



Association between Diet, Sleep Pattern, and Menstrual Cycle among Female Medical Students

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Authors' contributions

This work was carried out in collaboration among all authors. Author YHD designed the study, performed the statistical analysis, wrote the protocol, managed the literature searches and wrote the first draft of the manuscript. Authors MCARH and LSS managed the analyses of the study. All authors read and approved the final manuscript.

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Abstract

Background: Female medical students are exposed to high academic stress, irregular sleep, and variable dietary habits, which may affect hormonal balance and menstrual health. This study examines the relationship between diet, sleep patterns, and menstrual cycle characteristics in this population.

Aims: The present study reveals the interconnectedness between diet, sleep pattern and menstrual cycle among female medical students

Study Design: A simple cross-sectional study using a structured questionnaire regarding demographic information, diets, sleep pattern, menstrual cycle and also the history of initial menarche.

Place and Duration of Study: Study conducted in the Faculty of Medicine, Universitas Kristen Indonesia, Jakarta-Indonesia. from October 2025 until April 2026.

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Methodology: Using simple random sampling methods, sampling technique will be related to the determination of the number of sample using the Slovin formula to estimate population proportion, where population size=112 and acceptable margin error (e)= 5% and the number of respondents using Slovin's formula is calculated as 87.5, rounded into 88. All data obtained from electronic structured questionnaire consist of demographic, diet pattern, sleep pattern and menstrual cycle pattern. All instrument has been tested for validity and reliability. Electronic data then collected and analyzed further using Chi-square ($p= 0.05$).

Results: Most respondents had good diets, good sleep patterns, and regular menstrual cycles. Bivariate analysis showed no association between age at menarche and menstrual cycle ($p=0.250$), diet and menstrual cycle ($p=0.391$), or sleep patterns and menstrual cycle ($p=0.391$).

Conclusion: Age of menarche, diet, and sleep patterns are not related to the menstrual cycle, so other factors likely play a greater role in influencing the menstrual cycle.

Keywords: Physiology; menarche; adolescent; calorie; hormonal; nutrition.

1. Introduction

The interconnectedness between diet, sleep, and the menstrual cycle is a bidirectional, cyclical relationship where each factor acts as both a modulator and a recipient of the others. Poor diet and restricted calorie intake can disrupt sleep and hormonal balance, leading to irregular cycles, while the hormonal shifts of the cycle itself affect sleep quality and nutritional needs (Daroedono et al., 2024, Sinha et al., 2017).

Female adolescents are prone to hormone-related issues due to puberty-driven fluctuations in estrogen, progesterone, and androgens, often causing mood swings, menstrual irregularities (affecting 75% of teens), acne, and weight changes (Soewangsa et al., 2024). Puberty triggers corticolimbic restructuring, increasing emotional reactivity. Common concerns include PMS, PMDD, and PCOS, alongside increased sensitivity to social pressure, e.g., as medical students (Yarlagadda et al., 2025, Zehra & Patangay, 2022).

Female adolescents in medical school face unique challenges and opportunities, with women now comprising over 54% of medical students, bringing increased gender diversity to the field (Mazza et al., 2025). Unfortunately, female medical students frequently encounter significant, often hidden, challenges due to female hormone-related conditions (such as PCOS, endometriosis, PMDD, or severe PMS) which are exacerbated by the intense stress and irregular hours of medical training that may directly impact their diet, sleep quality, and academic performance, physical, and emotional well-being, often leading to reduced quality of life and, in some worse case scenario, forcing them to consider leaving the medical profession. The aim of this study was to reveal the interconnectedness between diets, sleep pattern and menstrual cycle among female medical students.

2. Material and Methods

This study used an observational analytical design with a cross-sectional approach. The study was conducted at the Faculty of Medicine, Universitas Kristen Indonesia, from October 2025 to April 2026. The study population consisted of all 112 female students of the Faculty of Medicine, Universitas Kristen Indonesia, class of 2023. The sample size (n) determined using the Slovin formula and a probability sampling technique using a simple random sampling method. the number of respondents using Slovin's formula with preferred margin error 5% and total respondent number 112, as follow.

$$n = \frac{N}{1+N(e)^2}$$

Where

n= The required sample size
(N)= total population (112)
e= acceptable margin of error (0.05)

and the result is calculated as 87.5, rounded into 88.

