BMC Women's Health

RESEARCH Open Access

Validation of the premenstrual symptoms questionnaire among Mongolian nursing school students

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Abstract

Background Premenstrual disorders (PMDs) signi□cantly a□ect the daily lives of women. This study evaluated the reliability and validity of the Mongolian-translated Premenstrual Symptoms Questionnaire (PSQ) among female nursing students at the Mongolian National University of Medical Sciences.

Methods This cross-sectional study was conducted from February 2023 to January 2024. The PSQ was translated into Mongolian, and its reliability and validity were assessed. A total of 431 participants completed the translated PSQ along with the Premenstrual Dysphoric Disorder (PMDD) Scale, Somatic Symptom Scale (SSS-8), Patient Health Questionnaire (PHQ-9), and Beck Anxiety Inventory (BAI). Reliability was evaluated via Cronbachebruary 2023 to <1 433.Mbvaluae1145 consistency. Validity was assessed via factor analysis and correlations with external measures.

Results The internal consistency of the Mongolian PSQ was 0. 945. Factor analysis supported the tool's construct validity, which revealed a one-factor structure consistent with that of the original Japanese PSQ. The PSQ had strong positive correlations with the PMDD Scale ($r = 0.760$), SSS-8 ($r = 0.640$), PHQ-9 ($r = 0.580$), and BAI ($r = 0.620$), which indicated good convergent validity.

Conclusion The Mongolian-translated PSQ is a reliable and valid tool for assessing premenstrual symptoms in female nursing students. These □ndings suggest that the PSQ is a useful tool for screening PMDs in this population.

Keywords Validity, Reliability, Premenstrual symptoms questionnaire, Nursing, Students, Mongolia

Background

Premenstrual syndrome (PMS) and premenstrual dysphoric disorder (PMDD) are signi cant health concerns for women worldwide that a ect their physical, emotional, and social well-being [1]. Research indicates that more than 90% of women experience some form of premenstrual symptoms during their reproductive years [2, 3]. Notably, the burden of premenstrual symptoms extends beyond individual experiences to encompass broader societal implications, such as reduced productivity and quality of life [4, 5]. Symptoms of PMS have been recognized as a common menstrual problem among

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adolescents and young women in various cultural contexts, including those in Japan and Mongolia. A Japanese study found that approximately one in nine female high school students reported missing school owing to severe symptoms of PMS [6]. In Mongolia, a regional progress review of menstrual health in East Asia and Paci c countries revealed that services and guidelines were implemented for education, information, and access to materials; however, menstrual healthcare support, a supportive social environment, non-discrimination, and participation were not adequately addressed. is gap may exacerbate the impact of PMS and PMDD on young women's health [7]. Furthermore, research evidence in this area is lacking, underscoring the need for further investigation into menstrual health issues in Mongolia.

Research conducted in Mongolia revealed a higher prevalence of PMS and PMDD at 23.8% and 4.7%, respectively among female college students than in China and Japan [8]. According to the Global Burden of Disease Study 2019, the burden of PMS is highest and lowest in low-middle, which includes Mongolia, and high sociodemographic index (SDI) regions, respectively. Factors, such as rising obesity rates and increasingly westernized diets, contribute to elevated prevalence in middle-income countries. Additionally, women with PMS have an increased risk of hypertension, suggesting a potential link between PMS and cardiovascular health issues. Socio-cultural in uences, including taboos and limited awareness in some regions, may also lead to underreporting of PMS while lower socioeconomic status can impede access to diagnosis and treatment, which can complicate care e orts [9]. Globally, a pooled analysis revealed a 47.8% prevalence of PMS, although this rate varied widely; France and Iran reported the lowest (12%) and highest (98%) rate, respectively. ese regional di erences, with Asia and Europe exhibiting the highest and lowest prevalence, respectively, are in uenced by various factors, such as age, physical activity, and nutrition. Differences in measurement tools across studies also contribute to the variability in reported rates [3, 10].

erefore, diagnosing and assessing the severity of the symptoms of PMS is challenging owing to the lack of standardized criteria and assessment tools, especially in the Mongolian language. Traditional methods, such as prospective daily charting of symptoms, are time-consuming and may result in reduced compliance [11]. Furthermore, the existing diagnostic criteria, including those outlined in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV and DSM-V), lack speci city for determining PMDD's severity. Hence, scholars have developed a signi cant number of screening tools, likely related to the evolution and improved conceptualization of female-speci c psychiatric illnesses [12]. e Premenstrual Symptoms Questionnaire (PSQ), comprising 14 items, o ers a comprehensive assessment of premenstrual symptoms and has been validated for use in epidemiological studies and clinical settings in both Japan and Mongolia [6, 13]. Its potential applications extend to diagnostic purposes, academic research, and evaluation of treatment outcomes in clinical trials.

