Clinical Epidemiology and Global Health 10 (2021) 100668

Contents lists available at ScienceDirect

Clinical Epidemiology and Global Health

journal homepage: www.elsevier.com/locate/cegh

Original article

Interlinking menstrual hygiene with Women's empowerment and reproductive tract infections: Evidence from India

Deepanjali Vishwakarma, Parul Puri, Santosh Kumar Sharma *

International Institute for Population Sciences (IIPS), Govandi Station Road, Deonar, Mumbai, 400088, Maharashtra, India

ARTICLE INFO

Keywords:
Empowerment
Hygiene
Menstruation
Methods
RTI
Women

ABSTRACT

Background: Breaking the silence on menstruation is essential for women and girls to achieve and exercise their full potential. The study explores the linkages between women empowerment, utilization of hygienic methods during menstruation, and its effect on reproductive tract infections (RTI) among women aged 15–24 years in India.

Methods: The study used the fourth round of Indian Demographic and Health Survey (NFHS-4), 2015–16. The information regarding the different dimensions of women empowerment has been collected from 122,351 women at the state level. Overall, 42,912 women aged 15–24 years surveyed in the state module were questioned regarding menstruation hygiene methods and different dimensions of women's empowerment. Bivariate and multivariate statistical techniques have been utilized to draw inferences from the data.

Results: Findings reveal that about 60% of women aged 15–24 utilized hygienic methods during menstruation in India. Owning a bank account, using mobile phones, and household decision-making emerged as significant factors that lead to the adoption of hygienic practices. Lack of menstrual hygiene method was found to result in adverse outcomes like RTI symptoms (genital sore/ulcer and had genital discharge)

Conclusions: The study concludes that the different dimensions of women empowerment are essential in accelerating the level of practicing hygienic menstruation methods and providing assistance against diverse malpractices and taboos attached to it. The existing approach for the use of menstrual hygiene methods should focus on women's right to decide on their own life and health.

1. Background[1]

Menstruation is the monthly vaginal bleeding at an interval of about 28 days from the uterine endometrium.[1] The time of onset of menstruation or menarche varies across countries. Still, the mean age of menarche is usually between 12 and 13 years across the well-nourished population in developed countries. Menstruation stops after menopause which, usually occurs between age 45–55 years.[2,3] Menstruation, being a normal biological process, is a vital sign of reproductive health, yet in many cultures, it is treated as something dismissive, shameful, or filthy. This prolonged silence around menstruation combined with limited access to information at home and in schools leaves a million women and girls with a little or no idea about the changes happening to their bodies and measures to deal with it menstruation.[4,5]

Menstruation and menstrual practices are still subjugated to many socio-cultural restrictions. It is observed that many adolescent girls and women are ignorant of the scientific facts and hygienic practices, which may lead to adverse health outcomes. Practicing hygienic practices during menstruation is of considerable importance, as it has implications on increased vulnerability to reproductive tract infections (RTI). Today, millions of women suffer from RTI and related complications, and often these infections are transmitted to the offspring of the pregnant mother.[6]

Most childbearing takes place inside a marital union in the cultural setting of India. Therefore, with increasing age at marriage and declining parity levels, women with regular menstrual cycles are increasing. However, most women do not have access to the necessary financial and non-financial logistics to manage satisfactory sanitation levels. Particularly vulnerable are young women from socially and economically deprived sections of society.[7]

* Corresponding author.
E-mail addresses: deepanjali.vishwakarma7@gmail.com (D. Vishwakarma), parulpuri93@gmail.com (P. Puri), santoshiips88@gmail.com (S.K. Sharma).

[1] List of abbreviations AOR: Adjusted Odds Ratio; NFHS: National Family Health Survey; PPS: Probability Proportional to Size (PPS); PSU: Primary Sampling Unit, RTI: Reproductive Tract Infection.

https://doi.org/10.1016/j.cegh.2020.11.001
Received 28 August 2020; Received in revised form 24 October 2020; Accepted 7 November 2020
Available online 19 November 2020

Indian society is still facing a lot of reluctance to discuss menstruation-related issues. Menstrual hygiene has empirically been the entry point to raise broader issues like gender equality and women empowerment, encompassing essential matters such as sex education, sexual and reproductive health & rights, child marriage, fistula, and female genital mutilation. Keeping the same view, each country must focus on ruling out all forms of discrimination against women, including those based on social norms surrounding menstruation. Menstruation must be implicitly addressed as a sign of good health and should be discussed openly. Thus, to exercise full potential by women, it is necessary to break the silence enclosing menstruation.[8]

Existing literature focuses on identifying the socio-economic and demographic determinants of menstruation and related issues. However, limited studies decoded menstruation as a socio-cultural phenomenon, comprising of different dimensions of women empowerment. Recent figures from the fourth round of the National Family Health Survey (NFHS-4), 2015–16, mention an upswing in the level of women's empowerment in the country.[9] The dimensions of women's empowerment consist of household decision-making, owning of the house or land, mobility, work status in the last 12 months paid in cash, owning the bank account, and owning the mobile phone. Thus, the present study explores the inter-relationship between different dimensions of women empowerment, utilization of menstrual hygiene methods, and its impact on reproductive tract infections among women aged 15–24 years in India.

2. Methods

This study has used the fourth round of National Family Health Survey (NFHS-4) conducted during 2015–16. The survey was guided under the supervision of the Ministry of Health and Family Welfare, Government of India. The International Institute for Population Sciences, Mumbai is the designated nodal agency, and ORC Macro, Calverton, Maryland, USA, currently known as the ICF International, has provided technical support in different rounds of NFHS. NFHS is a nationally represented survey, providing data on various aspects of population, family planning, maternal and child health, child survival, HIV/AIDS and sexually transmitted infections (STIs), reproductive health, and nutrition in India.

