

AWARENESS AND USAGE OF MENSTRUAL TRACKING APPS AMONG FEMALES AGED 18-24 YEARS

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ABSTRACT

Background: Menstrual tracking applications have emerged as important digital health tools that assist women in monitoring menstrual cycles, predicting periods, and improving reproductive health awareness. Despite their increasing use, there is limited evidence regarding awareness, attitudes, and usage patterns among young women, particularly in the Indian context.

Aim: To assess the awareness and usage of menstrual tracking applications among females aged 18-24 years.

Methods: A hospital-based cross-sectional descriptive study was conducted among 300 young women of age 18-24 years attending the outpatient department of Obstetrics and Gynaecology. Participants who had used a menstrual tracking application at least once in the past year were included. Data were collected using a pretested structured questionnaire assessing knowledge, attitude, and practice (KAP). Descriptive statistics were used to summarize variables, and inferential analysis including chi-square test and logistic regression was performed to identify factors Associated with good practice. A p-value <0.05 was considered statistically significant.

Results: Among 300 participants, the majority were aged 21–24 years (53.7%), undergraduates (64.0%), and from urban areas (68.7%). Good knowledge regarding menstrual tracking applications was observed, with 85.0% aware of cycle prediction, 80.0% aware of symptom tracking, and 81.7% recognizing their role in understanding menstrual patterns. However, only 70.0% were aware of limitations in fertility prediction and 68.3% recognized that these applications are not reliable contraceptive methods.

A positive attitude was reported by most participants, with 83.3% agreeing that apps help in understanding menstrual cycles, 81.7% finding them easy to use, and 78.3% willing to recommend them. However, 63.3% expressed concerns regarding data privacy.

Among app users (n=225), good practice was observed in 76.9% of participants aged 21–24 years compared to 63.6% in younger participants (p=0.016). Higher education (75.0% vs 58.3%, p=0.004), urban residence (78.3% vs 60.6%, p=0.037), good knowledge (78.4% vs 45.5%, p<0.001), and positive attitude (78.8% vs 57.1%, p<0.001) were significantly associated with good practice. Multivariate analysis identified knowledge (Adjusted OR=0.29), attitude (Adjusted OR=0.44), and education (Adjusted OR=0.57) as independent predictors.

Privacy concerns (n=83), lack of knowledge (n=72), and technical issues (n=47) were identified as major barriers, while education and awareness (29%), better privacy protection (25%), improved accuracy (24%), and doctor recommendation (22%) were key facilitators.

Conclusion: The study demonstrates that have good awareness and a positive attitude toward menstrual tracking applications, with moderate to high levels of usage. Knowledge, attitude, and educational status significantly influence effective utilization. Addressing privacy concerns, improving user education, and enhancing application accuracy may further strengthen adoption and promote better reproductive health outcomes.

KEYWORDS: Menstrual tracking applications; young women ; digital health; menstrual health; knowledge attitude practice; mobile health; reproductive health

INTRODUCTION

Menstruation is a normal physiological process that reflects the functional integrity of the hypothalamic–pituitary–ovarian axis and serves as an essential marker of reproductive health in females [1]. The menstrual cycle involves cyclical hormonal changes that regulate endometrial proliferation and shedding, and its characteristics such as cycle length, duration, and flow are important indicators of overall gynecological health [2]. In young girls, menstrual cycles are often

irregular during the initial years following menarche due to immaturity of the endocrine axis, which may be associated with symptoms such as dysmenorrhea, mood disturbances, and reduced quality of life [3]. These menstrual-related issues can significantly impact daily activities, academic performance, and psychosocial well-being, thereby highlighting the importance of early menstrual health awareness and management [4].