is study assumed that a culturally adapted PSQ could improve assessment consistency for PMS in Mongolia. erefore, our study aimed to evaluate the validity and reliability of the PSQ as a patient-reported outcome measurement (PROM) tool to assess PMS among Mongolian students. We sought to validate the PSQ and contribute toward the enhancement of assessment accuracy and better management of PMS in clinical practice.

Methods

Participants

We recruited female students from the School of Nursing at the Mongolian National University of Medical Sciences (MNUMS) between February 2023 and January 2024. Inclusion and exclusion criteria were developed based on previous research [6, 13]. Inclusion criteria were female students who had not been pregnant or lactating within the past 12 months and had a regular menstrual cycle. Exclusion criteria included the use of psychotropic medication, suspicion of pregnancy or menopause, and medical conditions, such as endometriosis, acute thyroid or pituitary disorders, or any other acute issues that a ected regular menstruation and rendered them ineligible to participate. Finally, data from 431 participants were analyzed, which resulted in a 14:30 ratio of the PSQ items to participants, which satis ed the statistical analysis requirements [14].

Ethical standards compliance

is study was approved by the Research Ethics Committee of the Mongolian National University of Medical Sciences (approval number: 2022/3–09). Prior to data collection, students who expressed interest in participating were provided with a consent form that detailed the study objectives and procedures. Participants were assured of their right to privacy and con dentiality. e study protocol followed the principles outlined in the 1964 Declaration of Helsinki and its subsequent amendments (see Fig. 1).

Demographic data

During the initial stages, demographic data, which included age, eld of study, marital status, parental status, contraceptive and painkiller usage history, experiences with women's health issues, broid myomas, hormonal therapy, attendance at women's health checkups, consultations with healthcare providers for premenstrual

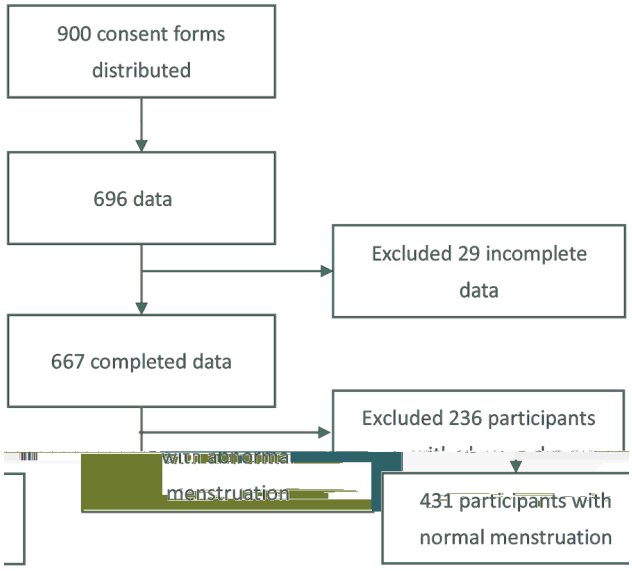

Fig. 1 Recruitment of the participants to assess the validity and reliability of the Mongolian version of Premenstrual Syndrome Questionnaire

syndrome (PMS), and coping strategies for menstrual tension, were obtained.

Instruments

Menstrual pain intensity

Menstrual pain intensity was assessed via a Numerical Rating Scale (NRS). Participants were asked to rate the severity of their menstrual pain over the preceding three months on a scale from 0 (no pain) and 10 (the most intense pain imaginable).

Premenstrual syndrome questionnaire (PSQ)

We used the PSQ, originally developed in Japanese by Takeda et al. in 2020. It comprised 11 items that corresponded to the symptoms listed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) criteria for PMDD. e PSQ was rigorously tested for reliability and validity to serve as a PROM tool to assess the scope of premenstrual symptoms. Its reliability was demonstrated by a Cronbach's alpha of 0.93. For structural validity, con rmatory factor analysis supported both one-factor and two-factor models, which indicated ex ibility in its structural t [6].

