Effect of Socioeconomic Conditions and Lifestyles on Menstrual Characteristics among Rural Women

Geetha P[1], Chenchuprasad C[2], Sathyavathi RB[2], Bharathi T[3], Surendranadha Reddy K[1] and Kodanda Reddy K[1]*

[1]Department of Anthropology, Sri Venkateswara University, Tirupati-517502, Andhra Pradesh, India
[2]Department of Adult and Continuing Education, Sri Venkateswara University, Tirupati-517502, Andhra Pradesh, India
[3]Department of Obstetrics and Gynecology, Sri Venkateswara Medical College, Tirupati-517 507, Andhra Pradesh, India

Abstract

Objective: The present study is aimed at assessing the menstrual characters and their association with life styles and socioeconomic gradients in free living adult rural women of Chittoor District, Andhra Pradesh, India.

Methods: In this study 752 married rural women in the age range of 20 to 40 years were screened by employing multistage random sampling technique. Data on life styles, socioeconomic conditions and menstrual characteristics were procured through pre-validated questionnaires.

Results: Oligomenorrhea and hypermenorrhea were noticed to an extent of 12% and 9% respectively. Menstrual problems were recorded among 32% of the women. Primary dysmenorrhea was the predominant ailment suffered by the subjects (30%). Multivariate analysis revealed that history of RTI/STDs, diabetes, menstrual problems, duration of menstrual flow and material used during menstruation were found to be significant (P<0.001) predictors of irregular menstrual cycle.

Conclusion: Advocation of preventive strategies in the form of promoting healthy life styles could be effective in correcting the menace.

Keywords: Menstrual cycle; Socio-economic status; Life styles; Rural women

Introduction

Reproductive morbidity is a broad concept that encompasses health problems related to reproductive organs and functions, including childbearing. Assessing menstrual characteristics is an indicator of women's reproductive biology [1]. Menstrual disorders include menstrual cycle irregularities (of duration or length), hyper- or hypomenorrhoea, poly or oligomenorrhoea, dysmenorrhoea, amenorrhoea, menorrhagia and premenstrual syndrome (PMS) [2,3]. Menstrual disorders have economic consequences in terms of health care costs involving expensive hormonal drugs and laboratory tests [4-6]. Prospective studies have clearly established a link between menstrual disorders and socioeconomic status, body mass index (BMI), life styles and other complications such as polycystic ovary syndrome (PCOS), hirsutism or infertility [6-8]. Menstrual disorders have multiple etiologies [9] and studies of associated variables have found relationship with diet and eating disorders [10], exercise [11], stress [12] and chronic diseases [13]. Several studies have reported variation in menstrual patterns and their correlates across the population groups [2]. Thus, it is important to understand whether, and to what extent the modifiable risk factors explain the variation in the prevalence rate of menstrual characteristics. Studies in this respect are very few especially from developing countries like India. Hence, the present study has been undertaken to assess the menstrual characteristics and their association with life style and socioeconomic conditions of free-living rural women.

Materials and Methods

The present research work intends to study the menstrual characteristics and their association with other confounding factors among the rural women aged 20 to 40 years. The design of the study was cross sectional in nature. A multistage random sampling technique was applied to draw the sample. There are three revenue divisions in Chittoor District. All the revenue divisions were taken into consideration. Each revenue division consists of 22 mandals of which two mandals were randomly selected from each division. In each mandal, 4 villages were randomly selected. In the selected villages 1155 houses were enlisted. Door to door survey was carried out to recruit the sample. After administering the inclusion and exclusion criteria, 854 women were found fit and finally, 752 women gave consent to participate in the study. The participation rate was 86 percent. Pilot study was conducted for befriending and explaining to the women participants the purpose of the study. Data collection took place between Dec 2011 and Jan 2013. The exclusion criteria were women with lactation, women who had undergone surgical menopause and having gross abnormality. The study was approved by the Departmental Ethics Committee of Sri Venkateswara University, Tirupati. Electoral roles were checked to ascertain the age of the participant to establish the correct age. Each person was interviewed privately at her residence and encouraged to describe any other health related problems she may have faced in her life.

