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Quality of life of adolescents with menstrual problems in Klang Valley, Malaysia: a school population-based cross-sectional study

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ABSTRACT

Objective To describe the prevalence of menstrual problems (heavy menses bleeding, dysmenorrhoea and oligomenorrhoea) and its impact towards quality of life among adolescents in Klang Valley, Malaysia.

Design Cross-sectional study.

Setting Adolescent girls at secondary schools in the Klang Valley, Malaysia.

Population 729 adolescents aged between 13 and 18 years.

Method A questionnaire survey using Menorrhagia Questionnaire and Paediatric Quality of Life-Teen Report Ages 13–18 (PedsQL).

Main outcome measures Self reports of menstrual bleeding patterns, morbidities and effect on quality of life.

Results The prevalence of menstrual problems among adolescents was 63.9% in the Klang Valley. Adolescents with menstrual problems had significant lower mean total score of PedsQL (70.23±13.53 vs 76.36±14.93, p=0.001), physical health summary score (74.10±16.83 vs 79.00±15.86, p<0.001) and psychosocial health summary score (68.05±14.27 vs 73.21±13.09, p=0.001) compared with those without menstrual problem. Adolescents experiencing heavy menses bleeding had the lowest physical and emotional function. Those with oligomenorrhoea had the lowest social function, whereas those with dysmenorrhoea had the lowest school function. Cigarette smoking, alcohol and medical illness had lower health-related quality of life, whereas taking oral contraceptive pills for menstrual problems was associated with higher scores in these adolescents.

Conclusion Menstrual problems among adolescents have a significant impact on their quality of life. It is probably wise to screen them at the school level, to identify those with low functional scores and to refer them for proper management at a tertiary adolescent gynaecology centre.

INTRODUCTION

Menstrual problems among adolescent females are common. It is estimated that 75% of them would experience some disorders associated with menstruation.[1] The most common menstrual problems among adolescents worldwide are heavy menses bleeding

Strengths and limitations of this study

► This was the largest school population-based cross-sectional study been conducted to evaluate the quality of life of adolescents with menstrual problems in Malaysia.

► This was the first study conducted in Malaysia among adolescents using Paediatric Quality of Life-Teen Report Ages 13–18 (PedsQL).

► This study used PedsQL, a better tool to reflect impact of menses problems to adolescents, particularly in social and school function.

► Confounding factors were further analysed to give a clearer picture regarding the impact on health-related quality of life among adolescents with menstrual problems.

► The study focused only at urban area, and the findings might not be applicable to the whole adolescents' population in Malaysia.

(HMB), oligomenorrhoea, dysmenorrhoea, amenorrhoea and premenstrual syndrome.

HMB is defined as excessive blood loss more than 80 mL per menses and accounts for a substantial proportion of healthcare resources among females of reproductive age. Although approximately 30% of adult females reported problem of HMB, its prevalence among adolescents varied worldwide, ranged from 10% to 30%.[2 3] HMB requires medical intervention as increased blood loss may be indicative of a serious disease that requires urgent intervention. However, even in the absence of a medical problem, help is warranted because of the disability that a woman experiences as a consequence of menstrual periods.

Dysmenorrhoea affects 60%–93% of adolescents and is characterised by recurrent cramping abdominal pain associated with nausea.[4 5] More than half of these girls missed school as a consequence of this problems.[5] Dysmenorrhoea and HMB were associated

with poor academic performance and limitation in outdoor activities whereas amenorrhoea was associated with low self-esteem.[6–10]

Although effective therapies for menstrual disorders exist, most of adolescents do not recognise their menses problems as a treatable medical conditions and do not always discuss their problems with healthcare providers.[11] Only about 2% of teenagers in USA received information regarding menstruation from their healthcare providers.[12] In Malaysia, only 11.1% of adolescents sought medical consultation for their menstrual disorders.[7]

In recent times, the concept of 'quality of life' has been used to quantify the effect of disease to patients.[13] Menstruation-related problems contribute to school absenteeism and significantly add to the problems faced by adolescents and their families during this complicated phase of development. The age of menarche continues to decrease in this population, and hence increase the possibility that menstrual-associated morbidities may have a greater negative impact in their lives.[14] Hence, it is important to study the effects of menstrual disorders among adolescents.

