RESEARCH ARTICLE

Validity and Reliability Testing of the Indonesian Version of the Exercise and Menstruation Questionnaire (EMQ-I) Assessing the Phenomenon of Menstruation in Sports

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Abstract

Menstruation is a natural biological process that occurs in women and is controlled by hormonal fluctuations. This study can support the achievements of female athletes, especially in Indonesia, where communication and perceptions related to menstruation have not been included in the criteria for creating training programs. This study aimed to examine the validity and reliability of the Indonesian version of the Exercise and Menstruation Questionnaire (EMQ-I) measuring the phenomenon of menstruation in sport. The population for this study was female athletes in Malang, Indonesia, aged 18-35 years, who participated in various sports with a total of 57 athletes. This study uses a methodological approach that combines qualitative and quantitative components. The qualitative stage involves translators and experts in the field of menstruation and sports to validate the content. The quantitative stage tests the validity and reliability using statistical analysis with results ranging from 0.628 to 0.909 and reliability ranging from 0.856 to 0.927. The results of the data analysis showed that 88.5% of the question items were valid to be announced to respondents. The total items to be announced were 33 items and had been tested for validity and reliability by experts and in-depth data analysis. This research is expected to be a literature material and input for coaches in Indonesia to create training programs that are suitable for women and improve sports achievements in Indonesia.

Keywords

Validity, Reliability, Exercise Menstruation Questionnaire, Sports

INTRODUCTION

Menstruation is the periodic discharge of blood and mucosal tissue from the inner lining of the uterus through the vagina (Goldstuck, 2020). Menstruation is a natural biological process that occurs in women as part of the menstrual cycle, which is controlled by hormonal fluctuations and is a sign that pregnancy has not occurred (Kiesner et al., 2020). Menstruation is characterized by the shedding of the uterine lining, which is triggered by falling progesterone levels. This process typically occurs every 21 to 35 days, with an average duration of 28 days, and is accompanied by symptoms such as cramps, bloating, and mood changes (Silberstein & Merriam, 2000).

Menstruation is a natural biological process that affects millions of women worldwide, including those who engage in sports and physical activities. Despite its prevalence, menstruation remains a taboo topic in many sports cultures, often leading to stigma, shame, and feelings of isolation among female athletes. The relationship between menstruation and sports is complex, with

menstruation often impacting athletes' training patterns, performance, and overall well-being (Carmichael et al., 2021; Passoni et al., 2023). Menstruation is a critical aspect of women's health, and its impact on sports performance is multifaceted. Hormonal fluctuations during the menstrual cycle can affect athletic performance, with some studies suggesting that menstruating athletes may experience decreased strength, endurance, and reaction time compared to non-menstruating athletes (Pasaribu et al., 2023). Additionally, menstrual cramps, bloating, and mood swings can disrupt training and competition schedules, leading to decreased motivation and overall performance. The uniqueness of women will not be a hindrance if they get the right treatment, especially in sports performance, in-depth education with adjustments to the conditions on the field is also very important to be carried out by the coach. With the instrument as a connector for female athletes regarding the adjustments felt by female athletes during menstruation and considerations for developing training programs for coaches who are currently holding women's teams. With these considerations, the researcher adopted the Indonesian Version of the Exercise and Menstruation Questionnaire (EMQ-I) is a comprehensive questionnaire that assesses various aspects of menstruation in sports, including the impact of menstruation on training patterns, athlete performance, and overall well-being. The questionnaire has been widely used in various cultural contexts, but its validity and reliability in the Indonesian setting remain untested. This study aims to address this gap by conducting a thorough validation and reliability testing of the EMQ-I in Indonesia.The ability of people in Indonesia to understand foreign languages, especially English, according to the EF English Proficiency Index (EF EPI) 2023 data is still low, namely ranked 79 out of 113 countries, therefore athletes and coaches are expected not to misunderstand the intent and purpose of the adapted question items, so that the research results are valid and can be continued to the next stage. This is very useful for reference in making programs and aligning training programs for coaches and athletes later.