The survey adopted a uniform sample design for all the states of the country. In each state, a two-and three-stage sampling procedure was exercised to select samples from rural and urban areas, respectively. The two-stage sample selection for the rural areas encompassed selecting villages, which served as Primary Sampling Units (PSUs), with Probability Proportional to Size (PPS) at the first stage, followed by the random selection of households within each PSU in the second stage. However, wards were selected with PPS sampling in the first stage for the urban areas, followed by randomly selecting one Census Enumeration Block (CEB) from each sampled ward. Finally, for the third stage, households were randomly selected within each selected CEB.

A total of 699,686 women were interviewed in the survey. The survey collected information about the methods used during menstruation from 247,833 women aged 15–24 years. However, the information on the dimensions of women empowerment has been collected only in the state module from 122,351 women. Overall, 42,912 women aged 15–24 were interviewed regarding menstrual protection and different dimensions of women empowerment. Thus, the present analysis is concentrated on 42,912 women aged 15–24 years to maintain uniformity.

NFHS women questionnaire included questions on different protection methods used during their menstruation to prevent bloodstains: whether they used clothes, locally prepared napkins, sanitary napkins, tampons, used nothing at all, and anything else. Though, this question was not asked to women age 25 and above who had undergone a hysterectomy or who never menstruated. For the present study, practices during menstruation considered hygienic were the locally prepared napkin, sanitary napkin, and tampons.

STATA version 14.0 (StataCorp^{TM}, Texas) software was used to draw inferences from the data. Bivariate and multivariable statistical techniques were used to understand the interplay between menstrual hygiene practices and women empowerment in India. The results were organized into three main sections: first, the profile of the respondent and the prevalence of menstrual hygiene practices by various socio-demographic characteristics and different dimensions of women empowerment was computed. In the second section, the study aimed to determine the factors associated with the use of hygienic methods during menstruation by selected socio-demographic characteristics and dimensions of women empowerment. The study further tests the existence of a significant association between the use of hygienic methods during menstruation and the incidence of RTI in the Indian context.

3. Description of the variables

3.1. Dependent variables

Two dependent variables have been used to understand the menstrual hygiene practices and reproductive health problems in India. First is the methods used for protection during menstruation to prevent blood stains from becoming evident: all methods were classified into two categories, hygienic and unhygienic. hygienic methods include Sanitary napkins, locally prepared napkins, and tampons. All other methods, including clothes and anything else that women used to prevent blood stains were categories as the unhygienic method.[9&10] Owing to the taboo linked with menstrutaion, women in India do not have adequate resources to dry the clothes in a hygienic manner, therefore, for the present analysis, clothes were considered to be an unhygienic method. The second dependent variable used for the study is the reproductive tract infections (RTI), including genital discharge and genital sore or ulcer. Genital discharge: the respondents were asked 'whether have you had a bad-smelling abnormal genital discharge during the last 12 months?', if women reported yes, they were considered to have a genital discharge problem. Genital sore or ulcer: the respondents were asked during the last 12 months, have you had a genital sore or ulcer? If women reported yes, they were considered to have a genital sore problem.

3.2. Independent variables

Independent variables utilized in this study can be broadly grouped into three categories, such as background characteristics, initiation of menstrual practices, and women empowerment. Background characteristics included educational attainment in years (No education, primary, secondary, higher secondary and above), age at marriage in years (marriage before 18 and after 18), marital status (currently married, married but *Gauna*[2] not performed, separated/deserted/widowed, divorced), marital duration (less than four years, 5–9 years, ten years and above), place of residence (rural and urban), religion (Hindu, Muslim, Others), wealth index (poorest, poorer, middle, richer, richest), Caste group (Scheduled Caste (SC), Scheduled Tribe (ST), Other Backward Class (OBC), Others (non-ST/SC/OBC) and type of toilet used (no toilet, flush, pit/dry toilet, Others). Wealth index was used as a proxy measure for assessing the economic status. Initiation of menstruation practice included age at menarche divided into four groups less than or equal to 12 years, 13–15 years, 16 years and above and few respondents reported that they don't know their menarche age; hence the fourth category is taken as 'don't know.' In this study, five dimensions of women empowerment have been analyzed. It includes variable such as women owning house/land, women owning a bank account and mobile

[2] Gauna is a ceremony performed in India, when the bride starts living with the bride groom.

phone which they use on their own, women who participates in household decision making, and women who worked in last twelve months and were paid in cash.

4. Results

Poor menstrual hygiene in developing countries has been an inadequately acknowledged problem, India being no exception. If menstrual hygiene is not given importance, it will elevate the risk of reproductive infections and other women's health issues. Fig. 1 shows the prevalence of methods used during menstruation to prevent the blood stains, such as cloths, locally prepared napkins, sanitary pads, tampons, using nothing and anything else. Results portray that the most widely used method during menstruation was cloth, which was utilized by 64% of the women sampled. Use of locally prepared napkins, sanitary napkins and tampons were 16%, 43% and 2% respectively which are designated as hygienic methods. About 0.5% women aged 15–24 years reported that they were not using anything during menstruation while 0.1% of women reported that they were using anything other than clothes, locally prepared napkins, sanitary napkins, and tampons.