Standard social survey methods like structured interview schedule, and in-depth interviews were used to collect the data. A schedule consisting of multidimensional questions on individual's

demographics, like age, age at menarche, age at marriage, life styles, fertility, education, occupation and income was procured. Information about women's perception on their own health problems, menstrual hygiene, menstrual problems, regularity of the cycle, use of hormonal contraceptives, bowel habit and prevalence of reproductive tract infections and sexual transmitted diseases (RTI/STDs) were collected. The prevalence of self reported non-communicable diseases was recorded. Regarding the birth control measures, 83 percent of the women have undergone tubectomy. In the remaining sample, no participant was found practicing temporary birth control measures. Hence, we dropped the variable for further statistical analysis to see its effect on menstrual characteristics.

Educational level of the participants and their family income were recorded through their public distribution cards. Physical activity was assessed based on subjects occupational and leisure time activities [14]. Participants were requested to recall their first experience of menstrual bleeding to ascertain the age at menarche. Information on age at marriage, first and last pregnancies, and number of pregnancies was gathered. Menstrual cycle length was defined as the gap between first day of one bleeding episode to previous day of next bleeding episode. Duration of menstrual flow was defined as the number of days from first bleeding initiation to last bleeding. Further, different problems related to menstruation were enquired. Since the sample is from rural background, there will be ample possibility that women may use materials other than sanitary napkin, which may exert adverse effect on menstrual health. To test this, women were enquired regarding the usage of sanitary material during menstruation. Precautionary measures were taken to check the recall bias on self reported information provided by the subject.

Statistical analysis was carried out via SPSS 16.0 and alpha level was set at $p < 0.05$. Qualitative variables were provided with percentages. Chi square test has been applied to see the strength of association with independent variables. Age adjusted multivariate (binary) logistic regression model with forward conditional entry was employed in predicting the menstrual characteristics. The independent variables entered were education, income, physical activity, duration of menstrual flow, menstrual problems, material used during menstruation, diabetes, hypertension, history of RTI/STDs and bowel habits. In each step the variables were entered at 0.05 and removed at 0.10. This model consists of five steps with variables like history of RTI/STDs, diabetes, menstrual problems, duration of menstrual flow and material used during menstruation. 91.2 percent of the cases were correctly classified. The false positives were 4 and false negatives were 62.

Results

In the present study, mean age of the women was 30.74 ± 4.85 yrs. Data on socioeconomic status, life styles and prevalence of self reported disease was shown in Table 1. Illiteracy was noticed to an extent of 16 percent. 11 percent of the women's income was below <24,000 INR and 52 percent of the women's income was in the range of 25,000-44,000 INR. Women with sedentary and heavy physical activity were 24 percent and 27 percent respectively. Self reported prevalence of diabetes and hypertension were 10 percent and 13 percent respectively.

Table 2 depicts the data on demographic and menstrual characteristics. 66 percent of the women got married at below 20 years of age. Age at first conception was <20 yrs for 31 percent of the women respondents. In the sample one fourth of the women attained menarche when they were less than 11 years old. Oligomenorrhea and hypermenorrhea were noticed to an extent of 12 percent and 9 percent respectively. During menstruation, 32 percent of the women suffered

from different menstrual problems. Primary dysmenorrhea (stomach ache and back ache, head ache, vomiting) was the predominant ailment suffered by 30% of subjects. Menorrhagia was noticed to an extent of 2.1 percent. 43 percent of the women were using domestic cloth as material during the menstruation, whereas 57 percent of the women were using commercial pad. Data on RTI/STDs and bowel habits were shown in Table 3. RTI/STDs were present in 19 percent of the women. Irregular bowel habits were noticed to an extent of 15 percent.

