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Subjects and Methods: In this study 752 married rural women in the age range of 20 to 40 years are screened by employing multistage random sampling technique. Data on life styles, socioeconomic conditions, self reported health status and menstrual characteristics has been procured through pre-validated questionnaires. Results: Menstrual problems are noticed to an extent of 31.9% respectively (Primary dysmenorrhea: 29.9% and Menorrhagia: 2.1%). In the present sample 12% of the women are suffering from oligomenorrhea and 9% with hypermenorrhea. Multivariate (binary) logistic regression analysis have revealed that subjects with poor self rated health have 4.689 times the risk of developing dysmenorrhea.

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Conclusion: Dysmenorrhea is found to be highly prevalent among rural women. Advocation of preventive strategies in the form of promoting healthy life styles can be effective to correct the menace.

Keywords: dysmenorrhea, menstrual cycle, socioeconomic status, life styles, rural women.

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I. INTRODUCTION

Assessing menstrual characteristics is an indicator for women's reproductive biology (Harlow and Ephross 1995). Menstrual disorders include menstrual cycle irregularities (of duration or length), hyper- or hypomenorrhoea, poly or oligomenorrhoea, dysmenorrhoea, amenorrhoea, menorrhagia and premenstrual syndrome (Ray et al. 2010; Santos et al. 2011). Menstrual disorders have economic consequences in terms of health care costs involving expensive hormonal drugs and laboratory tests (Rodrigues et al. 2011; Karout et al. 2012; Lentz et al. 2012).

Dysmenorrhea is considered to be the most common symptom of all menstrual complaints and poses a greater burden of disease than any other gynecological complaint (Patel et al. 2006; Sood et al. 2012). Dysmenorrhea or painful menstruation is defined as a severe, painful, cramping sensation in the lower abdomen that is often accompanied by other symptoms, such as sweating, headache, nausea, vomiting, diarrhea, and tremulousness, all occurring just before or during the menses (Lentz et al. 2012). The reported prevalence of dysmenorrhea of any severity varies between 16% and 91% in women of reproductive age. The lowest prevalence of 16% is reported in a random sample of Japanese women aged 17–51 years (Ohde et al. 2008). The highest prevalence of 91% is reported in a random sample of Iranian women aged 16–56 years (Tavallaee et al. 2011). George and Bhaduri (2002) found dysmenorrhea to be a common problem in India with prevalence of 87.7%. However, the true prevalence of dysmenorrhea among the Indian adult women is not yet established.

Prevalence studies have shown several factors that are associated with dysmenorrhea like age (Messing et al. 1993), smoking (Mishra et al. 2000), higher body mass index (Harlow and Park 1996), earlier age at menarche (Harlow and Park 1996), nulliparity (Sundell et al. 1990), longer and heavier menstrual flow (Harlow and Park 1996), family history of dysmenorrhea (Parveen et al. 2009) and usage of oral contraceptives (Juang et al. 2006) besides depression and stress

(Gordley et al. 2000). Other common factors, such as education (Chen et al. 2000), employment (Ng et al. 1992), alcohol consumption (Harlow and Park 1996), marital status (Messing et al. 1993), and physical activity (Harlow and Park 1996), show largely negative or inconclusive results. Thus it is important to understand whether, and to what extent the modifiable risk factors explain the variation in the prevalence of dysmenorrhea. Towards this end umpteen studies are available on adolescent sample in Indian populations (Deo and Ghattargi 2007; Agarwal and Agarwal 2008; Karthiga et al. 2011; Kural et al. 2015). Studies pertaining to the prevalence of dysmenorrhea and its risk factors among the Indian adult women are very limited (Khatri and Gupta 1978; Bang et al. 1989; Bhatia et al. 1997). India being multilingual and multiethnic there is a need to have data from each and every population segments to weigh the risk. In the light of this background, the present study has been undertaken to assess the prevalence of dysmenorrhea and its association with life style and socioeconomic conditions of free living rural adult women.

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

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

graphics, like age, age at menarche, age at marriage, life styles, fertility, education, occupation and income are 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) have been collected. The prevalence of self reported non-communicable diseases is recorded. Regarding the birth control measures, 83 percent of the women have undergone tubectomy. In the remaining sample, no participant is found practicing temporary birth control measures. Hence, we have dropped the variable for further statistical analysis to see its effect on menstrual problems.

