# Effects of menarche, parity, primiparous age, and reproductive diseases on uterine fibroids of rural women in China

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# Abstract

**Objectives:** Given the increasing prevalence of hysteromyoma among the Chinese rural women of childbearing age, it is imperative that more attention should be given to researching risk factors that predispose women to this condition so that early preventive measures may be taken. Our study investigates potential risk factors for uterine fibroids such as participants' demographic characteristics (age, ethnicity, education), physiological characteristics (age at menarche, primiparous age), and the occurrence of several different female reproductive diseases (vaginitis, pelvic inflammatory disease).

**Methods:** 2,200 rural women of reproductive age were screened from a cross-sectional study carried out in the Anhui province. Data was collected by questionnaire surveys, gynecological and laboratory examinations and were subjected to univariate and multivariate analysis to evaluate the risk factors for uterine fibroids.

**Results:** Of the 2,200 women, 440 had uterine fibroids. In general, women with endometriosis, ovarian cysts and early menarche were more likely to suffer from hysteromyoma. Factors including higher parity, late age of first childbirth, and a regular menstrual cycle were protective against uterine fibroids.

**Conclusions:** Our findings indicate that parameters such as earlier age of menarche, early primiparous age lower parity and a variety of female reproductive diseases could increase the risk of uterine fibroids. These findings may be used to guide the formulation of effective prevention and intervention protocols to improve the reproductive health of rural women.


# Introduction

Uterine fibroids originate from muscle cells in the uterus and are often initially diagnosed as small nodules or polyps. Large fibroids may present as a lower abdominal mass. uterine fibroids or uterine fibroid tumor is the most common female pelvic benign tumor and is classified based on its location relative to the layers of the uterus (as subserous, intramural or submucosa), occurring in 20%-40% in women of reproductive age[1,2]. The incidence of uterine fibroids varies with race and age[3]. Uterine fibroids are steroid dependent[4]. Due to the influence of estrogens and progestogens[5], uterine fibroids rarely occurs prior to menarche and rarely after the onset of menopause. Women with uterine fibroids may present with increased menstruation, prolonged menstruation, and lower abdominal pain during menstruation. However, many patients remain asymptomatic or possess vague symptoms[6], leading to late detection and inevitable surgical intervention. Most patients with large uterine fibroids are often left with the sole treatment option of hysterectomy, which is also the main reason why women in general are hospitalized for gynecological diseases[7,8]. Studies have suggested that an earlier menarche is a risk factor for uterine fibroids[9]. Early age of menarche has also been associated with other conditions such as type 2 diabetes, angiocardiopathy, metabolic diseases[10,11], and cancers[12]. The age of menarche is influenced by both genetic and environmental childhood factors[13], such as nutrition, geographic location,

stressful events, light, and the presence of a chronic infectious disease[14-16], thereby supporting the "developmental origins of health and disease" hypothesis.

Thus, exploring the relationship between age of menarche, parity, female reproductive diseases and hysteromyoma is of remarkable clinical and public health importance, especially in the context of the declining age of menarche and increasing prevalence of hysteromyoma.

# Material And Methods

### Setting and sample

This cross-sectional study was conducted between August 2005 and November 2007 in the Anhui province, which is located in the east-central part of China covering an area of 39,600 $km^2$ and with a population of more than 70 million. At that time, more than 50% of the population resided in rural areas of the province; 17 million women were of child-bearing age, and nearly 80% were married[17].

This survey was designed by the Population and Family Planning Commission of Anhui Province and performed by the Department of Public Health of Anhui Medical University. All participants obtained informed consent and the study was approved by the Anhui Provincial Science and Technology Department and the Research Ethics Committee of Anhui Medical University. Data regarding women's health were collected via questionnaires and clinical gynecological examinations (the latter were considered as the gold standard for diagnosing diseases in this study). The relevant clinical examination was to confirm the presence of female reproductive diseases such as vaginitis and pelvic inflammatory disease, while the questionnaire was to determine the demographic characteristics and previous medical history of the participants. This study is a cross-sectional study. Specific methods for participants selecting are described below.

