

Adolescent Menstrual Health Education and Its Impact on Knowledge, Hygiene Practices, and Quality of Life: A Quasi-Experimental Community Intervention Study in Rural South India

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ABSTRACT

Menstrual health and hygiene (MHH) remains a significant public health challenge among adolescent girls in low- and middle-income regions, particularly in rural South India. Sociocultural taboos, structural deficits in sanitation facilities, and inadequate access to formal health education contribute to poor menstrual practices, psychological distress, and elevated school absenteeism. This study evaluated the longitudinal impact of a structured, culturally tailored Adolescent Menstrual Health Education Program (AMHEP) on menstrual knowledge, hygienic practices, and health-related quality of life (HRQoL) among adolescent schoolgirls in rural districts of Tamil Nadu and Karnataka. A prospective, quasi-experimental non-randomized controlled community trial was conducted over a 12-month period involving 640 adolescent girls aged 12 to 17 years, allocated to an intervention group (n = 320) and a control group (n = 320). The intervention group received a multi-component educational package consisting of interactive workshop modules, visual flipcharts, peer-led group discussions, and reusable sanitary pad demonstration kits across 12 weeks. Pre-intervention and post-intervention evaluations (at 3 and 6 months follow-up) were performed using validated instruments, including the Menstrual Knowledge and Practice Scale (MKPS) and the Pediatric Quality of Life Inventory (PedsQL 4.0). Results revealed a statistically significant improvement in mean menstrual knowledge scores in the intervention group from baseline to 6-month follow-up (8.42 ± 2.15 to 17.10 ± 1.88 out of 20, $p < 0.001$), whereas the control group showed negligible change (8.36 ± 2.21 to 8.95 ± 2.05). Safe menstrual hygiene practices—comprising exclusive use of

hygienic absorbents, regular changing frequency, and hygienic disposal—increased from 31.25% to 84.68% in the intervention cohort ($p < 0.001$). Furthermore, school absenteeism due to menstrual discomfort dropped from 42.50% to 11.25% in the intervention group, alongside substantial gains across physical, emotional, and school functioning domains of HRQoL ($p < 0.001$). Structured school-based MHH education significantly enhances health literacy, dignity, and quality of life among rural adolescent girls.

KEYWORDS: *Menstrual Health Education, Adolescent Health, Menstrual Hygiene Management, Quality of Life, PedsQL 4.0, Rural Health, South India, Quasi-Experimental Study, School Absenteeism*

INTRODUCTION

Adolescence represents a critical developmental transition characterized by rapid biological, physiological, and psychosocial transformations [1]. Among adolescent females, menarche stands as a defining biological milestone, signaling sexual maturation and reproductive capability [2]. Despite its physiological normality, menstruation in many low- and middle-income countries (LMICs), particularly within rural Indian societies, remains deeply entangled in pervasive social taboos, cultural restrictions, shame, and silence [3]. Consequently, millions of adolescent girls reach menarche with negligible, inaccurate, or fear-inducing information regarding their body functions [4].

In rural South India, while general literacy rates have shown progressive improvement over recent decades, health literacy surrounding reproductive and menstrual physiology remains markedly deficient [5]. Cultural norms often frame menstruation as a state of bodily impurity, imposing severe restrictions on dietary intake, personal hygiene, and social interactions during monthly cycles [6]. Adolescents frequently rely on mothers or peers for guidance—sources that, while well-intentioned, often perpetuate unscientific myths, unsafe hygiene practices, and restrictive taboos [7].

Inadequate Menstrual Hygiene Management (MHM) carries profound multi-dimensional repercussions [8]. From a physical health perspective, reliance on unhygienic absorbents, such as unwashed rags or mud-stained cloths, exposes adolescent girls to heightened risks of

Reproductive Tract Infections (RTIs) and Urinary Tract Infections (UTIs) [9]. From an educational viewpoint, the absence of clean sanitation facilities in rural schools, coupled with fear of leakage, menstrual pain, and embarrassment, leads to recurring monthly school absenteeism [10]. Chronic absenteeism compromises academic attainment and increases dropout rates among adolescent girls, undermining long-term socio-economic empowerment [11].