This study aimed to examine the validity and reliability of the Indonesian version of the Exercise and Menstruation questionnaire. This study sought to adapt an existing questionnaire into the Indonesian language. Our findings are expected to contribute to a culturally sensitive research instrument that can be reliably used in Indonesia to explore the implications of menstruation on exercise, thereby facilitating more nuanced health and exercise interventions and research in the domain.

MATERIALS AND METHODS

The methodological approach of this study is in line with the development and validation framework outlined in previous research which combines qualitative and quantitative components (Ahmed & Ishtiaq, 2021; Surucu & Maslakci, 2020). The qualitative phase involved translators and experts in the field of menstruation and sport to conduct content validation to assess the clarity and understandability of the question items. Then, the quantitative phase was conducted by conducting validity and reliability tests using statistical analysis.

Population and Sample

The population in this study was 135 female athletes in Malang, Indonesia. The sampling technique in this study used purposive sampling, where sample selection was carried out based on criteria (Campbell et al., 2020). The inclusion criteria in this study were female athletes aged 18-35 years and participating in various sports. Meanwhile, the exclusion criteria are not willing to be a respondent. The sample calculation in this study was carried out using the Slovin formula so that a sample of 57 female athletes was obtained

Ethics Statement

This research is in the process of ethical testing which will later be issued by the Universitas Negeri Malang, numbered 21.08.4/ UN32.14.2.8/ LT/2024. Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures.

Data Collection Tools

Data Collection Tools in this study were demographic questionnaires and the Indonesian version of the Exercise and Menstruation Questionnaire (EMQ-I). Data Collection was conducted with an online survey using Google Forms, with links shared through social media and sports organizations. The data collection period was

six weeks, allowing participants to complete the survey at their own pace.

Data Analysis

Data analysis in this study was conducted to determine the demographic data of the research sample, validity and reliability tests of EMQ-I. Demographic data was analyzed using SPSS (Statistical Package for the Social Sciences) version 26. Validity and reliability analysis were carried out using SmartPLS version 3

RESULTS

Demographics

Table 1. Shows the average age of respondents was 20.98 years, with the youngest being 18 years old and the oldest 29 years old.

Table 1. Distribution of respondents by age

Characteristics	Mean	Min - Max	Std. Deviation
Age	20.98	18.0 - 29.0	2.33

Standard Deviation (Std. Deviation)

Meanwhile, Table 2 shows that most of the respondents are athletes in combat sports (50.9%) and are at the club competition level (42.1%).

Table 2. Distribution of respondents by sports and competition level

Characteristics	n	%
Sports		
Big ball games	14	24.6
Small ball games	10	17.5
Aquatics	3	5.3
Combat	29	50.9
Athletics	1	1.8
Competition Level		
Recreational	11	19.3
Club	24	42.1
National	17	29.8
International	5	8.8

Total (n); Percentage (%)

Evaluation of The Questionare's Validity and Reliability Test

The Indonesian Version of the Exercise and Menstruation Questionnaire (EMQ-I) is a comprehensive questionnaire that assesses various aspects of menstruation in sports. In this study, researchers identified the questionnaire items and divided them into several subscales, namely menstrual characteristics, use of contraceptive drugs, the effect of menstruation on training, discussions with coaches, changes in training patterns, and the effect of menstruation on performance. Items 1 and 2 contained age and age at first menstruation (menarche) questions. The blueprint of these items can be seen in Table 3.