The inclusion criteria for this study were female students of the Faculty of Medicine, Universitas Kristen Indonesia, graduating class of 2023 who were willing to participate. Exclusion criteria included respondents with a history of reproductive system disorders, such as polycystic ovary syndrome (PCOS), secondary amenorrhea, or thyroid disorders, and respondents undergoing therapy that could affect the menstrual cycle. The study variables included age at menarche, diet, and sleep patterns as independent variables, and menstrual cycle as dependent variables. The research instrument was a structured questionnaire consisting of three sections: diet, sleep patterns (using characteristics questionnaire, the Pittsburgh Sleep Quality Index or PSQI), and menstrual cycle. Measurements were conducted using a five-point Likert scale. The instruments were tested for validity and reliability before being used in the study.10 Data collection was conducted online using Google Forms. Data analysis was performed univariately to describe respondent characteristics and bivariately using the Chi-Square test with a significance level of $p < 0.05$.

3. Results and Discussion

This research, with a population of female medical students as subjects, was conducted on a total of 107 respondents, which exceeds the number of respondents according to the calculation results, which was only 88 people. The results are presented in narrative and tabular form with statistical analysis in the following section.

The mean age of our respondents is 20.35 years old, with the youngest is 19 years old and the oldest is 23 years old. Similar study conducted previously by Angelina and Sari (2025) also obtain almost similar mean age (20.29 years old) (Angelina & Sari, 2025). The median age of female medical students in Indonesia typically estimated ranges between 19 and 22 years old. This age range aligns directly with the standard timeline of undergraduate medical education in Indonesia, where the majority of students enter university right after high school and spend roughly 3.5 to 5 years completing their preclinical phases before entering clinical clerkship phases. to 21) years. Studies on Indonesian medical students indicate that female students generally achieve higher Grade Point Averages (GPAs) and academic performance than their male counterparts (Daroedono, et al., 2024, Sethi, et al., 2024, Bhatti, et al., 2023).

Our data at least contributes to the bulk of science regarding female medical student diet and sleep pattern combined with age of menarche which is highly valuable. In academic literature, the intersection of these specific factors is a critical and growing area of study. The unique, high-stress lifestyle of medical students provides an excellent model to understand how chronic sleep deprivation and dietary habits impact female reproductive health and hormone regulation. Not to mention that the context of its specificity among Indonesian medical students, which may show its own pattern when compared with other countries or other scientific fields.

Table 1. Age, age of menarche, diet pattern, sleep pattern and menstrual cycle data of respondents (n=107)

Description of respondents (n=107)	n	%	
Age (years)	19	7	6.5
	20	67	62.6
	21	22	20.6
	22	10	9.3
	23	1	0.9
Age of menarche	<12	29	27.1
	≥12	78	72.9
Dietary pattern	Good	96	89.7
	Poor	11	10.3
Sleep pattern	Good	96	89.7
	Poor	11	10.3
Menstrual cycle	Regular	89	83.2
	Irregular	18	16.8

The age of menarche for most of our respondents is >12 years old (n=78 respondents, or 72.9%) and this is in line with result of Indonesia's Basic Health Research in 2018 which reveals that the average age of menarche in Indonesia is 13 years (20,0%), with an earlier occurrence at the age of less than nine years and some later up to 20 years (Yani, et al., 2023). Menarche is actually a milestone denoting a female's first menstrual bleeding, signaling the onset of potential reproductive capacity (Lacroix, et al., 2023). The history of menarche is defined

by a significant drop in its onset age over the past century, establishing a direct link to how the modern menstrual cycle matures (Papadimitriou, 2016). The average age of menarche (the first period) among female medical students generally ranges between 12.4 to 12.9 years. Studies consistently show that medical students, like other young women, with early menarche have a higher likelihood of experiencing longer bleeding durations and dysmenorrhea (menstrual pain) later in life (Elah Sadiqi & Salih, 2024).