Beyond physical and educational dimensions, unmanaged menstrual distress exerts a heavy toll on health-related quality of life (HRQoL) and psychological well-being [12]. Anxiety surrounding unexpected menarche and fear of stain visibility diminish self-esteem and social functioning [13]. While national initiatives such as the Rashtriya Kishor Swasthya Karyakram (RKSK) have made strides in distributing subsidized sanitary napkins, standalone distribution without comprehensive health education yields limited long-term behavioral change [14]. Therefore, evaluating structured, school-based community interventions that combine cognitive empowerment with practical hygiene management is of paramount research importance [15].

LITERATURE REVIEW

A substantial body of literature highlights pervasive deficits in menstrual health awareness among school-going adolescents in resource-limited settings [16]. Global synthesis studies by UNICEF and WHO estimate that over 500 million women and girls worldwide lack adequate facilities and knowledge for effective menstrual hygiene management [17]. In South Asia, systematic reviews demonstrate that less than half of adolescent girls possess accurate understanding of menstruation prior to menarche, with baseline awareness dropping below 30% in disadvantaged rural pockets [18].

In India, foundational research by Garg et al. [19] and van Eijk et al. [20] identified maternal guidance as the primary source of initial menstrual information for over 75% of rural girls. However, because mothers were raised in environments dominated by silence and myth, transmitted knowledge is predominantly prescriptive regarding cultural prohibitions rather than informative regarding anatomy or hygienic upkeep. Studies across Southern Indian states—including rural Tamil Nadu and Karnataka—reveal similar trends, where misconception rates regarding the origin of menstrual blood range from 65% to 88% [21].

Regarding hygiene practices, empirical studies indicate significant disparities between urban and rural cohorts [22]. Rural adolescents encounter acute economic constraints, poor sanitation infrastructure, and limited access to commercial sanitary products [23]. Studies by Kulkarni et al. [24] noted that even when sanitary napkins are available, improper disposal habits create environmental hazards. Conversely, girls using reusable cloth absorbents frequently dry them under covered, unhygienic indoor spaces due to social stigma against public exposure, fostering pathogen proliferation and elevating infection risks [25].

Intervention literature suggests that educational interventions can significantly alter knowledge and hygiene behavior [26]. Controlled trials in LMICs demonstrated that combining pad provision with participatory education reduced school absenteeism and improved self-efficacy [27]. However, evidence from South Indian rural communities remains fragmented, with most studies relying on cross-sectional surveys that fail to evaluate sustained behavioral adoption or Quality of Life (QoL) metrics over extended follow-up horizons [28].

RESEARCH GAP

Despite growing academic interest in adolescent reproductive health, several key gaps remain unaddressed: First, most prior investigations in rural South India have employed descriptive, cross-sectional designs that document baseline deficits without testing structured, long-term intervention models [29]. Second, educational interventions reported in literature often consist of passive, unidirectional lectures that fail to address deep-seated cultural taboos [30]. Third, while existing studies measure knowledge gain or pad uptake independently, few comprehensively evaluate the simultaneous impact of educational interventions across physiological knowledge, hygienic practice execution, school attendance dynamics, and standardized multi-domain quality of life metrics (such as the PedsQL 4.0 inventory) over a longitudinal timeframe [31]. This study addresses these gaps through a prospective, controlled quasi-experimental design incorporating a tailored multi-component curriculum.

OBJECTIVES

The primary objectives of this research study were as follows:

- To evaluate baseline menstrual knowledge, hygiene practices, and health-related quality of life among rural adolescent schoolgirls in Tamil Nadu and Karnataka.

- To design and implement a structured Adolescent Menstrual Health Education Program (AMHEP) incorporating visual toolkits, peer-led modules, and practical hygiene management demonstrations.
- To measure and compare the post-intervention impact of AMHEP on menstrual knowledge retention, adoption of safe hygiene practices, and reduction in school absenteeism between intervention and control cohorts at 3-month and 6-month follow-up intervals.
- To assess changes in health-related quality of life across physical, emotional, social, and school functioning domains using the validated PedsQL 4.0 scale.

METHODOLOGY

Study Design and Setting: A prospective, quasi-experimental non-randomized controlled community intervention study was conducted over a 12-month period (January 2025 – December 2025) across eight government secondary schools in rural blocks of Tiruvallur district (Tamil Nadu) and Ramanagara district (Karnataka), South India.