Tabel 3. Blueprint item-item the Indonesian version of the exercise and menstruation questionnaire (EMQ-I)

No	Subscales	Questionnaire Item Numbers
1	Characteristics of menstruation	3, 4, 5, 6, 7, 8, 9, 10, 11
2	History of contraceptive drugs	12, 13, 14, 15, 16, 17, 18
3	Training during menstruation	19, 20, 21, 22
4	Training during menstruation	26, 27, 28, 29, 30
5	Training pattern	31, 32, 33, 34, 35
6	Performance and menstruation	23, 24, 25

Validity testing is a measuring tool that shows the level of validity of an instrument, one of which is by using the loading factor value of the PLS-SEM analysis. The loading factor value shows that there are 40 CBS-S questionnaire items that have been modified into the language ranging from 0.628 to 0.909 (Figure 1). These results indicate that the 40 items are valid. Meanwhile, there are 4 question items that have a loading factor value of less than 0.6, so they are concluded to be invalid namely items K6, K7, and K8 on the latent variable characteristics of menstruation and item O2 on the latent variable training pattern (Figure 1).

Discriminant validity analysis is also carried out using PLS-SEM. Questionnaire items are concluded to have discriminant validity if they have a higher correlation of latent variable values compared to other items. The analysis results show the value of discriminant validity, namely history of contraceptive drugs 0.729, performance and menstruation 0.745, training pattern 0.547, training during menstruation 0.880, characteristics of menstruation 0.775, and discussion with coach 0.768 (Table 4). These results indicate that there is one latent variable, namely head coach, which has lower discriminant validity compared to other item values which are higher than other item values (compared vertically with other latent variable correlations). Therefore, the results of the analysis can be concluded that all items have a relationship with different attribute measurement tools.
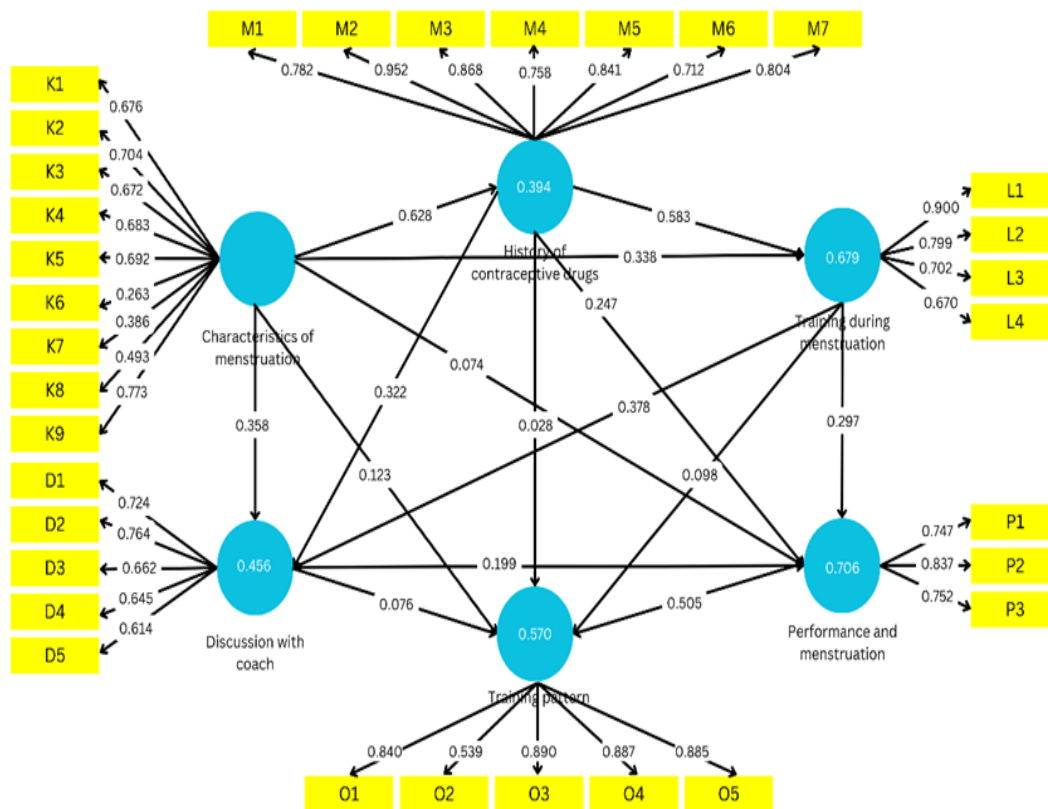