4.1. Profile of the respondents included in the study

Table 1 shows the profile of the selected women sample aged 15–24 years. About three-fourths of the women reported that their age at menarche was 13–15 years. A substantial proportion (18%) of women said that their age at menarche was either 12 years or less. Only 4% of the women had attained menarche on or after 16 years of age. Additionally, 1% of women didn't know about their age at menarche. About 67% of women aged 15–24 years had attained the secondary level of education, 15% had a higher level of education, whereas 10% of the respondent never went to school. In the sample, 62% of the women were never married. A substantial proportion (43%) of the respondent were married before the age of 18 years. More than one-third of the women reported that they did not have any toilet facility at home. Forty-eight percent of them had a flush toilet, and 11% had a pit/dry toilet. Findings depict that 71% of women aged 15–24 years belonged to rural areas. A significant proportion of the respondent comprised Other Backward Class (OBC), while Schedule Caste (SC) and Schedule Tribe (ST) constituting equal proportions, i.e., 19%. The majority of the respondents belonged to the Hindu religion (73%), followed by Muslims (17%) and the remaining 11% from other religious backgrounds (Christian, Sikh, Buddhist, etc.). Regional variation was also noticed among the women aged 15–24 years. A majority of women belonged to the Northern (30.6%), followed by Eastern (17.5%), Western (15.5%), Southern (12.3%), North-eastern (12.0%), and Central (12.1%) part of the country. Wealth Index analysis portrays that the sample comprised of a higher proportion of women from poorer and middle wealth quintile followed by the poorest, richer, and richest. More than fourth-fifths of the respondent reported that they had regular exposure to mass media.

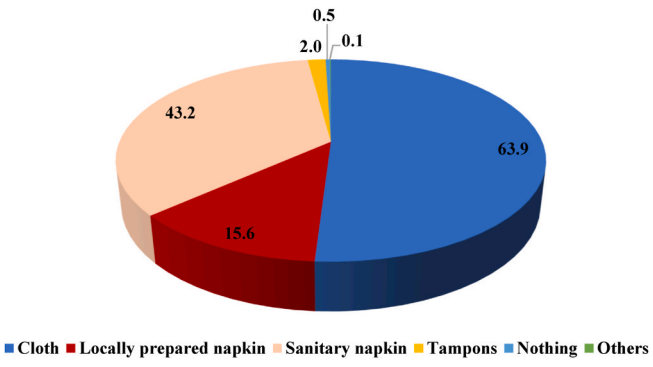

Fig. 1. Prevalence of methods used during menstruation among women age 15–24 years, 2015–16, India.

Table 1
Socio-demographic profile of the women age 15–24 years, NFHS-4 (2015–16), India.

Background characteristics	Weighted Percentage (State M)*	Total
Respondent current age (in years)		
Less than 18	30.7	13,160
18 and above	69.3	29,752
Age at Menarche (in years)		
≤12	18.3	7870
13–15	76.4	32,780
16and above	4.2	1792
Don't Know	1.1	470
Education		
No education	10.1	4340
Primary	8.4	3611
Secondary	67.0	28,754
Higher	14.5	6207
Marital status		
Never married	61.7	26,460
Currently married	36.9	15,813
Married but gauna not performed	0.8	333
Separated/deserted/widowed/ Divorced	0.7	306
Age at marriage (in years)		
Before 18	42.7	6898
18 and above	57.3	9247
Type of toilet used		
No toilet	36.1	15,486
Flush	48.3	20,737
Pit/dry	10.5	4484
Others	5.1	2205
Residence		
Urban	29.0	12,447
Rural	71.0	30,465
Caste		
Scheduled Castes (SC)	19.2	7837
Scheduled Tribes (ST)	18.6	7597
Other Backward Class (OBC)	41.6	16,966
Others	20.6	8398
Religion		
Hindu	72.6	31,157
Muslims	16.8	7226
Others	10.6	4529
Region		
East	17.5	7505
West	15.5	6668
North	30.6	13,116
South	12.3	5292
North-East	12.0	5153
Central	12.1	5178
Wealth Index		
Poorest	17.7	7612
Poorer	22.2	9510
Middle	22.2	9533
Richer	20.5	8808
Richest	17.4	7449
Regular exposure of media		
No	15.5	6645
Yes	84.5	36,267
Services talked about menstrual hygiene (in last 3 months)		
No	98.87	42,428
Yes	1.13	484
Total	**100.0**	**42,912**

* State module

4.2. Practices of menstrual hygiene methods

Hygiene-related practices during menstruation are of considerable importance, as they may cause vulnerability to Reproductive Tract Infections (RTIs). Table 2 depicts statistics for women aged 15–24 years who use hygienic methods for protection (locally prepared napkins, sanitary napkins, and tampons) during menstruation according to some

Table 2
Percentage distribution of women aged 15–24 years who used hygienic methods of protection during the menstrual period by some selected socio-demographic characteristics, NFHS-4 (2015–16) India.