Regarding diet pattern, 96 respondents (89.7%) claimed that they had good diet pattern. Compared to a similar study conducted among 165 medical students in Bali, Indonesia, only 53.9% respondents exhibited dietary pattern close to the recommended dietary allowance (RDA) (Wijaya, et al., 2024). Dietary or eating patterns directly dictate a medical student's academic achievement (Fatima, et al., 2024, Ali, et al., 2023), physical health (Carcoana, et al., 2024), future health risk (Ahlawat, et al., 2024), self-esteem (Kosendiak, et al., 2024) and future professional credibility which may become the initial object of observation when patient initially met a doctor or in other word, patient's trust and perception (Jetly et al., 2020, Bleich, et al., 2013). In Indonesia, where students face rigorous clinical rotations and the commonly found "triple burden" of malnutrition (undernutrition, micronutrient deficiencies like anemia, and over nutrition) among adolescents, a balanced diet is critical for maintaining cognitive function, preventing burnout, and avoiding stress-induced gastritis.

In case of sleep pattern, 96 respondents (89.7%) admit that they had good sleep pattern. The results we obtained were very superior when compared with the findings of Wei et al through a similar study, that only 23.8% had good sleep quality (Wei, et al., 2025). The fact regarding sleep patterns among medical students are characterized by a high prevalence of poor sleep quality (Paceli, et al., 2022), insomnia related exams (Qasim, et al., 2021), and irregular schedules. Which affect overall well-being (Fischer, et al., 2020). Driven by heavy academic loads and clinical rotations (Siagian, 2022), these disrupted habits lead to severe daytime sleepiness (Oliveira, et al., 2025), unbearable fatigue (Uyar, et al., 2016), reduced learning concentration (Paceli, et al., 2022), and mental health challenges (Vidović, et al., 2025).

Further bivariate analysis conducted between factor age of menarche, diet pattern and sleeping pattern vs menstrual cycle, as presented in Table. 2

Table 2. Bivariate analysis between factor age of menarche, diet pattern and sleeping pattern vs menstrual cycle

		Menstrual cycle		n	p-value
		Regular (%)	Irregular (%)		
Age of menarche	< 12 years old	22 (75.9%)	7 (24.1%)	29	0.250
	≥ 12 years old	67 (85.9%)	11 (14.1%)	78	
Dietary pattern	Good	81 (84.4%)	15 (15.6%)	96	0.391
	Poor	8 (72.7%)	3 (27.3%)	11	
Sleep pattern	Good	81 (84.4%)	15 (15.6%)	96	0.391
	Poor	8 (72.7%)	3 (27.3%)	11	

Our findings reveal that, there is no correlation between menarche and menstrual cycle among female medical student ($p = 0.250$) and this is in line with the result obtained by Akbarzadeh in Iran (Akbarzadeh, et al., 2017). Even though that early menarche (typically occurring before age 12) is significantly correlated with a higher prevalence of primary dysmenorrhea (Mammo, et al., 2022) and longer menstrual flow lengths (Song, et al., 2022). However, among female medical students, academic stress, clinical training, and sleep deprivation frequently alter these baseline hormonal patterns, often leading to temporary oligomenorrhea (Soewangsa, et al., 2024) or cycle irregularity (Beroukhim, et al., 2022).

Regarding dietary pattern and menstrual cycle, there is also no correlation between both variables ($p = 0.391$). On contrary to our findings, Ahmed and Lotfy from Egypt reported that Females medical students with irregular cycles ($p=0.472$), heavy menstrual blood flow ($p=0.007$), and severe dysmenorrhea ($p=0.029$) also reported lower adherence to the regular and adequate Mediterranean diet (Ahmed & Lotfy, 2024). Our statistical analysis is relatively weak due to failure to meet underlying model assumptions and this is perhaps the limitation of this study.