Firstly, the Anhui province was stratified based on administrative region and landforms. Subsequently, several towns were picked out randomly within the stratification. Secondly, administrative villages situated within a 5 km radius from local town family planning service center were randomly selected. Women who met the inclusion criteria were included in this study. Women who could not recall with certainty their age at first menstruation were excluded to minimize bias in the outcome. A total of 53,652 women were interviewed, of which 52,874 responded to the questionnaires. Due to the limited scientific research funds and human resources, the examination of uterine fibroids was only carried out in three randomly selected villages. An examination specific to ruling in the presence of uterine fibroids was done, however, the location and number of fibroids were not examined in detail. Given that several women that participated in the study from these three towns were also partaking in excessive farm work at home, many did not arrive at the designated examination area after submitting the initial questionnaire. Therefore, women who had provided only questionnaires but without clinical examination data from regions were excluded from the study. A final result of 2,200 samples were finally included in our study.

### Questionnaire and date collection

Questionnaire survey was conducted by trained staffs who were instructed to obtain specific information such as the sociodemographic characteristics (age, ethnic, education level, etc.), menstrual history (including menstrual cycle, the days and blood volume during period, menstrual regularity), obstetric history (parity, primiparous age, cesarean section or natural birth and so on), and medical history. Prior to the start of the study, investigators were given permission by the participants to visit their homes and to maintain a record of their home addresses in order to ensure data accuracy and completion (if any problems occurred, we can find them to resolve it). Information of women who arrived at the family planning service station of the villages were recorded. Residents who failed to show up were visited by investigators.

### Gynecological examination and classification

Gynecologists, laboratory technicians, and health workers obtained female reproductive health statuses through gynecological examination and laboratory testing. Initially, subjects were interviewed to determine information such as previous gynecological history, abnormal pelvic symptoms, and hypogastric discomfort or pain. Vaginal swabs and blood samples were obtained for detection of reproductive tract infections. The gynecological diseases that were tested in this study included vaginitis, pelvic inflammatory disease, dysmenorrhea, endometriosis and ovarian cysts. B-type abdominal ultrasound performed by two senior doctors from the radiological department with at least 3 years of experience. The female vagina is a balanced environment with a variety of microorganism's coexistence. When the balance is broken, pathogenic microorganisms can grow and dominate in the vagina[18]. The vaginal discharge is obtained with swabs and sent to the laboratory for test. If there are pathogenic microorganisms in the secretion, the diagnosis of vaginitis can be confirmed by combining with the symptoms of the participant (such as itching of the vulva and increased vaginal discharge). Pelvic inflammation disease (PID): infections in the female reproductive organs and surrounding connective tissue, patients often complaint abdominal pain and lumbosacral pain[19]. Dysmenorrhea: pain in the lower abdomen and waist during menstruation that can affect the quality of life[20]. Endometriosis: endometrial tissue grows outside the uterine cavity and myometrium and patient appears secondary and progressively aggravated dysmenorrhea, irregular menstruation[21]. Ovarian cyst: cystic mass in one or both ovaries, a kind of ovarian tumor[22]. B-type ultrasonography can be used to detect uterine fibroids, ovarian cysts, pelvic effusion in the lower abdomen of patients with pelvic inflammation, and so on. Clinicians can diagnose all the above diseases based on the results from ultrasound, laboratory tests, and signs and symptoms of the patients.

Onset of menarche was categorized based on the following parameters: ≤ 12, 13-16 (Ref. group), ≥17 years. Primiparous age was also divided into three groups: ≤ 20, 21-25 (Ref. group), ≥ 26 years. Parity was defined as the following: 0-1, 2-3 (Ref. group), ≥ 4 children. According to the severity of symptoms, dysmenorrhea was divided into three groups: no (Ref. group), mild, and severe. Most of the remaining dichotomous data were divided into two groups: non-exposed group (no = 0) and exposed group (yes = 1).

