

ASSOCIATION BETWEEN PSYCHOLOGICAL DISTRESS, SLEEP QUALITY, AND VARIABILITY OF PHYSIOLOGICAL VAGINAL DISCHARGE AMONG ADOLESCENT GIRLS

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Abstract

Physiological vaginal discharge is a normal condition in adolescent girls, yet variations in its characteristics often cause concern. Psychological distress and sleep quality are suspected to influence the variability of physiological vaginal discharge. This study aimed to analyze the relationship between psychological distress, sleep quality, and the variability of physiological vaginal discharge in adolescent girls. This cross-sectional study involved 120 female students aged 15–18 years at a Banyuwangi Regency high school. Psychological distress was measured using the Kessler Psychological Distress Scale (K10), sleep quality using the Pittsburgh Sleep Quality Index (PSQI), and discharge variability was categorized into "low" and "high" based on secretion characteristics recorded via four-day self-logs. Data analysis employed the chi-square test and logistic regression. Results showed significant associations between psychological distress ($p=0.018$) and sleep quality ($p=0.038$) with the variability of physiological vaginal discharge. High psychological distress (OR=4.20; 95% CI: 1.45–12.15; $p=0.008$), very high psychological distress (OR=6.40; 95% CI: 1.85–22.10; $p=0.003$), and poor sleep quality (OR=2.75; 95% CI: 1.20–6.30; $p=0.017$) increased the likelihood of high variability. Psychological distress was the most dominant factor. These findings indicate that psychological aspects and sleep quality can influence the reproductive health of adolescent girls.

Keyword: Adolescent girls, Psychological distress, Physiological vaginal discharge, Sleep quality

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1. Introduction

The production of vaginal secretions is a natural physiological response to hormonal changes during puberty in adolescent girls. Rising

estrogen levels activate the cervical glands the primary source of these secretions which serve to maintain moisture and pH balance while protecting the mucosa against irritation

and infection. One manifestation of this process is physiological vaginal discharge, characterized by the release of secretions in the absence of pathological signs. Although it is a normal condition, the characteristics of physiological discharge such as quantity, consistency, and frequency can vary in accordance with hormonal fluctuations throughout the reproductive cycle [1]. Such variations often give rise to concerns among adolescents, particularly those with limited understanding of reproductive health [2].

Vaginal discharge is a condition commonly experienced by women across various age groups. Globally, it is estimated that more than 50% of women worldwide experience vaginal discharge, with the first episode often occurring during puberty in adolescent girls [3]. In Indonesia, 2023 data from the BKKBN indicates that approximately 90% of women have experienced vaginal discharge, with 60% of cases occurring among adolescent girls [4]. At the local level, the prevalence of vaginal discharge among adolescent girls is also reported to be quite high, varying across regions and study populations. For instance, a study at SMK Kesehatan Bali Dewata showed that 62.7% of adolescent girls experienced vaginal discharge [5]. Most cases of vaginal discharge in adolescents are physiological, associated with hormonal changes during puberty and the reproductive cycle.

In addition to physiological vaginal discharge, mental health issues and sleep disturbances are also commonly found among adolescents. Adolescent girls are known to be more vulnerable to stress and depression than adolescent boys, particularly during puberty [6]. On the other hand, sleep disturbances are a common issue among the adolescent population, with insomnia symptoms reported in approximately 20–30% of adolescents and clinical insomnia found in about 4–10% [7]. The high vulnerability to psychological distress and sleep disturbances during adolescence highlights the importance of examining the

impact of these two factors on adolescent reproductive health.

Psychological distress and sleep disturbances are known to affect various physiological functions of the body, including the female reproductive system. Psychological distress can influence hormonal regulation through activation of the hypothalamic-pituitary-adrenal (HPA) axis, whereas poor sleep quality is associated with disruptions to circadian rhythms and hormonal balance [8]. Changes in both systems have the potential to affect hormonal balance, immune function, and reproductive mucosal homeostasis, thereby impacting women's reproductive health [9].