Percentage frequencies and strength of association between menstrual characteristics and other confounding factors were shown in Tables 4-6. The frequency of irregular menstrual cycle decreases when subject's education increases ($P<0.03$). As the women's income ($P<0.02$) and physical activity ($P<0.04$) increases, irregular menstruation frequency decreases. It was also found that irregular menstrual cycle is associated significantly with other problems such as hypermenorrhea ($\chi^2=10.35$; $P<0.00$), menstrual problems ($\chi^2=31.47$: $P<0.00$), diabetes ($\chi^2=57.98$: $P<0.00$), hypertension ($\chi^2=8.62$: $P<0.00$), RTI/STDs ($\chi^2=89.76$: $P<0.00$), domestic cloth as material used during menstruation ($\chi^2=25.72$: $P<0.00$) and irregular bowel habits ($\chi^2=14.56$: $P<0.00$).

Results of the binary logistic regression are presented in Table 7. The results show that the chance of having irregular menstrual cycle was higher among the women who are reported to have RTI/STD followed by the diabetes. Menstrual hygiene (domestic cloth as material during menstruation), menstrual problems and duration of menstrual flow exerted an effect leading to irregular menstrual cycle. The results further indicate that none of the socioeconomic variables were found to be significant predictors of irregular menstrual cycle.

Discussion

Menstrual disorders represent an important area of unmet need for reproductive health services for women in developing countries. The current study delineates the effect of socioeconomic and life styles on menstrual characteristics. The prevalence of different menstrual

Variable	Females (N=752)	
	n	%
Education		
Illiterate	118	15.7
Primary Education	290	38.6
Secondary Education	198	26.3
Higher Education	146	19.4
Family Income in INR		
<24000	81	10.8
25000-44000	391	52.0
>45000	280	37.2
Physical activity		
Sedentary	179	23.8
Mild	250	33.2
Moderate	122	16.2
Heavy	201	26.7
Diabetic		
Yes	78	10.4
No	674	89.6
Hypertensive		
Yes	101	13.4
No	651	86.6

Table 1: Socioeconomic status, life styles and prevalence of self-reported non-communicable diseases of the study sample.

Variable	Females (N=752)	
	n	%
Age at Marriage		
< 20 yrs	496	66.0
20-23 yrs	215	28.6
24-27 yrs	28	3.7
>27 yrs	13	1.7
<20 yrs	232	30.9
20-23yrs	466	62.0
24-26 yrs	18	2.4
>26 yrs	28	3.7
Age at menarche		
< 11 yrs	183	24.3
12-13 yrs	438	58.2
14-15 yrs	131	17.4
Menstrual cycle		
Normal (28-35 days)	662	88.0
Irregular [Oligomenorrhea (36-50 days)]	90	12.0
3 days	21	2.8
4 days	190	25.3
5 days	475	63.2
>7 days (Hypermenorrhea)	66	8.8
Menstrual problems		
Yes	240	31.9
No	512	68.1
Type of problem		
Primary Dysmenorrhea (Stomach ache and Back ache & Head ache and Vomitings)	224	29.9
Menorrhagia (heavy bleeding)	16	2.1
Material used during menstruation		
Cloth	323	43.0
Pad	429	57.0

Table 2: Data on demographic and menstrual characteristics of the study sample.

Variable	Females (N=752)	
	n	%
History of RTI / STD infections		
Yes	142	18.9
No	610	81.1
Bowel habits		
Regular	643	85.5
Irregular	109	14.5

Table 3: Data on RTI/STDs and bowel habits of the study sample.

characters in the study population were comparatively lower than studies of Hong et al. [15] and higher than that reported by Khatri and Gupta [16] and Bang et al. [17]. Bachmann and Kemmann [18] observed oligomenorrheae to an extent of 12 percent and amenorrheae 2.6 percent in their sample. In the present study, the observed prevalence of oligomenorrhea is in line with other works [19].

