

## CORRELATION OF PRIMARY DYSMENORRHEA WITH THE MEDITERRANEAN DIET IN WOMEN FROM 16 TO 50 YEARS

DOI: <https://doi.org/10.46733/PESH2514293r>

(Original scientific paper)

Iva Rrugia<sup>1</sup>, Daniela Shukova Stojmanovska<sup>2</sup>, Seryozha Gontarev<sup>2</sup>, Georgi Georgiev<sup>2</sup>

<sup>1</sup>Department Faculty of medical technical sciences, European University of Tirana, Albania

<sup>2</sup>Faculty of physical education, sport and health, University "Ss. Cyril and Methodius", North Macedonia

---

### Abstract

The gynecological condition primary dysmenorrhea creates operational problems for women aged 16 to 50 years old during their daily activities. The research examined how the Mediterranean diet impacts the occurrence and intensity of primary dysmenorrhea among women between 16 and 50 years old. The researchers conducted a cross-sectional study which collected data from 401 participants through an online survey that measured their menstrual symptoms and eating habits and body mass index (BMI). The survey results showed that primary dysmenorrhea symptoms affected 70.3% of all study participants. The study demonstrated that participants who scored high on the KIDMED index for Mediterranean diet assessment had a 63.7% chance of experiencing dysmenorrhea but those with low KIDMED scores showed an 80% occurrence rate. The research findings demonstrated a substantial link ( $p = 0.025$ ) which proves that following the Mediterranean diet results in fewer cases of primary dysmenorrhea. The ANOVA results showed a significant difference between KIDMED index scores of participants who had dysmenorrhea and those who did not ( $F = 6.816$ ,  $p = 0.009$ ). The KIDMED index scores reached 5 points for women with dysmenorrhea while those without dysmenorrhea scored 6.65 points with 2.43 standard deviations and 2.59 standard deviations respectively. The research data showed that dysmenorrhea patients had an average BMI of 23.17 while non-dysmenorrhea patients had an average BMI of 23.73. The research data shows that the observed differences between groups fail to reach statistical significance. The research needs more longitudinal and experimental studies to establish the relationship between diet selection and body mass index with menstrual health and pain management.

**Key words:** Primary dysmenorrhea, Mediterranean diet, KIDMED index, BMI, Women's health.

---

### Introduction

The medical term for menstrual cramps that occur without any disease is primary dysmenorrhea as defined by Kho & Shields (2020). The condition begins at the start of a woman's first menstrual cycle and continues until she stops having children while bringing symptoms such as nausea and fatigue and lower back pain (Hu, et al., 2020; Samaha, 2023; Unsal, et al., 2010). The primary source of pain emerges from prostaglandin elevation which leads to strong uterine contractions that cause tissue ischemia and distress (Itani et al., 2022; Samaha, 2023). The condition exists at different rates among various populations according to studies which show it affects 16% to 91% of people (Fang, 2023; Omidvar, et al. 2015). As was noted by Wang, et al. (2022) the prevalence of primary dysmenorrhea has grown since 2010 according to 2022 studies which show the condition affected 58.8% of women before 2010 but now impacts 71.1% of women in current research. People who experience this condition face major life quality deterioration because their symptoms include emotional distress and social isolation and decreased academic performance and work or school absences. Armour, et al. (2019) and De Sanctis, et al. (2015) found that 71.1% of young girls suffer from dysmenorrhea which makes it hard for them to study and participate in sports and social activities. The research of Hadjou, et al. (2022) and Parra-Fernández, et al. (2020) shows that dysmenorrhea will develop into hyperalgesic priming when it remains untreated. The body operates this process without human intervention which leads to a higher risk of chronic pelvic pain in women (MacGregor, et al., 2023). The condition affects many people yet only 6% of those affected obtain professional assistance while 70% handle their condition through self-management which includes dangerous medication misuse. Apart from the known risk factors, such as early menarche, copious bleeding

and family history, the modeling of symptoms is increasingly taking into account lifestyle factors such as diet and body mass index (BMI). Scientists perform research to understand how following a mediterranean diet affects menstrual disorder treatment including dysmenorrhea management. The mediterranean diet includes many fruits and vegetables and legumes and whole grains and nuts and olive oil but fish and dairy products should be limited to small portions. The dietary model contains vital bioactive compounds which function as antioxidants and anti-inflammatory agents. The mentioned characteristics help reduce menstrual discomfort according to Bavi et al. (2016). The mediterranean diet contains omega-3 fatty acids and magnesium and vitamin E which research indicates reduce prostaglandin production to lower uterine contractions and reduce pain intensity (Cirillo, 2023; Najafi, et al., 2018). Studies show plant-based foods contain antioxidants which fight oxidative stress that causes menstrual disorders (Veronese, et al., 2019). As is shown by the existing literature, physical activity has a positive effect in lowering the severity of menstrual symptoms, improving the circulation and release of endorphins (Abid, et al., 2020; Dehnavi, et al., 2018). The research focuses primarily on dietary aspects through its examination of how mediterranean diet adherence affects primary dysmenorrhea symptoms and their intensity. Research studies have investigated BMI as a potential factor for menstrual pain but their findings have not produced definitive results. The research data regarding symptom intensity in overweight patients produces conflicting results because some studies identified more severe symptoms yet other investigations failed to establish any relationship (Hu, et al., 2020; Ibrahim, et al., 2021). Research indicates that complete lifestyle achievement depends on getting adequate nutrition and performing physical exercise on a regular basis.