Background characteristics	Prevalence of menstrual hygiene practices
Respondent current age (in years)	
Less than 18	58.8
18 and above	59.9
Age at Menarche (in years)	
≤12	60.4
13–15	59.8
16 and above	61.3
Don't know	8.1
Education	
No education	18.7
Primary	32.5
Secondary	62.0
Higher	86.2
Marital status	
Never married	65.5
Currently married	51.6
Married but gauna not performed	40.7
Separated/deserted/widowed/ Divorced	36.1
Age at marriage (in years)	
Before 18	41.5
18 and above	59.1
Type of toilet used	
No toilet	39.3
Flush	74.8
Pit/dry	57.8
Others	56.7
Residence	
Urban	77.3
Rural	50.5
Caste	
Scheduled Castes (SC)	56.4
Scheduled Tribes (ST)	41.1
Other Backward Class (OBC)	59.4
Others	69.8
Religion	
Hindu	59.3
Muslims	56.6
Others	74.4
Region	
East	44.9
West	62.3
North	57.9
South	81.3
North-East	51.9
Central	41.1
Wealth Index	
Poorest	21.5
Poorer	41.7
Middle	61.6
Richer	76.5
Richest	88.8
Regular exposure of media	
No	20.8
Yes	66.1
Services talk about menstrual hygiene	
No	59.5
Yes	69.5
Total	**59.6 (N = 42,912)**

selected background characteristics. Overall, approximately 60% of the women reported that they had used hygienic methods during menstruation. Menarche, the onset of the first menstrual cycle, is a significant milestone in a woman's life. The prevalence of hygienic methods used to prevent blood-stains during menstruation was 60% among women who had attained age at menarche at the age of 16 years and above, 13–15 years and before or 12 years. Only 8% of women, who didn't know about their age at menarche, reported that they had used hygienic methods during menstruation.

Results show that education is positively associated with using hygienic methods during menstruation to prevent blood-stains. More than fourth-fifths of the higher secondary educated women reported using hygienic methods, followed by 62% secondary class educated women. Only 19% of women with no education used hygienic methods to prevent blood-stains from soiling the attire. The prevalence of hygienic methods was higher among never-married women (66%) while, 52% of currently married women reported to use hygienic methods during menstruation. Further, the result shows that hygienic methods during menstruation were higher among women who married after 18 years of age (59%) compared to those who married before age 18 years (42%). About two-fifths of women reported that they had used hygienic methods despite having no toilet facility at home. Among the women aged 15–24 years of age, the prevalence of hygienic methods used during menstruation was 75% among those who had a flush toilet and 58% with having pit/dry toilet at home.

Hygienic practices during menstruation were not up to the mark in the rural areas as compared to the urban areas. The prevalence of hygienic methods used during menstruation was 51% among women residing in the rural areas whereas, the prevalence was higher in urban areas (77%). Caste-wise analysis using hygienic methods during menstruation portrays that the prevalence is higher among women who belong to caste groups other than SC/ST/OBC (69.8%). The prevalence of the use of hygienic practices was 56%, 41%, and 59% for SC, ST, and OBC, respectively. It was found that about three-fourths of women from other religious groups (Christian, Sikh, etc.) reported a higher prevalence of hygienic methods used during menstruation than the Hindu and Muslim. The prevalence of reported use of hygienic methods for all regions in India was above 50%; however, the results depict only 45% and 41% prevalence for the Eastern and Central region, respectively. The study results portray a greater proportion (66%) of women reporting the use of hygienic methods during menstruation, who were regular exposure to mass-media.

4.3. Women empowerment and use of hygienic method for protection during menstruation

Working status of women, decision making regarding household, and owning of the asset, and use of mobile phone in the current era are important influencers in usage or non-usage of hygienic methods during menstruation. Fig. 2 shows the percent distribution of women age 15–24 years using hygienic methods during menstruation by different dimensions of empowerment. Results show that owning rights of the house or land among women has no positive effect on the use of hygienic method during menstruation. Only 56% of women those who have own house or land, reported using hygienic methods in contrast to women those who have no house or land (61%). Those women who have reported owning the bank account, among them more than two-thirds (71%) use hygienic methods during menstruation. Further, results show that 73% of respondents who have mobile phones, were using hygienic methods to prevent blood-stains during menstruation.

In order to study the association between women empowerment and use of hygienic methods for managing menstruation, bivariate logistic regression models have been utilized. Two models have been used to determine the factors associated with hygienic methods used during menstruation among women age 15–24 years in India. Model 1comprised of the selected socio-demographic characteristics, whereas, Model 2 included different dimensions of women empowerment along with socio-demographic characteristics to determine the significant contribution of women empowerment on the hygienic menstruation methods (Table 3).

Results show that those women who have attained the age at menarche at 16 years and above were significantly more likely (AOR = 1.20, p-value <0.05) to use hygienic method during menstruation in Model 1. Also, as years of schooling increase, the odds of using hygienic methods during menstruation significantly increased in both the models. However, in Model 2, when women empowerment was taken into

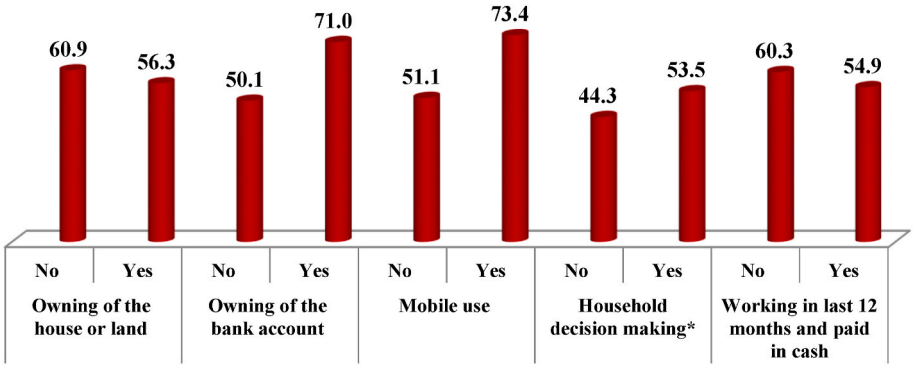

Fig. 2. Percent distribution of women age 15–24 using hygiene method during menstruation by different dimensions of empowerment. NFHS-4, 2015–16. *The information of Household decision making is available only for currently marriage women.

consideration the odds of using hygienic methods was found to be less. Results from logistic regression model show that the practice of hygiene method was 1.26 (p-value<0.01) and 1.27 (p-value <0.05) times more likely among women those who are married at age 18 years and above in Model 1 and 2 respectively.

