

Development and Psychometric Evaluation of the Menstrual Comfort Scale Based on Kolcaba's Comfort Theory

Hacer YALNIZ DİLCEN

Bartın University

Gülezer ADA

gada@bartin.edu.tr

Bartın University

Hülya TÜRKMEN

Balıkesir University

Research Article

Keywords: Menstrual comfort, menstruation, scale development

Posted Date: October 14th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10942548/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

This study aimed to develop the Menstrual Comfort Scale (MCS) based on Kolcaba's Comfort Theory and to examine its psychometric properties.

Methods

This methodological study was conducted in three stages. Women aged 18 years and older who had a menstrual cycle and agreed to participate were included in the study (N = 422). The study included a total of 422 participants; data were collected from 221 participants in the first stage and 201 in the second stage. Exploratory factor analysis (EFA) was performed on the dataset obtained in the first stage. Following the first-stage analyses, data were collected from a second sample, and confirmatory factor analysis (CFA) was conducted to test the factor structure of the scale. Data were collected online via Google Forms. The data collection instruments consisted of a Participant Information Form and the draft version of MCS. Reliability was evaluated using Cronbach's alpha and McDonald's omega coefficients.

Results

The developed scale consisted of 15 items and three subdimensions (psycho-spiritual comfort, physical comfort, and environmental comfort). The three-factor structure explained 56.87% of the total variance. CFA demonstrated that the model provided a good fit to the data ($\chi^2 (84) = 130.722$, $p = .001$; $\chi^2/df = 1.556$; RMSEA=.053; CFI=.970; GFI=.920) and that it exhibited high internal consistency ($\alpha = 0.919$; $\omega = 0.906$).

Conclusion

The findings indicate that the Menstrual Comfort Scale is a valid and reliable tool for assessing menstrual comfort. MCS may serve as a useful guide for healthcare professionals in determining women's menstrual comfort levels and in providing appropriate care.

Introduction

The duration of the menstrual cycle and associated symptoms may vary among individuals; many women may experience a range of physical and emotional symptoms during menstruation. Menstrual problems are considered a significant public health issue, as they adversely affect women's reproductive health, psychological well-being, and overall quality of life (Thiyagarajan et al., 2024).

The ability of women to manage their menstrual processes in a hygienic and comfortable manner is essential for maintaining a healthy, productive, and dignified lives. In this context, menstrual comfort is not limited to physical health but is also associated with psychological, social, and academic well-being. Ensuring menstrual comfort requires access to clean water resources, adequate sanitation and hygiene services, private spaces for changing hygienic products, and appropriate facilities for the safe disposal of used materials (Morrison et al., 2016). In particular, inadequate hygiene conditions in home and educational environments may reduce menstrual comfort levels among adolescent girls and women and lead to various adverse outcomes, such as infections (Sangra et al., 2019). When considered specifically among university students, it has been reported that the physical and environmental challenges experienced during menstruation may negatively affect academic performance, class attendance, and participation in education (Munro et al., 2021).

The literature includes a limited number of studies examining the social, psychological, and environmental factors that shape the menstrual experience. However, factors such as self-efficacy in menstrual management, experiences of menstrual-related stigma, social support systems, and sanitation conditions have been reported to play a significant role in women's menstrual experiences and overall well-being (Barrington et al., 2021; Hennegan et al., 2019). Qualitative studies indicate that individuals with low self-confidence in managing menstruation may experience anxiety in social and academic settings, whereas those with higher self-efficacy may manage menstruation more comfortably. These findings demonstrate that menstruation is not merely a physiological process but a multidimensional experience influenced by psychosocial and environmental factors (Hennegan et al., 2019; Maria Hyttel et al., 2017; Martinez-Vázquez et al., 2022; Nalugya et al., 2020). Considering the multidimensional nature of menstrual comfort, there is a need for theory-based measurement tools that can comprehensively evaluate this experience. Kolcaba's Comfort Theory provides a holistic theoretical framework that explains comfort as experienced by individuals across physical, psycho-spiritual, sociocultural, and environmental dimensions (Kolcaba, 2003; Kolcaba, 2015). This theory has formed the theoretical basis for various instruments developed to assess general comfort levels and comfort in clinical care processes, such as postoperative care, intensive care, and palliative care (Kolcaba, 1992; Kolcaba, 2003; Dowd et al., 2007; Wilson & Kolcaba, 2004; Barbosa et al., 2021; Wensley et al., 2022). However, no theory-based measurement tool has yet been identified for evaluating individuals' comfort levels in the context of menstruation. A comprehensive assessment of the physical, psychological, and environmental experiences during menstruation is an important need for women's health research. Accordingly, the present study aims to develop the Menstrual Comfort Scale, based on Kolcaba's Comfort Theory, and to examine its psychometric properties to enable a multidimensional evaluation of women's comfort during menstruation.

Research Hypotheses

H1

The Menstrual Comfort Scale is multidimensional, and a meaningful factor structure will emerge from exploratory factor analysis.

H2

The factor structure obtained from exploratory factor analysis will be confirmed by confirmatory factor analysis.

H3

The factor loadings of the Menstrual Comfort Scale will be at acceptable levels, and the items will significantly represent their respective factors.

H4

The total variance explained by the scale will be at an acceptable level in the social and health sciences.

H5

The Menstrual Comfort Scale will exhibit high internal consistency reliability.

H6

The subdimensions of the scale will demonstrate reliable internal consistency.

H7

The model-fit indices for the confirmatory factor analysis will be at acceptable levels.

Methods

Study Design

This methodological study was conducted to develop a measurement tool to assess menstrual comfort and to examine its psychometric properties (Fig. 1).