## Material & Methods

### Participants

401 randomly selected women participated in the study. The participants completed a questionnaire that was structured to evaluate menstrual symptoms, eating habits and body mass index (BMI). Participants were women from the ages of 16 to 50 years who were experiencing menstruation. The research included participants who had primary dysmenorrhea symptoms to investigate the connection between dysmenorrhea severity and body mass index (BMI) and mediterranean diet consumption.

### Procedure/Test protocol

In this study, three main categories of variables were analyzed: Eating habits, measured on the basis of the KIDMED index, based on the questionnaire validated by Torun, N.T., & Yildiz, Y. (2013). The KIDMED questionnaire consists of 16 questions, each one evaluated with positive (+1) or negative (-1) points, reflecting the level of compliance with a mediterranean diet. Based on the total points, the participants were classified thusly: low compliance ( $\leq 3$ ), moderate compliance (4–7) and high compliance ( $\geq 8$ ).

Table I. KIDMED questionnaire and index according to Torun & Yildiz (2013)

KIDMED questionnaire and Index	Scoring
Consume fruit or fruit juice every day	+ 1
Consume fruit a second time every day	+ 1
Consume fresh or cooked vegetables every day	+ 1
Consume fresh or cooked vegetables more than once a day	+ 1
Consume fish regularly (at least 2–3 times a week)	+ 1
Consume fast food > 1 / week (hamburger)	-1
Consume legumes > 1 / week (lentils, beans, peas)	+ 1
Consume pasta or rice almost every day (5 or > 5 / week)	+ 1
Consume cereals or seeds (bread) for breakfast	+ 1
Consume nuts (at least 2–3 / week)	+ 1
Use olive oil	+ 1
Skips breakfast	-1
Consume dairy products for breakfast (yogurt, milk, etc.)	+ 1
Consume commercially produced pastries for breakfast	-1
Consume 2 yogurts and / or cheese (40g) per day	+ 1
Consume sweets and cakes several times a day	-1
KIDMED index interpretation	
Weak adherence $\leq 3$	
Optimal adherence = 4–7	
High adherence $\geq 8$	

Symptoms of primary dysmenorrhea, evaluated on the basis of abbreviated versions of the questionnaires Menstrual distress questionnaire (Moos, 1968) and Menstrual symptom questionnaire (Chesney & Tasto, 1975). This section included five questions related to the presence of primary dysmenorrhea, the severity of pain (light, moderate and severe), the regularity of menstruation, the duration of bleeding ( $\leq 4$ , 5–6, or  $\geq 7$  days) and the quantity of blood (small, moderate, and large). BMI (body mass index) requires height and weight data from participants to generate the calculation. The World Health Organization (2007) established the BMI calculation formula which works for all age groups according to the following formula:

- BMI= weight in kg/ height in m<sup>2</sup>
- BMI under 15 → extremely underweight
- BMI from 15 – 18.4 → underweight
- BMI from 18.5 – 24.9 → normal weight
- BMI from 25 – 29.9 → overweight
- BMI from 30 – 34.9 → obese
- BMI over 35 → extremely obese

*Data collection and analysis / Statistical analysis*

The research team performed statistical calculations to determine average values and standard deviations and minimum and maximum points and coefficient of variation for all measured variables. Several statistical tests were applied to evaluate group differences including: Independent samples T-test, ANOVA for univariate variance analysis and MANOVA for multivariate group comparisons between BMI categories and dysmenorrhea severity levels and Chi-Square tests to examine how BMI categories relate to dysmenorrhea severity and how mediterranean diet consumption affects dysmenorrhea symptoms. Descriptive statistics (average and standard deviation and minimum and maximum values and coefficient of variation for all studied variables) was calculate.

**Results**

*Prevalence of primary dysmenorrhea*

The study included 401 women who showed that 282 participants (70.3%) experienced primary dysmenorrhea but 119 participants (29.7%) did not have primary dysmenorrhea symptoms (table 2 and figure 1).

Table 2. Frequency of primary dysmenorrhea among participants

PD Status	Frequency (n)	Percent (%)
Yes	282	70.3
No	119	29.7
<b>Total</b>	<b>401</b>	<b>100</b>