Although irregular cycling is not generally associated with adverse health outcomes, oligomenorrhea may be associated with infertility, which is a major concern of women in many developing countries [20]. Oligomenorrhea may also be problematic when it is a symptom of other health problems that require treatment, such as hypothyroidism [21], endometrial tuberculosis [22] or AIDS wasting [23]. The outcome of the Gambian study found an association between cervical and uterine tumors with irregular bleeding [24]. Thus an elevation of oligomenorrhea in the rural women of the present study indicates the risk of developing menstrual disorders.

Dysmenorrhea is one of the most common complaints and gynecological problems among worldwide women [25-27]. The prevalence of dysmenorrhea varies between 16% and 91% in women of reproductive age, with severe pain in 2% to 29% [15]. Agarwal and Agarwal [27] reported high prevalence of dysmenorrhea (71.96%) among adolescent girls of Gwalior. Similar findings were reported by McKay and Diem [28]: (67%), Jayashree and Jayalakshmi [29]: (74%), and Harlow and Park [30]: (71.6%). In the present study, approximately one third of the women (32.0%) exhibited menstrual problems like dysmenorrhea as primary dysmenorrhea and menorrhagia. Our results are in good agreement with Burnett et al. [31] and low when compared to Northern India (76.9%) [32], Chennai (61%) [33] and Delhi (63.5%) [34]. In the present study dysmenorrhea and hepermenorrhea were risk factors for about 2.778 and 2.593 times. This indicates that menstrual disorder is an important public health problem and those who were living freely in rural areas were experiencing severe or moderate dysmenorrhea, which might have a negative effect on health related quality of life (HRQoL) as evinced by self reported health status (40% as fair/poor).

Oligomenorrhea may also be associated with other reproductive morbidities like RTI/STDs. RTIs/STDs may result in serious health

Variable	N	Menstrual cycle				x^2- value	P-value
		Regular		Irregular (oligomenorrhea)			
		n	%	n	%		
Education							
Illiterate	118	97	82.2	21	17.8	8.70	0.03
Primary	290	251	86.6	39	13.4		
Secondary	198	178	89.9	20	10.1		
Higher	146	136	93.2	10	6.8		
Income in INR							
<24000	81	66	81.5	15	18.5	7.70	0.02
25000-44000	391	339	86.7	52	13.3		
>45000	261	257	91.8	23	8.8		
Physical activity							
Sedentary	179	151	84.4	28	15.6	8.41	0.04
Mild	250	214	85.6	36	14.4		
Moderate	122	112	91.8	10	8.2		
Heavy	201	185	92	16	8		

* p<0.05

Table 4: Percentage frequencies of menstrual cycle by socioeconomic status and physical activity.

Variable	N	Menstrual cycle				x^2- value	P-value
		Regular		Irregular (oligomenorrhea)			
		n	%	n	%		
Normal (< 6days)	686	612	89.2	74	10.8	10.35	0.00
Hypermenorrhea (>7days)	66	50	75.8	16	24.2		
Menstrual problems							
Yes	240	118	78.3	52	21.7	31.47	0.00
No	512	474	92.6	38	7.4		
Material used during menstruation							
Cloth	323	262	81.1	61	18.9	25.72	0.00
Pad	429	400	93.2	29	6.8		

* p<0.05

Table 5: Percentage frequencies of menstrual cycle by confounding factors.

Variable	Menstrual cycle					χ²- value	P-value
	N	Regular		Irregular (oligomenorrhea)			
		n	%	n	%		
Diabetes							
Yes	78	48	61.5	30	38.5	57.98	0.00
No	674	614	91.1	60	8.9		
Hypertension							
Yes	101	80	79.2	21	20.8	8.62	0.00
No	651	582	89.4	69	10.6		
History of RTI/STD Infections							
Yes	142	92	64.8	50	35.2	89.76	0.00
No	610	570	93.4	40	6.6		
Bowel habits							
Regular	643	578	89.9	65	10.1	14.56	0.00
Irregular	109	84	77.1	25	22.9		

* $p<0.05$.

Table 6: Percentage frequencies of menstrual cycle by diabetes, hypertension, infections and bowel habits of the study sample.