e premenstrual symptoms listed in PSQ included (i) depressed mood, (ii) anxiety or tension, (iii) tearfulness, (iv) anger or irritability, (v) decreased interest in work, home, or social activities, (vi) di culty concentrating, (vii) fatigue or lack of energy, (viii) overeating or food cravings, (ix) insomnia or hypersomnia, (x) feeling overwhelmed, and (xi) physical symptoms, such as tender breasts, feeling of bloating, headache, joint or muscle pain, or weight gain. It also enquired whether the premenstrual symptoms experienced interfered with (a) work e ciency, productivity, or home responsibilities, (b) social activities, or (c) relationships with coworkers or family. Participants were asked to rate the severity of their premenstrual symptoms and their interference with activities as follows: 1, not at all; 2, mild; 3, moderate; and 4, severe. e total score ranged between 14 and 56 points. Furthermore, participants were divided into three groups based on their premenstrual symptoms: PMDD, moderate to severe PMS, and no/mild PMS, according to Steiner et al.'s criteria [15].

The PSQ translation

e translation process from the original Japanese version to a Mongolian version adhered to the following seven steps to ensure accurate translation, cultural adaptation, and content validation of the PSQ for use in the Mongolian context [16]. Before the process, we identi ed the translation process and its components, established the rationale behind each step, and designated responsible individuals as forward and backward translators and expert team members for extensive discussion, which included obstetrician gynecologists, linguists, nurses, and medical doctors who spoke both Japanese and Mongolian and had experience of cognitive debrie ng. Step (1) Forward Translation: Two independent translators, an expert medical linguist and English-pro cient nurse, translated the PSQ from Japanese to Mongolian, which resulted in two separate Mongolian versions. Step (2) e two translated versions were compared by an expert committee that collaboratively reviewed them and resolved ambiguities, inconsistencies, and meanings to achieve a consensus. Step (3) Blind back-translation of the preliminary translated version: e Mongolian version was back-translated into Japanese by di erent medical linguistic translators and Japanese-pro cient nurses. Step (4) Comparison of the two back-translated versions.

e translated versions were thoroughly examined and discussed by the study team. Discrepancies in format, wording, syntax, meaning, and relevance were identi ed and resolved. e team aimed to harmonize the translations for a consensus on the content accuracy and appropriateness. Step (5) Pilot testing of the pre- nal version in the target language with a monolingual sample. e comprehensibility of the translated questionnaire was achieved via a cognitive debrie ng test that involved 30 female students from the School of Nursing, MNUMS, who provided feedback for further re nement. e pilot study con rmed that no improvements were required to the Mongolian version of the PSQ, except question 12. Question 12 was made comprehensible to Mongolian participants via addition of examples. Step (6) Preliminary psychometric testing of the pre- nal version of the translated instrument with a bilingual sample. e principal investigator reviewed the cognitive debrie ng results

and identi ed any necessary modi cations to enhance the questionnaire's understanding. e nal version was released for psychometric testing among a sample of the target population.

External instruments for validation

Despite the absence of similar alternatives in Mongolia, four instruments–the premenstrual dysphoric disorder scale (PMDD), somatic symptom scale-8 (SSS-8), Patient health questionnaire–9 (PHQ-9), and Beck Anxiety Inventory (BAI)–were used. rough a forward-backward translation process and subsequent discussions within the study team, a nal version was established, which demonstrated strong internal consistency in the pilot study with 30 students, $\alpha=0.960$, $\alpha=0.903$, $\alpha=0.936$, $\alpha=0.963$, respectively. is underscored the reliability of the translated PMDD scale, SSS-8, PHQ-9, and BAI employed in our validation study.

Premenstrual dysphoric disorder scale (PMDD scale)

e PMDD scale was developed based on the DSM-IV criteria by Miyaoka et al. [17] and was modi ed from the premenstrual symptom screening tool (PSST) developed by Steiner et al. [15]. It comprised two parts. Part A comprised 12 symptoms; of these, 10 were from DSM-IV and two additional questions were formulated by dividing "insomnia or hypersomnia" into "insomnia" and "hypersomnia" as separate symptoms. If one answered "yes" to at least one symptom in part A, the participant was required to answer part B of the DSM-IV criteria. e PMDD comprised three subscales: "fatigue and/or physical symptoms," "depressive mood," and "dysfunctional relationships and/or anger." Participants were diagnosed as having PMDD if they answered "severe" for at least one of the following items in section A: depressive mood, anxiety, tearfulness, and anger; "moderate" or "severe" for at least four items in section A; and "severe" for at least one item in section B regarding the interference with activities and relationships. e PMDD scale was used to rate the severity of premenstrual symptoms and their interference with activities as follows: 1, not at all; 2, mild; 3, moderate; and 4, severe. e total score ranged between 17 and 68 [18]. e PMDD scale had high reliability, Cronbach $\alpha=0.91$, and demonstrated good concurrent validity. It was strongly correlated with the Self-rating Depression Scale (SDS) as well as con rmed its validity via the assessment that a signi cant portion of women with depressive disorders (43.1%) meet the criteria for PMDD. Previous studies revealed that the PSQ and its short-form were strongly correlated with the PMDD scale [6, 13].