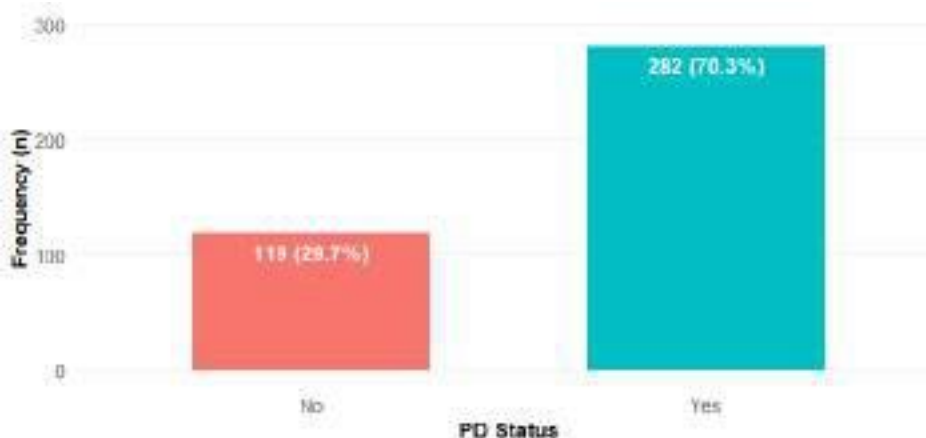


Figure 1. Distribution of participants according to primary dysmenorrhea (PD) status.

*Basic descriptive statistical parameters*

The baseline descriptive parameters were calculated based on the KIDMED index and the body mass index (BMI), in connection with the presence or absence of primary dysmenorrhea. The parameters include the arithmetical average (M), the standard deviation (SD), the minimum and maximum values, as well as the confidence interval 95% (CI) for the average (table 3 and figure 2).

Table 3. Basic descriptive statistical parameters of KIDMED Index and BMI based on PD status

Variable	PD Status	N	Mean	SD	Min	Max	95% CI Lower	95% CI Upper
KIDMED Index	Yes	282	5.92	2.59	-1.00	12	5.62	6.23
	No	119	6.65	2.43	-1.00	11	6.21	7.09
BMI (kg/m <sup>2</sup> )	Yes	282	23.17	3.64	15.92	35.86	22.74	23.59
	No	119	23.73	3.62	16.36	36.05	23.08	24.39

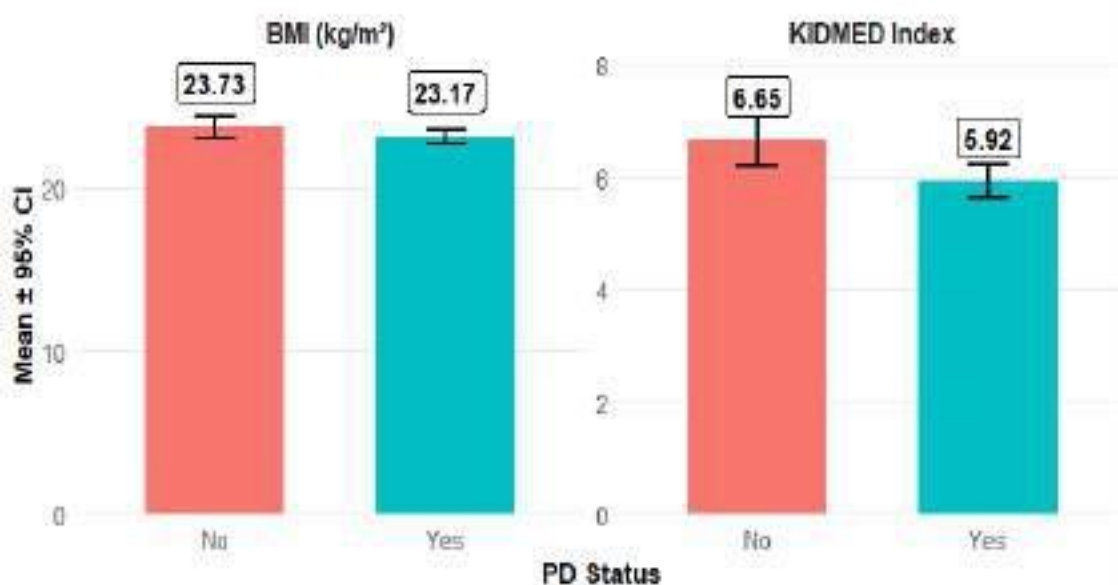


Figure 2. Comparison of mean Body Mass Index (BMI) and KIDMED Index according to primary dysmenorrhea (PD) status.

From the obtained results it can be seen that BMI and the KIDMED values has similar values in both groups (with and without primary dysmenorrhea (PD)).

*Proportional differences according to KIDMED adherence*

In table 4 and figure 3 are presented data about KIDMED index in women with and without symptoms of primary dysmenorrhea (PD). It can be seen that in the category with weak KIDMED index, participate 80% of the subjects with PD and only 20% without PD. In the group with high KIDMED index the percentage of subjects without PD is almost double (36%).

Table 4. Proportional differences in KIDMED adherence categories based on PD status

KIDMED Category	PD: Yes (n/%)	PD: No (n/%)	Total (n)
Weak ( $\leq 3$ )	84 (80.0%)	21 (20.0%)	105
Optimal (4–7)	119 (69.2%)	53 (30.8%)	172
High ( $\geq 8$ )	79 (63.7%)	45 (36.3%)	124
Total	282 (70.3%)	119 (29.7%)	401



Figure 3. Distribution of participants across KIDMED Index categories according to primary dysmenorrhea (PD) status.

Participants were categorized into three groups based on the KIDMED index: weak compliance ( $\leq 3$  points), optimal compliance (4–7 points) and high compliance ( $\geq 8$  points). The distribution of primary dysmenorrhea symptoms within these categories is displayed in table 4 and figure 3.