Variables	β	S.E.	Sig	OR*	95% CI for OR	
					Lower	Upper
Duration of menstrual flow	0.953	0.36	0.008	2.593	1.28	5.255
Menstrual problems	1.022	0.267	0.001	2.778	1.647	4.686
Material used during menstruation	1.029	0.27	0.001	2.799	1.65	4.749
Diabetes	1.471	0.317	0.001	4.353	2.339	8.102
History of RTI/STD Infections	1.817	0.268	0.001	6.156	3.642	10.404
Constant	-3.917	0.277	0.001	0.02		

Variable(s) entered on step 1: History of RTI/STD Infections
Variable(s) entered on step 2: Diabetes
Variable(s) entered on step 3: Menstrual problems
Variable(s) entered on step 4: Material used during menstruation
Variable(s) entered on step 5: Duration of menstrual flow
* adjusted for age
OR= Odds ratio
The logistic regression model is Y= -3.917+1.817(History of STD/RTIs) + 1.471 (Diabetes) + 1.029 (Material used during menstruation) + 1.022(Menstrual problems) + 0.953 (Duration of menstrual flow). Where Y=irregular menstrual cycle.

Table 7: Multivariate (binary) logistic regression model to predict the menstrual characteristics.

consequences among women such as infertility, ectopic pregnancy, preterm labor, miscarriage, stillbirth, pelvic inflammatory disease, cervical cancer, increased susceptibility to opportunistic infections and pregnancy associated complications [35]. A cross examination of the data on reproductive health status of the women indicates that 19 percent had the history of RTIs/STDs and exhibited risk for about 6.156 times pertaining to oligomenorrhea. This will add additional burden apart from menstrual problems affecting reproductive health and overall quality of life.

Self reported disease history of diabetes was found to be another significant risk factor in developing menstrual disorders. The odds of oligomenorrhea were 4.353 for diabetes. Diabetic women are prone to menstrual problems emphasizing the hazardous effect of hyperglycemia on menstrual regularity and menstrual problems. Similar observations were made in other population groups [36]. Women in the reproductive age require using proper sanitary napkins to maintain the menstrual hygiene. About half of the women interviewed during the study were using cloth as sanitary napkin during menstruation and were experiencing about 3 times higher risk in developing oligomenorrhea. This indicates poor attention paid to the menstrual hygiene by rural women in India. In the present study, 65 percent of the women who were using cloth as sanitary napkins stated that inaccessibility of the commercial pad in rural areas is the predominant reason. Similar results were observed in a rural community of Northern India [37].

Reproductive health of women permeates with social, cultural and lifestyle significance [38]. A number of population based studies, investigated variations in menstrual function vis-à-vis menstrual problems and their correlates [39]. In the present study, though the factors like education, income, physical activity and bowel habits have independently shown significant association with irregular menstrual cycle, yet these effects were nullified in the presence of other confounding factors. Ciccone et al. [40] study has clearly demonstrated that educating the subject on health and management will have greater impact in reducing the burden of risk. The outcome of the work warrants a strong partnership between the care manager and the subject and collaboration between the physician and the care manager in the health management. Our results are in agreement with the above study. These results will help us in training community health advisors who could play a key role in the advising rural women regarding the importance of these risk factors.

The potential limitations of our study are 1) Even though the questionnaire is standardized, certain practical problems like birth control measures and stressful events limit us in gaining the reliable data 2) Lack of data on diet and nutritional anthropometry are expected to have significant effect on menstrual characteristics. Further, classification of the subjects based on the economic levels in rural settings of India is a laborious exercise, because the window between low and high income groups is narrow.

The findings of our study could be generalized and applied to all the rural women of India with similar socioeconomic and cultural background. In conclusion, it is inferred that a significant portion of the women in the present study was suffering with oligomenorrhea, dysmenorrhea, and hypermenorrhea. The confounding factors for the promotion of the irregularities were duration of menstrual flow, menstrual problems, history of RTI/STDs, diabetes and material used during menstruation. Hence advocation of preventive strategies in the form of improving healthy life styles could be effective in correcting the menace.