Findings further suggest that women who had no toilet facility at home were less likely to practice hygienic methods during menstruation to prevent blood-stains than their counterparts in both the logistic models. Finding of the study depicts that women residing in rural areas were significantly 33% (p-value <0.01) less likely to use menstrual hygiene practices in both the models. Results of multivariable analysis by different caste group portray that women belonging to the OBC category were significantly less likely to use hygienic method during menstruation in both the regression models. Those women belonging to other religion (Sikh, Christian, Jain, etc.) than Hindu and Muslim religion were more likely to use the hygienic methods in both the models. Multivariate logistic regression results show that the women who belong to Northern, Southern and North-eastern region, were significantly more likely to use hygienic methods during menstruation, whereas, women belonging to Central region were less likely in Model 1. However, in Model-2 the women from North-eastern region were not found to be significantly associated with hygienic practices. Outcomes from the analysis of wealth index gives a similar pattern in both the regression models, which suggests that as wealth status of the household increases the odds of using hygiene method during menstruation increases simultaneously.

The women with regular exposure to mass-media were more likely (OR = 1.72, p-value <0.01) and (OR = 1.65, p-value <0.01) to use hygienic methods in Model-1 and Model-2. Those women who have reported owning a bank account were 1.09 (p-value <0.05) times more likely to use hygienic methods during menstruation to prevent the blood-stains than their counterparts. Further, results show that women who have mobile phone are significantly (OR = 1.26, p-value<0.01) more likely to use hygienic methods to prevent blood-stains during menstruation. Those women who have a take on household decision making are more likely to use hygienic methods during menstruation.

The present study also analyzed the association between use of hygienic practices during menstruation and two self-reported RTI symptoms namely genital sore/ulcer and genital discharge in the last 12 months (Table 4). Results of logistic regression showed that there is a significant association between the practicing hygienic methods during menstruation and RTI symptoms (genital sore/ulcer and had genital discharge) in the last 12 months among age 15–24 years. Those women who have not used hygienic methods during menstruation were significantly 1.59 (p-value<0.001) times and 1.37 (p-value<0.001) times more likely to have a genital sore/ulcer and had genital discharge.

5. Discussion

To achieve social sustainability, on the whole, UN Millennium Development Goals-2000, emphasized the development of women, by empowering them, promoting gender equality and imparting them with health and well-being. However, as we have advanced post the 2015 world, WASH – water, sanitation, and hygiene has emerged as a pivotal concern. WASH deals with cleanliness, sanitation, hygiene awareness and its implementation as a practice among women and children.[11]

Menstruation is a normal physiological process, a phenomenon, unique to women. In Indian society, there are diverse ways of welcoming this period of a woman's life. There are the variety of ceremonies which are of celebrated in different parts of the country, some of which are referred as, *'Ritu Kala Samskara'*, *Manjal Neerattu Vizha'*, and, *'Xoru Biya'* etc. These ceremonies are mainly designed to acknowledge the reproductive and marriageable status of young girls. However, these ceremonies do not impart any knowledge about maintaining the phenomenon in a hygienic way to these young girls.

Additionally, there are numerous myths which are attached with menstruation in India; it is considered filthy. Owing to the shame, which is attached to menstruation, not just for individuals from rural areas but also, urban areas, call it by different synonyms like 'test match', 'that time of the month', 'lady time', 'happy birthday' etc. Some customs of Indian society, including sending women to basic huts outside the village premises, 'gaokar', and are forced to live in grubby surroundings. These norms compel women to overlook the importance of hygiene during menstruation. Lack of menstrual hygiene was found to result in adverse health outcomes like, various yeast infections and RTI.[12]

Findings of the study reveal that around two-thirds of the women age 15–24 years used cloths during menstruation to prevent blood-stains and 17% of women used locally prepared napkins. These findings were also consistent with the results of the other studies conducted in India,[13,14] which portrayed that the majority of the young girls were using old clothes, homemade napkins, and very few used cotton wool or sanitary napkins. The prime reason for using cloth is that, it is inexpensive and easily accessible. Women use all kinds of old, ragged, and rejected clothes to serve the purpose. However, using clothes as an alternative is more popular among women in the rural areas and urban slums dwellers.[15,16&17] The prime reason that a higher proportion of women in rural areas still utilize homemade napkins during menstruation is because of the higher prices and lack of availability of the ready-made sanitary napkins in the rural parts of the country.[17]

Findings of the study revealed that overall more than one-thirds of the women in age-group 15–24 years were still using the unhygienic methods during menstruation to prevent the blood-stains. Acceptance of the unhygienic practices during menstruation may be because of its easy availability, for example cloth is easily washable and convenient to dry in the open, reusable, and has the good absorbing capacity.

Results portrays that education, regular exposure of mass media and

Table 3
Logistic regression model for use of hygienic methods of protection during the menstrual period, NFHS-4, 2015-16.