Dietary patterns significantly impact the menstrual cycles of female medical students, largely by disrupting hormonal balances (Mazza, et al., 2024). Unfortunately, in the context of medical student, a study from Texas, United States revealed a decline in meal regularity, balanced meal structures, and food access since the start of medical school (Yarlagadda, et al., 2025). Frequent consumption of junk food which contains trans/saturated fats causes hormonal imbalances by altering estrogen and progesterone levels (Mazza, et al., 2024, Latif, et al., 2022). This significantly elevates the risk of premenstrual syndrome (PMS) and dysmenorrhea (Zehra & Patangay, 2023, Latif, et al., 2022).

Micronutrient Deficiencies due to low intakes of vital micronutrients (e.g., calcium, vitamin D, and zinc) are also directly associated with an increased likelihood of menstrual irregularities (Matsas, et al., 2023) and severe pain (Saei Ghare Naz, et al., 2020). Furthermore, Nutritional Status (BMI), both underweight and overweight BMIs—often exacerbated by poor dietary habits or irregular eating schedules—disrupt the hypothalamus-pituitary-ovarian (HPO) axis (Dobranowska, et al., 2024, Lonardo, et al., 2024). This can lead to amenorrhea (absence of periods) or heavy bleeding called secondary amenorrhea (Lord, et al., 2024). High-stress academic environments (Aljaber, et al., 2019) or other social condition (Maity, et al., 2022) often lead to poor eating habits—such as skipping meals, consuming excessive simple sugars, and high fast-food intake (Yarlagadda, et al., 2025)—which are strongly correlated with dysmenorrhea (painful periods) and menstrual irregularities (Mazza, et al., 2024, Latif, et al., 2022).

In the context of sleep pattern and menstrual cycle, the result of our study showed no significant correlation ($p = 0.391$). Our findings supported by Kar & Agrawala which reveal that 60% of women are good sleepers and 40% are bad sleepers in follicular phase. Similarly, 30.67% are good sleepers and 69.33% are bad sleepers in luteal phase. The reasons are different according to the phase of menstrual cycle. In other words, women do not sleep similar to men nor do they sleep similar on all the days of their menstrual cycle. Hormonal fluctuations throughout a woman's menstrual cycle heavily influence her sleep pattern (Rugvedh, et al., 2023). Rising estrogen typically promotes better rest (Joffe, et al., 2011), while upswing in progesterone act as a sedative that can cause daytime fatigue (Andersen, et al., 2006). Conversely, poor or inconsistent sleep can increase cortisol and disrupt the hormonal signals required for regular menstrual cycles (Kim, et al., 2015). Awareness of this condition among the women population, change in life style and seeking medical help whenever necessary is highly recommended. Our study limitations are the reliance on self-reported data (introducing recall bias) and also perhaps cross-sectional designs (making it difficult to prove causation), and the confounding influence of other socioeconomic and genetic factors which cannot be incorporated in this study and should be explore more in the future study.

4. Conclusion

Age at menarche, dietary habits, and sleep patterns were not found to be significantly associated with menstrual cycle characteristics in the present context, suggesting that other determinants may exert a more substantial influence on menstrual cycle regulation. Medical students represent a particularly vulnerable population with respect to menstrual cycle irregularities. This association appears to be closely linked to the unique demands of medical education, including intensive academic workloads, psychological stress, and lifestyle-related factors that may adversely affect menstrual health. Consequently, factors inherent to the medical academic environment are likely to play a more prominent role in influencing menstrual cycle patterns among this population.

Consent

As per international standards or university standards, respondents' written consent has been collected and preserved by the author(s).

Ethical Approval

It is not applicable.

Disclaimer (Artificial Intelligence)

Author(s) hereby declare that no generative AI technologies such as large language models (chatgpt, copilot, etc.) And text-to-image generators have been used during the writing or editing of this manuscript.

Competing Interests

Authors have declared that they have no known competing financial interests OR non-financial interests OR personal relationships that could have appeared to influence the work reported in this paper.