The results of Pearson's Chi-square test showed that PD prevalence rates between KIDMED categories were statistically different. The Chi-square test results show  $\chi^2 = 7.417$  with 2 degrees of freedom and a p-value of 0.025.

*Differences in means based on PD status (ANOVA)*

Table 5. Differences in KIDMED Index and BMI according to PD status (ANOVA)

Variable	Source	Sum of Squares	df	Mean Square	F	Sig.
KIDMED Index	Between Groups	43.996	1	43.996	6.816	0.009
	Within Groups	2575.46	399	6.455		
	Total	2619.456	400			
BMI (kg/m <sup>2</sup> )	Between Groups	26.794	1	26.794	2.031	0.155
	Within Groups	5264.067	399	13.193		
	Total	5290.861	400			

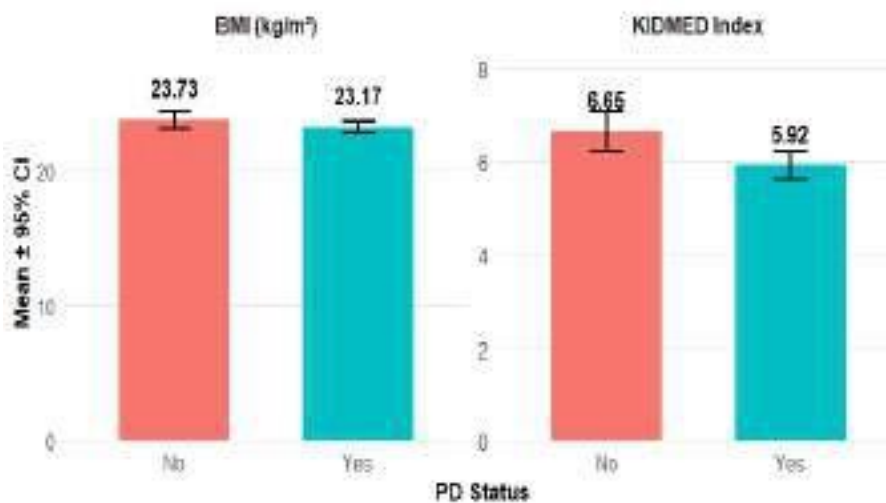


Figure 4. Mean values of Body Mass Index (BMI) and KIDMED Index according to primary dysmenorrhea (PD) status.

Univariate analysis of variance (ANOVA) was used to test the differences in the KIDMED index average and BMI between participants who reported primary dysmenorrhea and those who did not report it (table 5 and figure 4).

Differences in the KIDMED index average among participants with and without primary dysmenorrhea was statistically significant ( $p = 0.009$ ). No significant change in BMI averages was found ( $p = 0.155$ ).

## Discussion

This study examined the link between primary dysmenorrhea, compliance with the Mediterranean diet and the body mass index (BMI) of women aged 16-50 years. The study found no statistical connection between BMI and primary dysmenorrhea although it showed a consistent pattern. The BMI measurements for women without primary dysmenorrhea exceeded those of women with primary dysmenorrhea (23.73 vs 23.17). The same results got Zhubaj V., et al. (2023) only on high school subjects. The study findings confirm previous studies which demonstrated that BMI shows no clear connection to menstrual pain. The research findings show that BMI fails to determine the severity of primary dysmenorrhea (Hajnasiri, et al., 2022; Khodakarami, et al., 2015; Takata, et al., 2023). Nevertheless, some studies have shown that BMI can affect menstrual pain. Chauhan & Kala (2012), Jamali, et al. (2020) Wu, et al. (2022) and Singh, Rajoura & Honnakamble (2019) observed that underweight women are more prone to experiencing severe symptoms of dysmenorrhea compared to women of normal weight. The research results indicate BMI status evaluation must assess underweight patients together with other weight categories to determine menstrual health. It is believed that underweight individuals are more at risk of primary dysmenorrhea due to hormonal abnormalities caused by low levels of body fat. Normal reproductive development and menarche require a sufficient amount of body fat. Researchers have stated that at least 17% body fat is necessary for the beginning of menarche, and around 22% to maintain regular menstruation (Frisch & McArthur, 1974; Frisch, 1987). Nevertheless, this is not universal, since some studies have shown that overweight or obese women also have a higher risk of primary dysmenorrhea. Taken together, the findings suggest that both underweight and overweight women may have a greater risk of primary dysmenorrhea and a greater severity of symptoms (Aktaş, 2023; Ju, et al., 2015; Donayeva, et al., 2023; Dwivedi, Singh & Gupta, 2024). The research shows that maintaining a normal BMI leads to superior health results for individuals. Diet is one of the main factors affecting deviations in BMI, both on the extremes and within the normal range.