Somatic symptom scale-8 (SSS-8)

e SSS-8 was rst developed for the DSM-V eld trials by Benjamin et al. in 2014, who investigated the newly established somatic symptom disorder. It was designed to be an abbreviated version of the established patient health questionnaire (PHQ-15). e SSS-8 had good reliability, Cronbach $\alpha=0.81$. It comprised eight items: (1) gastrointestinal disorders, (2) back pain, (3) arm, leg, or joint pain, (4) headache, (5) chest pain and shortness of breath, (6) dizziness, (7) fatigue and low energy, and (8) sleep disturbance. Responses were rated on a 5-point response format (0–4), which resulted in a total score that ranged between 0 and 32. e SSS-8 had good construct and criterion validity. It correlated well with other measures of social support and related constructs, such as well-being and mental health [19].

Patient health questionnaire (PHQ-9)

e PHQ-9 is a widely used self-report questionnaire that employs the DSM-IV nine-symptom criteria to diagnose major depressive episodes. A total score of 10 indicates a major depressive episode. e total PHQ-9 score was used to classify the severity of depressive episodes (minimal, mild, moderate, moderately severe, or severe). Cronbach's alpha for the PHQ-9 typically ranged from 0.86 to 0.89 in various studies, which indicated good internal consistency. e PHQ-9 demonstrated strong construct and criterion validity. It correlated well with other measures of depression, such as the Hamilton Depression Rating Scale (HAM-D) and Beck's Depression Inventory (BDI) [20].

Beck's anxiety inventory (BAI)

Anxiety symptoms were measured via Beck Anxiety Inventory (BAI), which comprised 21 self-rating items scored on a 4-point Likert scale that ranged from 0 to 3. It assessed the impact of each anxiety symptom in the preceding week of menstruation. e nal score was obtained by summing the scores obtained for all the items and used to classify the anxiety severity into three categories (low, moderate, or high). e BAI demonstrated strong internal consistency, Cronbach's alpha values of approximately 0.92, which indicated excellent reliability. It also had good construct and criterion validity. It correlated well with other measures of anxiety, such as the Hamilton Anxiety Rating Scale (HAM-A) and State-Trait Anxiety Inventory (STAI) [21].

Statistical analysis

Descriptive statistics were used to summarize basic data features. Frequencies and percentages were calculated for categorical variables, whereas mean, minimum, and maximum values were computed for continuous variables. Chi-squared test of independence was used to

examine the di erences between the demographic categorical variables in the Mongolian version of the PSQ. It determined whether a signi cant association existed between two categorical variables via a comparison of the observed frequencies in each category with the expected frequencies. Contingency tables were created for each pair of categorical variables and chi-square statistic was calculated. Prior analysis, the assumptions of the chi-squared test, which included the independence of observations and minimum expected cell frequency, were checked. Normality assumption of the data was assessed via the Kolmogorov-Smirnov test, which considered a test distribution as normal when the signi cance level was $p<0.05$.

Reliability of the PSQ was evaluated via an assessment of the internal consistency of the items through Cronbach's alpha and split-half correlation methods. e split-half method involved division of the test into two halves and assessment of their correlation, where a higher correlation indicated better internal consistency. An alpha coe cient of ≥0.7 was considered satisfactory.

Validity was investigated via construct, criterion, and convergent validity. Kaiser-Meyer-Olkin (KMO) test was used to evaluate sampling adequacy for factor analysis. Furthermore, Bartlett's test of sphericity was employed to examine whether the correlations between variables were su ciently large for the factor analysis to be meaningful. A KMO value of >0.7 was considered acceptable. e p-value of <0.05 was considered signi cant for Bartlett's test.