Conceptual Framework and Scale Development Process

Conceptual Framework and Definition of the Construct

The scale development process was structured according to relevant literature and theoretical approaches. Initially, the construct to be measured was theoretically defined, and its content domain was determined. The process was carried out using an inductive approach grounded in existing theories. To examine women's perceptions of comfort during menstruation, a comprehensive literature search was

conducted in the Cochrane Library, PubMed, Scopus, and Google Scholar databases using the keywords “menstruation,” “menstrual comfort,” “menstruation scale,” “scale development,” “comfort,” and “Kolcaba’s comfort theory.” However, no theory-based measurement tool was identified for assessing menstrual comfort among women of reproductive age. During scale development, an extensive literature review was conducted based on Kolcaba’s Comfort Theory. According to Kolcaba, comfort is a state of relief, ease, and transcendence achieved when individuals’ needs are met across physical, psycho-spiritual, social, and environmental dimensions. In line with this theoretical framework, the scale items were structured to encompass these four dimensions (physical, psycho-spiritual, social, and environmental) (Kolcaba, 1991; 1994; 1996; Kolcaba, Tilton, & Drouin, 2006).

Item Pool Development

Items were developed to cover all dimensions of the construct. To address the gap in the literature, a comprehensive pool of 49 items was generated, with at least 10 items in each subdimension (physical, psycho-spiritual, social, and environmental). This item pool was designed to conceptualize menstrual comfort as a multidimensional construct within the framework of Kolcaba’s Comfort Theory.

Content Validity and Expert Review

The scale development process was conducted in accordance with the stages proposed by DeVellis (2021). First, the characteristics of the construct were identified based on expert opinions and a literature review, and a draft scale consisting of 49 items was developed.

The initial draft was sent to 20 experts with experience in scale development, midwifery, and obstetric nursing. Of these, 12 experts provided feedback and evaluated the items in terms of semantic clarity and content relevance. Experts were asked to rate each item on a 4-point scale (1 = not appropriate, 2 = somewhat appropriate, 3 = quite appropriate, 4 = appropriate).

Content Validity Index (I-CVI, S-CVI)

The Lawshe (1975) method was used to assess content validity. The content validity ratio (CVR) and content validity index (CVI) were calculated based on experts’ evaluations to quantify content validity. The analysis revealed that all CVR values of the scale items were above 0.874, and the overall CVI of the scale was 0.881.

According to Yurdagül (2005), when the number of experts is 10, the minimum acceptable CVR value at a significance level of 0.05 is 0.62. Since the CVI exceeded this threshold, content validity was statistically significant. Accordingly, 21 items with insufficient content or weak semantic coherence were removed based on the Lawshe technique. The remaining 28 items were revised for language and clarity based on expert feedback, reducing the scale from 49 to 28 items.

Pilot Testing and Face Validity

The 28-item draft Menstrual Comfort Scale was administered to 10 women with characteristics similar to those of the target sample. Based on participant feedback, six items that were not clearly understood were revised for wording and clarity. The findings indicated that the scale was suitable for psychometric analyses. Data obtained from the pilot study were not included in the main analysis.

Participants and Sampling

The study population consisted of women living in Türkiye who consented to participate. A non-probability sampling method, specifically snowball sampling, was used to recruit participants.

The inclusion criteria were being aged 18 years or older, being of reproductive age with an active menstrual cycle, fully completing the data collection form, and voluntarily agreeing to participate in the study. The exclusion criteria included incomplete responses, menopausal status, and lack of consent.

Sample Size Determination

Determining sample size in scale development studies remains a debated issue. Although traditional approaches recommend a sample size of 5–10 times the number of items (DeVellis, 2017), recent literature suggests that this approach may be insufficient (Erkuş & Selvî, 2019) (Erkuş, 2019; Goretzko et al., 2021). Researchers emphasize that factors such as the number of factors, magnitude of factor loadings, and communalities should be considered when determining sample size (Beavers et al., n.d.; Schumacker, 2014; Sürücü et al., 2024).

To avoid capitalization on chance and enhance generalizability, the factor structure obtained through Exploratory Factor Analysis (EFA) was tested using Confirmatory Factor Analysis (CFA) in an independent sample. According to recent literature, at least 200 participants are recommended for EFA (Sürücü et al., 2024).

Accordingly, the dataset was divided into two independent subsets: 221 participants for EFA and 201 participants for CFA. The total sample consisted of 422 participants. According to COSMIN recommendations, a sample size greater than 200 is required at each stage to ensure high methodological quality (Mokkink et al., 2018, 2023).

Data Collection Procedure

Data were collected online using the Google Forms platform. The data collection tools included a Participant Information Form and a draft Menstrual Comfort Scale, developed by the researchers.

Snowball sampling was used during the recruitment process. The survey link was shared via social networks, and data collection was completed within the specified period. Incomplete or improperly filled forms were excluded from the analysis.

Research Instruments

Participant Information Form

The form consists of 12 items designed to assess participants' sociodemographic and menstrual characteristics. It includes variables such as age, marital status, educational level, age at menarche, duration, regularity, and frequency of the menstrual cycle, and family history of premenstrual symptoms (in mother or sister).

Draft Menstrual Comfort Scale

The draft Menstrual Comfort Scale, developed to assess women's perceptions of comfort during menstruation, consists of 15 items and three subdimensions. The scale uses a 5-point Likert-type format ranging from 1 (strongly disagree) to 5 (strongly agree).

Data Analysis

The data were analyzed using SPSS for Windows 26.0 and AMOS 24.0. Reliability analysis was conducted to assess the internal consistency of the items. Internal consistency was evaluated using Cronbach's alpha and McDonald's omega coefficients.

To assess construct validity, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed. The suitability of the data for factor analysis was tested using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's Test of Sphericity. Factors were extracted based on eigenvalues greater than 1 (Kaiser criterion) and on visual inspection of the scree plot.

