & Giray, S. (2009) Prevalence and predictors of dysmenorrhea among students at a university in Turkey. *Int. J. Gynaecol. Obstet.*, **107**, 39-43.

Parker, M.A., Sneddon, A.E. & Arbon, P. (2010) The menstrual disorder of teenagers (MDOT) study: determining typical menstrual patterns and menstrual disturbance in a large population-based study of Australian teenagers. *BJOG*, **117**, 185-192.

Pitangui, A.C., Gomes, M.R., Lima, A.S., Schwingel, P.A., Albuquerque, A.P. & de Araújo R.C. (2013) Menstruation disturbances: prevalence, characteristics, and effects on the activities of daily living among adolescent girls from Brazil. *J. Pediatr. Adolesc. Gynecol.*, **26**, 148-152.

Proctor, M. & Farquhar, C. (2006) Diagnosis and management of dysmenorrhoea. *BMJ*, **332**, 1134-1138.

Rigon, F., De Sanctis, V., Bernasconi, S., Bianchin, L., Bona, G., Bozzola, M., Buzi, F., Radetti, G., Tatò, L., Tonini, G., De Sanctis, C. & Perissinotto, E. (2012) Menstrual pattern and menstrual disorders among adolescents: an update of the Italian data. *Ital. J. Pediatr.*, **38**, 38.

Sultan, C., Gaspari, L. & Paris, F. (2012) Adolescent dysmenorrhea. *Endocr. Dev.*, **22**, 171-180.

Teperi, J. & Rimpelä, M. (1989) Menstrual pain, health and behaviour in girls. *Soc. Sci. Med.,* **29**, 163-169.

Tokuyama, S. & Nakamoto, K. (2011) Unsaturated fatty acids and pain. *Biol. Pharm. Bull.*, **34**, 1174-1178.

Wilson, C., Emans, S.J., Mansfield, J., Podolsky, C. & Grace, E. (1984) The relationships of calculated percent body fat, sports participation, age, and place of residence on menstrual patterns in healthy adolescent girls at an independent New England high school. *J. Adolesc. Health Care*, **5**, 248-253.