Adolescent health has emerged as a global public health priority, with approximately 1.2 billion adolescents worldwide requiring targeted interventions to address their unique health needs [5]. Menstrual health, in particular, has gained increasing attention as an integral component of adolescent well-being. The World Health Organization emphasizes that improving menstrual health literacy is essential for empowering young girls and enabling them to make informed decisions regarding their reproductive health [6]. In addition, the United Nations Population Fund recognizes menstrual health and hygiene as a critical factor influencing gender equality, school attendance, and overall quality of life among adolescent girls [7]. Lack of awareness, cultural stigma, and inadequate access to reliable information continue to pose significant barriers, especially in low- and middle-income countries such as India [8].

With rapid advancements in technology, digital health tools have emerged as innovative solutions to bridge gaps in health education and service delivery. Menstrual tracking applications (MTAs) are among the most widely used digital health tools, enabling users to record menstrual cycles, predict future periods, monitor symptoms, and gain insights into their reproductive health [9]. These applications offer features such as reminders, symptom tracking, ovulation prediction, and personalized health information, which can enhance menstrual awareness and self-management [10]. The increasing penetration of smartphones and internet accessibility has further facilitated the widespread adoption of such applications among young adults.

Recent data suggest a substantial rise in the use of mobile health applications globally. According to Pew Research Center, a significant proportion of young individuals actively use mobile applications for health-related purposes, reflecting a growing trend toward digital self-care [11]. Similarly, global market analyses indicate that menstrual tracking apps are among the most frequently downloaded health applications, with millions of users worldwide relying on them for cycle tracking and reproductive health monitoring [12]. A recent mixed-methods study reported that more than 60% of millennial and Generation Z women use menstrual tracking apps primarily for predicting cycles and increasing health awareness [13]. Furthermore, studies evaluating these applications have highlighted their potential to improve knowledge, promote behavioral change, and support clinical decision-making when integrated into healthcare systems [14].

Despite the increasing popularity of menstrual tracking applications, concerns remain regarding their accuracy, reliability, and user understanding. A scoping review of menstrual and fertility tracking apps demonstrated considerable variability in the quality of information provided and emphasized the need for evidence-based content and user education [15]. Moreover, issues related to data privacy, user trust, and digital literacy may influence the adoption and sustained usage of these applications, particularly among young females who may lack adequate guidance in interpreting app-generated data. In the Indian context, research on menstrual tracking app usage among young females remains limited. Cultural taboos, inadequate menstrual education, and disparities in digital access further complicate the effective utilization of such technologies. While urban populations may demonstrate higher awareness and usage, rural and semi-urban populations often face barriers related to affordability, accessibility, and sociocultural constraints. Therefore, understanding the knowledge, attitudes, and practices (KAP) related to menstrual tracking applications among females aged 18-24 years is essential to identify gaps and design targeted interventions.

Given the growing relevance of digital health tools and the need for improved menstrual health literacy, this study aims to assess the awareness and usage of menstrual tracking applications among females aged 18-24 years. By evaluating user knowledge, attitudes, and practices, as well as identifying barriers and facilitators influencing app usage, the study seeks to generate evidence that can inform public health strategies, enhance digital health integration, and promote better reproductive health outcomes among females aged 18-24 years.

METHODOLOGY

This study will be conducted as a hospital-based cross-sectional descriptive study in the Outpatient Department of Obstetrics and Gynaecology at Sree Balaji Medical College and Hospital, Chennai. The study population will consist of females aged 18-24 years attending the outpatient clinic who have used a menstrual tracking application at least once within the past one year. Participants who are willing to provide informed written consent will be included, while those who are unwilling to participate will be excluded from the study.

The sample size was calculated using the standard formula for estimating a single population proportion:

$$n = Z^2 p(1-p)/d^2$$

Assuming a prevalence (p) of 50% to ensure maximum sample representation, with a 95% confidence interval ($Z = 1.96$) and a margin of error (d) of 5%, the minimum required sample size was estimated to be 384 participants. However, considering feasibility constraints and the hospital-based nature of the study, a sample size of 300 participants was finalized. This sample size is considered adequate for descriptive cross-sectional studies and ensures sufficient statistical power to detect meaningful associations [11]. A convenience sampling technique was adopted, and eligible participants were recruited consecutively until the required sample size of 300 was achieved.

