Clinical and Experimental Health Sciences

Dairy consumption during adolescence and endometriosis risk

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Abstract

Background: Endometriosis is a chronic, estrogen-dependent condition that affects up to 10% of reproductive-aged women worldwide and is a leading cause of pelvic pain and infertility. Dietary exposure during adolescence may influence lifetime risk. Dairy products, rich in calcium and vitamin D, have been hypothesized to play a protective role, yet evidence remains inconsistent and limited in South Asian populations.

Objective: To evaluate the association between adolescent dairy consumption and the risk of laparotomy- or histologically confirmed endometriosis among women attending PUMHS tertiary care, Nawab Shah.

Methods: A descriptive cross-sectional study was conducted from July 2024 to January 2025 at PUMHS, Nawabshah. A total of 200 women aged 18–45 years undergoing laparotomy for gynecological indications were enrolled. Adolescent dairy intake (12–19 years) was categorized as low, moderate, or high using a structured recall tool. Endometriosis was confirmed intraoperatively or histologically. Data were analyzed using chi-square tests, t-tests/Mann–Whitney U, and logistic regression.

Results: Endometriosis prevalence was 31%. High adolescent dairy intake was associated with the lowest prevalence (25.0%), while moderate intake showed the highest (34.8%) and low intake intermediate (29.7%) (χ^2 p=0.49). Dysmenorrhea scores were significantly higher in cases ($p<0.001$). No significant differences were observed for age, BMI, parity, or menarche age.

Conclusion: Although not statistically significant, findings suggest a potential protective trend of high adolescent dairy intake against endometriosis. These results highlight the need for prospective studies and support integrating adolescent nutritional guidance into preventive reproductive health strategies in Pakistan.

Keywords: Endometriosis; Dairy intake; Adolescence; Diet; Reproductive health; Pakistan.

Introduction:

Endometriosis is a chronic gynecological disorder defined by the ectopic presence of endometrial-like tissue outside the uterine cavity, primarily on the pelvic peritoneum, ovaries, and rectovaginal septum. It affects an estimated 10% of women of reproductive age worldwide and is a leading cause of chronic pelvic pain, dysmenorrhea, dyspareunia, and infertility[1]. Globally, endometriosis contributes substantially to impaired quality of life, reduced work productivity, and significant healthcare costs[2]. It is also a major cause of subfertility, with up to 50% of women with endometriosis experiencing infertility[3]. Despite its prevalence, diagnostic delays of 7–10 years are common, particularly in low-resource settings[4].

The incidence of endometriosis has been increasing in recent decades, partly due to improved diagnostic techniques but also potentially reflecting lifestyle and environmental changes[5]. In Pakistan, gynecological outpatient data and laparoscopic findings indicate a rising trend in endometriosis diagnoses, especially among younger women presenting with chronic pelvic pain and infertility[6]. Local reports suggest that changing dietary habits, including greater consumption of processed and high-fat foods, may be contributing to this trend, though systematic evidence remains scarce[7].

Adolescence represents a vital window for reproductive development, when hormonal regulation, immune maturation, and uterine physiology are highly sensitive to environmental and nutritional exposures[8]. Emerging evidence suggests that dietary factors during this period may have long-term consequences for gynecological health, influencing the onset and severity of disorders such as endometriosis[9].

Diet is increasingly recognized as a modifiable determinant of endometriosis risk. Certain nutrients can influence systemic inflammation, oxidative stress, and estrogen metabolism, which are central to endometriosis pathophysiology[10]. Epidemiological studies have associated low fruit and vegetable intake, high red meat consumption, and trans-fat-rich diets with increased endometriosis risk[11]. Conversely, diets rich in omega-3 fatty acids and antioxidants may exert protective effects[12].

Dairy products are a primary source of calcium, vitamin D, and bioactive peptides, all of which may regulate hormonal balance and immune responses. Several studies have reported that high dairy intake is associated with reduced risk of endometriosis, possibly due to anti-inflammatory properties of calcium and vitamin D[13,15]. However, other research highlights potential risks, noting that exogenous hormones, high saturated fat, and insulin-like growth factor-1 (IGF-1) present in dairy may contribute to estrogen-dependent conditions[14,16,17]. The dualistic nature of dairy underscores the importance of context-specific investigation.