The research by Güzeldere, et al. (2023) shows that food consumption has an impact on menstrual issues which include dysmenorrhea. The study by Latif, et al. (2022) revealed that following the Mediterranean diet is strongly linked to the occurrence of primary dysmenorrhea ( $\chi^2 = 7.417$ ,  $p = 0.025$ ). The prevalence of primary dysmenorrhea was lower among women with a high KIDMED index (63.7%), followed by those with optimal compliance (69.2%), and highest among those with low compliance (80%). This result suggests the Mediterranean diet may have a potential protective effect with respect to menstrual pain. The KIDMED index scores showed a significant difference between participants with and without primary dysmenorrhea. The KIDMED index average score reached 6.64 (SD = 2.43) in participants without primary dysmenorrhea but participants with primary dysmenorrhea scored 5.92 (SD = 2.58). The research indicates that better quality food consumption helps decrease the intensity of symptoms. It is well known that eating habits may affect the levels of estrogen circulation (Chakraborty, et al., 2016). According to Jahjaga A., et al (2022) the group diagnosed with cerebral tumor has the largest number of patients with a low KIDMED Index (28,6%) and have in average the highest BMI = 28, which indicates excessive body mass.

The consumption of animal-based foods and processed oils leads to elevated estrogen levels which can cause endometrial tissue to grow abnormally (Iacovides, et al., 2015). The breakdown of the thicker endometrium tissue during menstruation produces elevated prostaglandin levels which results in stronger menstrual cramps (Barnard, et al., 2000). The Mediterranean diet protects against chronic diseases such as cardiovascular conditions and cancer according to research because it contains anti-inflammatory and antioxidizing compounds (Serra-Majem, et al., 2019). These mechanisms have received acknowledgment for their function in reproductive health. The Mediterranean diet elements of omega-3 fatty acids, fruits and vegetables and whole grains help control prostaglandin production and oxidative stress which are directly related to dysmenorrhea. Research conducted in the present day demonstrates that people who eat Mediterranean-style and practice healthy eating habits experience decreased primary dysmenorrhea symptoms and lower risk of developing the condition (Cirillo, et al., 2023; Mucuk, et al., 2022; Ciołek, et al., 2023; Franco-Antonio, et al., 2025; Güzeldere, et al., 2024). The research results support earlier

studies which showed that antioxidant-rich foods help reduce menstrual pain (Hansen & Knudsen, 2013; Najafi, et al., 2018; Bajalan, et al., 2019; Tuttolomondo, et al., 2019; Deutch, et al., 2000; Onieva-Zafra, et al., 2020). The cross-sectional study design prevents researchers from establishing cause-and-effect relationships between variables despite these established findings. The reliability of self-reported information about eating habits and symptoms decreases because of recall bias. The research demonstrates that people can control primary dysmenorrhea symptoms through dietary improvements and lifestyle modifications as an alternative to medication (Franco-Antonio, et al., 2025; Brown, et al., 2024). It is recommended that future studies use longitudinal or intrusive design to verify these links and to investigate the physiological mechanism through which the quality of a diet affects menstrual health. The research shows that young girls with severe menstrual symptoms need right away dietary advice and lifestyle education.

## Conclusions

The study investigated the connection between mediterranean diet consumption and body mass index (BMI) values with primary dysmenorrhea in women aged 16 to 50.

- The study showed that 282 participants (70.3%) experienced primary dysmenorrhea and 119 participants (29.7%) did not have primary dysmenorrhea symptoms;
- The KIDMED index average scores were higher in participants who did not experience primary dysmenorrhea (KIDMED index = 6,65) in comparison to those who had ones (KIDMED index = 5,92), which indicates that better dietary quality could help protect menstrual health;
- It was found that women who were more aligned with a mediterranean diet had a lower prevalence of primary dysmenorrhea symptoms. So, 80% of women with low compliance to mediterranean diet experienced primary dysmenorrhea symptoms while 63.7% of women with high compliance to the diet experienced these symptoms;
- The research data revealed no meaningful statistical relationship between BMI and primary dysmenorrhea yet showed that primary dysmenorrhea patients had slightly lower BMI (BMI=23,17) than women without this condition (BMI=23,73).