Data will be collected using a pretested and structured questionnaire designed to assess knowledge, attitude, and practice (KAP) related to menstrual tracking applications. The knowledge component will evaluate awareness regarding the functions, accuracy, and health-related aspects of these applications. The attitude component will explore perceptions regarding usefulness, trustworthiness, privacy concerns, and overall satisfaction. The practice component will assess the frequency of usage, specific features utilized, and whether participants share app-generated data with healthcare providers.

Prior to data collection, informed consent will be obtained from all participants. The questionnaire will be administered in person in a confidential and private setting to ensure accurate and unbiased responses. All collected data will be anonymized and securely stored to maintain participant confidentiality. Socio-demographic details such as age, educational status, and socioeconomic background will be recorded as independent variables, while KAP scores will be considered dependent variables.

The collected data will be entered into a secured database and analyzed using Statistical Package for the Social Sciences (SPSS) version 25 or R software. Descriptive statistics will be used to summarize demographic characteristics and KAP scores. Inferential statistical tests, including the chi-square test and independent t-test, will be applied to determine associations between variables. Logistic regression analysis will be performed to identify predictors of good practice regarding menstrual tracking application usage. A p-value of less than 0.05 will be considered statistically significant.

Ethical principles will be strictly adhered to throughout the study. Participation will be entirely voluntary, and participants will have the right to withdraw at any stage without any consequences. No personal identifiers will be recorded, and confidentiality will be strictly maintained. As this is a non-interventional study involving only questionnaire-based data collection, the risk to participants is minimal. Data will be stored in password-protected systems accessible only to the investigators.

RESULTS

Table 1. Sociodemographic and menstrual characteristics of study participants (N = 300)

Category	n (%) (n=300)
Age (in years)	
18–20	139 (46.3)
21–24	161 (53.7)
Marital Status	
Single	268 (89.3)
Married	32 (10.7)
Educational Status	
Higher secondary	63 (21.0)
Undergraduate	192 (64.0)
Postgraduate	45 (15.0)
Occupation	
Student	226 (75.3)
Employed	62 (20.7)
Others	12 (4.0)
Place of residence	
Urban	206 (68.7)
Rural	94 (31.3)
SES	
Class I–II	173 (57.7)
Class III–V	127 (42.3)
Age at menarche	
<12 years	41 (13.7)
12–13 years	156 (52.0)
14–15 years	79 (26.3)
>15 years	24 (8.0)
Menstrual cycle pattern	
Regular	212 (70.7)
Irregular	88 (29.3)

The study included a total of 300 participants, most of whom were aged 21–24 years (53.7%), followed by those aged 18–20 years (46.3%), indicating that the study population predominantly comprised young adults. A large majority of the participants were single (89.3%), with only 10.7% being married. Regarding educational status, nearly two-thirds of the participants were undergraduates (64.0%), while 21.0% had completed higher secondary education and 15.0% were postgraduates. In terms of occupation, most participants were students (75.3%), with 20.7% employed and a small proportion (4.0%) engaged in other occupations.

More than two-thirds of the participants resided in urban areas (68.7%), whereas 31.3% belonged to rural areas. Based on socioeconomic status, 57.7% of participants were classified under Class I–II, while 42.3% fell into Class III–V, suggesting a predominance of participants from higher socioeconomic strata. With respect to menstrual characteristics, the majority of participants reported attaining menarche between 12–13 years (52.0%), followed by 14–15 years (26.3%). Early

menarche (<12 years) was reported by 13.7%, while late menarche (>15 years) was observed in 8.0% of participants. Most participants reported having a regular menstrual cycle (70.7%), whereas 29.3% experienced irregular cycles. Overall, the study population mainly consisted of young, unmarried, urban-dwelling undergraduate students with predominantly regular menstrual cycles, providing an appropriate demographic profile for assessing knowledge, attitude, and practices related to menstrual tracking applications

Table 2. Knowledge regarding menstrual tracking applications (N = 300)