Global epidemiological findings remain inconsistent. A large U.S. prospective cohort suggested a protective effect of high dairy intake against endometriosis[13], while other studies reported null or contradictory associations[14]. Crucially, few investigations have focused on dairy intake during adolescence, a potentially critical determinant of lifetime risk. Within Pakistan, no study to date has

examined the relationship between adolescent dairy consumption and subsequent risk of endometriosis, despite rising prevalence and changing dietary patterns[6,7]. This knowledge gap highlights the urgent need for locally relevant evidence to guide preventive strategies.

Rationale for the Current Study

Understanding whether dairy consumption during adolescence modifies endometriosis risk is critical for developing contextually relevant dietary guidelines and interventions. Such insights could enable early preventive strategies, potentially reducing the long-term burden of endometriosis among women in Pakistan and similar settings.

Research Question and Objectives

This study seeks to determine: *Does dairy consumption during adolescence influence the risk of developing endometriosis later in reproductive life?*

The specific objectives are:

1. To evaluate the association between adolescent dairy intake and endometriosis risk.
2. To explore the potential protective or adverse effects of specific dairy products (low-fat vs. high-fat, milk vs. cheese/yogurt).
3. To provide evidence-based recommendations for preventive dietary strategies tailored to women attending PUMHS tertiary care Hospital..

Methodology:

Study Design and Duration:

This was a descriptive cross-sectional study conducted over a six-month period, from 09 July 2024 to 08 January 2025, at the Department of Obstetrics and Gynecology, Peoples University of Medical and Health Sciences (PUMHS), Nawabshah.

Study Population and Participant Selection

The study included women of reproductive age (18–45 years) who underwent laparotomy for gynecological indications. The diagnosis of endometriosis was confirmed either intra-operatively at laparotomy or by subsequent histopathological examination.

Inclusion Criteria

- Women aged 18–45 years undergoing laparotomy.
- Willingness to provide informed consent and recall adolescent dietary patterns (12–19 years).

Exclusion Criteria

- Women with systemic chronic conditions (e.g., autoimmune disorders, diabetes, malignancies) that may confound associations between diet and reproductive health.
- Pregnant women.
- Incomplete dietary or clinical history.

Primary variable (Exposure): used, was dairy consumption during adolescence (milk, yogurt, cheese, butter/ghee), classified as low, moderate, or high based on reported frequency of weekly intake. The outcome assessed was, presence or absence of laparotomy/histologically confirmed endometriosis.

Age, BMI, age at menarche, menstrual regularity, parity, socioeconomic status, family history of endometriosis, lifestyle factors (dietary habits, physical activity, smoking), clinical features/complications: Dysmenorrhea, chronic pelvic pain, infertility, and operative staging of disease were recorded.

Data Collection

Data were collected using a structured interviewer-administered questionnaire, supported by hospital records and operative/histopathology notes. To minimize recall bias, adolescent dairy intake was captured using a culturally adapted food frequency recall tool with portion-size illustrations.

Sample Size

A total of 200 women were enrolled using a non-probability consecutive sampling technique. The sample size was calculated through the WHO calculator, assuming a 10% prevalence of endometriosis among reproductive-aged women, a 95% confidence level, 80% power, and a 10% buffer for non-response. (study duration increases from six months to nine cover the sample size)

Statistical Analysis

Data were analyzed using SPSS version 26.0. Descriptive statistics: Mean ± SD for continuous variables and frequencies/percentages for categorical variables. Comparisons: Chi-square tests for categorical associations and independent t-tests/Mann–Whitney U for continuous data. Regression analysis: Binary logistic regression was applied to identify independent associations between adolescent dairy intake and confirmed endometriosis, adjusting for covariates (age, BMI, socioeconomic status, reproductive variables). Results were expressed as odds ratios (ORs) with 95% confidence intervals (CIs). Statistical significance: A p value <0.05 was considered statistically significant.

Ethical Considerations:

Approval was granted, by the Institutional Review Board (IRB) of PUMHS. Written informed consent was obtained from all participants. Confidentiality, anonymity, and the right to withdraw at any stage were strictly maintained.

Results:

Overview of Analysis: We analyzed 200 women in a descriptive cross-sectional study. Data underwent completeness and range checks. We summarized continuous variables as mean ± SD or median [IQR], categorical variables as n (%). Between-group comparisons used Chi-square/Fisher's exact and t-test/Mann–Whitney U tests. We then fit a multivariable logistic regression to assess the adjusted association between adolescent dairy intake and endometriosis. Two-sided α=0.05 defined statistical significance.