Author Contributions

Conceived and designed the study: KKR, TB, PG, KSNR. Data Collection: PG, TB, CP, RBS. Analyzed the data: PG, KKR. Wrote the paper: KKR, KSNR, PG

References

1. Harlow SD, Ephross SA (1995) Epidemiology of menstruation and its relevance to women's health. Epidemiol Rev 17: 265-286.

2. Ray S, Mishra SK, Roy AG, Das BM (2010) Menstrual characteristics: a study of the adolescents of rural and urban West Bengal, India. Ann Hum Biol 37: 668-681.

3. Santos IS, Minten GC, Valle NCJ, Tuerlinckx GC, Silva AB, et al. (2011)

Menstrual bleeding patterns: a community-based cross-sectional study among women aged 18-45 years in Southern Brazil. BMC Women's Health 11: 26.

4. Bitzer J, Tschudin S, Stadlmayr W (2005) [Menstruation and its impact on women's health]. Zentralbl Gynakol 127: 282-287.

5. Houston AM, Abraham A, Huang Z, D'Angelo LJ (2006) Knowledge, attitudes, and consequences of menstrual health in urban adolescent females. Journal of Pediatric and Adolescent Gynecology 19: 271-275.

6. Karout N, Hawai SM, Altuwaijri S (2012) Prevalence and pattern of menstrual disorders among Lebanese nursing students. East Mediterr Health J 18: 346-352.

7. Sanyal S, Ray S (2008) Variation in the menstrual characteristics in adolescents of West Bengal. Singapore Med J 49: 542-550.

8. Glueck CJ, Morrison JA, Daniels S, Wang P, Stroop D (2011) Sex hormone-binding globulin, oligomenorrhea, polycystic ovary syndrome, and childhood insulin at age 14 years predict metabolic syndrome and class III obesity at age 24 years. J Pediatr 159: 308-313.

9. Chang PJ, Chen PC, Hsieh CJ, Chiu LT (2009) Risk factors on the menstrual cycle of healthy Taiwanese college nursing students. Australian and New Zealand Journal of Obstetrics and Gynaecology 49: 689- 694.

10. Krause ED, Robins CI, Lynch TR (2000) A mediational model relating sociotrophy, ambivalence over emotional expression, and disordered eating. Psychology of Women Quarterly 24: 328-335.

11. Ornstein RM, Copperman NM, Jacobson MS (2011) Effect of weight loss on menstrual function in adolescents with polycystic ovary syndrome. J Pediatr Adolesc Gynecol 24: 161-165.

12. Lin HT, Lin LC, Shiao JS (2007) The impact of self-perceived job stress on menstrual patterns among Taiwanese nurses. Ind Health 45: 709-714.

13. Chhabra S, Venkatraman S (2010) Menstrual dysfunction in rural young women and the presence of polycystic ovarian syndrome. J Obstet Gynaecol 30: 41-45.

14. Singh RB, Gosh S, Niaz MA, Rastogi V (1997) Validation of physical activity and socio-economic status questionnaire in relation to food intakes for the five city study and proposed classifications for Indians. Journal of Association of Physicians of India 45: 603–607.

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

16. Khatri R, Gupta AN (1978) Effect of childbirth on menstrual pattern. Indian J Med Res 67: 66-72.

17. Bang RA, Bang AT, Baitule M, Choudhary Y, Sarmukaddam S, et al. (1989) High prevalence of gynaecological diseases in rural Indian women. Lancet 1: 85-88.

18. Bachmann GA, Kemmann E (1982) Prevalence of oligomenorrhea and amenorrhea in a college population. Am J Obstet Gynecol 144: 98-102.

19. Harlow SD, Campbell OM (2004) Epidemiology of menstrual disorders in developing countries: a systematic review. BJOG 111: 6-16.

20. Inhorn MC (1998) Infertility and the quest for conception in Egypt. In: Barlow R, Brown JW, editors: Reproductive Health and Infectious Disease in the Middle East. Aldershot England: Ashgate Publishing, 114-132.