Knowledge item	Correct n (%)	Incorrect / Don't know n (%)
Predict next menstrual period	255 (85.0)	45 (15.0)
Track symptoms (pain/mood)	240 (80.0)	60 (20.0)
Identify fertile days	225 (75.0)	75 (25.0)
Regular data entry improves accuracy	235 (78.3)	65 (21.7)
Stores health data digitally	220 (73.3)	80 (26.7)
Helps understand menstrual cycle patterns	245 (81.7)	55 (18.3)
Helps identify irregular cycles and need for medical consultation	230 (76.7)	70 (23.3)
Some apps may not be fully accurate for fertility prediction	210 (70.0)	90 (30.0)
Menstrual tracking apps are not a reliable contraceptive method	205 (68.3)	95 (31.7)

Table 2 depicts the level of knowledge of participants regarding menstrual tracking applications. A high proportion of participants (85.0%) correctly knew that these applications can predict the next menstrual period, while 80.0% were aware of their role in tracking menstrual-related symptoms such as pain and mood changes. Additionally, 81.7% of participants recognized that menstrual tracking applications help in understanding individual menstrual cycle patterns, thereby improving self-awareness.

Knowledge regarding identification of fertile days was observed in 75.0% of participants. More than three-fourths (78.3%) correctly understood that regular data entry improves the accuracy of app predictions. Awareness about the ability of these applications to detect irregular cycles and prompt medical consultation was present in 76.7% of participants. However, knowledge regarding app limitations was comparatively lower. Only 70.0% were aware that fertility predictions may not always be scientifically accurate, and 68.3% correctly recognized that menstrual tracking applications are not reliable contraceptive methods. These findings indicate good overall functional knowledge but highlight gaps related to accuracy, limitations, and safe use, emphasizing the need for targeted educational interventions.

Table 3. Attitude towards menstrual tracking applications (N = 300)

Attitude statement	Positive n (%)	Neutral/Negative n (%)
Helps understand menstrual cycle	250 (83.3)	50 (16.7)
Trust app accuracy	220 (73.3)	80 (26.7)
Concerned about data privacy	190 (63.3)	110 (36.7)
Easy to use	245 (81.7)	55 (18.3)
Would recommend to others	235 (78.3)	65 (21.7)

Table 3 presents the attitudes of participants toward menstrual tracking applications. A substantial majority of participants (83.3%) reported a positive attitude, stating that menstrual tracking applications help them understand their menstrual cycle, indicating strong perceived usefulness of these applications. Nearly three-fourths of the participants (73.3%) expressed trust in the accuracy of menstrual tracking applications, although more than one-quarter (26.7%) remained neutral or negative, suggesting some degree of skepticism regarding app reliability. Concerns related to data privacy were reported by 63.3% of participants, highlighting that privacy remains an important consideration despite the overall favorable perception of these applications. Ease of use was positively perceived by 81.7% of participants, reflecting good user-friendliness of menstrual tracking applications. Additionally, 78.3% of participants indicated that they would recommend these applications to others, further emphasizing a generally positive attitude.

Overall, the findings demonstrate a predominantly positive attitude toward menstrual tracking applications among participants. However, notable concerns regarding data privacy and app accuracy persist, underscoring the need for enhanced awareness about data security measures and validation of app reliability to strengthen user confidence.

Table 4. Univariate analysis of factors associated with good practice of menstrual tracking application usage (Among app users, n = 225)

Variable	Good practice n (%)	Poor practice n (%)	OR (95% CI)	p-value
Age				
Age 21–24 yrs	100 (76.9)	30 (23.1)	Reference	0.016
Age 18–20 yrs	70 (63.6)	40 (36.4)	0.53 (0.32–0.89)	
Education				
Undergraduate & above	135 (75.0)	45 (25.0)	Reference	0.004
Higher secondary	35 (58.3)	25 (41.7)	0.45 (0.26–0.78)	
Area				
Urban	130 (78.3)	36 (21.7)	Reference	0.037
Rural	40 (60.6)	26 (39.4)	0.57 (0.34–0.97)	
Knowledge				
Good knowledge	145 (78.4)	40 (21.6)	Reference	<0.001
Poor knowledge	25 (45.5)	30 (54.5)	0.26 (0.14–0.46)	
Attitude				
Positive attitude	130 (78.8)	35 (21.2)	Reference	<0.001
Neutral/Negative attitude	40 (57.1)	30 (42.9)	0.35 (0.20–0.62)	