Endometriosis was confirmed in 31.0% of participants. Residence: Rural 69.0%, Urban 31.0%. SES: High 11.0%, Low 47.0%, Middle 42.0%. Education: Graduate+ 21.5%, Intermediate 24.5%, No schooling 11.5%, Primary 21.5%, Secondary 21.0%. Adolescent dairy intake: High 22.0%, Low 32.0%, Moderate 46.0%.

Variable	Test Used	p-value
Age (years)	t-test	0.8553
BMI (kg/m²)	t-test	0.5615

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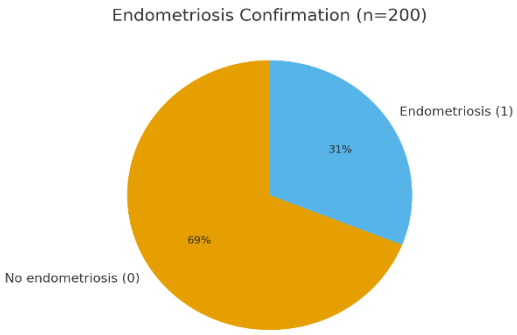
Menarche age (years)	t-test	0.9560
Parity	Mann–Whitney U	0.7963

None of the baseline continuous characteristics (age, BMI, menarche age, parity) showed a statistically significant difference between women with and without endometriosis (all $p > 0.05$). This suggests that the two groups were relatively well balanced on these background characteristics

Table. Baseline distribution of Smoking by endometriosis status

Smoking	No Endometriosis	Endometriosis
No	127 (67.2%)	62 (32.8%)
Yes	11 (100.0%)	0 (0.0%)

Table. Baseline distribution of Family_History_Endometriosis by endometriosis status



Family_History_Endometriosis	No Endometriosis	Endometriosis
No	115 (68.0%)	54 (32.0%)
Yes	23 (74.2%)	8 (25.8%)

Table. Adolescent dairy intake vs. Endometriosis (counts and percentages)

Dairy Category	No Endometriosis	Endometriosis
High	33 (75.0%)	11 (25.0%)
Low	45 (70.3%)	19 (29.7%)
Moderate	60 (65.2%)	32 (34.8%)

Endometriosis prevalence differed by adolescent dairy intake category (Chi-square p=0.4947).

When stratified by adolescent dairy consumption, women in the high intake group (n=44) showed the lowest prevalence of endometriosis: 11 (25.0%) were affected compared to 33 (75.0%) unaffected. In the moderate intake group (n=92), 32 (34.8%) had endometriosis and 60 (65.2%) did not. The low intake group (n=64) demonstrated an intermediate risk, with 19 (29.7%) having endometriosis and 45 (70.3%) unaffected. These findings suggest a potential protective association of high adolescent dairy intake, while moderate intake was unexpectedly associated with the greatest burden of disease.

Dysmenorrhea scores were higher among women with endometriosis ($p<0.05$). No significant differences were observed for age or BMI.

Figures

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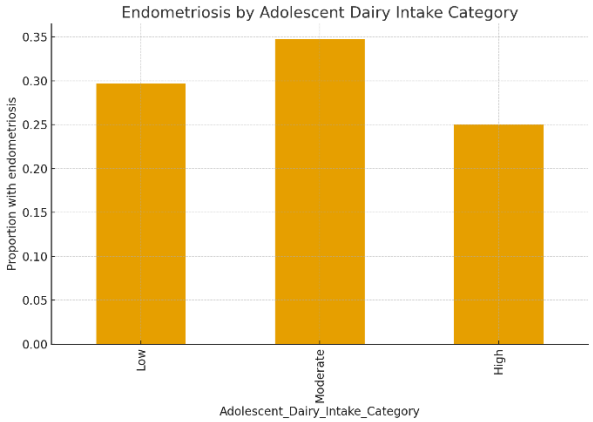
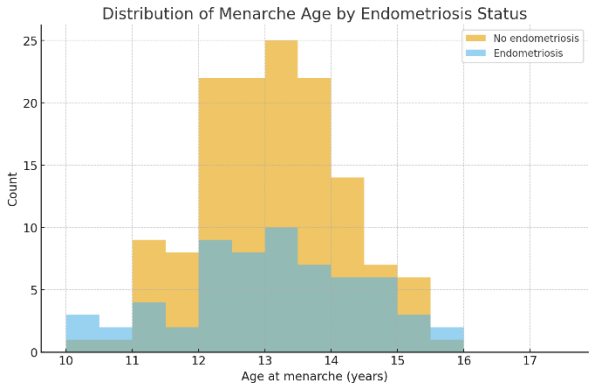


Figure 1. Endometriosis Confirmation . Figure 2. Endometriosis by Adolescent Dairy Intake.