Figure 1. PLS-SEM: validity and reliability testing of the ındonesian version of the exercise and menstruation questionnaire

Reliability is determined by how well an instrument's results can be trusted and how well it can adjust for changes that occur. To put it another way, consistency can be achieved when it is observed by individuals who differ at different times. Data must be adjusted using reliable instruments, such as the Cronbach's alpha coefficient (Table 5). The results of the reliability test on the 47 items compiled to compile the sports coaching behavior scale consisting of history of contraceptive drugs, performance and menstruation, training pattern, training during menstruation, characteristics of menstruation, discussion with coach have cronbach's alpha coefficient values ranging from 0.856 to 0.927 which indicates the reliability of these items.

Tabel 4. Discriminant validity result

	History of Contraceptive drugs	Performance and menstruation	Training pattern	Training during menstruation	Characteristics of menstruation	Discussion with coach
History of Contraceptive drugs	0.792					
Performance and menstruation	0.745	0.835				
Training pattern	0.605	0.738	0.547			
Training during menstruation	0.785	0.763	0.634	0.880		
Characteristics of menstruation	0.628	0.711	0.614	0.688	0.775	
Discussion with coach	0.605	0.660	0.557	0.573	0.611	0.768

Table 5. Reliability test results

	Cronbach's alpha coefficients
History of contraceptive drugs	0.912
Performance and menstruation	0.856
Training pattern	0.927
Training during menstruation	0.887
Characteristics of menstruation	0.900
Discussion with coach	0.901

DISCUSSION

Menstruation is the nature for women, many aspects can affect performance as a female athlete in a state of menstruation. The ups and downs of hormones before, during, and after menstruation can have an impact on psychological, performance, physical, and so on (Jonge, 2003). Previous research has shown that hormonal fluctuations during the menstrual cycle can affect mood, pain, fatigue, and sports performance in female athletes (Marsh & Jenkins, 2002). Therefore, this is very interesting to study and can be a reference and advice for the stable performance of female athletes.

Menstruation is usually expressed in research using sub-phases, such as early follicular, late follicular, ovulatory, early luteal, mid luteal, and late luteal (Pitchers & Elliott-Sale, 2019). Physical performance will change during the menstrual phase due to various mechanisms, such as changes in muscle activation, substrate metabolism, thermoregulation and body composition (Carmichael et al., 2021). Compared with anaerobic and aerobic performance, muscle strength is more affected by the menstrual phase (Carmichael et al.,

2021). According to Martínez-Cantó et al. (2018) a significant decrease in strength components occurs during the menstrual period (early follicular) compared to the luteal phase (day 18-20 days). In studies conducted by (Tasmektepligil et al., 2010; Thein et al., 1995) the effect of menstrual phase on strength components was examined in dominant and non-dominant limbs. There was a significant increase in grip strength of the dominant hand in the late follicular phase and a significant but non-phase-specific difference in grip strength of the non-dominant hand. The strength ratio decreased significantly in the follicular phase compared to the luteal phase but there was no change in the dominant limb strength ratio (Thein et al., 1995). Changes in strength components in the menstrual phase appear to differ based on limb or muscle group dominance. Concentrations of female sex hormones can cause changes in power production, which can affect muscle strength. Negative perceptual responses are exacerbated during pre-menstrual (e.g. mood disorders) and during the menstrual period (e.g. menstrual symptoms and decreased strength) compared to the luteal and ovulatory phases. This is in line with research by Cockerill et al. (1992) that athletes experienced

increased mood disturbances and decreased strength components during the pre-menstrual period compared to mid-cycle. Female athletes perceive the menstrual period with feelings of discomfort, pain and mood disorders (Cook et al., 2021). Similarly, a narrative review illustrated that athletes perceived a decrease in their performance during the early follicular phase and late luteal phase compared to the rest of the menstrual cycle (Carmichael et al., 2021). According to Yim et al. (2018) the menstrual phase is a phase prone to risk of soft tissue injury because in that phase the muscles and tendons will experience stiffness.