To date, most published literatures looked into the prevalence of menstrual disorders among adolescents. However, only a few studies have investigated the quality of life of adolescents with menstrual disorders.[15–17] These studies used the Medical Outcome Survey 36-item short form health survey and Child Health Questionnaire—Child Self Report Form to assess the quality of life among young females with specific menstrual problems. Although they demonstrated the negative impact on their lives, neither of these tools included the impact on school performance and activities, which is an integral part of an adolescent's life.

Therefore, this study was designed to determine the prevalence of menstrual disorders and to evaluate the quality of life scores among adolescents with menstrual problems at Klang Valley in Malaysia. Besides that, the study also aimed to identify predictors of low quality of life scores in these adolescents. This may help clinicians to identify adolescents at risk of poor quality of life and improve the identified modifiable predictors or factors.

METHODS
Participants and recruitment
The study was conducted over a period of 1 year, involving 1050 adolescents aged 13–18 years old from 20 selected secondary schools in Klang Valley, Malaysia. The 20 schools were randomly selected from 207 schools by computer generated randomisation. Sample size was calculated by using Kish formula with prevalence of menstrual disorder among adolescents of 75%. The total sample required was 750 adolescents. The study was conducted in the selected schools with the permission of the school principal and class teachers. The adolescents were selected by simple randomisation method. They were given the information sheet and parental consent form 1 week before the

questionnaire was provided. Only those who returned the parental consent form were recruited. They were given 30 min to complete the self-administered questionnaire. Those with intellectual disability, inadequate reading skills or significant psychiatric problem, and those who were known to be pregnant or had previously been pregnant were excluded from this study.

Questionnaire
For the purpose of this study, the original Menorrhagia Questionnaire (MQ) in English was translated into three languages (Bahasa Malaysian, Mandarin and Tamil) by the Malaysian Translators Association, a certified professional body in Malaysia for the purpose of translation or interpretation of any document into multiple languages. The Paediatric Quality of Life-Teen Report Ages 13–18 (PedsQL) has a validated questionnaire in Malay, Mandarin and Tamil. It was used with the permission of the Mapi Research Trust, Lyon, France.

The MQ is a 13-items questionnaire designed by Ruta et al.[18] However, only the first seven questions of this tool were used to classify the type of menstrual problem in this study. The PedsQL is a brief 23-item multidimensional instrument designed by Varni et al for measuring paediatric health-related quality of life (HRQL).[19] It consists of four parts: (1) physical functioning with eight items, (2) emotional function with five items, (3) social function and (4) school function, both with five items, respectively. The validity of PedsQL is well established.[20] The instructions asked how much a problem each item posed over the past month. The response scale used a 5-point Likert-type format ranging from 0 to 4, in which 0 indicated never a problem while 4 indicated almost always a problem. The raw score for each item was reverse-scored (0=100, 1=75, 2=50, 3=25 and 4=0) and transformed to a scale of 0–100, with higher scores indicating better HRQL.[20] The total score was presented as mean score, computed as the sum of items divided by the number of items assessed by all scales. The Physical Health Summary score consisted of 8 items as similar as physical function part, while the Psychosocial Health Summary score included 15 items from emotional function, social and school function.

Data on the demographic information were incorporated into the questionnaire. The data collection process was piloted with 50 adolescents at a secondary school selected at random. This was undertaken to confirm the length of time required to complete the questionnaire and to refine the contents and process based on feedback from the participants. From the pilot study, the Cronbach alpha was 0.812 with no negative feedback received. The questionnaire took about 20 min to complete with no difficulties. Therefore, the study was commenced 1 week after the pilot test.