### Statistical analysis

Two students utilized EpiData3.1 [EpiDataForeningen (EpiData Association), Odense, Denmark] to enter data and SPSS23.0 was used to analyze data separately. We first performed a bivariate analysis with risk estimates for uterine fibroids using odds ratio (OR) with 95% confidence interval (CI) for each predictor. Then, a multivariate analysis using nonconditional multiple logistic regression was applied to jointly assess the risk factors for uterine fibroids, reporting the estimated adjusted OR ($OR_{adj}$) with 95% CI. The enter method was used and only predictors with a p-value < 0.05 in the bivariate analysis entered the multivariate model. In all tests, p-value < 0.05 was considered to be statistically significant.

## Results

### Demographic characteristics as well as reproductive health status

Of the 2,200 women included in this study, 440 had uterine fibroids. The incidence of uterine fibroids was 20%. Participants' demographic characteristics, female physiology, and reproductive diseases are shown in Table 1-3. The average age of the 2,200 rural women of child-bearing age was 39.54 ± 5.96 years and all ages less than 50 years. Women between the ages of 36 to 45 years made up the largest proportion of our study (64.7%). 2190 (99.5%) women were of Han ethnicity. 1,569 (73.1%) of them were educated below primary school level. Nearly half of the women (45.5%) never attended school (not listed). Most women have stable marriages (97.5%), the rest (2.5%) comprised to women who were divorced, widowed or remarried. 54.1% of them have a yearly family income less than 10,000 RMB.

Approximately two-thirds (70.4%) of women experienced menarche at the age of 13-16 and 11% before the age of 12. 1855 (84.3%) of women had 2 or 3 children. 1472 (66.9%) women had their first child at the age of 21-25 and 415 (18.9%) had their first child before the age of 20. 731 (33.2%) women had vaginitis, 254 (11.55%) women had pelvic inflammatory disease, and 900 (41%) women had dysmenorrhea. More details about the various characteristics of women are presented in Tables 1-3.

### The distribution of uterine fibroids among different analyzed variables

There were no statistical differences between the frequency distribution of uterine fibroids in groupings based on ethnicity, occupation, and yearly family income. However, statistical differences were demonstrated between different ages, education level, and marital status (p < 0.05). There was statistical difference in the frequency distribution of uterine fibroids based on menarche, parity, and age of first childbirth (p < 0.001). With regards to the presence of female reproductive diseases, there were significant differences found in the distribution of uterine fibroids based on a history of vaginitis, endometriosis, ovarian cyst, and menstrual disorders (p < 0.001), with the exception of dysmenorrhea and pelvic inflammation. More information is depicted in Table 1.

### Risk factors for uterine fibroids

Binary logistics regression analysis with the dependent variable of women with or without fibroids (no = 0, yes = 1) and independent variables of various characteristics revealed that several common sociodemographic factors (ethnicity, occupation, education level, marital status, yearly family income), with the exception of age, were not associated with uterine fibroids (Table 2). In contrast to the age group of those between 26 to 35 years, patients that were more than 35 years old had a higher risk of developing uterine fibroids.

Results in Table 3 suggested that AOM (age of menarche), parity, and age of first childbirth were significantly associated with uterine fibroids. Those with early AOM (≤ 12, OR = 1.57, 95%CI: 1.16-2.12) or early primiparous age (≤ 20, OR = 1.36, 95%CI:1.05-1.75) or lower parity (0-1 child, OR = 1.58, 95%CI: 1.05-2.37) were found to possess a higher risk of uterine fibroids. However, the presence of pelvic inflammation and dysmenorrhea were not associated with the risk of uterine fibroids. Other factors that were independently associated with an increased risk of uterine fibroids were vaginitis (OR = 4.05, 95%CI: 3.26-5.04), endometriosis (OR = 20.3, 95%CI: 7.68-53.4), ovarian cyst (OR = 8.84, 95%CI: 4.72-16.53), and a menstrual disorder (OR = 9.17, 95%CI: 4.59-18.33). Table 3 depicts further clinical data.