Varimax rotation was applied, and each item was assigned to the factor with the highest loading (≥ 0.30) (Costello & Osborne, 2005). Model fit was evaluated using the following criteria: Comparative Fit Index ($0.90 \leq CFI \leq 0.95$), Goodness of Fit Index ($0.90 \leq GFI \leq 0.95$), Incremental Fit Index ($0.90 \leq IFI \leq 0.95$), Standardized Root Mean Square Residual ($0.05 \leq SRMR \leq 0.10$), Root Mean Square Error of Approximation ($0.05 \leq RMSEA \leq 0.08$), and $\chi^2/df \leq 3$ (DeVellis, 2021; Tabachnick et al., 2015).

Descriptive statistics (frequency, percentage, mean, and standard deviation) were used to analyze sociodemographic variables, and statistical significance was set at $p \leq 0.05$.

Ethical Considerations

Ethical approval

was obtained from the Social and Human Sciences Ethics Committee of Bartın University (Approval Date: 25 July 2024; Protocol No: 2024-SHH-0622). The study was conducted in accordance with the principles of the Declaration of Helsinki. Prior to participation, informed consent was obtained from all participants. Participants were informed about anonymity, their right to withdraw, and the voluntary nature of the study. Contact information for the researchers was also provided to address concerns regarding participation.

Demographic Characteristics

A total of 422 participants were included in the study, of whom 221 constituted Sample 1 and 201 constituted Sample 2. Sociodemographic characteristics of the participants are presented in Table 1.

In Sample 1, the mean age was 24.26 ± 5.67 years, the mean age at menarche was 14.16 ± 0.95 years, the mean menstrual cycle length was 30.99 ± 12.02 days, and the mean duration of menstrual bleeding was 5.89 ± 2.02 days.

In Sample 2, the mean age was 22.23 ± 4.90 years, the mean age at menarche was 12.20 ± 0.71 years, the mean menstrual cycle length was 29.36 ± 6.47 days, and the mean duration of menstrual bleeding was 5.89 ± 2.02 days.

The proportion of single participants was 85.1% in Sample 1 and 91.5% in Sample 2. The majority of participants were university graduates. The proportions of participants reporting regular menstrual cycles were 67.4% in Sample 1 and 74.1% in Sample 2.

Table 1
Sociodemographic Characteristics of the Participants

	Sample 1	Sample 2
	All participants (N: 221)	All participants (N: 201)
Age	24.26 ± 5.67 (Min: 18, Max: 39)	22.23 ± 4.90 (Min: 18, Max:39)
Age at menarche	14.16 ± 0.95 (Min:13, Max:17)	12.20 ± 0.71 (Min: 10, Max: 13)
Menstrual cycle length	30.99 ± 12.02 (Min: 17, Max: 90)	29.36 ± 6.47 (Min: 15, Max: 60)
Duration of menstruation	5.89 ± 2.02 (Min: 0, Max: 25)	5.80 ± 1.32 (Min: 1, Max: 10)
Average duration of experienced symptoms	4.64 ± 3.34 (Min: 1, Max: 20)	29.36 ± 6.47 (Min: 1, Max: 15)
Marital status		
Single	188 (85.1)	184 (91.5)
Married	33 (14.9)	17 (8.5)
Educational status		
High school	13 (%5.9)	13 (6.5)
University and above	208 (%94.1)	188 (93.5)
Is your menstrual cycle regular?		
Yes	149 (67.4)	149 (74.1)
No	72 (32.6)	52 (25.9)
Does your mother or sister experience premenstrual symptoms?		
Yes	153 (69.2)	145 (72.1)
No	68 (30.8)	56 (27.9)

Abdominal bloating, tension, and pain were the most frequently reported premenstrual complaints, observed in the majority of participants [343 (81.28%)]. This was followed by mood changes [280 (66.35%)] and breast tenderness [258 (61.14%)]. Among psychological symptoms, stress was common [230 (54.50%)], and mild depressive symptoms were reported by approximately half of the participants [209 (49.53%)].

Symptoms predominantly occurred in the premenstrual period [321 (76.06%)] and remained common during menstruation [271 (64.21%)].

When coping strategies for menstrual pain were examined, more than half of the participants (231; 54.74%) reported using analgesics. This was followed by attempting to sleep [207 (49.05%)] and using hot water bottles [206 (48.82%)], whereas engaging in exercise was notably less common [51 (12.09%)].

Phase 3: Validity and Reliability of the Scale Structure (Item Reduction and Examination of Factor Structure)

Structural Validity

The Kaiser–Meyer–Olkin (KMO) measure and Bartlett’s Test of Sphericity were used to evaluate sampling adequacy for factor analysis in both datasets. The KMO value was 0.910, indicating excellent sampling adequacy. Bartlett’s Test of Sphericity was statistically significant ($\chi^2(120) = 1963.84, p < .001$), demonstrating that the correlations among variables were sufficient for factor analysis (Table 2).

Table 2
Kaiser–Meyer–Olkin (KMO) and Bartlett’s Test of Sphericity values of the populations

Algorithms	Indicators	Values	
		AFA	DFA
		All participants	All participants
KMO	KMO	.923	.921
Bartlett’s Test of Sphericity	Approx. Chi-Square	2429.870	1610.314
	df	171	105
	p	.000	.000

Exploratory Factor Analysis (EFA)

Exploratory factor analysis (EFA) was conducted using principal axis factoring to examine the factor structure of the Menstrual Comfort Scale. The initial form of the scale consisted of 28 items.

Item elimination decisions during the EFA process were based on predefined statistical and theoretical criteria. These included factor loadings below .40, communalities below .40, and items that weakened the theoretical coherence of the factor structure (Büyüköztürk, 2023; Child, 1990; Tabachnick et al., 2015). Initial analyses indicated that some items had low communalities and were not adequately explained by a single factor. Accordingly, items with low communalities and weak structural contributions (Items 1, 6, 7, 8, 10, 11, 18, 19, 27, and 28) were removed.