Data analysis
All data were collected in an electronic database and analysed using SPSS V.23.0. Mean was used for normally distributed continuous variables and analysis of variance

Table 1 Demographic data of the study population (N=729)

Variables	n	%
Race		
Malay	453	62.1
Chinese	210	28.8
Indian	57	7.8
Others	9	1.2
Religion		
Buddhist	187	25.7
Christian	36	4.9
Hindu	48	6.6
Islam	457	62.7
Sikh	1	0.1
Siblings		
0	25	3.4
1–3	326	44.7
>3	378	51.9
BMI		
<20 underweight	431	59.1
20–24.9 normal	225	30.9
25–29.9 overweight	54	7.4
>30 obese	19	2.6
Job		
Part-time	39	5.3
Not working	690	94.7

All data are presented in frequency (%).
BMI, body mass index.

Table 2 Social characteristics of the study population (N=729)

Variables	n	%
Cigarette		
Never	697	95.6
Once or twice	11	1.5
Once in a while but not regularly	17	2.3
Regularly in the past	4	0.5
Cigarette in 30 days		
Not at all	719	98.6
Less than one cigarette per day	5	0.7
1–5 cigarettes per day	3	0.4
6–9 cigarettes per day	1	0.1
20 or more cigarettes per day	1	0.1
Alcohol		
Never	678	93.0
Once	20	2.7
Twice	11	1.5
3–5 times	9	1.2
6–9 times	1	0.1
10 or more times	10	1.4
Involved in sexual relationship		
Yes	21	2.9
No	708	97.1
Contraception		
Yes	5	0.7
No	724	99.3
Taken oral contraception pills for menstrual problems		
Yes	28	3.8
No	701	96.2

All data are presented in frequency (%).

test was used to compare mean score for PedsQL. SD, a summary measure of the differences of each observation from the mean, was also calculated. Logistic regression analysis was used to determine the predictor factors for HRQL.

Patient and public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this study.

RESULTS

A total of 1050 adolescents were approached with all parent consented to participate in this study. Only 729 adolescents (69.4%) completed and returned the questionnaire for analysis. A total of 89 adolescents (8.5%) did not return the questionnaire and 232 (22.1%) returned incomplete questionnaire.

The demographic characteristics of sample population are presented in table 1. The majority of the sample population were Malays (62.1%), followed by Chinese (28.8%), Indian (7.8%) and others (1.2%). Surprisingly, more than half (59%) of the respondents were underweight, with only 31% of them had a normal body mass index (BMI). About 5.3% of the sample population were working part-time to support the family, after school and during the weekends.

Table 2 shows the social characteristics of the study population. In the sample population, 95.6% did not smoke. The majority of them (93.0%) did not take alcohol in the past 2 weeks. Twenty-one adolescents (3%) from the sample population were involved in a sexual relationship. Only 5 (0.7%) of the sexually active adolescents practised contraception.

A large proportion of adolescents had learnt about menstruation from their mothers (78.3%) and from school (49.3%). About 25%–30% of them had gained knowledge from friends and books or magazines. The use of the internet among adolescents as the source of information was low at 3.4%, and a very small percentage (1.7%) learnt about menstruation from their fathers. The majority of the sample population (94%) had no medical problems. The most common medical problem seen