Table 4 presents the univariate analysis of factors associated with good practice of menstrual tracking application usage among 225 app users. Age showed a significant association with practice patterns, with participants aged 21–24 years demonstrating a higher proportion of good practice (76.9%) compared to those aged 18–20 years (63.6%). Participants in the younger age group had significantly lower odds of good practice (OR = 0.53; 95% CI: 0.32–0.89; $p = 0.016$). Educational status was also significantly associated with practice. Participants with undergraduate education and above reported a higher level of good practice (75.0%) compared to those with higher secondary education (58.3%). Those with lower educational status had significantly reduced odds of good practice (OR = 0.45; 95% CI: 0.26–0.78; $p = 0.004$).

Place of residence demonstrated a significant relationship with practice of app usage. Urban residents had a higher proportion of good practice (78.3%) compared to rural residents (60.6%), and rural participants had significantly lower odds of good practice (OR = 0.57; 95% CI: 0.34–0.97; $p = 0.037$). Knowledge regarding menstrual tracking applications showed a strong association with practice. Participants with good knowledge had a substantially higher proportion of good practice (78.4%) compared to those with poor knowledge (45.5%). Poor knowledge was associated with markedly reduced odds of good practice (OR = 0.26; 95% CI: 0.14–0.46; $p < 0.001$).

Similarly, attitude toward menstrual tracking applications was significantly associated with practice. Participants with a positive attitude demonstrated a higher prevalence of good practice (78.8%) compared to those with neutral or negative attitudes (57.1%). Participants with neutral or negative attitudes had significantly lower odds of good practice (OR = 0.35; 95% CI: 0.20–0.62; $p < 0.001$).

Overall, the univariate analysis indicates that older age, higher education, urban residence, good knowledge, and a positive attitude were significantly associated with good practice of menstrual tracking application usage among app users.

Table 5. Multivariate logistic regression analysis of factors associated with good practice of menstrual tracking application usage (Among app users, n = 225)

Variable	Adjusted OR (95% CI)	p-value
Knowledge		
Good knowledge	Ref	<0.001
Poor knowledge	0.29 (0.16–0.53)	
Attitude		
Positive attitude	Ref	0.008
Neutral/Negative attitude	0.44 (0.24–0.81)	
Education		
Undergraduate & above	Ref	0.045
Higher secondary	0.57 (0.33–0.99)	

Table 5 presents the results of the multivariate logistic regression analysis conducted among 225 app users to identify independent predictors of good practice of menstrual tracking application usage. After adjusting for potential confounders, knowledge, attitude, and educational status remained significantly associated with good practice.

Participants with poor knowledge regarding menstrual tracking applications had significantly lower odds of good practice compared to those with good knowledge (Adjusted OR = 0.29; 95% CI: 0.16–0.53; $p < 0.001$). This indicates that inadequate knowledge substantially reduces the likelihood of appropriate and effective use of menstrual tracking applications. Similarly, attitude toward menstrual tracking applications independently influenced practice patterns. Participants with a neutral or negative attitude had significantly lower odds of good practice compared to those with a positive attitude (Adjusted OR = 0.44; 95% CI: 0.24–0.81; $p = 0.008$).

Educational status also showed a significant independent association. Participants with higher secondary education were less likely to demonstrate good practice compared to those with undergraduate education and above (Adjusted OR = 0.57; 95% CI: 0.33–0.99; $p = 0.045$). Overall, the multivariate analysis indicates that good knowledge, a positive attitude, and higher educational status are independent predictors of good practice of menstrual tracking application usage, even after controlling for other factors. These findings emphasize the importance of educational and awareness-based interventions to improve effective utilization of menstrual tracking applications.