Several previous studies indicate a link between psychological factors, sleep quality, and reproductive health. Sleep disturbances have been reported to affect reproductive health through alterations in hormonal regulation, circadian rhythms, metabolic function, and inflammatory responses, thereby potentially impacting the balance of female reproductive function [10]. Circadian rhythm and sleep disturbances during adolescence are also known to have long-term effects on the body's physiological regulation, highlighting the importance of sleep quality for maintaining health during this developmental period [11]. Furthermore, stress during adolescence and young adulthood has been reported to be associated with changes in the activity of the hypothalamic-pituitary-adrenal (HPA) axis, which plays a crucial role in regulating the stress response, hormonal balance, and various physiological processes in the body [12]. Among the female adolescent population in Indonesia, sleep quality and stress levels were also found to be significantly associated with the occurrence of primary dysmenorrhea [13].

Although the relationship between stress, sleep quality, and various reproductive health disorders has been extensively studied, most research still focuses on pathological conditions, such as menstrual disorders, reproductive

tract infections, and fertility [14][15]. To date, research examining the variability of physiological vaginal discharge as part of the female reproductive system's normal response remains very limited. Furthermore, few studies have simultaneously evaluated the roles of psychological distress and sleep quality regarding the variability of physiological vaginal discharge in adolescent girls. Consequently, the factors associated with variations in physiological vaginal discharge among adolescents are not yet adequately understood.

Based on this gap, this study aims to analyze the relationship between psychological distress and sleep quality and the variability of physiological vaginal discharge among adolescent girls.

2. Method

This study employs an analytic observational design with a cross-sectional approach to examine the relationship between psychological distress, sleep quality, and variations in physiological vaginal discharge among adolescent girls. The study was conducted at a high school in Banyuwangi Regency between January and June 2025. The sample consisted of 120 female students aged 15–18 years who had reached menarche, selected via purposive sampling based on specific inclusion and exclusion criteria. Inclusion criteria comprised adolescents who had reached menarche, had no acute or chronic health disorders, had not used antibiotics or undergone hormonal therapy within the previous three months, and exhibited physiological vaginal discharge. Exclusion criteria included respondents with pathological vaginal discharge, incomplete questionnaire data, or a refusal to participate in the study.

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The criteria for physiological and pathological vaginal discharge used in this study are presented in Table 1. The variability of physiological vaginal discharge was classified into "low variability" and "high variability," as shown in Table 2. Respondents were categorized as having high variability if they exhibited changes in two or more characteristic indicators during the four-day observation period, whereas changes in fewer than two indicators were categorized as low variability.

Data were collected via the K10 questionnaire, PSQI, and self-log reports after respondents provided informed consent. Subsequently, the data were analyzed using SPSS version 26 through univariate analysis, the chi-square test, and logistic regression, with a significance level of $p < 0.0$

Table 1. Differences in Characteristics Between Physiological and Pathological Vaginal Discharge

Indicator	Physiological Vaginal Discharge	Pathological Vaginal Discharge
Common causes	Hormonal changes (puberty, menstrual cycle)	Bacterial, fungal, or parasitic infections; STIs

Color	Tends to be clear; can sometimes be milky white	Yellow, green, gray, or blood-tinged
Odor	Odorless or slightly acidic (characteristic scent of normal flora)	Fishy, pungent, or unpleasant odor
Texture	Thin to slightly viscous; non-clumping	Thick, clumpy, or frothy
Amount	Light to moderate; varies according to the hormonal cycle	Excessive and continuous
Onset	Follows the hormonal cycle (ovulation/menstruation)	Unrelated to the hormonal cycle
Associated symptoms	Does not cause itching, burning, or irritation	Itching, burning, or pain in the genital area

Based on these characteristics of physiological vaginal discharge, the variability of vaginal secretions was further classified into "low variability"

and "high variability" categories, based on changes in characteristics during the observation period. The categorization criteria are presented in

Table 2. Differences in vaginal discharge characteristics between the low-variability and high-variability categories