Table 3 Sociodemographic of adolescents with menstrual problems

	HMB (n=205)	Dysmenorrhoea (n=225)	Amenorrhoea/ oligomenorrhoea (n=36)	P value
Age (years) mean±SD	15.71±1.41	15.81±1.69	15.42±1.40	0.608
Ethnicity				
Malay	140 (46.8%)	140 (46.8%)	19 (6.4%)	0.047
Chinese	48 (41.1%)	53 (45.2%)	16 (13.7%)	
Indian	16 (35.6%)	28 (62.2%)	1 (2.2%)	
Others	1 (20.0%)	4 (80.0%)	0 (0.0%)	
BMI>30	5 (33.6%)	9 (60.0%)	2 (13.3%)	0.023
Job				
Part-time	17 (46.0%)	15 (40.5%)	5 (13.5%)	0.423
Not working	188 (43.8%)	210 (49.0%)	31 (7.2%)	
Alcohol				
Yes	12 (41.4%)	15 (51.7%)	2 (6.9%)	0.980
No	193 (44.1%)	210 (48.1%)	34 (7.8%)	
Smoking				
Yes	12 (48.0%)	11 (44.0%)	2 (8.0%)	0.719
No	193 (43.8%)	214 (48.5%)	34 (7.7%)	
Sexual				
Yes	6 (42.9%)	8 (57.1%)	0 (0.0%)	0.697
No	199 (44.0%)	217 (48.0%)	36 (8.0%)	
Taken OCPs for menstrual problems n (%)				
Yes	15 (53.7%)	11 (39.2%)	2 (7.1%)	0.388
No	191 (43.6%)	214 (48.7%)	34 (7.7%)	
Medical problem n (%)				
Yes	15 (45.4%)	16 (48.5%)	2 (6.1%)	0.946
No	190 (43.8%)	209 (48.3%)	34 (7.9%)	

Analysis of variance test.
All data are presented in frequency (%).
BMI, body mass index.

was asthma (2.7%), followed by gastritis and anaemia (1.2% each). Others include heart disease, thalassaemia, anxiety disorder, recurrent urinary tract infection and orthopaedic-related problems.

Out of the total 729 adolescents who had menses, only 28 (4%) had taken oral contraceptive pills (OCPs) for menstrual problems. The mean age for menarche in the study population was 12.14±1.11 years old. The prevalence of menstrual problems was 63.9% (466) among the studied adolescents. The majority of them, 225 (30.9%) experienced dysmenorrhoea, followed by 205 (28.1%) had HMB, 33 (4.5%) had oligomenorrhoea and 3 (0.4%) with amenorrhoea.

The prevalence of adolescents with menstrual problems was 63.9% among the study population. The most common menstrual problem was dysmenorrhoea (30.9%), followed by HMB (28.1%) and amenorrhoea/oligomenorrhoea (4.9%). The sociodemographic characteristics of the adolescents with different menstrual problems are

presented in table 3. There was a significant predisposition of dysmenorrhoea as the most common menstrual disorder across all ethnicities. Obesity (BMI>30) was also predominant in the dysmenorrhoea group. Among the sexually active group, 14 (66.7%) had menstrual problems and 7 (33.3%) had no menstrual problems.

Overall, adolescents with menstrual problems had significant lower mean total score of PedsQL (70.23±13.53 vs 76.36±14.93, p=0.001), physical health summary score (74.10±16.83 vs 79.00±15.86, p<0.001) and psychosocial health summary score (68.05±14.27 vs 73.21±13.09, p=0.001) compared with those without menstrual problem. There was a significant difference in all four domains of the PedsQL between adolescents with normal menses and those with menstrual problems. Adolescents with menstrual problem had lower scores compared with the normal population (table 4). Those with HMB have the lowest total score, and physical health functioning and the lowest psychosocial scores (table 5). HMB alone

Table 4 Comparison of Paediatric Quality of Life-Teen Report Ages 13–18 scores

	Normal (n=263)	Menstrual problems (n=466)	P value
Physical	79.00±15.86	74.10±16.83	<0.001
Emotional	65.98±20.79	59.08±20.61	<0.001
Social	82.29±16.42	78.03±17.70	0.001
School	74.97±15.78	70.94±17.44	0.002
Total score	76.36±14.93	70.23±13.53	0.001

Independent t-test.
All data are presented in mean±SD.

contributed to a lower physical score compared with dysmenorrhoea and amenorrhoea/oligomenorrhoea. Amenorrhoea/oligomenorrhoea had the lowest social function and dysmenorrhoea had the lowest school function. However, these differences were not statistically significant (table 5).