Additionally, items that weakened theoretical integrity and did not contribute meaningfully to the factor structure (Items 20, 21, and 22) were excluded. After each item removal, the analysis was rerun, and the stability of the factor structure was reassessed.

Following Varimax rotation, items loaded meaningfully onto three factors. Factor loadings ranged from 0.49 and 0.88, and no significant cross-loadings were observed.

An eigenvalue analysis revealed three factors with eigenvalues greater than 1 ($F1 = 7.35$; $F2 = 1.81$; $F3 = 1.15$). Together, these three factors explained 56.87% of the total variance, indicating a satisfactory and robust factor structure.

The first factor consisted of seven items representing psycho-spiritual comfort; the second, six items reflecting physical comfort; and the third, three items representing environmental comfort (Table 3).

The overall Cronbach's alpha of the scale was 0.920. The alpha values were 0.892, 0.855, and 0.770 for the psycho-spiritual, physical, and environmental comfort subdimensions, respectively (Table 3).

Corrected item-total correlations ranged from .432 to .701 for the psycho-spiritual comfort subdimension, .403 to .648 for the physical comfort subdimension, and .452 to .793 for the environmental comfort subdimension. These findings indicate a high level of internal consistency.

Table 3
Exploratory factor analysis data for the Menstrual Comfort Scale (N = 220)

Item No	Item	Factor 1 (Psycho-spiritual Comfort)	Factor 2 (Physical Comfort)	Factor 3 (Environmental Comfort)	h ²
1	17. I feel at peace	.719	–	–	.619
2	15. I feel balanced	.718	–	–	.701
3	13. I feel safe	.674	–	–	.567
4	16. My self-confidence remains strong	.671	–	–	.623
5	14. I don't feel helpless	.637	–	–	.543
6	12. I feel mentally at ease	.614	–	–	.458
7	19. My social relationships aren't negatively affected	.527	–	–	.432
8	5. My work or school performance is not negatively affected	–	.704	–	.648
9	4. I feel I can maintain my energy levels.	–	.678	–	.630
10	3. My sleep schedule is not disrupted.	–	.651	–	.528
11	2. I can easily continue my routine physical activities.	–	.615	–	.492
12	9. I do not feel tired	–	.515	–	.403
13	26. I do not have difficulty concentrating.	–	.490	–	.509
14	24. I do not experience difficulties in maintaining my privacy.	–	–	.876	.793
15	23. I can easily access the hygiene products I need.	–	–	.822	.702
16	25. I can find an environment where I feel comfortable at work or school.	–	–	.519	.452
Eigenvalue		7,352	1,805	1,147	
Variance Explained Total (%56.87)		43,264	9,225	4,384	

Item No	Item	Factor 1 (Psycho-spiritual Comfort)	Factor 2 (Physical Comfort)	Factor 3 (Environmental Comfort)	h^2
Cronbach's Alpha (.920)		.892	.855	.770	

h^2 = Communality

Confirmatory factor analysis

The structure obtained from EFA, consisting of 16 items and three factors, was tested using CFA on an independent sample of 201 participants. During the CFA process, parameters affecting model fit were examined, and Item 25 was identified as producing high modification indices and showing associations with multiple factors. Based on theoretical and statistical considerations, Item 25 was removed from the model. Following this modification, a notable improvement in model fit indices was observed (Fig. 2).

The three-factor measurement model was tested using maximum likelihood estimation. The fit indices indicated good model fit to the data: χ^2 (84) = 130.722, $p = .001$; $\chi^2/df = 1.556$; RMSEA = .053 (90% CI [.034–.070], PCLOSE = .382); CFI = .970; TLI = .962; IFI = .970; NFI = .921; GFI = .920; and AGFI = .885. A χ^2/df value below 2, an RMSEA below .06, and CFI, TLI, and IFI values above .95 support a good model fit (Table 4).

Table 4
Confirmatory Factor Analysis Model Fit Indices

Index	Value	Acceptable Criteria
χ^2	130.722	
df	84	
χ^2/df	1.556	< 3 good
RMSEA	.053	≤ .06 good
90% CI RMSEA	.034 – .070	
PCLOSE	.382	> .05 good
CFI	.970	≥ .95 very good
TLI	.962	≥ .95 very good
IFI	.970	≥ .95 very good
NFI	.921	≥ .90 acceptable
GFI	.920	≥ .90 acceptable
AGFI	.885	≥ .85 acceptable

Standardized factor loadings ranged from .623 to .838 for the first factor, .579 to .824 for the second factor, and .838 to .863 for the third factor. All factor loadings were statistically significant ($p < .001$), indicating strong and meaningful relationships between items and their respective latent constructs.

Inter-factor correlations indicated a high correlation between Factor 1 and Factor 2 ($r = .859$), a moderate correlation between Factor 1 and Factor 3 ($r = .394$), and a low-to-moderate correlation between Factor 2 and Factor 3 ($r = .327$). These results indicate that the factors are related yet distinguishable constructs.

During model refinement, modification indices were evaluated within the theoretical framework, and only error covariances between items within the same subdimension (e.g., e11–e12; e4–e5; e5–e6) were included. These modifications led to a significant improvement in model fit and confirmed the three-factor structure.

According to the CFA results presented in Table 4, standardized factor loadings ranged between .579 and .863 and were all statistically significant ($p < .001$). These values indicate that the items are strongly associated with their respective latent constructs. The loadings ranged from .623–.838 for Factor 1, .579–.824 for Factor 2, and .838–.863 for Factor 3. In particular, the high loadings in the third factor suggest that this dimension exhibits a strong, homogeneous structure.