Indicator	<i>Low variability</i>	<i>High variability</i>
Frequency of occurrence	Consistently follows a hormonal cycle pattern (e.g., occurring only during ovulation or the pre-menstrual phase)	Occurs more frequently or does not strictly follow the cycle pattern, yet remains within the physiological range
Texture and color	Remains relatively stable throughout the observation period (clear or milky white, without significant changes)	Undergoes changes during the observation period (from thin to thicker consistency or slight color variations), but stays within physiological limits
Amount of secretion	Tends to remain constant from day to day	Experiences fluctuations in quantity (increase or decrease) during the observation period, but not to an excessive degree
Influence of external factors (lifestyle, stress)	Shows no changes linked to external factors	No pathological symptoms present (remains within physiological limits)
Associated symptoms	Absence of pathological symptoms (itching, pain, strong odor)	Not accompanied by pathological symptoms
Clinical significance	Minimal variation, reflecting physiological stability	Variations are more dynamic, representing an adaptive physiological response to internal and external factors

The variability of physiological vaginal discharge was determined based on changes in the characteristics of the vaginal secretions including color, texture, quantity, and frequency of occurrence observed over a four-day period. All observed characteristics remained within physiological limits and showed no signs of pathological discharge.

3. Results And Discussion

A. Univariate Analysis: Respondent Characteristics

Table 3. Distribution of Respondent Characteristics (n=120)

Variable	Category	f (n)	(%)
Age	15 – 16 years	22	18,3%
	16 – 17 years	58	48,3%
	17 – 18 years	40	33,4%

Age at Menarche	< 9 years	0	0,0%
	9–12 years	70	58,3%
	13–14 years	35	29,2%
	≥ 15 years	15	12,5%
Level of Psychological Distress (K10)	Low	38	31,7%
	Moderate	42	35,0%
	High	25	20,8%
	Very high	15	12,5%
Sleep Quality (PSQI)	Good	55	45,8%
	Poor	65	54,2%
Physiological Vaginal Discharge	Low variability	75	62,5%
	High variability	45	37,5%

The results of the univariate analysis indicate that the majority of respondents fall into the mid-adolescent age group, exhibit a moderate level of psychological distress, and tend to have poor sleep quality. The majority of respondents also presented with physiological vaginal discharge characterized by low variability.

B. Bivariate Analysis: Levels of Psychological Distress, Sleep Quality, and Physiological Vaginal Discharge

Table 4. Chi-square test results regarding the relationship between variables and physiological vaginal discharge

Aspect	Vaginal discharge		Total (n)	p-value
	Low variability (n)	High variability (n)		
Level of Psychological Distress				0,018
Low	32	6	38	
Moderate	28	14	42	
High	10	15	25	
Very high	5	10	15	
Sleep Quality				
Good	41	14	55	0,038
Poor	34	31	65	

Chi-square test results indicate a significant association between the level of psychological distress and physiological vaginal discharge ($p = 0.018$). The higher the level of psychological distress, the greater the proportion of respondents exhibiting high variability. Sleep quality also shows a significant association with physiological vaginal discharge ($p = 0.038$), with respondents reporting poor sleep quality more frequently exhibiting high variability compared to those with good sleep quality.

C. Multivariate Analysis

Table 5. Logistic Regression Results

Variable	Category	Odds ratio (OR)	95% CI	p-value
Level of Psychological Distress	Low	1	-	-
	Medium	1,87	0,72 – 4,85	0,198
	High	4,20	1,45 – 12,15	0,008*
	Very high	6,40	1,85 – 22,10	0,003*
Sleep Quality	Good	1	-	-
	Poor	2,75	1,20 – 6,30	0,017*

* $p < 0,05$ indicates statistical significance

Respondents with high levels of psychological distress had 4.20 times higher odds of experiencing high variability compared to the low-distress group ($p=0.008$). Meanwhile, respondents with very high levels of psychological distress had 6.40 times higher odds of experiencing high variability ($p 0.003$). Poor sleep quality was also significantly associated with an increased risk of high variability, with odds 2.75 times higher compared to the group with good sleep quality ($p=0.017$).

4. Discussion

The research findings align with the psychoneuroimmunology perspective, which explains that psychological stress can activate the hypothalamic-pituitary adrenal (HPA) axis and increase cortisol secretion, thereby affecting immune system regulation and hormonal balance [8].