References

- Ahlawat, P., Dwivedi, A., Dwivedi, N., Mahuar, G., Singh, K., Mahaur, M., et al. (2024). To assess dietary habits and associated risk factors among medical students in North Delhi: A major health concern. *Tungs' Medical Journal*, 18(2), 80–85. <https://doi.org/10.4103/ETMJ.ETMJ-D-24-00014>
- Ahmed, G. S., & Mohamed Lotfy, A. M. (2024). Dietary pattern and menstrual disorders among female university students. *International Journal of Adolescent Medicine and Health*, 36(5), 497–504. <https://doi.org/10.1515/ijamh-2024-0124>
- Akbarzadeh, M., Tayebi, N., & Abootalebi, M. (2017). The relationship between age at menarche and primary dysmenorrhea in female students of Shiraz schools. *Shiraz E-Medical Journal*, 18(9), e14520. <https://doi.org/10.5812/semj.14520>
- Ali, M., Aslam, M., Ali, F., & Sagheer, U. (2024). Impact of eating habits on academic performance among 4th year medical students of a private college Faisalabad. *Journal of Bahria University Medical and Dental College*, 14(3), 212–216. <https://doi.org/10.51985/JBUMDC2024382>
- AlJaber, M. I., Alwehaibi, A. I., Algaed, H. A., Arafah, A. M., & Binsebayel, O. A. (2019). Effect of academic stressors on eating habits among medical students in Riyadh, Saudi Arabia. *Journal of Family Medicine and Primary Care*, 8(2), 390–400. https://doi.org/10.4103/jfmpc.jfmpc_455_18
- Andersen, M. L., Bittencourt, L. R., Antunes, I. B., & Tufik, S. (2006). Effects of progesterone on sleep: A possible pharmacological treatment for sleep-breathing disorders? *Current Medicinal Chemistry*, 13(29), 3575–3582. <https://doi.org/10.2174/092986706779026200>
- Angelina, S., & Sari, T. (2025). Primary dysmenorrhea and sleep quality: A study in Tarumanagara University medical students. *Green Medical Journal*, 7(2), 73–80. <https://doi.org/10.33096/gmj.v7i2.208>
- Beroukhim, G., Esencan, E., & Seifer, D. B. (2022). Impact of sleep patterns upon female neuroendocrinology and reproductive outcomes: A comprehensive review. *Reproductive Biology and Endocrinology*, 20(1), 16. <https://doi.org/10.1186/s12958-022-00889-3>
- Bhatti, U., Chohan, M. N., Effendi, S., Khidri, F. F., Ahmadani, R., & Ghaffar, B. (2023). Gender-based variation in the academic performance of medical students: A cross-sectional study. *BioSight*, 4(2–3), 45–50. <https://doi.org/10.46568/bios.v4i2-3.81>
- Bleich, S. N., Gudzone, K. A., Bennett, W. L., Jarlenski, M. P., & Cooper, L. A. (2013). How does physician BMI impact patient trust and perceived stigma? *Preventive Medicine*, 57(2), 120–124. <https://doi.org/10.1016/j.ypmed.2013.05.005>
- Carcoana, A. O. D., Tomlinson, S., DeWaay, D., & Izurieta, R. F. (2024). Medical students' dietary habits: Motivations and barriers to reaching health goals. *Journal of Family Medicine and Primary Care*, 13(5), 1739–1746. https://doi.org/10.4103/jfmpc.jfmpc_1016_23
- Darosedono, E., Fachly, A. H. R., Salshabila, A. A., Pasoro, D. I. S., Kambu, G. H., Destrian, F., ... Siagian, F. E. (2024). Cramming analysis based on time to start studying and time the exam being held. *International Neuropsychiatric Disease Journal*, 21(4), 6–17. <https://doi.org/10.9734/indj/2024/v21i4438>
- Elah Sadiqi, M. A., & Salih, A. A. (2024). The effect of psychological stress on the menstrual cycle among medical students. *JPMA. The Journal of the Pakistan Medical Association*, 74(10, Suppl.-8), S164–S167. <https://doi.org/10.47391/JPMA-BAGH-16-36>
- Fatima, T., Fatima, R., & Ashraf, S. (2024). Effect of diet quality on academic performance of medical students in Lahore: Diet quality and academic performance. *Journal of Health and Rehabilitation Research*, 4(3), 1–4. <https://doi.org/10.61919/jhrr.v4i3.1501>
- Fischer, D., McHill, A. W., Sano, A., Picard, R. W., Barger, L. K., Czeisler, C. A., ... Phillips, A. J. (2020). Irregular sleep and event schedules are associated with poorer self-reported well-being in U.S. college students. *Sleep*, 43(6), zsz300. <https://doi.org/10.1093/sleep/zsz300>
- Jetly, K., Hamzah, Z., & Nawari, A. M. (2020). Doctor's body mass index (BMI) on patient's attitudes of trust, compassion, and adherence to advice. *International Medical Journal*, 27(4), 438–443. <https://www.seronjihou.com/article/doctor-s-body-mass-index-bmi-on-patient-s-attitudes-of-trust-compassion-and-adherence-to-advice>
- Joffe, H., Petrillo, L. F., Koukopoulos, A., Viguera, A. C., Hirschberg, A., Nonacs, R., Somley, B., Pasciullo, E., White, D. P., Hall, J. E., & Cohen, L. S. (2011). Increased estradiol and improved sleep, but not hot