# Discussion

Women residing in rural areas are often of lower socioeconomic status and have less access to family planning services compared to cities. It comes as no surprise that rural women are at a higher risk of gynecological diseases. Although the fertility rate of rural women in the Anhui province is high, prevention of gynecological diseases is still insufficient. Related research has confirmed sub-mucosal fibroids are more likely to lead to irregular bleeding and adverse reproductive outcomes in women[23,24]. Prior studies have also illustrated that infertility is associated with uterine fibroids[9,25], especially at earlier ages[26]. Our study found that 20% of the participant cohort of 2200 cases had fibroids. This is in line with available data[1,2] that states that fibroids are the most common pelvic tumor and is found in 20%-40% of women of child-bearing age. The prevalence of uterine fibroids is also age dependent. In fact, it is equivalent to the effect of estrogen because the secretion of estrogen varies in different age groups. Our research indicated that highest prevalence (68.2%) of fibroids groups was found among women aged 36-45 years, and of lower prevalence (16.6%) among those aged < 35 years, and were the rarest among (15.2%) women aged ≥ 46 years. Our finding of women between 36-45 years being the most common group to develop uterine fibroids is in agreement with previous studies[27]. This demonstrates that age is a risk factor for uterine fibroids[27,28]. Uterine fibroids are estrogen-dependent, so decreased hormone levels in menopausal women may also explain the lower prevalence (15.2%) of fibroids in those aged above 46 years in the current study. Menstruation represents the periodic shedding of the endometrium that is influenced by various hormones. Early menarche may occur due to higher estrogen levels[29]. Earlier menarche indicates earlier initiation of ovulation and therefore a longer overall duration of exposure to estrogen and progesterone[30], which could explain our results that early menarche age (≤ 12 years, OR = 1.57, 95%CI: 1.16-2.12) is a risk factor for fibroids, a finding that has also been confirmed by previous studies[9,31]. Furthermore, our results indicate that higher parity was protective against uterine fibroids. There was an increase in uterine

fibroid prevalence with decreasing parity[26,32]. One hypothesis for this phenomenon suggests that the protective effect of pregnancy on fibroids occurs during the period of postpartum uterine involution, which resembles uterine remodeling. This process involves high rates of apoptosis and muscle cell contraction, both of which are necessary for regaining uterine size. Uterine remodeling appears to enhance the selective elimination of abnormal uterine cells, such as cells that form uterine fibroids[33]. Other reasons behind protective effect of pregnancy is the theoretical reduced exposure to physiological estrogen and progesterone.

Women with symptomatic uterine fibroids have a higher risk of endometriosis[34], nevertheless, our results suggests that endometriosis is a risk factor (OR = 20.3, 95%CI: 7.7-53.5) for uterine fibroids, which reflects mutual causality.

Earlier studies have revealed that women who have been diagnosed with bacterial vaginosis were more likely to have multiple instead of single fibroids[35]. This is consistent with our study that found a positive association between vaginitis (OR = 4.05, 95%CI: 3.26-5.04) and the risk of developing uterine fibroids.

The symptoms of genital tract infection are usually ignored by women as they are not inherently debilitating or obvious, however, long-term infection can trigger endometrial proliferation, resulting in uterine fibroids[36,37]. Early primiparous age (≤ 20, OR = 1.3, 95%CI: 1.01-1.68) has been associated with a significant increase in the prevalence of uterine fibroids. It is well known that the age of childbirth influences pregnancy outcomes. The reproductive age with the lowest risk of adverse pregnancy outcome (miscarriage, premature birth and stillbirth) is between 26 to 30 years old. Early ages of first childbirth places the fetus at risk of prematurity and stillbirth; and the mother at risk of gynecological diseases and cancer[38-40]. Other studies have shown that miscarriage significantly increases the risk of uterine fibroids[41,42]. Our study also correlates the presence of ovarian cysts (OR = 8.84, 95%CI: 4.72-16.53) and menstrual disorders (OR = 9.17, 95%CI: 4.59-18.33) to the prevalence of uterine fibroids. The ovary is a gonad responsible for secreting female reproductive hormones. Ovarian cysts often result in abnormal secretion of hormones that can induce the formation of uterine fibroids. Kato et al. identified that ovarian tumors possessing a functioning stroma correlated positively to higher serum estrogen levels[43]. Furthermore, Jiao et al. ascertained that an array of abnormally expressed genes present in patients with menstrual disorders were also found to be genes involved in the signaling pathways of oncogenesis[44].