Educational level of the participants and their family income are recorded through their public distribution cards. Physical activity is assessed based on subjects occupational and leisure time activities (Singh et al. 1997). Participants are requested to recall their first experience of menstrual bleeding to ascertain the age at menarche. Information about age at marriage, first and last pregnancies, and number of pregnancies has been gathered. Menstrual cycle length is defined as the gap between first day of one bleeding episode to previous day of next bleeding episode. Duration of menstrual flow is defined as the number of days from first bleeding initiation to last bleeding. Further, different problems related to menstruation are enquired. Since the sample is from rural background, there would be ample possibility that women might have used materials other than sanitary napkin, which may have exerted adverse effect on menstrual health. To test this, women have been enquired regarding the usage of sanitary material during menstruation. Precautionary measures are taken to check the recall bias on self reported information provided by the subject.

Statistical analysis is carried out via SPSS 16.0 and alpha level is set at $p < 0.05$. Qualitative variables are 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 is employed in predicting the menstrual problems. The independent variables, entered are education, income, physical activity, self reported health, age at menarche (continuous variable), duration of menstrual flow, regularity of the cycle, material used during menstruation, history of RTI/STDs and bowel habits. In each step the variables are entered at 0.05 and removed at 0.10. This model consists of four steps with variables like self rated health, regularity of cycle, duration of menstrual flow, and age at menarche.

III. RESULTS

In the present study, mean age of the women was 30.74 ± 4.85 yrs. Data on socioeconomic status, life styles and self reported health status is shown in table I. Illiteracy is noticed to an extent of 16 percent. 11 percent of the women's income is below <24,000 INR and 52 percent of the women's income is in the range of

25,000-44,000 INR. Women with sedentary and heavy physical activity are 24 percent and 27 percent respectively. In the present study 60 percent of the women have opined that their self reported health status is good, while 38 percent have perceived that their self reported health as fair. Around 2 percent of the women have expressed poor health status.

Table I : Socioeconomic, life style and self reported health status of the sample.

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		
Low income (<24000)	81	10.8
Middle income (25000-44000)	391	52.0
High income (>45000)	280	37.2
Physical activity		
Sedentary	179	23.8
Mild	250	33.2
Moderate	122	16.2
Heavy	201	26.7
Self reported health		
Good	454	60.4
Fair	285	37.9
Poor	13	1.7

Table II 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 is 31 percent among the women <20 yrs of age. In the study population, one fourth of the women have attained menarche <11 of age. Oligomenorrhea and hypermenorrhea are noticed to an extent of 12 percent and 9 percent respectively. During menstruation, 32 percent of the women have suffered from different menstrual problems. Primary dysmenorrhea (stomach ache and back ache, head ache, vomiting) is the predominant ailment suffered by 30 % of subjects. Menorrhagia is noticed to an extent of 2.1 percent. 43 percent of the women are said to be using domestic cloth as material during the menstruation, whereas 57 percent of the women have become acclimatized to use commercial pad. Data on RTI/STDs and bowel habits are shown in table III. RTI/STDs have been diagnosed in 19 percent of the women. Irregular bowel habits are noticed to an extent of 15 percent.

Table II : Data on demographic and menstrual characteristics 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
Age at first conception		
<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
Duration of menstrual flow		
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 Vomiting)	224	29.9
Menorrhagia (heavy bleeding)	16	2.1
Material used during menstruation		
Cloth	323	43.0
Pad	429	57.0

Table III : Data on RTI/STDs and bowel habits 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

Percentage frequencies and strength of association between menstrual problems and other confounding factors are shown in tables IV-VI. Subject's physical activity and educational level failed to show significant association with the presence of menstrual problems. The frequency of menstrual problems have found decreased when subject's income increases ($P < 0.001$). Subjects self perception of poor self reported health status elevates the menstrual problems. It is also found that menstrual problems associated significantly with other problems such as hypermenorrhea ($\chi^2 = 14.84$; $P < 0.00$), oligomenorrhea ($\chi^2 = 31.47$; $P < 0.00$), RTI/STDs ($\chi^2 = 4.55$; $P < 0.03$), domestic cloth as material used during menstruation ($\chi^2 = 6.32$; $P < 0.01$) and irregular bowel habits ($\chi^2 = 9.97$; $P < 0.02$).