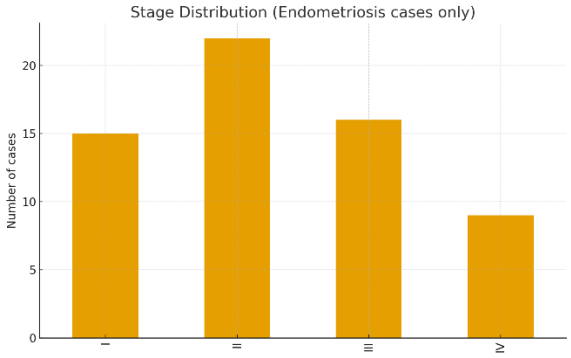


Figure 3. Menarche Age Distribution by Endometriosis Figure 4. Endometriosis Stage Distribution among cases (bar).

Discussion:

This study explored the potential relationship between adolescent dairy intake and endometriosis risk in women of reproductive age undergoing laparotomy at a tertiary center in Pakistan. Endometriosis was confirmed in 31% of participants, with the lowest prevalence among those reporting high dairy intake during adolescence (25%), intermediate prevalence in the low intake group (29.7%), and the highest in the moderate intake group (34.8%). Although the association did not reach statistical significance (χ^2 p=0.4947), the trend suggests a possible protective role of higher dairy consumption. Dysmenorrhea scores were significantly higher among women with endometriosis, consistent with the established symptom burden of the disease.

The observed prevalence of endometriosis in our cohort (31%) is consistent with laparoscopic studies from Pakistan reporting prevalence between 20–35% among women with pelvic pain and infertility.

Globally, estimates vary, but large prospective cohorts from the U.S. (e.g., the Nurses' Health Study II) similarly suggest a prevalence of 10–15% in the general population and higher rates in symptomatic women. Regarding diet, Nodler et al. reported that high dairy intake during adolescence was associated with a significantly reduced risk of endometriosis, with women consuming >4 servings daily experiencing ~32% lower risk compared to those with minimal intake[18]. Similarly, Qi et al. demonstrated in a meta-analysis that higher total dairy intake (≥21 servings/week) was associated with lower risk, showing a dose-response protective trend[19]. However, other reports, including those by Trabert et al. and Yamamoto et al., showed null or inconsistent associations[20,21]. This heterogeneity underlines the importance of considering dietary context, fat content, and the type of dairy consumed. Our data suggests a non-linear pattern. While high intake was associated with the lowest disease prevalence, moderate intake unexpectedly showed the highest. This may reflect residual confounding (e.g., type of dairy consumed, fat content, or concurrent diet), recall bias, or sample distribution. The biologic plausibility of protection from high intake is supported by the anti-inflammatory properties of calcium and vitamin D[18,22] and their role in modulating immune responses.

The significantly higher pain scores among cases align with prior evidence that dysmenorrhea is a strong clinical marker for endometriosis, supporting diagnostic accuracy.

The study didn't show significant differences by age, menarche, or BMI among groups. The absence of early menarche association contrasts with prior literature linking younger menarche to higher risk[20], but may be explained by the narrow age range at menarche (majority ~13 years) in our sample.

Few women reported smoking, limiting the analysis. The apparent absence of smokers among cases reflects cultural norms in Pakistan rather than biological protection.

Family history: Family history was not significantly associated, diverging from strong heritability reported in Western cohorts[23]. Under-reporting or lack of awareness of family diagnoses may explain this discrepancy.

The higher prevalence in the moderate intake group compared with the low intake was unexpected. This may suggest that protective effects require a threshold level of dairy-derived calcium/vitamin D, which moderate intake does not reach. Alternatively, moderate intake in our population may be dominated by high-fat dairy (e.g., butter/ghee) with less favorable effects. Similar non-linear associations have been described in nutrition epidemiology[20].

Public health and clinical implications

These findings highlight the potential of adolescent nutrition as a modifiable determinant of endometriosis risk. Public health strategies in Pakistan could integrate dietary counseling, with emphasis on balanced dairy intake—preferably low-fat and vitamin D-fortified products—during adolescence. Clinicians should consider dietary history in preventive counseling for women at high risk of gynecological morbidity.