Explained variance (R^2) ranged from 0.335 to 0.745, indicating that a substantial proportion of each item's variance was explained by its corresponding factor. These findings support the construct validity of the three-factor model (Table 5).

Table 5
Standardized Factor Loadings and Squared Multiple Correlations for the Three-Factor Model

Factor	Item	λ	R^2
F1	item1	.784	.614
	item2	.795	.632
	item3	.776	.602
	item4	.701	.491
	item5	.666	.444
	item6	.838	.702
	item7	.623	.388
F2	item8	.774	.599
	item9	.824	.679
	item10	.579	.335
	item11	.662	.438
	item12	.655	.429
	item13	.714	.510
F3	item14	.838	.702
	item15	.863	.745
Note. λ = standardized factor loading; R^2 = squared multiple correlation (proportion of variance in the observed variable explained by the latent factor). All factor loadings were statistically significant at $p < .001$.			

Cronbach's alpha coefficients were calculated to assess internal consistency. The overall alpha coefficient for the scale was 0.919, indicating high internal consistency. For the subdimensions, alpha values were .892 for Factor 1, .856 for Factor 2, and .838 for Factor 3 (Table 6).

Corrected item–total correlations ranged from .562 to .755 for Factor 1, from .581 to .774 for Factor 2, and were .723 for Factor 3. All items had item–total correlations above .30, indicating that the items were consistent with the measured construct and that the scale demonstrated a homogeneous structure. No meaningful increase in alpha was observed when any item was removed, supporting the contribution of each item to the overall structure.

Table 6
Internal Consistency Reliability of the Menstrual Comfort Scale

Factor	Number of Items	Cronbach's α	Item–Total Correlation Range	McDonald's ω
Factor 1	7	.892	.562 – .755	.906
Factor 2	6	.856	.581 – .774	.874
Factor 3	2	.838	.723	.845
Total Scale	15	.919	—	—

McDonald's omega coefficients were calculated to provide a more robust estimate of internal consistency. Omega values were 0.906 for Factor 1, 0.874 for Factor 2, and 0.845 for Factor 3 (Table 6), indicating strong composite reliability across all subdimensions.

Composite Reliability (CR) and Average Variance Extracted (AVE) were calculated to assess convergent validity. CR values were .91 for Factor 1, .88 for Factor 2, and .85 for Factor 3, all exceeding the recommended threshold of .70. AVE values were .59, .55, and .72, respectively, indicating that each construct explained more than 50% of the variance in its indicators (Table 7). These findings demonstrate adequate convergent validity.

CR values ranged from 0.85 to 0.91, and AVE values ranged from 0.55 to 0.72; both exceeded recommended thresholds. According to the Fornell–Larcker criterion, discriminant validity is supported when the square root of AVE values exceeds inter-factor correlations. Although the correlation between Factor 1 and Factor 2 was high ($r = .859$), the three-factor structure was retained based on theoretical justification (Table 7).

Table 7
Construct Reliability, Convergent and Discriminant Validity

Factor	CR	AVE	F1	F2	F3
F1	.91	.59	.77		
F2	.88	.55	.859	.74	
F3	.85	.72	.394	.327	.85
Note. Diagonal values (bold) represent the square root of AVE. Off-diagonal values indicate inter-factor correlations.					

Discussion

This study aimed to examine the validity and reliability of the Menstrual Comfort Scale, based on Kolcaba's Comfort Theory, for assessing women's comfort levels during menstruation. The findings indicate that the scale demonstrates a three-factor structure and possesses adequate psychometric properties.

The results of the Exploratory Factor Analysis (EFA) revealed that the scale consists of three factors: psycho-spiritual comfort, physical comfort, and environmental comfort. This structure is generally consistent with Kolcaba's Comfort Theory, which conceptualizes comfort as a multidimensional experience encompassing physical, psycho-spiritual, sociocultural, and environmental domains (Kolcaba, 1994; Kolcaba, 2003; Kolcaba, 2015). The theory has been widely used as a theoretical foundation in studies evaluating comfort in healthcare and supports the multidimensional nature of the concept (Gonçalves Martins et al., 2022; Wensley et al., 2020). In the present study, the absence of a distinct sociocultural factor may be explained by the contextual overlap among comfort dimensions. Studies based on Kolcaba's theory suggest that certain dimensions may merge depending on the context in which comfort is measured (Aloustani et al., 2026; Marques et al., 2025). Items comprising the environmental comfort factor, such as privacy, access to hygiene products, and the availability of appropriate facilities, indicate that social and environmental aspects may be perceived jointly in the context of menstruation. Therefore, the identified three-factor structure supports the context-sensitive and multidimensional nature of the comfort construct.

According to the EFA results, the total variance explained by the scale was 56.87%. In measurement tools developed in the social and health sciences, a total explained variance between 40% and 60% is generally considered acceptable (Backhaus et al., 2021; Costello & Osborne, 2005; Hair et al., 2010). Furthermore, factor loadings ranging from 0.49 to 0.87 indicate that the items strongly represent their respective factors. In the literature, factor loadings above .40 are considered acceptable, while those above .50 are regarded as strong (Hair et al., 2010; Tabachnick et al., 2015). Similarly, studies in health sciences report that the total explained variance of developed scales typically ranges between 45% and 65% (Boateng et al., 2018; Kyriazos & Stalikas, 2018). Taken together, these findings support the structural validity of the developed scale.

The results of the Confirmatory Factor Analysis (CFA) demonstrated that the three-factor measurement model provided a good fit to the data. The fit indices were $\chi^2 (84) = 130.722$, $p = .001$, and $\chi^2/df = 1.556$. A χ^2/df ratio below 2 indicates a good model fit (Hair et al., 2010; Kline, 2023). Additionally, RMSEA was .053, with a 90% confidence interval of .034–.070, indicating good fit (Brown, 2015). Incremental fit indices were also satisfactory, with CFI (.970), TLI (.962), and IFI (.970) exceeding .95, which is considered a strong indicator of good model fit (Hair et al., 2019; Kline, 2023). Moreover, NFI (.921), GFI (.920), and AGFI (.885) were within acceptable ranges. These findings confirm that the three-factor structure obtained from EFA is supported by CFA.