Barriers and facilitators related to menstrual tracking application usage (Section E)

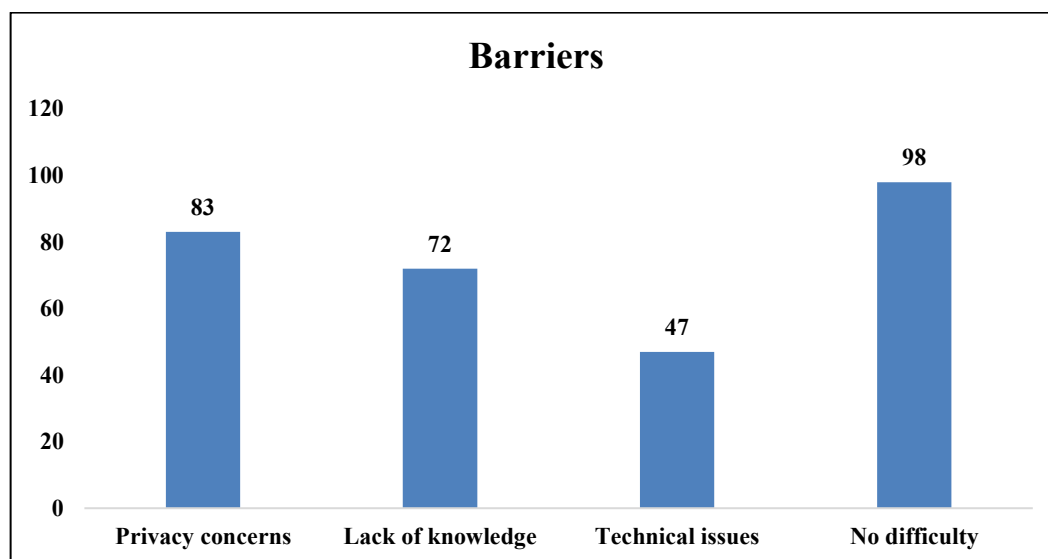


Fig 1: Barriers to usage / regular usage

Figure 1 illustrates the perceived barriers related to the usage and regular usage of menstrual tracking applications among the study participants. The most commonly reported issue was no difficulty in using the application, as indicated by 98 participants, suggesting that a substantial proportion of users did not face any major obstacles in app usage. Among the reported barriers, privacy concerns were the most prominent, reported by 83 participants, highlighting apprehensions regarding the safety and confidentiality of personal and health-related data stored in menstrual tracking applications. This underscores the importance of data security and user trust in digital health tools.

Lack of knowledge regarding the proper use or full functionality of the applications was reported by 72 participants, indicating that insufficient awareness and understanding may hinder optimal and consistent usage. Technical issues, such as app malfunctions or usability problems, were reported by 47 participants, making it the least common barrier. Overall, while the majority of participants did not experience significant difficulties in using menstrual tracking applications, concerns related to privacy, inadequate knowledge, and technical challenges remain notable barriers. These findings suggest the need for improved user education, transparent data protection policies, and enhanced technical support to promote sustained and effective use of menstrual tracking applications.