**Conflicts of interest** – We have no conflict of interest to declare.

## References

- Abid, F., Amer, M., Faiz, S., Azam, F., Shaheen, A., & Javed, N. (2020). Dysmenorrhea in Students: Characteristics and Predictors. *Journal of Shifa Tameer-E-Millat University*, 3(2), 75–80. <https://doi.org/10.32593/jstmu/vol3.iss2.96>
- Aktaş, D. (2023). The Relationships Between Primary Dysmenorrhea with Body Mass Index and Nutritional Habits in Young Women. *Journal of Education and Research in Nursing*, 143–149. <https://doi.org/10.14744/jern.2021.93151>
- Armour, M., Ee, C. C., Naidoo, D., Ayati, Z., Chalmers, K. J., Steel, K. A., De Manincor, M. J., & Delshad, E. (2019). Exercise for dysmenorrhoea. *Cochrane Database of Systematic Reviews*, 2019(9). <https://doi.org/10.1002/14651858.CD004142.pub4>
- Bajalan, Z., Alimoradi, Z., & Moafi, F. (2019). Nutrition as a Potential Factor of Primary Dysmenorrhea: A Systematic Review of Observational Studies. *Gynecologic and Obstetric Investigation*, 84(3), 209–224. <https://doi.org/10.1159/000495408>
- Barnard, N. D., Scialli, A. R., Hurlock, D., & Bertron, P. (2000). Diet and sex-hormone binding globulin, dysmenorrhea, and premenstrual symptoms. *Obstetrics and gynecology*, 95(2), 245–250. [https://doi.org/10.1016/s0029-7844\(99\)00525-6](https://doi.org/10.1016/s0029-7844(99)00525-6)
- Bavil, D. A., Dolatian, M., Mahmoodi, Z., & Baghban, A. A. (2016). Comparison of Lifestyles of Young Women With and Without Primary Dysmenorrhea. *Electronic Physician*, 8(3), 2107–2114. <https://doi.org/10.19082/2107>
- Brown, N., Martin, D., Waldron, M., Bruinvels, G., Farrant, L., & Fairchild, R. (2024). Nutritional practices to manage menstrual cycle related symptoms: A systematic review. *Nutrition Research Reviews*, 37(2), 352–375. <https://doi.org/10.1017/S0954422423000227>
- Chakraborty, T. R., Donthireddy, L., Adhikary, D., & Chakraborty, S. (2016). Long-Term High Fat Diet Has a Profound Effect on Body Weight, Hormone Levels, and Estrous Cycle in Mice. *Medical science monitor : international medical journal of experimental and clinical research*, 22, 1601–1608. <https://doi.org/10.12659/msm.897628>
- Chauhan, M., & Kala, J. (2012). Relation Between Dysmenorrhea and Body Mass Index in Adolescents with Rural Versus Urban Variation. *The Journal of Obstetrics and Gynecology of India*, 62(4), 442–445. <https://doi.org/10.1007/s13224-012-0171-7>
- Chesney, M. A., & Tasto, D. L. (1975). The development of the menstrual symptom questionnaire. *Behaviour Research and Therapy*, 13(4), 237–244. [https://doi.org/10.1016/0005-7967\(75\)90028-5](https://doi.org/10.1016/0005-7967(75)90028-5)
- Ciołek, A., Kostecka, M., Kostecka, J., Kawecka, P., & Popik-Samborska, M. (2023). An Assessment of Women's Knowledge of the Menstrual Cycle and the Influence of Diet and Adherence to Dietary Patterns on the Alleviation or Exacerbation of Menstrual Distress. *Nutrients*, 16(1), 69. <https://doi.org/10.3390/nu16010069>
- Cirillo, M. (2023). Mediterranean Diet and Oxidative Stress: A Relationship With Pain Perception in Endometriosis. *International Journal of Molecular Sciences*, 24(19), 14601. <https://doi.org/10.3390/ijms241914601>