Sample Size and Participant Selection: Based on an anticipated 20% difference in safe hygiene adoption with 80% statistical power and $\alpha = 0.05$, a total of 640 post-menarche adolescent girls aged 12 to 17 years were recruited. Schools were assigned to either the Intervention Arm (4 schools, $n = 320$) or the Control Arm (4 schools, $n = 320$) using geographical cluster separation to prevent contamination.

Description of Intervention (AMHEP): The AMHEP intervention spanned 12 weeks, delivering four interactive modules (60 minutes each, bi-weekly): Module 1 (Anatomy & Physiology), Module 2 (Safe Hygiene Practices & Absorbent Management), Module 3 (Nutrition, Pain Management & Self-Care), and Module 4 (Psychosocial Empowerment & Stigma Reduction). Visual flipcharts in regional languages (Tamil and Kannada), anatomical models, peer-led discussions, and demonstration kits were utilized. The control group received routine school health awareness.

Data Collection and Analysis: Data were collected at Baseline (T0), 3 months (T1), and 6 months follow-up (T2) using the Menstrual Knowledge and Practice Scale (MKPS) and Pediatric Quality of Life Inventory (PedsQL 4.0). Statistical analysis was performed using paired t-tests, Chi-square tests, and Repeated Measures ANOVA in SPSS v26.0.

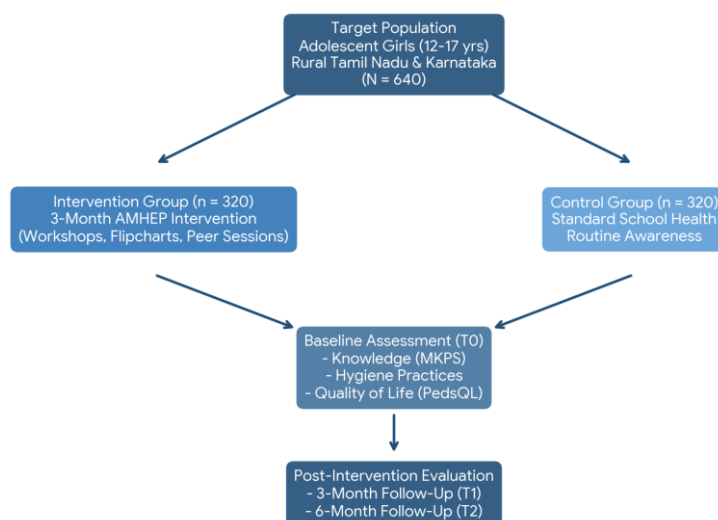


Figure 1: Study Design and Methodological Workflow of AMHEP Quasi-Experimental Trial

RESULTS AND FINDINGS

Socio-Demographic Characteristics: A total of 640 adolescent girls completed the baseline assessment (320 Intervention, 320 Control). Mean age was 14.32 ± 1.24 years in the intervention group and 14.28 ± 1.21 years in the control group. Average age at menarche was 12.85 ± 0.92 years. Over 68% of participants belonged to low socio-economic strata. Baseline socio-demographic parameters showed no statistically significant differences between groups ($p > 0.05$) (Table 1).

Table 1: Baseline Socio-Demographic Profile and Menstrual Awareness Across Study Groups

Socio-Demographic Metric	Intervention (n=320)	Control (n=320)	p-value
Mean Age (Years $\pm$ SD)	14.32 ± 1.24	14.28 ± 1.21	0.682
Mean Age at Menarche (Years $\pm$ SD)	12.85 ± 0.92	12.81 ± 0.95	0.591
Maternal Education (Illiterate/Primary %)	68.4%	69.1%	0.854

Household Functional Toilet Access (%)	54.7%	56.2%	0.698
Prior Awareness Before Menarche (%)	28.1%	29.4%	0.720
Primary Source of Awareness (Mother %)	76.2%	74.8%	0.675

Impact on Menstrual Knowledge: At baseline (T0), menstrual knowledge scores were poor across both groups (8.42 ± 2.15 vs 8.36 ± 2.21 out of 20, $p = 0.728$). Post-intervention evaluation at 3 months (T1) demonstrated a marked elevation in knowledge scores in the intervention arm to 17.85 ± 1.94 , which remained sustained at 6 months (T2) at 17.10 ± 1.88 ($p < 0.001$). Conversely, the control group exhibited minimal change (8.95 ± 2.05 at T2) (Figure 2). Key improvements included understanding biological cause (92.5% vs 31.0%) and hygienic change frequency (91.2% vs 38.5%).