Table IV : Percentage frequencies of menstrual problems by socioeconomic, physical activity and self reported health status.

Variable	Menstrual problems					χ ² - value	P-value
	N	Yes		No			
		n	%	n	%		
Education							
Illiterate	118	48	40.7	70	59.3	5.78	0.122
Primary	290	93	32.1	197	67.9		
Secondary	198	58	29.3	140	70.7		
Higher	146	41	28.1	105	71.9		
Income in INR							
Low income (<24000)	81	36	44.4	45	55.6	15.76	0.001
Middle income (25000-44000)	391	135	34.5	256	65.5		
High income (>45000)	261	67	25.7	194	74.3		
Physical activity							
Sedentary	179	69	38.5	110	61.5	6.33	0.096
Mild	250	81	32.4	169	67.6		
Moderate	122	36	29.5	86	70.5		
Heavy	201	54	26.9	147	73.1		
Self reported health							
Good	454	115	25.3	339	74.7	23.745	0.000
Fair	285	118	41.4	167	58.6		
Poor	13	7	53.8	6	41.4		

* p<0.05

Table V : Percentage frequencies of menstrual problems by confounding factors.

Variable	Menstrual problems					χ ² - value	P-value
	N	Yes		No			
		n	%	n	%		
Duration of menstrual flow							
Normal (< 6days)	686	205	29.9	481	70.1	14.84	0.000
Hypermenorrhea (>7days)	66	35	53.0	31	47.0		
Menstrual cycle							
Regular	662	188	28.4	474	71.6	31.47	0.000
Irregular	90	52	57.8	38	42.2		
Material used during menstruation							
Cloth	323	119	36.8	204	63.2	6.32	0.012
Pad	429	121	28.2	308	71.8		

* p<0.05

Table VI : Percentage frequencies of menstrual problems by history of RTI/STD and bowel habits of the study sample.

Variable	Menstrual problems					χ ² - value	P-value
	N	Yes		No			
		n	%	n	%		
History of RTI/STD Infections							
Yes	142	56	39.4	86	60.6	4.55	0.033
No	610	184	30.2	426	69.8		
Bowel habits							
Regular	643	191	29.7	452	70.3	9.97	0.022
Irregular	109	49	45.0	60	55.0		

* p<0.05.

Results of the binary logistic regression are presented in table VII. The results show that the chances of having menstrual problems are 2.986 times higher among the women with fair self rated health. The risk of menstrual problems is 4.689 when subjects self perception of health status as poor. The odds of menstrual problems are 3.472 among the women with

oligomenorrhea (95%CI: 2.154-5.599). Women with hypermenorrhea are thrice at risk towards menstrual problems (95% CI: 1.881-5.728). Women attaining the menarche at 14-15 years show odds of 0.763. In other words attaining early menarche (<11 years) are 1.31 times (1/0.763) higher chances of developing dysmenorrhea.

Table VII : Multivariate (binary) logistic regression model to predict the menstrual problems.

Variables	β	S.E.	Sig	OR*	95% CI for OR	
					Lower	Upper
Self rated health						
Good				Ref.		
Fair	0.992	0.175	0.000	2.696	1.914	3.797
Poor	1.545	0.592	0.009	4.689	1.471	14.949
Regularity of cycle	1.245	0.244	.000	3.472	2.154	5.599
Duration of Menstrual flow	1.189	0.284	0.000	3.283	1.881	5.728
Age at menarche	-.271	0.079	0.001	0.763	0.653	0.891
Constant	1.868	0.972	0.055	6.478		

Variable(s) entered on step 1: Self reported health

Variable(s) entered on step 2: Regularity of cycle

Variable(s) entered on step 3: Duration of Menstrual flow

Variable(s) entered on step 4: Age at menarche

* adjusted for age

OR= Odds ratio

The logistic regression model is $Y = 1.868 + 0.992$ (fair self reported health) $+ 1.545$ (poor self reported health) $+ 1.245$ (Regularity of cycle) $+ 1.189$ (Duration of Menstrual flow) $- 0.271$ (Age at menarche). Where Y=Menstrual problems.