Table 6 summarises the influence of demographic, clinical status and social factors on HRQL. In the linear regression, cigarette smoking, alcohol and medical illness had negative relationships with HRQL. This indicates that the more the adolescents smoked, drank alcohol and had medical problems, the lower the functional scores. Similarly, there was positive relationship with taking oral contraceptive pills for menstrual problems.

DISCUSSION

The study revealed that the prevalence of menstrual disorders in the Klang Valley was 63.9%. The most common menstrual problem seen in the study population was dysmenorrhoea (30.9%), followed by HMB (28.1%), oligomenorrhoea (4.5%) and amenorrhoea (0.4%). This was similar to other studies performed in the past.[7 11 12 21] The mean age of adolescents at menarche in this study was 12.14±1.11, which was also similar to most the previous studies.[11 22]

HMB was found in 28.1% of adolescents. This was much higher compared with only 18% of the sample population suffering from HMB in previous literature.[7] This could be attributed to the sedentary life-style, increasing obesity and stress level among adolescents.[23–26] HMB often occurred after menarche due to anovulatory cycles with an immature hypothalamic–pituitary–ovarian axis.[27] HMB could be an emotional stress as evidenced by lowest mean emotional function score among the studied adolescents. This finding was similar compared with other studies.[16 28] In the present study, adolescents often felt depressed, helpless and worried with their HMB. These emotional feelings had direct negative impact to their school and social performance. Pawar *et al* found that more than half of adolescents were reported missing from school due to HMB.[29] Unfortunately, these debilitating psychosocial implications are often overlooked and neglected as clinicians always focus on restoring the normal menses cycle flow. The present study provides a new insight and need for clinicians to incorporate the psycho-emotional evaluation into routine care for adolescents with HMB.

Interestingly, adolescents with HMB in this study demonstrated lower mean physical health summary score compared with previous study using the similar PedsQL questionnaire.[16] The body habitus, region and ethnicity of the studied population could be the contributing factors for this difference. Adolescents with HMB often felt tired, easily fatigue and had difficulty in performing sports activities. Wang *et al* demonstrated that 79.2% of adolescents reported that HMB severely affected their ability to participate in sports or physical activities.[30] This inadvertently resulted to more sedentary life-style and

Table 5 Paediatric Quality of Life-Teen Report Ages 13–18 scores among adolescents with menstrual problems

	HMB (n=205)	Dysmenorrhoea (n=225)	Amenorrhoea/ oligomenorrhoea (n=36)	P value
PH	72.27±18.93	75.17±15.70	76.39±16.76	0.328
PS	67.96±15.18	69.79±15.07	68.80±17.38	0.621
Emotional	56.08±21.42	60.09±20.24	57.92±21.33	0.226
Social	76.48±17.93	79.31±17.82	75.83±18.69	0.441
School	71.32±18.10	69.98±16.46	72.64±18.95	0.665
Total score	69.46±14.54	71.35±12.65	71.44±15.51	0.534

Analysis of variance test.
All data are presented in mean±SD.
PH, physical health summary score; PS, psychosocial health summary score.

Table 6 Predictors for health-related quality of life

	Unstandardised coefficients β	95% CI for β		P value
		Lower bound	Upper bound	
Age	−0.091	−0.706	0.523	0.771
BMI	−0.126	−0.433	0.182	0.423
Race	1.113	−0.634	2.861	0.211
Job	1.673	−0.627	3.972	0.154
Cigarette	−4.652	−7.610	−1.693	0.002
Alcohol	−2.870	−4.673	−1.067	0.002
Sexual	7.402	0.133	14.672	0.052
Contraception	11.040	−2.433	24.512	0.108
Taken oral contraception pills for menstrual problems	7.976	2.691	13.260	0.003
Medical problem	−2.712	−4.551	−0.874	0.004

Simple logistic regression.
Dependent variable: total score.
BMI, body mass index.

increase obesity among adolescents, leading to a vicious cycle of worsening HMB.