Standardized factor loadings ranged from .579 to .863, and all parameters were statistically significant ($p < .001$). Factor loadings above .50 indicate that the items strongly represent their corresponding factors (Hair et al., 2019). In addition, Composite Reliability (CR) values ranging from .85 to .91 and Average Variance Extracted (AVE) values above .50 demonstrate that the scale has adequate convergent validity (Hair et al., 2010).

Regarding internal consistency, the Cronbach's alpha coefficient for the total scale was .91, while the alpha values for the subdimensions ranged between .83 and .89. In the literature, alpha values above .70 are considered acceptable, and values above .80 indicate high internal consistency (Hair et al., 2010; Taber, 2018). These findings suggest that both the scale and its subdimensions provide highly reliable measurements.

Recent psychometric literature emphasizes that reporting only Cronbach's alpha is insufficient and recommends the inclusion of McDonald's omega for a more accurate assessment of internal consistency (Dunn, 2020; Hayes, 2017). In this study, the omega coefficients were also high, further supporting the internal consistency of the scale. Additionally, it is highlighted that reporting both Cronbach's alpha and omega coefficients provides a more comprehensive evaluation of reliability in scale development studies in women's health (Boateng et al., 2018; DeVellis & Thorpe, 2021). Overall, the findings indicate that the Menstrual Comfort Scale is a reliable measurement tool. This study also presents a new instrument that assesses menstrual comfort across multiple dimensions. The scale's theoretical foundation in Kolcaba's Comfort Theory contributes to a more comprehensive and theoretically grounded understanding of comfort in the context of menstruation.

Limitations

This study has several limitations. First, the use of a specific sample may limit the generalizability of the findings. Therefore, it is recommended that the scale be tested in different age groups, sociocultural contexts, and diverse samples.

Second, because the data were collected online, the sample was limited to individuals with internet access. This may restrict the representativeness of the findings for the general population.

Third, due to the cross-sectional design of the study, the temporal stability of the scale could not be assessed. Future studies should examine test-retest reliability to evaluate the stability of the scale over time.

Additionally, applying the scale in different cultural contexts and using it in intervention studies related to menstrual health may further contribute to the literature.

Conclusion

This study demonstrates that the Menstrual Comfort Scale is a valid and reliable measurement tool. The scale fills an important gap in the literature by evaluating menstrual comfort multidimensionally, encompassing psycho-spiritual, physical, and environmental dimensions.

Given that most studies on menstruation focus on symptoms, the development of a measurement tool that evaluates comfort within a holistic framework represents a significant contribution to women's

health research. In this context, the scale is considered a valid and reliable instrument that can be used both in clinical practice and in research on menstrual health.

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Social and Human Sciences Ethics Committee of Bartın University (Approval Date: 25 July 2024; Protocol No: 2024-SHH-0622). The study was conducted in accordance with the principles of the Declaration of Helsinki. Informed consent was obtained from all participants prior to participation. Participation was voluntary, and participants were informed about anonymity and their right to withdraw from the study at any time.

Consent to participate

Informed consent was obtained from all participants prior to participation.

Clinical trial number

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Funding

The author(s) reported there is no funding associated with the work featured in this article.

Author Contribution

HYD: Conceptualization; data collection; formal analysis; visualization; validation and project administration; writing—original draft and writing—review and editing. GA: Conceptualization and writing, data collection—original draft and review and editing. HT: Conceptualization and writing, data collection—original draft.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

1. Aloustani S, Parsai M, Siyasari AR, Rizi S, Papi M, S., Zafarramazanian F. Applications of Kolcaba's Comfort Theory to improve nursing practice: A narrative review. *J Nurs Rep Clin Pract*. 2026;4(2):110–5.
2. Backhaus K, Erichson B, Gensler S, Weiber R, Weiber T. *Multivariate Analysis: An Application-Oriented Introduction*. Springer Nature; 2021.
3. Barrington DJ, Robinson HJ, Wilson E, Hennegan J. Experiences of menstruation in high income countries: A systematic review, qualitative evidence synthesis and comparison to low- and middle-income countries. *PLoS ONE*. 2021;16(7):e0255001. <https://doi.org/10.1371/journal.pone.0255001>.
4. Beavers AS, Lounsbury JW, Richards JK, Huck SW, Skolits GJ, Esquivel SL. (n.d.). *Practical Considerations for Using Exploratory Factor Analysis in Educational Research*. <https://doi.org/10.7275/QV2Q-RK76>
5. Boateng GO, Neilands TB, Frongillo EA, Melgar-Quiñonez HR, Young SL. Best Practices for Developing and Validating Scales for Health, Social, and Behavioral Research: A Primer. *Front Public Health*. 2018;6:149. <https://doi.org/10.3389/fpubh.2018.00149>.
6. Brown TA. *Confirmatory factor analysis for applied research*. Guilford; 2015.
7. Büyüköztürk Ş. (2023). *Handbook of data analysis for social sciences*. Pegem Atıf İndeksi, 001–214.
8. Child D. (1990). *The essentials of factor analysis, 2nd ed* (pp. viii, 120). Cassell Educational.
9. Costello AB, Osborne J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assess Res Evaluation*, 10(1). <https://openpublishing.library.umass.edu/pare/article/id/1650/>
10. DeVellis RF. (2021). *Scale development: Theory and applications*.
11. DeVellis RF, Thorpe CT. *Scale development: Theory and applications*. Sage; 2021.
12. Dunn WW. (2020). Validity. In *Developing norm-referenced standardized tests* (pp. 149–168). Routledge. <https://www.taylorfrancis.com/chapters/edit/10.4324/9781315859811-7/validity-winnie-dunn>
13. Erkuş A, Selvî H. (2019). *Psikolojide Ölçme ve Ölçek Geliştirme III: Ölçek Uyarlama ve 'Norm' Geliştirme*. Pegem Akademi Yayıncılık. <https://doi.org/10.14527/9786052416594>
14. Gonçalves Martins A, Pontífice Sousa P, Margarida Marques R. Comfort: Theoretical Contribution to Nursing. *Cogitare Enfermagem*. 2022;27:1–7. <https://doi.org/10.5380/ce.v27i0.87723>.
15. Hair JF, Black WC, Babin BJ, Anderson RE, Tatham RL. (2010). *Multivariate data analysis* (7. Baskı). Pearson. Hallahan, TA, Faff, RW, McKenzie, MD (2004). *An Empirical Investigation of Personal Financial*