- De Sanctis, V., Soliman, A., Bernasconi, S., Bianchin, L., Bona, G., Bozzola, M., Buzi, F., De Sanctis, C., Tonini, G., Rigon, F., & Perissinotto, E. (2015). Primary Dysmenorrhea in Adolescents: Prevalence, Impact and Recent Knowledge. *Pediatric Endocrinology Reviews*: PER, 13(2), 512–520.
- Dehnavi, Z. M., Jafarnejad, F., & Kamali, Z. (2018). The Effect of aerobic exercise on primary dysmenorrhea: A clinical trial study. *Journal of Education and Health Promotion*, 7, 3. [https://doi.org/10.4103/jehp.jehp\\_79\\_17](https://doi.org/10.4103/jehp.jehp_79_17)
- Deutch, B., Jørgensen, E. B., & Hansen, J. C. (2000). Menstrual discomfort in Danish women reduced by dietary supplements of omega-3 PUFA and B12 (fish oil or seal oil capsules). *Nutrition Research*, 20(5), 621–631. [https://doi.org/10.1016/s0271-5317\(00\)00152-4](https://doi.org/10.1016/s0271-5317(00)00152-4)
- Donayeva, A., Amanzholkyzy, A., Nurgaliyeva, R., Gubasheva, G., Abdelazim, I. A., & Samaha, I. I. (2023). The relation between primary dysmenorrhea in adolescents and body mass index. *Przeglad menopauzalny = Menopause review*, 22(3), 126–129. <https://doi.org/10.5114/pm.2023.131314>
- Dwivedi, D., Singh, N., & Gupta, U. (2024). Prevalence of Menstrual Disorder in Women and Its Correlation to Body Mass Index and Physical Activity. *Journal of obstetrics and gynaecology of India*, 74(1), 80–87. <https://doi.org/10.1007/s13224-023-01914-0>
- Fang, X. (2023). Scientific Knowledge Graph of Dysmenorrhea: A Bibliometric Analysis From 2001 to 2021. *Journal of Pain Research*, Volume 16, 2883–2897. <https://doi.org/10.2147/jpr.s418602>
- Franco-Antonio, C., Santano-Mogena, E., & Cordovilla-Guardia, S. (2025). Dysmenorrhea, premenstrual syndrome, and lifestyle habits in Young University students in Spain: A cross-sectional study. *Journal of Nursing Research*, 33(1). <https://doi.org/10.1097/jnr.0000000000000657>
- Frisch R. E. (1987). Body fat, menarche, fitness and fertility. *Human reproduction (Oxford, England)*, 2(6), 521–533. <https://doi.org/10.1093/oxfordjournals.humrep.a136582>
- Frisch, R. E., & McArthur, J. W. (1974). Menstrual cycles: fatness as a determinant of minimum weight for height necessary for their maintenance or onset. *Science (New York, N.Y.)*, 185(4155), 949–951. <https://doi.org/10.1126/science.185.4155.949>
- Güzeldere, H. K. B., Efendioğlu, E. H., Mutlu, S., Esen, H. N., Karaca, G. N., & Çağırđar, B. (2024). The relationship between dietary habits and menstruation problems in women: a cross-sectional study. *BMC women's health*, 24(1), 397. <https://doi.org/10.1186/s12905-024-03235-4>
- Hadjou, O.-K., Jouannin, A., Lavoue, V., Leveque, J., Esvan, M., & Bidet, M. (2022). Prevalence of dysmenorrhea in adolescents in France: Results of a large cross-sectional study. *Journal of Gynecology Obstetrics and Human Reproduction*, 51(3), 102302. <https://doi.org/10.1016/j.jogoh.2021.102302>
- Hajnasiri, H., Bahrami, N., Allen, K.-A., & Alimoradi, Z. (2022). Association of Body Mass Index and Dysmenorrhea: A Systematic Review and Meta-Analysis of Observational Studies. *Current Womens Health Reviews*, 18(3), e031121194769.
- Hansen, S. O., & Knudsen, U. B. (2013). Endometriosis, dysmenorrhoea and Diet. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 169(2), 162–171. <https://doi.org/10.1016/j.ejogrb.2013.03.028>
- Hu, Z., Tang, L., Chen, L., Kaminga, A. C., & Xu, H. (2020). Prevalence and Risk Factors Associated with Primary Dysmenorrhea among Chinese Female University Students: A Cross-sectional Study. *Journal of Pediatric and Adolescent Gynecology*, 33(1), 15–22. <https://doi.org/10.1016/j.jpag.2019.09.004>
- Iacovides, S., Avidon, I., & Baker, F. C. (2015). What we know about primary dysmenorrhea today: A critical review. *Human Reproduction Update*, 21(6), 762–778. <https://doi.org/10.1093/humupd/dmv039>
- Jahjaga A., Shukova Stojmanovska D., Gontarev S., & Georgiev G. (2022). Correlation of mediterranean diet with some diseases. *Journal of physical education and sport*, Vol. 22, issue 4, pages: 1051-1060. DOI: 10.7752/jpes.2022.04133.
- Ibrahim, S. M., Aboushady, R. M. N., Kishk, D., & Abdeldaiem, N. A. (2021). Lifestyle Risk Factors and Occurrence of Primary Dysmenorrhea Among Adolescents: Suggested Guidelines. *Egyptian Journal of Health Care*, 12(2), 1844–1861. <https://doi.org/10.21608/ejhc.2021.269547>
- Itani, R., Soubra, L., Karout, S., Rahme, D., Karout, L., & Khojah, H. M. J. (2022). Primary Dysmenorrhea: Pathophysiology, Diagnosis, and Treatment Updates. *Korean Journal of Family Medicine*, 43(2), 101–108. <https://doi.org/10.4082/kjfm.21.0103>
- Jahjaga, A., Shukova Stojmanovska, D., Gontarev, S., & Georgiev, G. (2022). *Journal of Physical Education and Sport (JPES)*, Vol. 22 (issue 4), Art 133, pp. 1051 – 1060.
- Jamali, T., Khalid, M., Shahid, T., Ghani, U., Baig, T., & Nasir, T. (2020). Severity and relation of primary dysmenorrhea and body mass index in undergraduate students of Karachi. A cross sectional survey. *Journal of the Pakistan Medical Association*, 0, 1. <https://doi.org/10.5455/JPMA.18303>
- Ju, H., Jones, M., & Mishra, G. D. (2015). A U-Shaped Relationship between Body Mass Index and Dysmenorrhea: A Longitudinal Study. *PLOS ONE*, 10(7), e0134187. <https://doi.org/10.1371/journal.pone.0134187>
- Khodakarami, B., Masoomi, S. Z., Faradmal, J., Nazari, M., Saadati, M., Sharifi, F., & shakhababaei, M. (2015). The Severity of Dysmenorrhea and its Relationship with Body Mass Index among Female Adolescents in Hamadan, Iran. *Journal of Midwifery and Reproductive Health*, 3(4). <https://doi.org/10.22038/jmrh.2015.4618>
- MacGregor, B., Allaire, C., Yong, P. J., & Bougie, O. (2023). Disease Burden of Dysmenorrhea: Impact on Life Course Potential. *International Journal of Women S Health*, Volume 15, 499–509. <https://doi.org/10.2147/ijwh.s380006>
- Moos, R. H. (1968). The Development of a Menstrual Distress Questionnaire: *Psychosomatic Medicine*, 30(6), 853–867. <https://doi.org/10.1097/00006842-196811000-00006>
- Mucuk, S., Yilmaz, M., & Onur, A. (2022). Relationship between Dysmenorrhea, Dietary Inflammatory Index, and C-reactive Protein Level. *Progress in Nutrition*, 23(4), e2021156. <https://doi.org/10.23751/pn.v23i4.11382>
- Najafi, N., Khalkhali, H., Moghaddam Tabrizi, F., & Zarrin, R. (2018). Major dietary patterns in relation to menstrual pain: A nested case control study. *BMC Women's Health*, 18(1), 69. <https://doi.org/10.1186/s12905-018-0558-4>
- Omidvar, S., Bakouei, F., Amiri, F. N., & Begum, K. (2015). Primary Dysmenorrhea and Menstrual Symptoms in Indian Female Students: Prevalence, Impact and Management. *Global Journal of Health Science*, 8(8), 135. <https://doi.org/10.5539/gjhs.v8n8p135>