The prevalence of dysmenorrhoea was 30.9%, which constituted moderate, severe and very severe abdominal cramps in this study population. Worldwide, the prevalence ranged from 50% to 80% and more than 15% reported severity which disrupt their daily activities.[11 31] In studies carried out in Australia, the prevalence was reported to be as high as 94% in school populations.[5 22] Dysmenorrhoea occurred commonly in midadolescents and late adolescents with established ovulatory cycles.[27 32] In this study, adolescents with dysmenorrhoea were found to be more obese. This was in contrast to other published trials that showed dysmenorrhoea to be inversely related to BMI.[33–35] However, other studies revealed that dysmenorrhoea occurred more frequently among obese adolescents.[36 37] Obese adolescents are associated with increased adipose tissue and circulating oestrogen, which resulted in oestrogen dominance diseases, and increased prostaglandins which caused dysmenorrhoea.

Studies had showed that dysmenorrhoea resulted in poor academic performance and social activities and directly caused the low school functioning scores.[9 31] Similarly, the present study demonstrated that adolescents with dysmenorrhoea had the lowest mean score in school function as compare to other menstrual problems. A systemic review showed that nearly 25% of adolescents were absent from school and majority reported that their academic performance was severely affected by dysmenorrhoea.[8] In order to overcome the disadvantage of dysmenorrhoea, there was an increased usage of nonsteroidal anti-inflammatory drugs among adolescents with menstrual problems.

Oligomenorrhoea was associated with polycystic ovarian syndrome (PCOS) and these individuals were reported to

have high levels of anxiety and depression.[10] As the result, adolescents with oligomenorrhoea had lower psychosocial scores compared with menorrhagia and dysmenorrhoea group. It was noted that adolescents with PCOS were 3.4 times more likely to be concerned about their future fertility, leading to lower scores in all domains except physical functioning.[15] Hence, early intervention and treatment should be provided to them as early as possible to improve their psychosocial scores.

This study illustrated the impact of menstrual problems on education among adolescents was significant. The disadvantages among those with menstrual problems were well demonstrated. School abstinence, disability to concentrate on studies, unable to participate in sports or school's physical activities may have long-term consequences for adolescent girls with menstrual problems. These negative effects will start at school and continue unchanged throughout their life. Hence, it is important that their menstrual problems should be addressed properly from the beginning. Teachers should have knowledge about menstrual problem in order for them to be able to educate and provided better emotional support to adolescents. Besides that, teachers should have confidence in providing counselling regarding menstrual topics and refer adolescents who required further care to healthcare providers.[38] This will ensure those required further attention will receive optimal care as early as possible.

Cigarette smoking, alcohol consumption and concurrent medical illness were all associated with lower quality of life among the study population. Adolescents on oral contraceptive pills for menstrual problems were found to have higher score of HRQL. Previous studies also reported the similar findings.[39 40] Hence, contraceptive pills are one of the most effective treatments in HMB

among young girls with menstrual problems to improve their quality of life.

Limitation

This study had several limitations. This study was conducted in secondary schools from the Klang Valley, where most of the students were residents of Selangor and Kuala Lumpur. Therefore, our findings may not be applicable to whole adolescents' population in Malaysia. More extensive studies involving multiple schools throughout Malaysia are required to test the outcome of the current study. This was also a cross-sectional descriptive study; therefore, was only able to show the association of variables with functional scores, without allowing true causal relationships to be ascertained. Longitudinal studies would be more appropriate to probe into the cause and effect of each menstrual problem. Furthermore, there were no data regarding the norm for the Malaysian population to compare with the individuals with menstrual problems. This study highlights the need for normogram for the Malaysian population.

CONCLUSION

Menstrual problems among adolescents have a significant impact on their quality of life. Each menstrual problem affects each domain differently. This calls for a more comprehensive approach towards managing adolescents with menstrual problems. It is possibly wise to screen students at the school level, to identify those individuals with low functional scores and to refer them for proper management at a tertiary adolescent gynaecology centre.