Risk Tolerance. Financial Services Review-Greenwich, 13(1), 57–78.

16. Hayes AF. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. Guilford; 2017.
17. Hennegan J, Shannon AK, Rubli J, Schwab KJ, Melendez-Torres GJ. Women's and girls' experiences of menstruation in low- and middle-income countries: A systematic review and qualitative metasynthesis. *PLoS Med*. 2019;16(5):e1002803. <https://doi.org/10.1371/journal.pmed.1002803>.
18. Kline RB. Principles and Practice of Structural Equation Modeling. Guilford; 2023.
19. Kyriazos TA, Stalikas A. (2018). *Applied Psychometrics: The Steps of Scale Development and Standardization Process*. <https://www.scirp.org/journal/paperinformation?paperid=87941>
20. Maria Hyttel MH, Faldt Thomsen C, Luff CFTB, Storrusten BLH, Nilah Nyakato HSV, V. N. N., Tellier M, M. T. Drivers and challenges to use of menstrual cups among schoolgirls in rural Uganda: A qualitative study. *Waterlines*. 2017;36(2):109–24. <https://doi.org/10.3362/1756-3488.16-00013>.
21. Marques MdoC, Goes M, João A, Oliveira H, Mendes C, Pires R, Bravo N. Comfort and Person-Centered Care: Adaptation and Validation of the Colcaba-32 Scale in the Context of Emergency Services. *Nurs Rep*. 2025;15(11):383.
22. Martinez-Vázquez S, Hernández-Martínez A, Rodríguez-Almagro J, Delgado-Rodríguez M, Martínez-Galiano JM. Relationship between perceived obstetric violence and the risk of postpartum depression: An observational study. *Midwifery*. 2022;108:103297.
23. Mokkink LB, De Vet HCW, Prinsen CAC, Patrick DL, Alonso J, Bouter LM, Terwee CB. COSMIN Risk of Bias checklist for systematic reviews of Patient-Reported Outcome Measures. *Qual Life Res*. 2018;27(5):1171–9. <https://doi.org/10.1007/s11136-017-1765-4>.
24. Mokkink LB, De Vet H, Diemeer S, Eekhout I. Sample size recommendations for studies on reliability and measurement error: An online application based on simulation studies. *Health Serv Outcomes Res Method*. 2023;23(3):241–65. <https://doi.org/10.1007/s10742-022-00293-9>.
25. Morrison J, Basnet M, Bhatta A, Khimbanjar S, Baral S. (2016). (*Health Research and Social Development Forum*).
26. Munro AK, Hunter EC, Hossain SZ, Keep M. A systematic review of the menstrual experiences of university students and the impacts on their education: A global perspective. *PLoS ONE*. 2021;16(9):e0257333. <https://doi.org/10.1371/journal.pone.0257333>.
27. Nalugya R, Tanton C, Hytti L, Kansiime C, Nakuya K, Namirembe P, Nakalema S, Neema S, Alezuyo C, Musoke N, Torondel S, Francis B, Ross SC, Bonell DA, Seeley C, J., Weiss HA. Assessing the effectiveness of a comprehensive menstrual health intervention program in Ugandan schools (MENISCUS): Process evaluation of a pilot intervention study. *Pilot Feasibility Stud*. 2020;6(1):51. <https://doi.org/10.1186/s40814-020-00585-2>.
28. Sangra S, Choudhary N, Kouser W, Fazal I. Assessment of knowledge, attitude and practice about menstruation and menstrual hygiene among adolescent girls in rural area of district Kathua, Jammu and Kashmir. *Int J Community Med Public Health*. 2019;6(12):5215. <https://doi.org/10.18203/2394-6040.ijcmph20195473>.

29. Schumacker RE. Learning statistics using R. Sage; 2014.
30. Sürücü L, Yıkılmaz İ, Maşlakçı A. Exploratory Factor Analysis (EFA) in Quantitative Researches and Practical Considerations. Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi. 2024;13(2):947–65. <https://doi.org/10.37989/gumussagbil.1183271>.
31. Tabachnick BG, Fidell LS, Ullman JB. (2015). *Using multivariate statistics* (Vol. 5). pearson Boston, MA. <https://www.pearsonhighered.com/assets/preface/0/1/3/4/0134790545.pdf>
32. Taber KS. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. Res Sci Educ. 2018;48(6):1273–96. <https://doi.org/10.1007/s11165-016-9602-2>.
33. Thiyagarajan D, Basit H, Jeanmonod R. (2024). *Physiology, Menstrual Cycle*.
34. Wensley C, Botti M, McKillop A, Merry AF. Maximising comfort: How do patients describe the care that matters? A two-stage qualitative descriptive study to develop a quality improvement framework for comfort-related care in inpatient settings. BMJ Open. 2020;10(5):e033336. <https://doi.org/10.1136/bmjopen-2019-033336>.