- flashes, predict enhanced mood during the menopausal transition. *The Journal of Clinical Endocrinology & Metabolism*, 96(7), E1044–E1054. <https://doi.org/10.1210/jc.2010-2503>
- Kar, S. S., & Agrawala, M. (2018). A study on sleep quality during different phases of menstrual cycle among medical students. *Journal of Evidence Based Medicine and Healthcare*, 5(33), 2419–2423. <https://doi.org/10.18410/jebmh/2018/499>
- Kim, T. W., Jeong, J. H., & Hong, S. C. (2015). The impact of sleep and circadian disturbance on hormones and metabolism. *International Journal of Endocrinology*, 2015, 591729. <https://doi.org/10.1155/2015/591729>
- Kosendiak, A. A., Adamczak, B. B., Kuźnik, Z., & Makles, S. (2024). How dietary choices and nutritional knowledge relate to eating disorders and body esteem of medical students? A single-center cross-sectional study. *Nutrients*, 16(10), 1414. <https://doi.org/10.3390/nu16101414>
- Lacroix, A. E., Gondal, H., Shumway, K. R., et al. (2023, March 11). *Physiology, menarche*. In *StatPearls*. StatPearls Publishing. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470216/>
- Lacroix, A. E., Gondal, H., Shumway, K. R., et al. (2026). *Physiology, menarche*. In *StatPearls*. StatPearls Publishing. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470216/>
- Latif, S., Naz, S., Ashraf, S., & Jafri, S. A. (2022). Junk food consumption in relation to menstrual abnormalities among adolescent girls: A comparative cross-sectional study. *Pakistan Journal of Medical Sciences*, 38(8), 2307–2312. <https://doi.org/10.12669/pjms.38.8.6177>
- Latif, S., Naz, S., Ashraf, S., & Jafri, S. A. (2022). Junk food consumption in relation to menstrual abnormalities among adolescent girls: A comparative cross-sectional study. *Pakistan Journal of Medical Sciences*, 38(8), 2307–2312. <https://doi.org/10.12669/pjms.38.8.6177>
- Lonardo, M. S., Cacciapuoti, N., Guida, B., Di Lorenzo, M., Chiurazzi, M., Damiano, S., & Menale, C. (2024). Hypothalamic-ovarian axis and adiposity relationship in polycystic ovary syndrome: Physiopathology and therapeutic options for the management of metabolic and inflammatory aspects. *Current Obesity Reports*, 13(1), 51–70. <https://doi.org/10.1007/s13679-023-00531-2>
- Lonardo, M. S., Cacciapuoti, N., Guida, B., Di Lorenzo, M., Chiurazzi, M., Damiano, S., & Menale, C. (2024). Hypothalamic-ovarian axis and adiposity relationship in polycystic ovary syndrome: Physiopathology and therapeutic options for the management of metabolic and inflammatory aspects. *Current Obesity Reports*, 13(1), 51–70. <https://doi.org/10.1007/s13679-023-00531-2>