Construct validity was assessed via the factor structure of the PSQ and determined via an exploratory factor analysis (EFA) with principal component analysis (PCA) and varimax rotation. Factor-item loading values higher than 0.30 were considered as satisfactory allocation of that item to the relevant factor. A con rmatory factor analysis (CFA) that used the maximum likelihood estimation method was performed to assess how well the EFA-extracted model t the observed data. To ensure no multicollinearity problems and a good model t, the following values of t indices were adopted: chi-squared/df<5, root mean square error of approximation (RMSEA)<0.8 (95% CI), goodness of t index (GFI), adjusted goodness of t index (AGFI), comparative t index (CFI), and Tucker-Lewis Index (TLI)>0.9. P values>0.05 were considered signi cant.

Pearson's correlation coe cient was used to verify the criterion validity via an examination of the relationships between the PSQ and other scales, the SSS-8, PHQ-9, BAI, and the PMDD scale. Correlation values (r) of 0.3–0.5, 0.5–0.7, and 0.7–0.9 indicated moderate, good, and excellent correlations, respectively.

Convergent validity was evaluated via the intraclass correlation coe cient (ICC) and weighted kappa statistics. ey were used to assess the agreement between the PSQ and PMDD scale, which was already validated. Weighted Kappa values ranged from −1 to 1, and higher values indicated better agreement. Based on the 95% CI of the ICC estimate, values<0.5, 0.5–0.75, 0.75–0.9, and >0.90 indicated poor, moderate, good, and excellent coe cient, respectively. All statistical analyses, except CFA, were performed via IBM SPSS Statistics for Windows (Version 27.0; IBM Corp., Armonk, NY). Signi cance level was set at $p<0.05$.

Results

Demographic characteristics

Data from 431 students with a normal menstrual cycle were analyzed. Study consent forms, along with information of the research background, were distributed to the students through their general university email addresses. Questionnaires were collected via Google Forms. Demographic characteristics revealed that three-fourths of the participants were aged between 16 and 25 years, and most were nursing students in their second year of study. ose who reported dysmenorrhea and a history of contraceptive or painkiller use as well as prior experiences with women's health issues were more prone to experiencing PMS and PMDD. Conversely, marital status, having children, history of broid myomas, hormonal therapy, routine women's health checkups, and seeking medical attention for premenstrual symptoms did not signi cantly in uence premenstrual symptoms (Table 1).

Reliability analysis

Cronbach's alpha coe cient, a metric of internal consistency reliability, yielded a value of 0.945, while the split-half correlation coe cient was 0.828. ese high coe cients underscored the reliability of the Mongolian version of the PSQ (Table 2).

Validity analysis

Construct validity

Application of the PCA as part of an EFA with varimax rotation to the Mongolian version of the PSQ yielded a one-factor solution, as shown in Table 3. is model explained 58.9% of the total variance across the 14 items. Factor loadings for this single factor ranged from 0.421 to 0.698, and all items had substantial loadings>0.40, which supported the uni-dimensionality of the scale. Analysis was conducted with 431 participants and deemed sufficient based on the criteria. e suitability of the factor model was further supported by a KMO value of 0.958 and signi cant p-value from Bartlett's test of sphericity ($p<0.001$). Additionally, the scree plot and eigenvalues con rmed the presence of a single-factor structure.

Table 1 Participants' demographic characteristics ($n = 431$)

		Premenstrual syndrome			Chi-squared test
		Normal	PMS	PMDD	*P* value
Age	mean ± SD	20.75 ± 4.24			0.866
	16–25	220	72	33	
	25<	74	23	9	
Menarche age	mean ± SD	13.71 ± 1.47			
Major	nursing	266	86	39	0.881
	others	28	9	3	
Grade	□rst	47	10	4	0.476
	second	191	65	26	
	third	40	17	9	
	fourth	16	3	3	
Marital status	married	28	8	0	0.113
	single	266	87	42	
Had a child	yes	36	12	1	0.154
	no	258	83	41	
Dysmenorrhea	yes	55	36	22	**0.001*** **
	no	239	59	20	
Ever used contraceptives	yes	25	23	7	**0.001*** **
	no	269	72	35	
Ever used pain killer	used	81	42	20	**0.001*** **
	not used	213	53	22	
Ever had woman's disease	yes	73	35	18	**0.010***
	no	221	60	24	
Ever had □broid myoma	yes	3	3	0	0.218
	no	291	92	42	
Ever had hormonal therapy	yes	8	7	2	0.124
	no	286	88	40	
Ever had woman's check-up	yes	143	50	26	0.253
	no	151	45	16	
Ever see a doctor due to PMS	yes	23	9	8	0.064
	no	271	86	34	
Types of action taken owing to menstrual tension	no action	118	31	23	0.050
	taken medicine	34	14	5	
	kept abdomen warm	43	21	7	
	sleep	44	20	4	
	others	55	9	3	