- Onieva-Zafra, M. D., Fernández-Martínez, E., Abreu-Sánchez, A., Iglesias-López, M. T., Padilla, F. M. G., González, M. P., & Parra-Fernández, M. L. (2020). Relationship Between Diet, Menstrual Pain and Other Menstrual Characteristics Among Spanish Students. *Nutrients*, 12(6), 1759. <https://doi.org/10.3390/nu12061759>
- Parra-Fernández, M. L., Onieva-Zafra, M. D., Abreu-Sánchez, A., Ramos-Pichardo, J. D., Iglesias-López, M. T., & Fernández-Martínez, E. (2020). Management of Primary Dysmenorrhea among University Students in the South of Spain and Family Influence. *International Journal of Environmental Research and Public Health*, 17(15), 5570. <https://doi.org/10.3390/ijerph17155570>
- Samaha, I. (2023). The Impact of Primary Dysmenorrhea on Adolescents' Activities and School Attendance. *Journal of Medicine and Life*, 16(10), 1462–1467. <https://doi.org/10.25122/jml-2023-0247>
- Serra-Majem, L., Román-Viñas, B., Sanchez-Villegas, A., Guasch-Ferré, M., Corella, D., & La Vecchia, C. (2019). Benefits of the Mediterranean diet: Epidemiological and Molecular Aspects. *Molecular Aspects of Medicine*, 67, 1–55. <https://doi.org/10.1016/j.mam.2019.06.001>
- Singh, M., Rajoura, O. P., & Honnakamble, R. A. (2019). Menstrual patterns and problems in association with body mass index among adolescent school girls. *Journal of Family Medicine and Primary Care*, 8(9), 2855–2858. [https://doi.org/10.4103/jfmpe.jfmpe.474\\_19](https://doi.org/10.4103/jfmpe.jfmpe.474_19)
- Shukova Stojmanovska D., Aleksovska Velichkovska L., Gontarev S., Georgiev G., & Pluncevic Gligoroska J. (2023). Differences in the Mediterranean diet index, smoking and regular physical activity among students on university “ss. Cyril and Methodius”. *Journal of Hygienic engineering and design*, vol. 44. <https://keypublishing.org/jhed/jhed-volumes/volume-44/>
- Torun, N. T., & Yildiz, Y. (2013). Assessment of Nutritional Status of 10 – 14 Years Old Adolescents Using Mediterranean Diet Quality Index (kidmed). *Procedia - Social and Behavioral Sciences*, 106, 512–518. <https://doi.org/10.1016/j.sbspro.2013.12.057>
- Tuttolomondo, A., Simonetta, I., Daidone, M., Mogavero, A., Ortello, A., & Pinto, A. (2019). Metabolic and vascular effect of the Mediterranean Diet. *International Journal of Molecular Sciences*, 20(19), 4716. <https://doi.org/10.3390/ijms20194716>
- Unsal, A., Ayranci, U., Tozun, M., Arslan, G., & Calik, E. (2010). Prevalence of dysmenorrhea and its effect on quality of life among a group of female university students. *Upsala Journal of Medical Sciences*, 115(2), 138–145. <https://doi.org/10.3109/03009730903457218>
- Veronese, N., Koyanagi, A., Stubbs, B., Cooper, C., Guglielmi, G., Rizzoli, R., Punzi, L., Rogoli, D., Caruso, M. G., Rotolo, O., Notarnicola, M., Al-Daghri, N., Smith, L., Reginster, J.-Y., & Maggi, S. (2019). Mediterranean diet and knee osteoarthritis outcomes: A longitudinal cohort study. *Clinical Nutrition*, 38(6), 2735–2739. <https://doi.org/10.1016/j.clnu.2018.11.032>
- Wang, L., Yan, Y., Qiu, H., Xu, D., Zhu, J., Liu, J., & Li, H. (2022). Prevalence and Risk Factors of Primary Dysmenorrhea in Students: A Meta-Analysis. *Value in Health*, 25(10), 1678–1684. <https://doi.org/10.1016/j.jval.2022.03.023>
- World Health Organization (2007). AnthroPlus. Retrieved August 15, 2020, from <https://www.who.int/>
- Wu, L., Zhang, J., Tang, J., & Fang, H. (2022). The relation between body mass index and primary dysmenorrhea: A systematic review and meta-analysis. *Acta Obstetrica et Gynecologica Scandinavica*, 101(12), 1364–1373. <https://doi.org/10.1111/aogs.14449>