- Lord, M., Jenkins, S. M., & Sahni, M. (2024, October 28). *Secondary amenorrhea*. In *StatPearls*. StatPearls Publishing. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK431055/>
- Lord, M., Jenkins, S. M., Sahni, M., et al. (2026). *Secondary amenorrhea*. In *StatPearls*. StatPearls Publishing. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK431055/>
- Maity, S., Wray, J., Coffin, T., Nath, R., Nauhria, S., Sah, R., Waechter, R., Ramdass, P., & Nauhria, S. (2022). Academic and social impact of menstrual disturbances in female medical students: A systematic review and meta-analysis. *Frontiers in Medicine*, 9, 821908. <https://doi.org/10.3389/fmed.2022.821908>
- Maity, S., Wray, J., Coffin, T., Nath, R., Nauhria, S., Sah, R., Waechter, R., Ramdass, P., & Nauhria, S. (2022). Academic and social impact of menstrual disturbances in female medical students: A systematic review and meta-analysis. *Frontiers in Medicine*, 9, 821908. <https://doi.org/10.3389/fmed.2022.821908>
- Mammo, M., Alemayehu, M., & Ambaw, G. (2022). Prevalence of primary dysmenorrhea, its intensity and associated factors among female students at high schools of Wolaita Zone, Southern Ethiopia: Cross-sectional study design. *International Journal of Women's Health*, 14, 1569–1577. <https://doi.org/10.2147/IJWH.S384275>
- Matsas, A., Sachinidis, A., Lamprinou, M., Stamoula, E., & Christopoulos, P. (2023). Vitamin effects in primary dysmenorrhea. *Life*, 13(6), 1308. <https://doi.org/10.3390/life13061308>
- Mazza, E., Troiano, E., Ferro, Y., Lisso, F., Tosi, M., Turco, E., Pujia, R., & Montalcini, T. (2024). Obesity, dietary patterns, and hormonal balance modulation: Gender-specific impacts. *Nutrients*, 16(11), 1629. <https://doi.org/10.3390/nu16111629>
- Oliveira, A. D. S., Porto, L. A. M., Ibiapina, M. S., Tavares, K. I. S., Rocha, L. S. D., Albuquerque, E. V. A., Medeiros, L. S., & Ximenes-da-Silva, A. (2025). Poor sleep quality and daytime sleepiness in medical students: Role of late bedtimes. *Revista da Associação Médica Brasileira (1992)*, 71(11), e20250630. <https://doi.org/10.1590/1806-9282.20250630>
- Paceli, V., Telussa, A., Setianingrum, E., & Nurina, R. (2022). Correlation between sleep quality and concentration in medical students of Nusa Cendana University. *Cendana Medical Journal*, 10(2), 301–308. <https://doi.org/10.35508/cmj.v10i2.9143>
- Papadimitriou, A. (2016). The evolution of the age at menarche from prehistorical to modern times. *Journal of Pediatric and Adolescent Gynecology*, 29(6), 527–530.