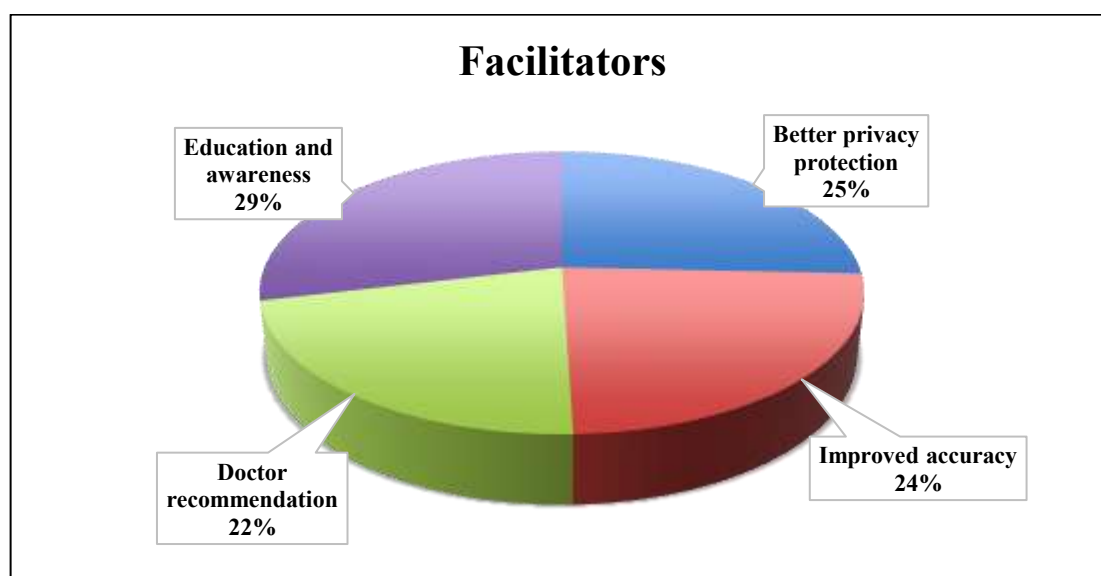


Fig 2: Facilitators for regular usage

Figure 2 illustrates the key facilitators that promote regular usage of menstrual tracking applications among the participants. The most commonly reported facilitator was education and awareness, accounting for 29%, indicating that increased knowledge and understanding about menstrual health and app functionality strongly encourage consistent app usage. This was followed by better privacy protection (25%), highlighting the importance of secure handling of personal and health-related data in enhancing user trust and sustained use of menstrual tracking applications. Improved accuracy (24%) was also identified as a major facilitator, suggesting that reliable and precise predictions motivate users to continue using these applications regularly.

Additionally, doctor recommendation (22%) emerged as an important facilitator, emphasizing the influence of healthcare professionals in promoting the acceptance and regular use of menstrual tracking applications. Overall, the findings indicate that educational initiatives, assurance of data privacy, accuracy of app outputs, and endorsement by healthcare providers play crucial roles in facilitating regular usage of menstrual tracking applications. Strengthening these factors may significantly improve user engagement and long-term adoption of such digital health tools.

DISCUSSION

The present study evaluated the awareness, attitudes, and practices regarding menstrual tracking among females aged 18–24 years and demonstrated that the majority of participants were young, educated, and predominantly from urban areas, with 53.7% aged 21–24 years and 64.0% being undergraduates. These findings are consistent with recent evidence by Hong et al., who reported that more than 60% of menstrual tracking application users belong to the millennial and Generation Z population, indicating that younger individuals are the primary users of such digital health tools [16]. Furthermore, Ko et al. highlighted that higher educational status is associated with better understanding and utilization of menstrual tracking applications, which aligns with the present study where good practice was higher among participants with undergraduate education and above (75.0%) compared to those with only higher secondary education (58.3%) [17]. With respect to knowledge, the present study observed that 85.0% of participants were aware that menstrual tracking applications can predict the next menstrual cycle, while 80.0% recognized their role in tracking symptoms such as pain and mood changes. These findings are comparable to those reported by Trépanier et al., who demonstrated that menstrual tracking applications are widely used for symptom monitoring and cycle prediction [18]. Similarly, Dantas et al. identified that most available menstrual tracking applications provide features related to cycle monitoring and symptom tracking, supporting the high level of awareness observed in the present study [19]. Additionally, 81.7% of participants in this study recognized that these applications help in understanding menstrual patterns, which is in agreement with findings from Maity et al., who emphasized the importance of menstrual awareness in improving academic and social functioning among young women [20]. However, gaps in knowledge were evident, as only 70.0% of participants were aware of the limitations in fertility prediction and 68.3% understood that these applications are not reliable contraceptive methods. This observation is supported by Durand et al., who reported that menstrual-related knowledge gaps persist even among educated populations, particularly regarding symptom interpretation and management [21].