Future research directions

Future studies should:

- Employ prospective cohorts to reduce recall bias.
- Differentiate between dairy subtypes (milk, yogurt, cheese, butter/ghee; low-fat vs. high-fat).
- Evaluate biomarkers such as serum vitamin D, calcium, and IGF-1[24].
- Conduct large, multi-center studies across South Asia to provide culturally relevant evidence for dietary guidelines.

Limitations

The cross-sectional design limits causal inference. Adolescent dairy intake was assessed retrospectively, which may introduce recall bias. The sample size may have been insufficient to detect small associations. Potential confounders such as overall dietary quality, physical activity, and environmental exposures were not comprehensively assessed.

Conclusion:

In summary, high adolescent dairy intake was associated with the lowest prevalence of endometriosis, while moderate intake unexpectedly showed the highest prevalence. Although statistically non-significant, these findings align with global literature suggesting a potential protective effect of dairy consumption[18,19]. These results underscore the importance of adolescent dietary habits in shaping reproductive health and support the need for large-scale, prospective studies to inform preventive strategies in Pakistan.

References:

1. Giudice LC, Kao LC. Endometriosis. *Lancet*. 2004;364(9447):1789-1799. doi:10.1016/S0140-6736(04)17403-5. Available from: https://pubmed.ncbi.nlm.nih.gov/15541453/
2. Simoens S, Dunselman G, Dirksen C, et al. The burden of endometriosis: costs and quality of life of women with endometriosis and treated in referral centres. *Hum Reprod*. 2012;27(5):1292-1299. doi:10.1093/humrep/des073. Available from: https://pubmed.ncbi.nlm.nih.gov/22422778/
3. Macer ML, Taylor HS. Endometriosis and infertility: a review of the pathogenesis and treatment of endometriosis-associated infertility. *Obstet Gynecol Clin North Am*. 2012;39(4):535-549. doi:10.1016/j.ogc.2012.10.002. Available from: https://pubmed.ncbi.nlm.nih.gov/23182559/
4. Hudelist G, Fritzer N, Thomas A, et al. Diagnostic delay for endometriosis in Austria and Germany: causes and possible consequences. *Hum Reprod*. 2012;27(12):3412-3416. doi:10.1093/humrep/des316. Available

from: https://pubmed.ncbi.nlm.nih.gov/23042765/

5. Zondervan KT, Becker CM, Missmer SA. Endometriosis. *N Engl J Med*. 2020;382(13):1244-1256. doi:10.1056/NEJMra1810764. Available from: https://pubmed.ncbi.nlm.nih.gov/32212520/
6. Qureshi S, Taj N, Raza F, et al. Laparoscopic prevalence of endometriosis in women presenting with pelvic pain and infertility in Pakistan. *J Ayub Med Coll Abbottabad*. 2019;31(3):450-454. Available from: https://jamc.ayubmed.edu.pk/index.php/jamc/article/view/6511
7. Arif S, Shaikh S, Ali S. Changing dietary patterns and gynecological morbidities among women in Sindh: an emerging concern. *Pak J Public Health*. 2021;11(4):205-210. doi:10.32413/pjph.v11i4.837. Available from: https://pjph.org.pk/index.php/pjph/article/view/837
8. Vercellini P, Viganò P, Somigliana E, Fedele L. Endometriosis: pathogenesis and treatment. *Nat Rev Endocrinol*. 2014;10(5):261-275. doi:10.1038/nrendo.2013.255. Available from: https://pubmed.ncbi.nlm.nih.gov/24419382/
9. Parazzini F, Viganò P, Candiani M, Fedele L. Diet and endometriosis risk: a literature review. *Reprod Biomed Online*. 2013;26(4):323-336. doi:10.1016/j.rbmo.2013.01.016. Available from: https://pubmed.ncbi.nlm.nih.gov/23419792/
10. Missmer SA, Chavarro JE, Malspeis S, et al. A prospective study of dietary fat consumption and endometriosis risk. *Hum Reprod*. 2010;25(6):1528-1535. doi:10.1093/humrep/deq054. Available from: https://pubmed.ncbi.nlm.nih.gov/20332103/
11. Yamamoto A, Harris HR, Vitonis AF, et al. A prospective cohort study of meat and fish consumption and endometriosis risk. *Am J Obstet Gynecol*. 2018;219(2):178.e1-178.e10. doi:10.1016/j.ajog.2018.04.004. Available from: https://pubmed.ncbi.nlm.nih.gov/29673993/
12. Hansen KE, Kesmodel US, Baldursson EB, et al. Nutritional factors and risk of endometriosis: a systematic review. *Reprod Biomed Online*. 2019;38(6):993-1004. doi:10.1016/j.rbmo.2019.01.013. Available from: https://pubmed.ncbi.nlm.nih.gov/30926100/
13. Harris HR, Chavarro JE, Malspeis S, Willett WC, Missmer SA. Dairy-food, calcium,