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REFERENCES

1 Mitan LA, Slap GB. Adolescent menstrual disorders. update. *Med Clin North Am* 2000;84:851–68.
2 Fraser IS, Mansour D, Breymann C, *et al*. Prevalence of heavy menstrual bleeding and experiences of affected women in a European patient survey. *Int J Gynaecol Obstet* 2015;128:196–200.
3 El-Hemaidi I, Gharaibeh A, Shehata H. Menorrhagia and bleeding disorders. *Curr Opin Obstet Gynecol* 2007;19:513–20.
4 Wilson CA, Keye WR. A survey of adolescent dysmenorrhea and premenstrual symptom frequency. A model program for prevention, detection, and treatment. *J Adolesc Health Care* 1989;10:317–22.
5 Hillen TI, Grbavac SL, Johnston PJ, *et al*. Primary dysmenorrhea in young Western Australian women: prevalence, impact, and knowledge of treatment. *J Adolesc Health* 1999;25:40–5.
6 Akinnubi CF. Influence of dysmenorrhea and menorrhagia on academic performance among female students in tertiary institutions in Ondo state Nigeria. *WJSS* 2016;3:34.
7 Lee LK, Chen PCY, Lee KK, *et al*. Menstruation among adolescent girls in Malaysia: a cross-sectional school survey. *Singapore Med J* 2006;47:869.
8 Armour M, Parry K, Manohar N, *et al*. The prevalence and academic impact of dysmenorrhea in 21,573 young women: a systematic review and meta-analysis. *J Womens Health* 2019;28:1161–71.
9 Sharma A, Taneja DK, Sharma P, *et al*. Problems related to menstruation and their effect on daily routine of students of a medical college in Delhi, India. *Asia Pac J Public Health* 2008;20:234–41.
10 Laggari V, Diareme S, Christogiorgos S, *et al*. Anxiety and depression in adolescents with polycystic ovary syndrome and Mayer-Rokitansky-Küster-Hauser syndrome. *J Psychosom Obstet Gynaecol* 2009;30:83–8.
11 Agarwal A, Venkat A. Questionnaire study on menstrual disorders in adolescent girls in Singapore. *J Pediatr Adolesc Gynecol* 2009;22:365–71.
12 Houston AM, Abraham A, Huang Z, *et al*. Knowledge, attitudes, and consequences of menstrual health in urban adolescent females. *J Pediatr Adolesc Gynecol* 2006;19:271–5.
13 Testa MA, Simonson DC. Assessment of quality-of-life outcomes. *N Engl J Med Overseas Ed* 1996;334:835–40.
14 Chumlea WC, Schubert CM, Roche AF, *et al*. Age at menarche and racial comparisons in US girls. *Pediatrics* 2003;111:110–3.
15 Trent ME, Rich M, Austin SB, *et al*. Quality of life in adolescent girls with polycystic ovary syndrome. *Arch Pediatr Adolesc Med* 2002;156:556–60.
16 Nur Azurah AG, Sanci L, Moore E, *et al*. The quality of life of adolescents with menstrual problems. *J Pediatr Adolesc Gynecol* 2013;26:102–8.
17 Fernández-Martínez E, Onieva-Zafra MD, Parra-Fernández ML. The impact of dysmenorrhea on quality of life among Spanish female university students. *Int J Environ Res Public Health* 2019;16:713.
18 Ruta DA, Garratt AM, Russell IT. Patient centred assessment of quality of life for patients with four common conditions. *Qual Health Care* 1999;8:22–9.
19 Varni JW, Seid M, Rode CA. The PedsQL: measurement model for the pediatric quality of life inventory. *Med Care* 1999;37:126–39.
20 Varni JW, Seid M, Kurtin PS. PedsQL 4.0: reliability and validity of the pediatric quality of life inventory version 4.0 generic core scales in healthy and patient populations. *Med Care* 2001;39:800–12.
21 Ozerdogan N, Sayiner D, Ayranci U, *et al*. Prevalence and predictors of dysmenorrhea among students at a university in turkey. *Int J Gynaecol Obstet* 2009;107:39–43.
22 Parker MA, Sneddon AE, Arbon P. The menstrual disorder of teenagers (MDOT) study: determining typical menstrual patterns and menstrual disturbance in a large population-based study of Australian teenagers. *BJOG* 2010;117:185–92.
23 Alagappan M, Rampal L, Zalilah MS. Prevalence of overweight/obesity and its associated factors among secondary school students in semi urban area in Malaysia. *Med J Malaysia* 2019;74:513–20.
24 Ahmad A, Zulaily N, Shahril MR, *et al*. Association between socioeconomic status and obesity among 12-year-old Malaysian adolescents. *PLoS One* 2018;13:e0200577.
25 Hj Ramli NH, Alavi M, Mehrinezhad SA, *et al*. Academic stress and self-regulation among university students in Malaysia: mediator role of mindfulness. *Behav Sci* 2018;8:12.
26 Mansor AA, Abdullah H, Azman A. Sedentary lifestyle and body weight status among youth at public secondary schools in Selangor. *IJARBSS* 2017;7:652–8.
27 Adams Hillard PJ, Adams PH. Adolescent menstrual health. *Pediatr Endocrinol Rev* 2006;3 Suppl 1:138–45.
28 Torres R, Zajer C, Menendez M, *et al*. *Heavy menstrual bleeding affects quality of life in adolescents*, 2017.