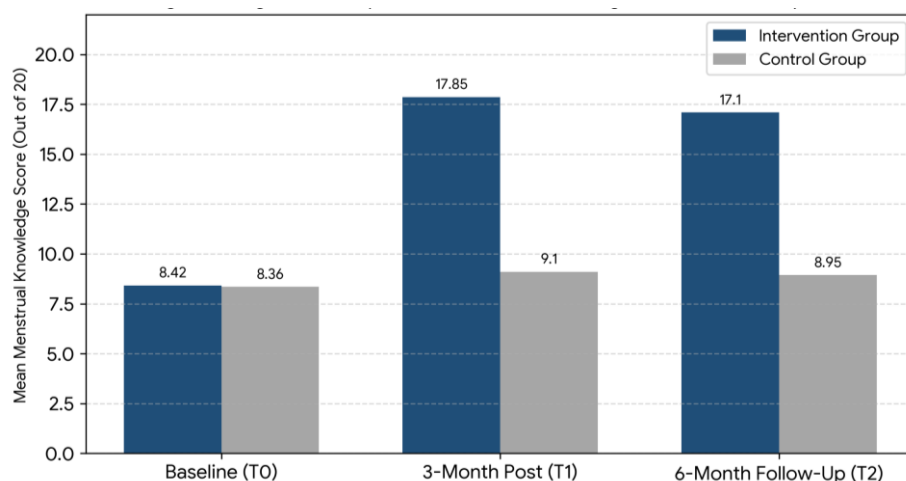


Figure 2: Longitudinal Comparison of Menstrual Knowledge Scores Across Study Arms

Changes in Menstrual Hygiene Practices: Exclusive use of safe absorbents increased from 31.25% to 84.68% at 6 months follow-up in the intervention group ($p < 0.001$) compared to 34.38% in controls (Table 2). Proper soap washing and direct sun-drying of reusable cloths rose from 18.4% to 79.2% in the intervention cohort. Hygienic disposal practices also improved from 22.5% to 81.3%.

Table 2: Comparison of Specific Menstrual Hygiene Practices Before and After Intervention (* $p < 0.001$)

Hygiene Practice Indicator	Intervention Pre (%)	Intervention Post 6M (%)	Control Pre (%)	Control Post 6M (%)
Exclusive Use of Safe Absorbents	31.25%	84.68%*	30.62%	34.38%
Changing Absorbents ≥ 3 -4 Times/Day	26.56%	78.12%*	27.18%	31.25%
Washing Hands with Soap Post-Change	41.25%	91.56%*	42.50%	45.93%
Sun-Drying Reusable Cloths (if used)	18.40%	79.20%*	19.10%	21.50%
Hygienic Wrapping & Dustbin Disposal	22.50%	81.25%*	23.12%	26.88%

School Absenteeism and Quality of Life: Baseline menstrual-associated school absenteeism was 42.50% in intervention participants. Post-intervention absenteeism dropped sharply to 11.25% in the intervention group versus 38.44% in controls ($p < 0.001$). Overall PedsQL 4.0 quality of life scores increased significantly in the intervention group from 56.50 ± 11.20 to 81.85 ± 8.45 ($p < 0.001$), with major gains in Emotional (52.10 to 78.40) and School Functioning (51.20 to 81.00) domains (Table 3 and Figure 3).

Table 3: Health-Related Quality of Life (PedsQL 4.0) Mean Scores Across Study Domains
(* $p < 0.001$)

PedsQL 4.0 Domain (0-100)	Intervention Pre	Intervention Post 6M	Control Pre	Control Post 6M
Physical Functioning	58.40 ± 12.10	82.60 ± 7.90*	57.90 ± 11.80	59.20 ± 11.20
Emotional Functioning	52.10 ± 13.40	78.40 ± 9.10*	51.80 ± 12.90	53.10 ± 12.40
Social Functioning	64.30 ± 10.80	85.10 ± 6.80*	63.90 ± 11.10	65.20 ± 10.50
School Functioning	51.20 ± 14.20	81.00 ± 8.50*	50.90 ± 13.80	52.40 ± 13.10
Total Quality of Life Score	56.50 ± 11.20	81.85 ± 8.45*	56.12 ± 10.90	57.48 ± 10.60