- Qasim, S. S., Alrasheed, A., Almesned, F. A., Alduhaymi, M., Aljehaiman, T., & Omair, A. (2021). Insomnia among medical students and its association with exams. *International Journal of Medicine in Developing Countries*, 5(2), 682–687. <https://doi.org/10.24911/IJMDC.51-1609614810>
- Rugvedh, P., Gundreddy, P., & Wandile, B. (2023). The menstrual cycle's influence on sleep duration and cardiovascular health: A comprehensive review. *Cureus*, 15(10), e47292. <https://doi.org/10.7759/cureus.47292>
- Saei Ghare Naz, M., Kiani, Z., Rashidi Fakari, F., Ghasemi, V., Abed, M., & Ozgoli, G. (2020). The effect of micronutrients on pain management of primary dysmenorrhea: A systematic review and meta-analysis. *Journal of Caring Sciences*, 9(1), 47–56. <https://doi.org/10.34172/jcs.2020.008>
- Sethi, I., Mastrogiacomio, C., Baldelli, P., Wackett, A., & Abdel-Misih, S. (2024). Gender-based differences in medical student self-ratings of clinical performance. *The Journal of Surgical Research*, 302, 286–292. <https://doi.org/10.1016/j.jss.2024.07.047>
- Siagian, F. E. (2022). Study the impact of cramming in medical students. *International Blood Research & Reviews*, 13(4), 53–64. <https://doi.org/10.9734/ibr/2022/v13i430186>
- Sinha, M., Ghate, J., Chatur, D. K., & Sinha, R. (2017). Gender difference in performance of undergraduate medical students for subjective and objective evaluation in physiology. *International Journal of Scientific Reports*, 3(2), 22–27. <https://doi.org/10.18203/issn.2454-2156.IntJSciRep20170353>
- Soewangsa, Q. A., Dewi, S., & Putri, M. P. D. (2024). Correlation of academic stress with oligomenorrhea in female medical students. *Journal of Widya Medika Junior*, 6(1), 18–24. <https://doi.org/10.33508/jwmj.v6i1.5369>
- Song, S., Choi, H., Pang, Y., Kim, O., & Park, H. Y. (2022). Factors associated with regularity and length of menstrual cycle: Korea Nurses' Health Study. *BMC Women's Health*, 22(1), 361. <https://doi.org/10.1186/s12905-022-01947-z>
- Uyar, K., Gündoğan, R., Gürbüz, Ö. B., & Özçakar, N. (2016). Status of fatigue and sleep quality in clinical medical students. *Marmara Medical Journal*, 29(3), 164–169.
- Vidović, S., Rakić, N., Kraštek, S., Pešikan, A., Degmečić, D., Zibar, L., Labak, I., Heffer, M., & Pogorelić, Z. (2025). Sleep quality and mental health among medical students: A cross-sectional study. *Journal of Clinical Medicine*, 14.
- Wei, T. S., Antoni, M., Rumiati, F., Heriyanto, H., & Rickie, R. (2025). The effect of sleep quality on menstrual cycle among class of 2023 medical students. *Jurnal MedScientiae*, 4(3), 225–229. <https://doi.org/10.36452/jmedscientiae.v4i3.4020>
- Wijaya, B. M., Awan, S. A., Weta, I. W., & Ani, L. S. (2024). Dietary patterns, physical activity, and nutritional status of medical students at Udayana University. *Intisari Sains Medis*, 15(1), 237–242. <https://doi.org/10.15562/ism.v15i1.1973>
- Yani, M., Azhari, A., Al Rahmad, A. H., Bastian, F., Ilzana, T. M., Rahmi, C. R., Andriaty, S. N., Chanda, A., & Salsabila, S. (2023). The relationship between menarche and nutritional status in junior high school students in Aceh Besar: A study from 30 years of armed conflict area, Aceh, Indonesia. *Action: Aceh Nutrition Journal*, 8(4), 635–641. <https://doi.org/10.30867/action.v8i4.1310>
- Yarlagadda, S., Hilmi, I., Mobley, M., & Cobbs, L. (2025). Dietary habit changes in preclinical medical students. *Cureus*, 17(11), e97240. <https://doi.org/10.7759/cureus.97240>
- Zehra, B., & Patangay, M. K. (2022). A study on prevalence of premenstrual syndrome, its association with dietary habits and stress levels among adolescent girls studying in girls college of Hyderabad. *Journal of Advanced Scientific Research*, 13(09), 70–80. <https://doi.org/10.55218/JASR.202213910>

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