Long-term elevation of cortisol can interfere with the function of estrogen in maintaining vaginal mucosal homeostasis [16]. Estrogen plays a role in increasing glycogen deposition in the vaginal epithelium, providing a substrate for *Lactobacillus* spp. to produce lactic acid. An imbalance in this process can alter the microbiota composition and raise the local pH, resulting in high variability in physiological vaginal discharge, even while remaining within physiological limits [17].

Furthermore, sleep quality showed a significant association with physiological vaginal discharge ($p=0.038$). Respondents with poor sleep quality exhibited higher variability compared to those with good sleep quality. This is supported by research indicating that sleep disturbances can elevate levels of cortisol and inflammatory mediators, as well as disrupt circadian rhythms, which play a role in hormonal regulation and immune function [18].

Multivariate analysis results indicate that psychological distress and sleep quality simultaneously influence high variability in physiological vaginal discharge. Respondents with high psychological distress were 4.20 times more likely and those with very high distress 6.40 times more likely to experience high variability compared to the low-distress group. Meanwhile, poor sleep quality increased the risk by 2.75 times. These findings suggest that psychological distress is a more dominant factor than sleep quality.

Biologically, psychological distress and sleep disturbances trigger neuroendocrine responses that affect the mucosal immune system. Prolonged

activation of the HPA axis elevates levels of cortisol which has immunosuppressive effects thereby potentially disrupting the balance of the vaginal microbiota and reducing protection against changes in the internal environment. Vaginal microbiota dynamics, influenced by hormonal and psychological factors, can exhibit high variability in the absence of clinical infection [19].

The vaginal mucosal immune system possesses complex defense mechanisms involving the epithelial barrier, microbiota, and local immune components. The vaginal epithelium functions not only as a physical barrier but also produces antimicrobial peptides (AMPs) such as defensins and cathelicidins—and immune mediators like cytokines and chemokines, which play a role in maintaining homeostasis and preventing pathogen colonization. Additionally, secretory immunoglobulin A (IgA) contributes to inhibiting the adhesion of pathogenic microorganisms and maintaining the balance of the microbiota [20].

However, in states of psychological distress and chronic sleep disturbance, activation of the HPA axis can impair mucosal immune system function. This leads to reduced activity of immune cells such as macrophages and dendritic cells and decreased production of protective mediators, thereby increasing susceptibility to alterations in the microbiota. This imbalance can trigger dysbiosis associated with high variability in physiological vaginal discharge, in the absence of signs of clinical infection [21].

Thus, the high variability in physiological vaginal discharge among adolescents in this study can be understood as a physiological response to psychological distress and impaired sleep quality, rather than as a pathological condition. Therefore, promotive interventions such as stress management, reproductive health education, and improvements in sleep quality are crucial for maintaining the physiological balance of the adolescent reproductive system.

If psychological distress and sleep disturbances remain chronically unmanaged, these changes have the potential to evolve into pathological conditions. Prolonged activation of the HPA axis can exacerbate local immunosuppression, reduce the dominance of *Lactobacillus* spp., and raise vaginal pH, thereby fostering an environment conducive to the growth of opportunistic microorganisms. This state of dysbiosis can increase the risk of bacterial vaginosis or vulvovaginal candidiasis. Furthermore, chronic sleep disturbances contribute to heightened systemic inflammation and immune response dysregulation, thereby increasing the risk of reproductive health issues. Consequently, without appropriate intervention, what begins as physiological high variability can progress to pathological manifestations [21].

5. Conclusion

This study concludes that psychological distress and sleep quality are significantly associated with high variability in physiological vaginal discharge among adolescent girls, with psychological distress being the most dominant factor. Higher levels of psychological distress and poorer sleep quality are associated with a greater likelihood of high variability in physiological vaginal discharge.

These findings indicate that variations in physiological vaginal discharge among adolescents are influenced not only by hormonal factors but also by psychological conditions and sleep quality, through psychoneuroimmunological mechanisms involving interactions between the nervous, endocrine, and immune systems.

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