***$p < 0.001$, *$p < 0.05$

e one-factor model demonstrated a good t, as indicated by various t indices: a chi-squared/df ratio of 4.361 with a signi cance level of $p < 0.001$, GFI = 0.866, AGFI = 0.817, TLI = 0.906, normed t index (NFI) = 0.904, re-lative t index (RFI) = 0.886, incremental t index (IFI) = 0.921, CFI = 0.924, parsimony normed t index (PNFI) = 0.765, parsimony comparative t index (PCFI) = 0.779, RMSEA = 0.098 (with 95% CI), and RMR = 0.04. Collectively, these indices suggested that the proposed factor model was a suitable representation of the observed data.

Table 3 Exploratory factor analysis via varimax-rotation method of the Mongolian version of the PSQ ($n = 431$)

Item number	PSQ questions	Extraction
PSQ1	Feel sad, depressed, despairing, and worthless	0.588
PSQ 2	Anxiety, anger, and frustration	0.629
PSQ 3	Suddenly sad, too sensitive, or become susceptible	0.620
PSQ 4	Bored and irritated	0.556
PSQ 5	Daily life (work, friends, hobbies, schools) is not interested	0.634
PSQ 6	Cannot concentrate on something	**0.698**
PSQ 7	Inactive, get tired, and easily tired	0.630
PSQ 8	Stay hungry or eat more, or over love a speci□c	0.491
PSQ 9	Over sleeping, di□culty getting up or sleeping, waking up at midnight, or abnormal sleeping	0.541
PSQ 10	Feeling overwhelmed, di□cult to react, and cannot make self-control	0.580
PSQ 11	Breast pain, headache, joint and muscle pain, weight gain, or edema	0.421
PSQ 12	I cannot do well of my job, my study at school, and daily chores at home	0.627
PSQ 13	I have lost part in hobbies or social activities or reduced participation in social activities	0.631
PSQ 14	In□uenced my relationship with others	0.608

Table 4 Correlations and agreement between the Mongolian version of the PSQ and PMDD scale

	Pearson's *r*	ICC	Weighed Kappa agreement
PSQ classi□cation vs. PMDD scale classi□cation	0.445***	0.496***	0.492***
PSQ total score vs. PMDD scale total score	0.892***	0.884***	

***$p < 0.001$

Criterion validity

e Mongolian version of the PSQ demonstrated strong agreement with the PMDD scale, as shown in Table 4.

Convergent validity

e Mongolian version of the PSQ had good correlation with the SSS-8 (0.517, $p < 0.001$), PHQ-9 (0.643, $p < 0.001$), and BAI scores (0.499, $p < 0.001$) and weak

Table 2 Reliability of the Mongolian version of the PSQ ($n = 431$)

Number of Items	Item mean	Minimum	Maximum	Cronbach's alpha (95% CI)			Split-half correlation
14	2.161	1.768	2.608	0.945	(0.938	0.953)	0.828

correlation with pain intensity (0.253, $p<0.001$) during menstruation Table 5A and 5B.

Discussion

e PSQ was rst translated into Mongolian and validated through rigorous analysis across multiple dimensions to establish its reliability and validity. is discussion synthesizes the ndings from demographic characteristics, reliability analysis, EFA, criterion validity, and convergent validity. ese ndings con rmed that the Mongolian version of the PSQ was a robust tool to assess PMS in this population.

Participants' demographic characteristics suggested a representative sample across factors, such as age, major, marital status, and other relevant information. Noteworthy variables, such as dysmenorrhea, contraceptive usage, painkiller intake, and history of women's diseases, emerged as statistically signi cant factors that were linked to the classi cations of PMS and PMDD, with a signi cance level of $p<0.05$. Existing research consistently highlighted a correlation between the severity of PMS/PMDD and dysmenorrhea, which indicated that as the severity of dysmenorrhea increases, so does the severity of PMS and PMDD [22]. Moreover, use of contraceptive medications was positively correlated with an increased risk of symptoms of PMS [23, 24]. Individuals with symptoms of PMS commonly resort to painkillers as part of their suggested treatment options [25]. Our study utilized the PSQ to succinctly capture these relationships. While some studies indicated that women under the 20 years of age and unmarried women were more vulnerable to PMS [26, 27], our ndings did not indicate a signi cant impact of age and marital status on PMS, which was consistent with previous research outcomes [28]. In addition, we found that PMS correlated with the women's health history of the study participants, which highlighted the potential sensitivity of the Mongolian version of the PSQ and addition of a cultural and linguistic perspective to the ndings. ese ndings aligned with those of previous studies, which highlighted the impact of these factors on PMS symptoms and underscored the importance of considering them in clinical assessments while validating the Mongolian version of the PSQ.