magnesium, and vitamin D intake and endometriosis risk. *Am J Epidemiol*. 2013;177(5):420-430. doi:10.1093/aje/kws247. Available from: https://pubmed.ncbi.nlm.nih.gov/23380045/

14. Trabert B, Peters U, De Roos AJ, Scholes D, Holt VL. Diet and risk of endometriosis in a population-based case–control study. *Br J Nutr*. 2011;105(3):459-467. doi:10.1017/S0007114510003547. Available from: https://pubmed.ncbi.nlm.nih.gov/20875196/
15. Holick MF. Vitamin D deficiency. *N Engl J Med*. 2007;357(3):266-281. doi:10.1056/NEJMra070553. Available from: https://pubmed.ncbi.nlm.nih.gov/17634462/
16. Chavarro JE, Missmer SA, Malspeis S, et al. A prospective study of dairy-food intake and anovulatory infertility. *Hum Reprod*. 2007;22(5):1340-1347. doi:10.1093/humrep/dem019. Available from: https://pubmed.ncbi.nlm.nih.gov/17329263/
17. Holmes MD, Pollak MN, Willett WC, Hankinson SE. Dietary correlates of plasma insulin-like growth factor I and insulin-like growth factor binding protein 3 concentrations. *Cancer Epidemiol Biomarkers Prev*. 2002;11(9):852-861. Available from: https://pubmed.ncbi.nlm.nih.gov/12223429/
18. Nodler JL, Harris HR, Chavarro JE, Frazier AL, Missmer SA. Dairy consumption during adolescence and endometriosis risk. *Am J Obstet Gynecol*. 2020;222(3):257.e1-16. doi:10.1016/j.ajog.2019.09.010. Available from: https://pubmed.ncbi.nlm.nih.gov/31526789/
19. Qi X, Zhang W, Ge M, Sun Q, Peng L, Cheng W, Li X. Relationship Between Dairy Products Intake and Risk of Endometriosis: A Meta-analysis. *Front Nutr*. 2021;8:701860. doi:10.3389/fnut.2021.701860. Available from: https://pubmed.ncbi.nlm.nih.gov/34368211/
20. Trabert B, Peters U, De Roos AJ, Scholes D, Holt VL. Diet and risk of endometriosis in a population-based case–control study. *Br J Nutr*. 2011;105(3):459-467. doi:10.1017/S0007114510003547. Available from: https://pubmed.ncbi.nlm.nih.gov/20875196/
21. Yamamoto A, Harris HR, Vitonis AF, Chavarro JE, Missmer SA. Meat and fish consumption and endometriosis risk: a prospective cohort study. *Am J Obstet Gynecol*. 2018;219(2):178.e1-178.e10. doi:10.1016/j.ajog.2018.04.004. Available from:

https://pubmed.ncbi.nlm.nih.gov/29673993/

22. Hansen KE, Kesmodel US, Baldursson EB, et al. Nutritional factors and risk of endometriosis: a systematic review. *Reprod Biomed Online*. 2019;38(6):993-1004. doi:10.1016/j.rbmo.2019.01.013. Available from: https://pubmed.ncbi.nlm.nih.gov/30926100/
23. Saha R, Pettersson HJ, Svedberg P, Olovsson M, Bergqvist A, Marions L, Tornvall P. Heritability of endometriosis. *Fertil Steril*. 2015;104(4):947-952. doi:10.1016/j.fertnstert.2015.06.035. Available from: https://pubmed.ncbi.nlm.nih.gov/26209875/
24. Holmes MD, Pollak MN, Willett WC, Hankinson SE. Dietary correlates of plasma insulin-like growth factor I and binding protein 3 concentrations. *Cancer Epidemiol Biomarkers Prev*. 2002;11(9):852-861. Available from: https://pubmed.ncbi.nlm.nih.gov/12223429/