IV. DISCUSSION

Menstrual disorders represent an important area of unmet need for reproductive health services for women in developing countries. Dysmenorrhea is one of the most common complaints and gynecological problems among worldwide women (George and Bhaduri 2002; Harel 2006; Agarwal and Agarwal 2010). WHO systematic review assessed the geographical distribution of chronic pelvic pain and indicated that the rate of dysmenorrhea was 16 to 81 percent (Latthe et al. 2006). Harlow and Campbell (2004) reviewed the studies in developing countries and indicated that the prevalence of dysmenorrhea is in between 15 to 68 percent among the adult women. On the other hand, studies from the developed countries have reported a range of 60 to 73 percent (Unsal et al. 2010). Studies among the Indian adolescents reveal a high of 67.2 (Sharma et al. 2008) and 84.2 percent respectively (Kural et al. 2015). The results of the present study are in agreement with the above studies that dysmenorrhea is common complaints among the adults which may have negative impact on health related quality of life. The variation in the prevalence rates across the population

groups may be due to ethnic, socio-cultural and life style factors (Al-Kindi and Al-Bulushi 2011).

Prospective studies have observed a significant decrease in the prevalence of dysmenorrhea with increasing age (Aykut et al. 2007). Patel et al (2006) in their study observed a higher prevalence of dysmenorrhea in early adult part of life and decreases with advancement of age. An examination of the results of this study also demonstrates an elevation of primary dysmenorrhea in <29 yrs age group and then the prevalence decreased with advancement of age, however the difference is statistically insignificant. Hence data was not reported and age was adjusted in the regression model to nullify its effects.

Reproductive health of women permeates with social, cultural and lifestyle significance (Marvan et al. 2003). A number of population based studies, investigated variations in menstrual function vis-à-vis menstrual problems and their correlates (Waller et al. 1998). Self-rating of health is the most frequently used tool to assess the health perceptions in epidemiological studies. Feeling fair/poor self rated health of the women in the present study are experiencing greater risk towards dysmenorrhea. Taperi and Rimpela (1989) study concluded that the experience of menstrual pain

seems to be related to self rated health as a whole and to life styles rather than to specific disorders and health practices. Our results reiterate the importance of self rated health in assessing the risk towards a condition.

Socioeconomic and behavioral risk factors for dysmenorrhea have long been of interest because of possibility of effective intervention. Associations between dysmenorrhea and being overweight, physical activity, and alcohol consumption have been inconsistent (Klein and Litt 1981). In the present study, though the factors like income, physical activity, sanitary napkin, history of RTI/STD infections and bowel habits have independently shown significant association with dysmenorrhea, yet these effects have been nullified in the presence of other confounding factors. Ciccone et al (2010) 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.

Research reports have shown a significant association between early menarche and dysmenorrhea; the underlying reason could be the fact that subjects who attain menarche early have longer exposure to uterine prostaglandins leading to higher prevalence of dysmenorrhea (Shrotriya et al. 2012). A higher proportion of the women in the sample (37% vs 20%) attained menarche <11 of age exhibited 1.31 times risk towards dysmenorrhea when compared to 14-15 years. Our data is in best agreement with other studies where age at menarche is an important factor (Patel et al. 2006).

Oligomenorrhea seems to be one of the potential risk factors for dysmenorrhea in the present study. Different studies have suggested that dysmenorrhea is more prevalent in women with longer cycles (El-Gilany et al. 2005). Two studies proposed that the presence of heavy menses or irregular menses have associated with increased risk for dysmenorrhea, with odds of 1.9 each respectively (Patel et al. 2006; Unsal et al. 2010). The sample under the study exhibited an odds of 3.472 towards dysmenorrhea. No conclusion can be drawn to address this effect because of the limited number of studies. Further menstrual bleeding duration of >7 days is another important risk factor for dysmenorrhea. Subjects who have bleeding duration for more than 7 days have more chance of getting dysmenorrhea with odds of 3.283. This finding is compatible with the result showing that the risk of dysmenorrhea is higher in women with long menstrual flows (Unsal et al. 2010).

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 which 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. Since the nature of data is self reporting, it may have resulted in under reporting of the conditions in few cases.

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 are suffering from dysmenorrhea. The confounding factors for the promotion of the irregularities are self reported health, irregular menstrual cycle, duration of menstrual flow and age at menarche. Hence advocacy of preventive strategies in the form of improving healthy life styles can be effective in correcting the menace.

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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

Conflict of Interest

None of the authors has a personal or financial conflict that has an interest in the subject of this Manuscript.

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