Cronbach's alpha for the 14-item PSQ was 0.945, which indicated excellent internal consistency. Cronbach's alpha values>0.9 were generally considered indicative of a highly reliable scale [29]. is suggested that the PSQ items consistently measured the same underlying construct of the symptoms of PMS. High Cronbach's alpha re ected that the questionnaire items were well correlated and that of the PSQ. Hence, the Mongolia version was a cohesive tool for assessing premenstrual syndrome symptoms. Its reliability was higher than that of the original Japanese version of the PSQ (Cronbach's alpha of

Table 5A Pearson's correlation coe□cient between Mongolian version of PSQ, SSS-8, PHQ-9, BAI and pain intensity level (*n*

0.930) [6], short form of the PSQ (Cronbach's alpha of 0.930), and our previous ndings (Cronbach's alpha of 0.868) [8]. While the PSQ was newly adapted into Mongolian, its strong internal consistency was similar with ndings from other PMS assessment tools, such as the PSST used in Iranian (Cronbach's alpha of 0.930), Brazilian Portuguese (Cronbach's alpha of 0.910), and Italian (Cronbach's alpha of 0.890), which suggested that it was a reliable measure [30–32]. e split-half correlation coefcient was 0.828, which indicated good reliability. Split-half reliability assessed the extent to which all parts of a test contributed equally to what was being measured. A correlation value of 0.828 suggested that the two halves of the PSQ provided similar results, which a rmed that the scale was stable and reliable.

EFA via the varimax rotation method revealed satisfactory extraction values for all the items, which ranged from 0.421 to 0.698. Items, such as "cannot concentrate" (0.698) and "not interested in daily life (work, friends, hobbies, schools)" (0.634), had high factor loadings, which con rmed their strong contribution to the underlying construct of PMS symptoms. e lower loading for "breast pain, headache, joint and muscle pain, weight gain, or edema" (0.421) suggested a need for further examination; however, it still indicated a meaningful contribution. Overall, these results supported the multidimensional structure of the PSQ and its comprehensive coverage of PMS symptoms, which was similar to that of the original Japanese version [6]. Application of EFA with varimax rotation yielded a single factor that collectively accounted for 58.9% of the total variance among the 14 items. is percentage indicated that a single underlying construct e ectively explained most of the variance in the PSQ items. e KMO measure of sampling adequacy was 0.958, which was well above the recommended threshold of 0.60, which indicated that the sample size was su cient for factor analysis. Additionally, Bartlett's test of sphericity was highly signi cant ($p < 0.001$), which further supported the appropriateness of the factor analysis model. e scree plot and eigenvalues con rmed the presence of a single-factor structure, which reinforced the uni-dimensional nature of the PSQ. CFA results demonstrated a good t for the one-factor model, as indicated by various t indices. Chi-squared to degrees of freedom ratio (χ^2/df) was 4.361, which, despite being slightly above the ideal range, was still acceptable in larger samples ($p < 0.001$).

Criterion validity was established via a comparison of the PSQ and PMDD scale. e PSQ total score had a strong correlation with the PMDD total score (Pearson's $r = 0.892$, ICC = 0.884), which indicated excellent alignment between the two measures. is nding is similar with Japanese PSQ total score and the PMDD scale total score (Spearman's $r = 0.88$, $p < 0.001$) as well as the PSQ-S (Short-form) total score demonstrated a strong correlation with the PMDD total score ($r = 0.854$), supports this validity and suggests cross-cultural robustness of the PSQ. However, moderate correlations for scale classi cations (Pearson's $r = 0.445$ and ICC = 0.492) suggested some discrepancies in categorical classi cation, which may re ect di erences in diagnostic criteria or symptom interpretation. e weighted kappa coe cient of 0.492 suggests a moderate, statistically signi cant level of agreement between PSQ and PMDD classi cations for individual symptoms in this study. However, this level of agreement is notably lower than previous research ndings, which reported a substantial agreement (kappa = 0.650). is di erence suggests that, while the PSQ aligns well with the PMDD scale in assessing overall symptom severity, there may be more variability in symptom classi cation between the two scales in this study compared to prior results.