Research by Paludo et al. (2022) found that some athletes' perceptual responses were better during the ovulatory phase (e.g. motivation and competitiveness) compared to the luteal or follicular phase. The ovulatory phase usually occurs around day 14 of the menstrual cycle, the normal range may vary from day 10 to day 20, depending on individual factors (Direkvand-Moghadam et al., 2014). The ovulatory phase has been shown to play a key role in positive responses to motivation and the desire to compete (Cook et al., 2018, 2021; Crewther & Cook, 2018; Sung & Kim, 2018). This phase also has an important impact on rapid force production. Muscle activation, specifically the rate at which early motor units are activated, is a key determinant of the rapid force production required to perform explosive movements (Vecchio et al., 2019). A positive relationship between ovulation and perceptual responses has been shown previously, with women appearing to exhibit increased libido, energy and competitiveness with partners (Motta-Mena & Puts, 2017). Therefore, it is reasonable to consider the period leading up to ovulation as an advantage for female athletes to maximize their performance in a training environment. From a practical point of view, coaches and practitioners can take advantage of the opportunity to adjust athletes' training load and intensity which can lead to major training adaptations. Validation of practical methods for monitoring menstrual phases may help optimize exercise periodization and link athletes' perceptual responses to exercise performance.

It is important to investigate the relationship between menstrual hormones and training responses in a longitudinally designed manner, to verify possible effects (Kurtoğlu et al., 2024; Koley & Bandyopadhyay, 2024). Elite sports organizations, including Chelsea Football Club and the United States Women's National Soccer and Swimming Team, have recently begun using a commercial smartphone app to track athletes' menstrual phases. The app is used by players to record when menstruation and various menstrual symptoms occur. Coaches and support staff can access the data entered into the app to identify whether changes in the athlete's performance or readiness occur at various phases of menstruation. If cyclical changes in sleep, recovery, and performance occur, individual strategies are developed to address those changes, including modifications to an athlete's sleep habits, training, diet, or lifestyle factors based on guidance provided by the app (Mikaeli Anne Carmichael et al., 2021; Jonge, 2003). Therefore, the Questionnaire that will be distributed in Indonesia is a first step that aims to educate coaches who oversee female athletes, that menstruation is an important thing to pay special attention to because this pattern repeats every month (Clarke et al., 2021). If the impact can be minimized and a solution found, this will be much more effective in supporting the best performance of the athletes being coached later. Previous research has shown that coaches who understand and consider athletes' menstrual cycles can help improve the performance and well-being of female athletes (Meignié et al., 2021).

A person's body and pain scale vary greatly, so coaches cannot generalize about an athlete's condition. The psychological factors of female athletes are also vulnerable because estrogen hormones are more abundant before, during, or after menstruation, which can be further reviewed by coaches and staff who are members of the training team (Mitsuhashi et al., 2023). One of the hormones secreted in the menstrual phase is estrogen which has a neuroexcitatory effect and progesterone inhibits cortical stimulation (Smith et al., 2002), these neuroexcitatory and inhibitory effects result in estrogen and progesterone having positive and negative relationships with power production, respectively (Gordon et al., 2013; Jonge, 2003).