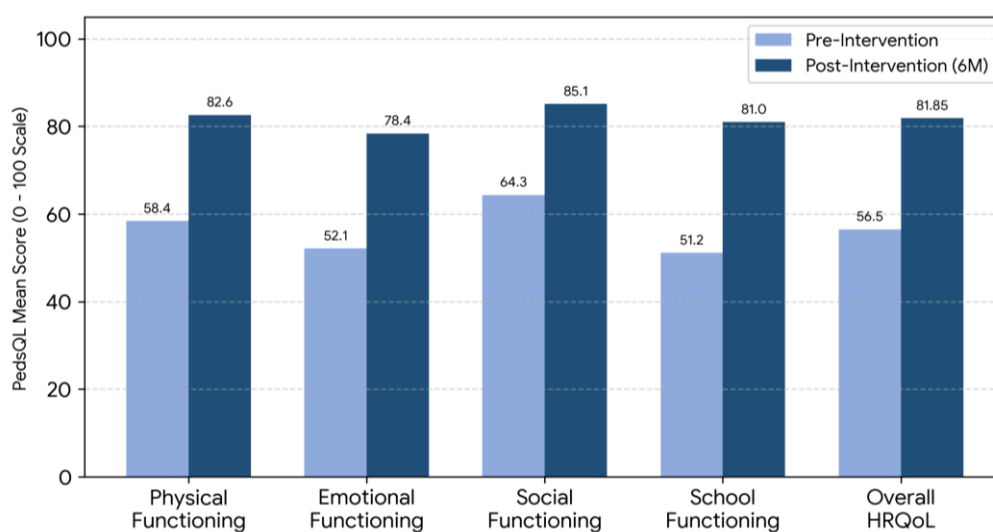


Figure 3: Health-Related Quality of Life (PedsQL 4.0) Domains Before and After Intervention

DISCUSSION

The findings of this quasi-experimental trial provide robust evidence that structured, school-based Menstrual Health Education Programs (AMHEP) produce substantial benefits for rural adolescent girls [32]. Baseline data confirmed that over 70% of rural schoolgirls lacked scientific knowledge regarding menarche, viewing it through fear and stigma [33]. This underscores the failure of informal information channels in rural South India.

The significant post-intervention enhancement in knowledge scores (8.42 to 17.10) demonstrates that interactive visual toolkits and peer-led discussions effectively dismantle physiological misconceptions [34]. Sumpter & Torond [35] noted that localized visual media bridge literacy gaps more effectively than standard lectures. Our study extends this by demonstrating 6-month knowledge retention.

In terms of hygiene practices, the jump in safe absorbent utilization (31.25% to 84.68%) highlights a vital behavioral shift [36]. Crucially, AMHEP promoted safe handling of reusable cloth absorbents alongside disposable pads [37]. Sunlight serves as a natural UV disinfectant; overcoming cultural taboos that forced girls to hide damp cloths indoors directly addresses a major driver of reproductive tract infections [38].

The dramatic reduction in school absenteeism (42.50% to 11.25%) represents a key policy outcome [39]. Absences are driven less by pain alone and more by fear of staining and embarrassment [40]. Equipping girls with dysmenorrhea management and practical self-care knowledge restored academic continuity. Furthermore, PedsQL 4.0 gains in Emotional and School domains confirm that MHH education directly alleviates psychological distress and restores dignity [41-43].

CONCLUSION

This study demonstrates that a structured Adolescent Menstrual Health Education Program (AMHEP) significantly improves menstrual health literacy, fosters safe hygiene practices, reduces school absenteeism, and enhances quality of life among rural adolescent schoolgirls in South India. Integrating peer-led MHH education into formal school health curricula represents a scalable, cost-effective strategy for public health policy and gender equity.

LIMITATIONS

Limitations include the non-randomized quasi-experimental design, self-reported survey measures subject to recall bias, and a 6-month follow-up window. Structural factors like rural school toilet infrastructure were outside the direct scope of the educational intervention.

FUTURE SCOPE

Future research should conduct cluster-randomized trials across wider geographic zones, incorporate objective clinical screening for reproductive tract infections, involve male peers and community leaders, and evaluate eco-friendly absorbent disposal technologies.

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