21. Hernández I, Cervera-Aguilar R, Vergara MD, Ayala AR (1999) [Prevalence and etiology of secondary amenorrhea in a selected Mexican population]. Ginecol Obstet Mex 67: 374-376.

22. Gonzalez Corinas M, Vidal Gonza´lez D, Cepero Cordero J, LashleyOliveras ML(1999) Dengue hemorragico. Studio cli´nico de 200 pacientes. Revista Cubana de Medicina 38: 13-18.

23. Harlow SD, Campbell OM (2000) Menstrual dysfunction: a missed opportunity for improving reproductive health in developing countries. Reprod Health Matters 8: 142-147.

24. Walraven G, Ekpo G, Coleman R, Scherf C, Morison L, et al. (2002) Menstrual disorders in rural Gambia. Stud Fam Plann 33: 261-268.

25. George A, Bhaduri A (2002) Dysmenorrhea among adolescent girls- symptoms experienced during menstruation. Health Promotion Education 17:4.

26. Harel Z (2006) Dysmenorrhea in adolescents and young adults: etiology and management. J Pediatr Adolesc Gynecol 19: 363-371.

27. Agarwal AK, Agarwal A (2010) A study of dysmenorrhea during menstruation in adolescent girls. Indian J Community Med 35: 159-164.

28. McKay L, Diem E (1995) Health concerns of adolescent girls. J Pediatr Nurs 10: 19-27.

29. Jayashree R, Jayalakshmi VY (1997) Socio-cultural dimensions of menstrual problems. Health Education South East Asia 12: 21-26.

30. Harlow SD, Park M (1996) A longitudinal study of risk factors for the occurrence, duration and severity of menstrual cramps in a cohort of college women. Br J Obstet Gynaecol 103: 1134-1142.

31. Burnett MA, Antao V, Black A, Feldman K, Grenville A, et al. (2005) Prevalence of primary dysmenorrhea in Canada. J Obstet Gynaecol Can 27: 765-770.

32. Kumar D, Goel NK, Puri S, Pathak R, Sarpal SS, et al. (2013) Menstrual Pattern among Unmarried Women from Northern India. J Clin Diagn Res 7: 1926-1929.

33. Sheila W, Malathy K, Premila S (1993) Menstrual and gynecological disorders in 500 school girls in Madras city. The Journal of Obstetrics and Gynaecology of India 43: 940-945.

34. Nair P, Grover VL, Kannan AT (2007) Awareness and practices of menstruation and pubertal changes amongst unmarried female adolescents in a rural area of East Delhi. Indian Journal of Community Medicine 32: 156-157.

35. World Health Organization (2005) Integrating STI/RTI Care for Reproductive health Sexually Transmitted and Other Reproductive Tract Infections: A guide to essential practice World Health Organization.

36. Ghalib AA (2009) The Effect of Glycemic Control on Menstrual cycle in Iraqi Diabetic women Iraqi. Journal of Community Medicine 22: 174-178.

37. Misra P, Upadhyay RP, Sharma V, Anand K, Gupta V (2013) A community-based study of menstrual hygiene practices and willingness to pay for sanitary napkins among women of a rural community in northern India. Natl Med J India 26: 335-337.

38. Marvan ML, Vacio A, Espinosa-Hernándeza G (2003) Menstrual-related changes expected by pre menarcheal girls living in rural and urban areas of Mexico. Social Science & Medicine 56: 863-868.

39. Waller K, Swan SH, Windham GC, Fenster L, Elkin EP, et al. (1998) Use of urine biomarkers to evaluate menstrual function in healthy premenopausal women. Am J Epidemiol 147: 1071-1080.

40. Ciccone MM, Aquilino A, Cortese F, Scicchitano P, Sassara M, et al. (2010) Feasibility and effectiveness of a disease and care management model in the primary health care system for patients with heart failure and diabetes (Project Leonardo). Vasc Health Risk Manag 6: 297-305.