Figures

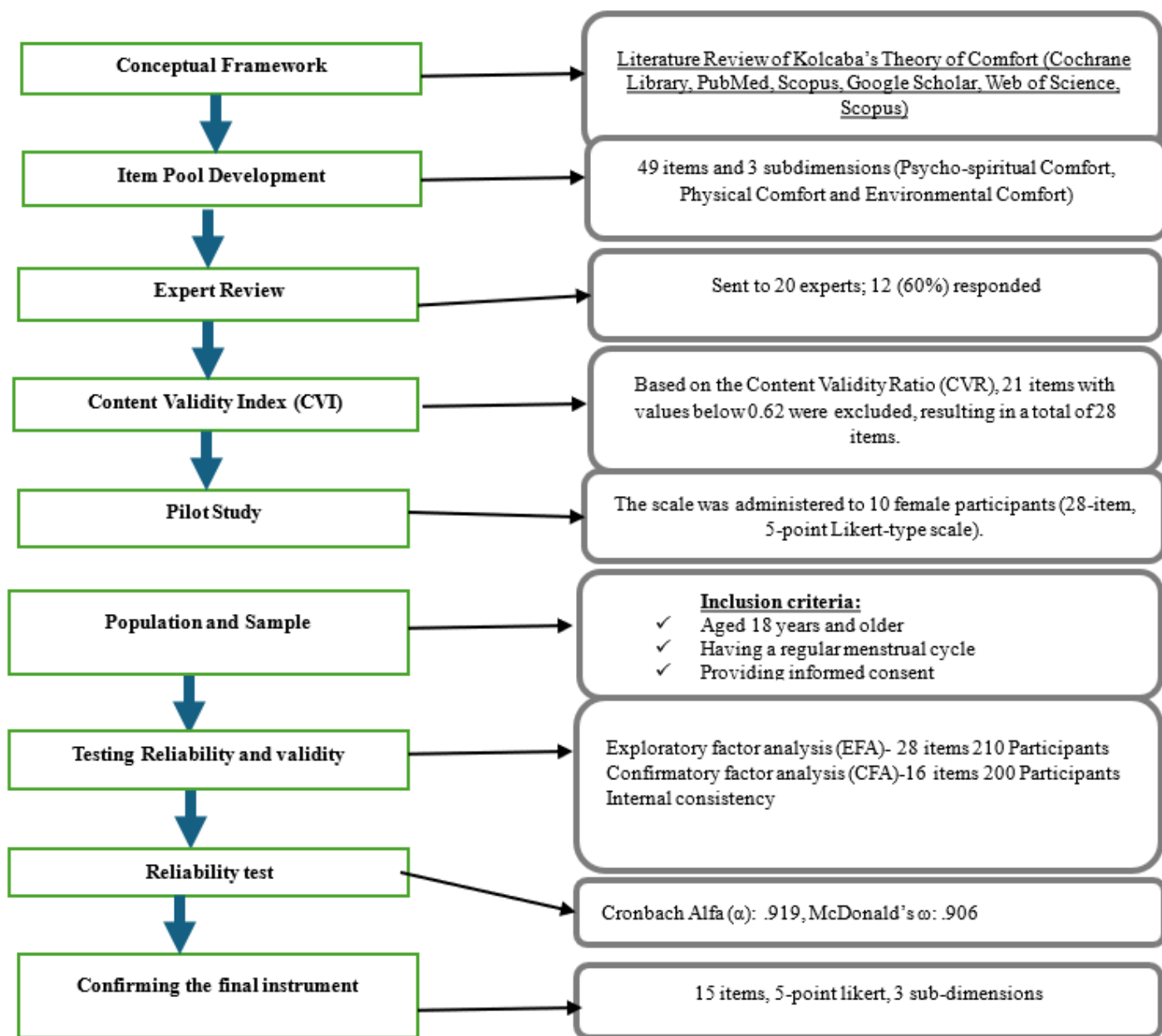
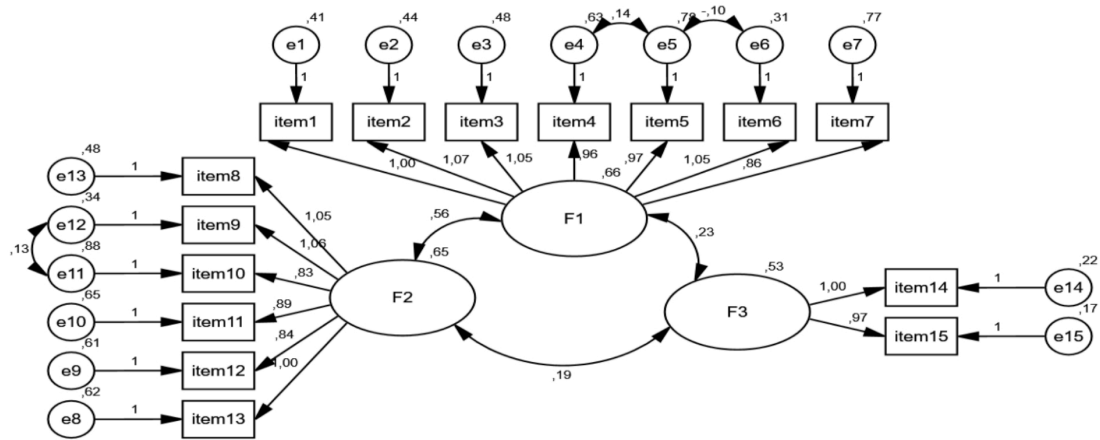


Figure 1

Flow chart



CMIN=130,722;DF=84;CMIN/DF=1,556;p=,001; RMSEA=,053;CFI=,970;GFI=,920

Figure 2

Model of First-Level Multifactor Confirmatory Factor Analysis of the Menstrual Comfort Scale