Background characteristics		Model 1	Model2
		Odds Ratio (95% CI)	**Odds Ratio (95% CI)**
Respondent current age (in years)	Less than 18®		
	18 and above	0.76*** [0.60–0.92]	0.66*** [0.53–0.81]
Age at Menarche in years)	≤12®		
	13–15	1.04 [0.94–1.16]	1.02 [0.92–1.14]
	16 and above	1.20** [0.99–1.44]	1.14 [0.95–1.37]
	Don't Know	0.36*** [0.24–0.56]	0.35*** [0.23–0.55]
Education	No education®		
	Primary	1.57*** [1.36–1.82]	1.52*** [1.31–1.76]
	Secondary	2.65*** [2.40–2.98]	2.43*** [2.16–2.74]
	Higher	6.01*** [4.99–7.24]	4.94*** [4.07–5.98]
Marital status	Never married®		
	Currently married	–	
	Married but gauna not performed	0.95 [0.73–1.24]	–
	Separated/ deserted/ widowed/Divorced	–	
Age at marriage (in years)	Before 18 ®		
	18 and above	1.26*** [1.16–1.36]	1.27** [1.06–1.32]
Type of toilet used	No toilet®		
	Flush	1.21*** [1.09–1.34]	1.18*** [1.06–1.32]
	Pit/dry	1.13 [0.97–1.31]	1.12 [0.97–1.31]
	Others	1.21*** [1.06–1.39]	1.33* [0.99–1.30]
Residence	Urban®		
	Rural	0.77*** [0.69–0.85]	0.77*** [0.69–0.85]
Caste	Scheduled Castes (SC) ®		
	Scheduled Tribes (ST)	0.93 [0.81–1.06]	0.91 [0.80–1.04]
	Other Backward Class (OBC)	0.92* [0.83–1.01]	0.90** [0.81–0.99]
	Others	1.09 [0.96–1.23]	1.04 [0.92–2.30]
Religion	Hindu ®		
	Muslims	1.03 [0.91–1.16]	1.03 [0.91–1.16]
	Others	1.95*** [1.65–2.30]	1.94*** [1.64–2.30]
Region	East®		
	West	1.06 [0.94–1.19]	1.09 [0.96–1.24]
	North	1.25*** [1.12–1.41]	1.25*** [1.11–1.41]
	South	1.90*** [1.66–2.19]	1.98*** [1.71–2.28]
	North-East	1.15* [0.98–1.37]	1.09 [0.92–1.30]
	Central	0.55*** [0.47–0.63]	0.57*** [0.49–0.67]
Wealth Index	Poorest®		
	Poorer	1.54*** [1.36–1.74]	1.52*** [1.34–1.72]
	Middle	2.58*** [2.26–2.95]	2.44*** [2.13–2.80]
	Richer	3.72*** [3.18–4.37]	3.44*** [2.93–4.05]
	Richest	6.89*** [5.66–8.40]	6.23*** [5.09–7.62]
	No ®		
Regular exposure of media	Yes	1.72*** [1.54–1.91]	1.65*** [1.48–1.85]
Services talk about menstrual hygiene	No®		
	Yes	1.02 [0.58–1.77]	1.08 [0.61–1.90]
Owning of the house or land	No ®		
	Yes		0.94 [0.87–1.02]
Owning of the bank account	No ®		
	Yes		1.09** [1.00–1.18]
Mobile use	No ®		
	Yes		1.55*** [1.43–1.68]
Household decision making	No ®		
	Yes		1.26*** [1.14–1.38]
Working in last 12 months and paid in cash	No ®		
	Yes		0.95 [0.83–1.08]
	Log likelihood	−8393.2331	−8126.9106

® Reference category, ***p < 0.01, **p < 0.05, *p < 0.1; 95% CI = 95% confidence interval.

Table 4
Odds ratio for symptoms of genital score ulcer and abnormal vaginal discharge in last 12 months among women using hygienic and unhygienic method during menstruation, NFHS-4 (2015–16), India.

	Had genital sore/ulcer in the last 12 months	Had genital discharge in the last 12 months
	Exp(B)@	**Exp(B)**
Hygienic (R)	1.000	1.000
Unhygienic	1.587***[1.335–1.887]	1.368***[1.240–1.510]

***Significant at $p < 0.001$.
The results are adjusted for socio-demographic characteristics and the different dimension of women's empowerment.

toilet facility at home play a crucial role in maintaining menstrual hygiene. A study conducted on determinants of menstrual hygiene among adolescent girls also reported that good menstrual hygiene was more among those girls who were studying in more than grade 10th in school, usage of the proper sanitary latrine at home and exposure to advertisements promoting usage of sanitary pads in mass media.[18]

The present study brought out that women from rural areas were more prone to use unhygienic methods during menstruation to prevent the blood-stains. This may be due to lack of mobility rights, poor wealth status of the households, lack of private toilet facility, lack of knowledge and awareness, lack of education and availability and accessibility of the hygienic methods, local customs as well as disposal and storage issues among women aged 15–24 years in India. Another study also portrayed a similar finding that a majority of rural women in India employ clothes and rags for menstrual hygiene. These materials might expose women to reproductive tract infections since it may be difficult for them to keep their used napkins clean and free of harmful bacteria. Washing reusable menstrual products with soap and drying them in sunlight may be difficult due to lack of water, privacy issues, and cultural taboos associated with menstruation.[19]

In India, tribal groups are considered as most vulnerable, and as a result, they are subjected to isolation in society. The study revealed that women belonging to schedules tribes are in a more vulnerable situation as they are less prone to use hygienic methods during menstruation as

compared to other caste groups. Bad cultural practices and taboos regarding the issue, has prevented the girls and women from articulating their needs for proper menstrual hygiene.[20]