Substrate availability and metabolism are also proposed mechanisms for variations in the various menstrual phases and impact on endurance performance. Estrogen is supposed to increase the availability of free fatty acids as fuel during exercise and promote lipid oxidation in skeletal muscle, and progesterone counteracts the action of estrogen by limiting fat oxidation (Oosthuyse & Bosch, 2010). In a small sample of recreational

athletes, when exercising at high intensity (90% of lactate threshold), carbohydrate oxidation was lower and fat oxidation greater during the mid-to-late luteal phase compared to the early follicular phase. Estrogen concentration is associated with these metabolic changes as estrogen levels are typically lowest during the early follicular phase (Zderic et al., 2001). During submaximal exercise, carbohydrate and lipid oxidation remain similar between the mid-luteal and late follicular phases (Hackney et al., 1994; Vaiksaar et al., 2011). Another study highlighted no changes in free fatty acid availability and peak whole-body lipid oxidation in the three menstrual phases, despite significant changes in estrogen and progesterone (Frandsen et al., 2020). Carbohydrate consumption before exercise also found no menstrual phase differences in the relative oxidation of carbohydrates and lipids during prolonged exercise (Campbell et al., 2001). The results of these studies do not provide a clear indication of how substrate metabolism during exercise may affect endurance performance, but suggest the possibility that metabolism is influenced by menstrual phase during higher intensity exercise.

From the explanation above, it can be seen that endurance performance is likely to be best at the beginning of the menstrual phase, and anaerobic performance and strength are best in the ovulation phase, strength and aerobic performance are worst at the end of the luteal phase and anaerobic performance can be worst at the end of the follicular phase (Carmichael et al., 2021). With complete data, the coach can take the right attitude and treatment during training and even matches, so that the athlete's performance is not problematic and can be overcome properly (Dasa et al., 2021). Previous research has shown that an athlete-centered approach, including open communication and appropriate support, can help female athletes overcome menstrual-related challenges (Brown & Knight, 2022). This questionnaire is specifically for female athletes throughout Indonesia, which is adopted from the Exercise and Menstruation in Australia questionnaire (Armour & Smith, 2023) which has been adapted to language that is easily understood by athletes in Indonesia, the majority of whom use Indonesian, so that misunderstandings in filling out the questionnaire can be minimized (Witkoś et al., 2024). The expected results are also valid and can help analyze the situation in detail, especially in female athletes in Indonesia, so it is hoped that there will be far more female athletes who can achieve maximum performance up to the world arena.

The results of data analysis show that 88.5% of the question items are valid for distribution, there are several invalid items due to essay questions that are not detected in the data analysis system used, and there are two question items that lead to medical which are then deleted because they do not lead to athlete performance and are only general questions whose data are not needed at this time. The total number of items to be distributed is 33 items and has been tested for validity and reliability by experts and in-depth data analysis.

The limitation of this study is that the samples used tend to be homogeneous in terms of age and sports. In this study, the youngest research sample was 18 years old and the oldest was 29 years old. According to the researcher, this age range cannot describe a broader menstrual experience. This refers to the use of contraceptive devices or drugs that will be more often used in female athletes who have a family. In addition, in this study, the respondents' sports were very limited, namely only three sports with the most respondents, namely combat, big ball games, and small games. This has not broadly described the menstrual picture in female athletes. Therefore, the limitations of this study do not generalize a more diverse population of female athletes.

Conclusion

The analysis results showed that there were four invalid question items, of which two questions were still used in the questionnaire by changing the sentence to a scale to make it easier to understand. In addition, another item (item number 32) was changed into an essay form, so that it could clarify the respondent's reasons and statements later. The two omitted items were considered unfamiliar because they used medical and uncommon questions. The results of this study can be used as an instrument to measure the phenomenon of menstruation in the context of sports so that it can help researchers and practitioners understand the impact of menstruation on athlete performance, especially female athletes. The limitation of this study is that the sample used tends to be homogeneous in terms of age and sport, so it cannot generalize a more diverse population of female athletes.

Conflict of interest

Ethical Statement

This research is in the process of ethical testing which will later be issued by the Universitas Negeri Malang, numbered 21.08.4/ UN32.14.2.8/ LT/2024. Participant provided informed consent, with the volunteer form covering research details, risks, benefits, confidentiality, and participant rights. The research strictly adhered to the ethical principles of the Declaration of Helsinki, prioritizing participant's rights and well-being in design, procedures, and confidentiality measures.

Author Contributions

ACKNOWLEDMENT

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