Convergent validity was assessed via correlations with the SSS-8, PHQ-9, BAI, and pain intensity levels. e PSQ demonstrated strong and signi cant correlations with these scales across all items, particularly the PHQ-9 (0.516–0.655) and SSS-8 (0.479–0.611). ese correlations con rmed that the PSQ e ectively captured the various symptoms associated with PMS, which included emotional, cognitive, and physical dimensions [33, 34]. e lower but still signi cant correlations with pain intensity levels highlighted the PSQ's ability to assess the physical discomfort associated with PMS, although less strongly than its emotional and cognitive symptoms. is pattern was consistent with previous research that indicated that while physical symptoms were a component of PMS [35], they were often secondary to emotional and cognitive symptoms regarding their impact on daily functioning [36].

A validation study of the Mongolian version of the PSQ provided strong evidence for its reliability and validity. High internal consistency, robust factor structure, strong criterion-related validity, and signi cant concurrent validity across multiple dimensions con rmed that the PSQ was a comprehensive tool for assessing PMS symptoms. ese ndings support its use in both clinical practice and research within the Mongolian context and contribute to better diagnosis and management of PMS.

Limitations

is study has several limitations. First, cultural differences. Although the PSQ was translated and culturally adapted to the Mongolian context, subtle cultural nuances might still in uence how participants understood and responded to the questionnaire items. Cultural di erences in the expression and perception of premenstrual symptoms may not have been fully captured by the translated PSQ. Second, availability of comparison

tools. While several external instruments (PMDD, SSS-8, PHQ-9, and BAI) were used for validation, the absence of similar validated premenstrual symptom questionnaires in Mongolia limited the comprehensive assessment of the validity of the PSQ against other established tools in the same language. ird, this study was conducted solely among students from one university in Ulaanbaatar, which may not be representative of the broader Mongolian female population or di erent age groups. Further studies may explore the PSQ's applicability in di erent demographics or settings.

Future studies should also utilize this validated scale to conduct further in-depth research on premenstrual syndrome and contribute to women's health in Mongolia. Additionally, the PSQ can be e ectively utilized in clinical settings for screening patients with PMS and PMDD. Integration of the PSQ into routine assessments can enable healthcare providers to better identify and address the needs of women experiencing these conditions, which can lead to improved patient care and outcomes.

Conclusions

e Mongolian version of the PSQ demonstrates high reliability and validity. It serves as an e ective tool for accurately assessing premenstrual symptoms among Mongolian female university students.

Abbreviations

AGFI	Adjusted Goodness of Fit Index
BAI	Beck Anxiety Inventory
CFA	Con□rmatory Factor Analysis
CFI	Comparative Fit Index
DSM	Diagnostic and Statistical Manual of Mental Disorders
EFA	Exploratory Factor Analysis
GFI	Goodness of Fit Index
ICC	Intraclass Correlation Coe□cient
KMO	Kaiser-Meyer-Olkin
MNUMS	Mongolian National University of Medical Sciences
NRS	Numerical Rating Scale
PHQ-9	Patient Health Questionnaire
PMDD	Premenstrual Dysphoric Disorder
PMDs	Premenstrual Disorders
PMS	Premenstrual Syndrome
PSQ	Premenstrual Symptoms Questionnaire
RMSEA	Root Mean Square Error of Approximation
SSS-8	Somatic Symptom Scale
TLI	Tucker-Lewis Index

Acknowledgements

We would like to express our appreciation to all participants for their cooperation in this study.

Author contributions

Conception and design were performed by D.C., and H.S. Translation was performed by D.C., E.Y., S.O., T.S., O.B., A.S., Y.A. and H.S. Data were acquired by T.S., E.Y. and O.B. Statistical analyses were conducted by D.C., S.O. and H.S. The □rst draft of the manuscript was written by D.C. and H.S. All authors critically revised and approved the □nal version of the manuscript.

Funding

No funding was received for conducting this study.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

This study was approved by the Research Ethics Committee of the Mongolian National University of Medical Sciences (approval number: 2022/3–09). Prior to data collection, students who expressed interest in participating were provided with a consent form detailing the study objectives and procedures. Participants were assured of their right to privacy and con□dentiality. The study protocol followed the principles outlined in the 1964 Declaration of Helsinki and its subsequent amendments.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Received: 3 August 2024 / Accepted: 3 December 2024
Published online: 23 December 2024

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