Women empowerment refers to creating an environment which enables women to take independent decisions on their personal development, giving them equal rights in the community, society, and workplace. The empowerment of women is the best strategy and the most effective tool to ensure their health and wellbeing, which is essential to achieve the Sustainable Development Goals.[21,22] In the diverse land of India, there are a variety of cultural beliefs, myths, and taboos relating to menstruation. There are unwritten rules and practices, about managing menstruation and intermingling with menstruating women, which are evident from most parts of the country. Amongst these unwritten regulation which are enforced on women, only few can be counted as beneficial, whereas, the majority of them have potentially unfavorable ramifications. The evidence generated by the present study supports the claim of heterogeneity in the following practices of hygienic methods for protection during menstruation by region in the country. The study findings emphasize that the problem (use of unhygienic practices during menstruation) is crucial for the Central and Eastern region of the country. This could be linked to the level of development, accessibility, availability and affordability of products that can be utilize to manage menstruation. Additionally, this finding can be directly limked to the status of women and attitude of society towards menstruation in these regions. Stigmatizing menstruation, which in plain terms, is a biological phenomenon often leads to the violation of several human rights, prominently the right to human dignity, right to non-discrimination, equality, bodily integrity, health, privacy and the right to freedom from inhumane and degrading treatment from abuse and violence.[8]

With the concern of these practices in our society, decision making the power of women can be utilized as a smooth and easy way to elevate the level of utilization of hygienic practices during menstruation. As the present study revealed that household decision making power of women has a positive association with the use of hygienic practices during menstruation to prevent the blood strain. If a woman can take decisions for the household, then there are higher chances that she can take decisions regarding the choice of hygienic methods for protection during menstruation.

Women working in the last 12 months and are paid in cash and having a personal bank account that they can use on their own are two important factors of economic empowerment of women. In the consistency of this fact, the study portrays that women, who have a personal bank account, are more prone to use hygienic methods for protection during menstruation. Economic status of women is a real issue behind the consistent use of hygienic methods during menstruation. Nowadays, sanitary pads or other hygienic methods are easily available in the stores, but the cost is high. In this situation, the use of hygiene method during menstruation become a challenging issue for women, especially for the one who depend on their spouse and families for economic support, or who belong to the economically deprived sections of the society. In addition to this, when the taxation rules of India, fixed 12% tax on sanitary pads, which is a basic requirement for tackling menstruation in a hygienic way, but, no tax on *'Nirodh'* (condom) or '*Sindoor' (*Vermilion*),* it's a high time for the policy makers to redesign taxation policies in a way preserve the benefits of women in India. Thus, ensuring the accessibility of cheap and tax-free menstrual products like sanitary napkins, tampons, menstrual cups, etc.

In the current era, increased access to mobile phones has offered a variety of profits and opportunity to reach marginalized sections, like women. These mobile phones can be easily used to disseminate information and update services to improve their well-being.[23] By far, mobile technologies are being used to elevate the quality of care-giving and to monitor and evaluate maternal and child health activities in developing countries.[24] Recently published report of National Family Health Survey (NFHS-4), reveals that overall 46% of Indian women own a mobile phone.[9] Use of health technologies through mobile phones overcomes structural barriers to health by allowing for more personalized methods of communication and community based educational outreach. One example is the *'Comm. Care'* program in the state of Bihar, India. This program uses a mobile application for counseling adolescent girls and women on menstrual hygiene, sexually transmitted disease and family planning methods.[25] Lack of menstrual hygiene was found to result in adverse outcomes like Reproductive Tract Infections.

6. Conclusion and recommendations

This study has highlighted the use of menstrual hygiene methods for protection during menstruation and its association with different dimensions of women empowerment in India. India is a diverse country, with disparities on the basis of sex, caste, creed, culture and wealth. These disparities often result in significant variations in health and social indicators among girls and women. Despite the improvement in the use of hygienic methods during menstruation, the condition is still not adequate. Status of women in India has improved in different dimensions, which have emerged essential in accelerating the level of practicing hygienic menstruation methods. However, the societal norms have affected the decision of using menstrual hygiene methods as evident from the present study, which depicts a positive association between household decision making power of women and use of hygienic methods during menstruation.

The bottom-top approach with women as a pivot, is the current strategy of implementing programme for use of menstrual hygiene methods which in turn enables protection from infections. This approach should focus at the women's right to decision on their own life and health. Since men play a significant role in all spheres of a woman's life including reproduction, men should also be involved in the programmes where the reproductive and sexual rights of women are addressed. Through teaching men to play responsible roles in the complex process of social and behavioral changes. This signals a need for couple-oriented counseling and Information Education and Communication (IEC) programmes to make an effort at removing the malpractices during menstruation. These programs should further focus on changing the mental setup by including inter-personal counseling and capacity building sessions by outreach workers, which may empower women with enhanced knowledge about their health and bodily rights.

Girls, boys and other family members should also receive accurate, timely information on the biological and psycho-social aspects of puberty, menstruation, and about importance of following hygienic practices to manage menstruation from different ways like mass media, school education, influencers, and community workers.

6.1. Limitation of the study

Present study is an effort to explore the interlinkages between dimensions of women empowerment, utilization of hygienic menstruation methods of protection and its impact on Reproductive Tract Infections among women aged 15–24 years in India. However, managing menstruation in a hygienic way should not be restricted to any specific age-group, but should be practiced religiously and homogeneously by all menstruating women. Additionally, it is crucial to explore similar linkgaes for women in other menstruating ages, however, NFHS do not provide data on the same, and this section of information is specifically restricted to women in age-group of 15–24 years. Thus, the present study is limited to women in the age-group 15–24 years.

Funding

No fund was available for this research.

Authors' contributions

D. Vishwakarma conceived the idea and analyzed it. P. Puri and S.K. Sharma designed the paper and analyzed it, interpreted the results and drafted the manuscript. Further P. Puri and D. Vishwakarma has reviewed the paper and edited accordingly. All the authors read and approved the final manuscript.