The attitude toward menstrual tracking applications in the present study was predominantly positive, with 83.3% of participants reporting that these applications help in understanding their menstrual cycle and 78.3% willing to recommend them to others. These findings are consistent with Schantz et al., who described menstrual tracking applications as valuable tools for personal health monitoring and epidemiological research [22]. Similarly, Earle et al. reported that a majority of users perceive these applications as beneficial for improving menstrual awareness and self-management, with usage rates ranging between 70% and 80% among app users [23]. However, despite the positive perception, 63.3% of participants in the present study expressed concerns regarding data privacy. This is in line with Worsfold et al., who identified variability in the type and quality of information provided by menstrual tracking applications, along with concerns about data handling and transparency [24].

In terms of practice, the present study demonstrated that participants aged 21–24 years had a higher proportion of good practice (76.9%) compared to those aged 18–20 years (63.6%), with a statistically significant association ($p = 0.016$). This finding is comparable to Karasneh et al., who reported that older users are more likely to engage consistently with menstrual tracking applications and adopt behavioral changes based on app usage [25]. Similarly, Grieger et al. observed that large-scale app users tend to actively engage with menstrual tracking features, indicating better practice patterns among experienced users [26]. Educational status also showed a significant association, with 75.0% of participants with undergraduate education demonstrating good practice compared to 58.3% among those with lower education levels ($p = 0.004$). This finding is supported by Ford et al., who reported that higher education is associated with improved fertility awareness and better utilization of reproductive health applications [27].

Urban residence was significantly associated with better practice (78.3%) compared to rural residence (60.6%) in the present study ($p = 0.037$). This disparity may be explained by differences in access to digital technologies and health information, as noted by Lupton et al., who emphasized the role of digital literacy in shaping health behaviors [28]. Additionally, qualitative evidence from Levy et al. suggests that user engagement with menstrual tracking applications is influenced by individual perceptions, cultural context, and accessibility [29]. The present study also found that 70.7% of participants had regular menstrual cycles, while 29.3% reported irregular cycles, which is consistent with findings by Schoep et al., who reported that a substantial proportion of women experience menstrual irregularities that can impact daily functioning and quality of life [30].

A key finding of the present study was the strong association between knowledge, attitude, and practice. Participants with good knowledge demonstrated significantly higher good practice (78.4%) compared to those with poor knowledge (45.5%), and those with a positive attitude had better practice (78.8%) compared to those with negative attitudes (57.1%) ($p < 0.001$). These findings were further supported by multivariate analysis, where knowledge (Adjusted OR = 0.29),

attitude (Adjusted OR = 0.44), and educational status (Adjusted OR = 0.57) emerged as independent predictors of good practice. These observations are in agreement with multiple studies, including Karasneh et al. and Schantz et al., who emphasized that awareness and perception significantly influence behavioral outcomes and effective utilization of digital health tools [22,25].

Regarding barriers, the present study identified privacy concerns (83 participants) as the most common barrier, followed by lack of knowledge (72 participants) and technical issues (47 participants). Similar findings were reported by Trépanier et al., who highlighted privacy and data security as major concerns affecting user trust and engagement [18]. On the other hand, facilitators identified in this study included education and awareness (29%), better privacy protection (25%), improved accuracy (24%), and doctor recommendation (22%). These findings are consistent with Hong et al. and Ko et al., who reported that improved app accuracy, increased awareness, and healthcare provider endorsement significantly enhance the adoption and sustained use of menstrual tracking applications [16,17].

Overall, the present study findings are consistent with existing literature and highlight that while awareness and attitudes toward menstrual tracking applications are generally favourable, gaps in knowledge, concerns regarding privacy, and disparities in usage persist. Addressing these issues through targeted education, and integration with clinical practice can enhance the effective utilization of menstrual tracking applications and contribute to better reproductive health outcomes.

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