29 Pawar A, Krishnan R, Davis K, *et al*. Perceptions about quality of life in a school-based population of adolescents with menorrhagia: implications for adolescents with bleeding disorders. *Haemophilia* 2008;14:579–83.

30 Wang W, Bourgeois T, Klima J, *et al*. Iron deficiency and fatigue in adolescent females with heavy menstrual bleeding. *Haemophilia* 2013;19:225–30.

31 Singh A, Kiran D, Singh H, *et al*. Prevalence and severity of dysmenorrhea: a problem related to menstruation, among first and second year female medical students. *Indian J Physiol Pharmacol* 2008;52:389–97.

32 Polat A, Celik H, Gurates B, *et al*. Prevalence of primary dysmenorrhea in young adult female university students. *Arch Gynecol Obstet* 2009;279:527–32.

33 Parazzini F, Chiaffarino F, Surace M, *et al*. Selected food intake and risk of endometriosis. *Hum Reprod* 2004;19:1755–9.

34 Chauhan M, Kala J. Relation between dysmenorrhea and body mass index in adolescents with rural versus urban variation. *J Obstet Gynaecol India* 2012;62:442–5.

35 Signorello LB, Harlow BL, Cramer DW, *et al*. Epidemiologic determinants of endometriosis: a hospital-based case-control study. *Ann Epidemiol* 1997;7:267–74.

36 Tembhurne S, Mitra M. Relationship between body mass composition and primary dysmenorrhoea. *Ind Jour of Physioth and Occupat Therapy - An Inter Jour* 2016;10:76–81.

37 Mohapatra D, Mishra T, Behera M, *et al*. A study of relation between body mass index and dysmenorrhea and its impact on daily activities of medical students. *Asian J Pharm Clin Res* 2016;9:297–9.

38 Duffy B, Fotinatos N, Smith A, *et al*. Puberty, health and sexual education in Australian regional primary schools: year 5 and 6 teacher perceptions. *Sex Educ* 2013;13:186–203.

39 Kristjánsdóttir J, Sundelin C, Naessen T. Health-Related quality of life in young women starting hormonal contraception: a pilot study. *Eur J Contracept Reprod Health Care* 2018;23:171–8.

40 Williams SL, Parisi SM, Hess R, *et al*. Associations between recent contraceptive use and quality of life among women. *Contraception* 2012;85:282–7.