Declaration of competing interest

The authors declared that they have no financial and non-financial competing interests.

Acknowledgments

Authors are thankful to all the project coordinators of National Family and Health Survey for their relentless efforts in producing such vital information for the different dimension of women empowerment, menstrual hygiene practices, and their reproductive health.

References

1 Padubidri VG, Daftary SN. Shaw's textbook of gynaecology (Chapter 3). In: *Physiology*. thirteenth ed. New Delhi: Churchill Livingstone Pvt Ltd; 2004:46.
2 Bhattacherjee S, Ray K, Biswas R, Chakraborty M. Menstruation: experiences of adolescent slum dwelling girls of siliguri city, West Bengal, India. *J Basic Clin Reprod Sci*. 2013;2(2):85–91.
3 Diaz A, Laufer MR, Breech LL. Menstruation in girls and adolescents: using the menstrual cycle as a vital sign. *Pediatrics*. 2006;118:2245–2250.
4 House S, Mahon T, Cavill S. Menstrual hygiene matters: a resource for improving menstrual hygiene around the world. *Reprod Health Matters*. 2013;21(41):257–259.
5 Santra S. Assessment of knowledge regarding menstruation and practices related to maintenance of menstrual hygiene among the women of reproductive age group in a slum of Kolkata, West Bengal, India. *Int J Commun Med Pub Health*. 2017;4(3):708–712.
6 Dasgupta A, Sarkar M. Menstrual hygiene: how hygienic is the adolescent girl? *Indian J Community Med: official publication of Indian Association of Preventive & Social Medicine*. 2008;33(2):77.
7 Dommaraju P. *Marriage and Fertility Dynamics in India*. 2012.
8 Water Supply and Sanitation Collaborative Council (WSSCC). *From Taboo to Empowerment: Menstruation and Gender Equality*; 2013. http://wsscc.org/2016/05/27/taboo-empowerment-menstruation-gender-equality/.
9 International Institute for Population Sciences (IIPS) and ICF. *National Family Health Survey (NFHS-4), 2015-16: India*. Mumbai: IIPS; 2017.
10 Anand E, Singh J, Unisa S. Menstrual hygiene practices and its association with reproductive tract infections and abnormal vaginal discharge among women in India. *Sexual Reprod Healthcare*. 2015;6(4):249–254.
11 Global Hunt Foundation (GHF). Bringing empowerment to women through menstrual hygiene. https://www.slideshare.net/GHFoundation/bringing-empowerment-to-women-through-menstural-hygiene-a-unicharm-india-and-ghf-iniitative; May 2, 2015.
12 Shah SP, Nair R, Shah PP, Modi DK, Desai SA, Desai L. Improving quality of life with new menstrual hygiene practices among adolescent tribal girls in rural Gujarat, India. *Reprod Health Matters*. 2013;21(41):205–213.
13 Nair P, Grover V, Kannan A. Awareness and practices of menstruation and pubertal changes amongst unmarried female adolescents in a rural area of East Delhi. *Indian J Community Med*. 2007;32:156–710, 4103/0970-0218.35668.
14 Khanna A, Goyal RS, Bhawsar R. Menstrual practices and reproductive problems: a study of adolescent girls in Rajasthan. *J Health Manag*. 2005;7(1):91–107.
15 Singh AJ. Place of menstruation in the reproductive lives of women of rural North India. *Indian J Community Med*. 2006;31(1):10.
16 Garg S, Sharma N, Sahay R. Socio-cultural aspects of menstruation in an urban slum in Delhi, India. *Reprod Health Matters*. 2001;9(17):16–25.
17 Dhingra R, Manhas S, Kohli N, Mushtaq A. A comparative study of understanding of menstrual process among married women belonging to two ecological settings. *J Hum Ecol*. 2007;22(3):261–265.
18 Sudeshna R, Aparajita D. Determinants of menstrual hygiene among adolescent girls: a multivariate analysis. *Natl J Community Med*. 2012;3(2):294–301.
19 Mahlet A, Woldetsadik. *Women's Menstrual Hygiene in India: The Health and Environmental Implications*. The Rand Blog; Aug 22, 2014. https://www.rand.org/blog/2014/08/womens-menstrual-hygiene-in-India-the-health-and-environmental.html.
20 Sridhar D, Gauthami N. Menstrual health status and cultural practices of tribal adolescent girls. *International Journal Of Community Medicine And Public Health*. 2017;4(11):4120–4124.
21 Annan K. *Article on Empowering Women the Most Effective Development Tool*. UN News Centre; 2005. Retrieved from http://www.un.org/apps/news/story.asp?NewsID=13478.
22 Chamar V. *Short Essay on Gender Inequality. Social Issues in India*. 2015.
23 Valk JH, Ahmed T, Rashid AT, Laurent Elder L. Using mobile phones to improve educational outcomes: an analysis of evidence from asia. *Int Rev Res Open Dist Learn*. 2010;11:1.
24 Singh SK, Sharma B, Vishwakarma D, Yadav G, Srivastava S, Maharana B. Women's empowerment and use of contraception in India: Macro and micro perspectives emerging from NFHS-4 (2015–16). *Sex. Reprod. Healthc*. 2019;19:15–23.
25 Health Literacy: Improving health, health systems, and health policy around the world: workshop summary. Institute of Medicine, Board on Population Health and Public Health Practice, Roundtable on Health Literacy (chapter 3) *Med Dent J*. 10-Jul-2013:12–234.