# Conclusion

In brief, our data indicates that female reproductive diseases and earlier menarche are risk factors for uterine fibroids, while multiple parity provides protection from uterine fibroids. Therefore, in order to reduce the prevalence of female uterine fibroids and improve the reproductive health index, it is necessary to take preventive measures. The relevant medical and health departments advocate for rural women to seek healthcare services in a timely manner to avoid late detection of uterine fibroids. Factors to improve nutrition may also have a role in influencing the onset of menarche include nutrition, a highly modifiable

risk factor. The government should exert the 12-year compulsory education policy as soon as possible (every child can enjoy the state compulsory education until high school graduation). Children can learn more knowledge, starting the social work then, and getting married later, which can lest the primiparous age early. The current generation of parents should be responsible to the national two-child policy to avoid having too few children.

### Limitations

Significant limiting factors of our study are funding and human resources, which in turn stunted our ability to provide a more detailed classification of the various types of gynecological diseases. Findings of ultrasonographical examinations are operator-dependent, leading to the possibility of missing women with smaller intrauterine fibroids. Additionally, the sample size in this study were small as women who were able to be clinically examined were only from three villages. Further research involving larger sample sizes are necessary to validate the findings in this study.

## Declarations

### Conflict of interest

All authors declare no conflict of interest.

### Authors' contributions

Author Bing-Jie Wu designed the study, performed the statistical analysis, wrote the protocol and the first draft of the manuscript. Bing-Jie Wu, Fei Zhong, Xiu-Jun Zhang and Cheng-Yang Hu helped in designing data collection, in data interpretation and in manuscript content revision. Chun-Yan Shao, Yun Zhu, Kai Huang and Wu Wei all participated in the data collection. All authors read approved the final version of the article.

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### Ethical compliance

All the research procedures referring to interviewees which were scrupulously designed and implemented in the study conformed to ethical standards of the Anhui Science and Technology Department and the Research Ethics Committee of Anhui Medical University in June 2006 (#060230060).

### Informed consent

Every participant involved in the research gave informed consent.

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### Availability of data and material

The corresponding author is available for further clarification

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# Abbreviations

AOM: age of menarche.

PID: pelvic inflammation disease.

OR: odds ratio.

CI: confidence interval.

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# Tables

**Table1:** Multiple characteristics of 2,200 women and the distribution of uterine fibroids among variables

| Variables | Women without uterine fibroids n (%) | Women with uterine fibroids n (%) | $\chi 2$ | P-value |
|---|---|---|---|---|
| **Women's age** | | | 10.73 | **0.013<0.5** |
| ≤25 | 37(82.2%) | 8(17.8%) | | |
| 26~35 | 377(85.3%) | 65(14.7%) | | |
| 36~45 | 1124(78.9%) | 300(21.1%) | | |
| ≥46 | 222(76.8%) | 67(23.2%) | | |
| **Ethnic** | | | 0.000 | =1.0 |
| Han ethnicity | 1752 (80.0%) | 438 (20.0%) | | |
| Minority | 8 (80.0%) | 2 (20.0%) | | |
| **Occupation** | | | 3.41 | 0.065 |
| Farmer | 1658 (80.4%) | 404 (19.6%) | | |
| Others [a] | 102(73.9%%) | 36(26.1%) | | |
| **Education** | | | 9.95 | **0.007<0.05** |
| ≤Primary school | 1276(81.3%) | 293(18.7%) | | |
| Middle school | 446(77.7%) | 128(22.3%) | | |
| Middle school | 38(66.7%) | 19(33.3%) | | |
| **Marital status** | | | 4.40 | **0.036<0.05** |
| Married | 1702 (79.7%) | 432 (20.3%) | | |
| Unstable marriage status | 51(91.1%) | 5(8.9%) | | |
| **Yearly family income** | | | 2.14 | 0.343 |
| Less than 4999 RMB | 329 (82.7%) | 69 (17.3%) | | |
| 5000–9999 RMB | 627 (79.7%) | 160 (20.3%) | | |
| More than 10,000 RMB | 796 (79.3%) | 208 (20.7%) | | |
| **Age of menarche [b]** | | | 33.02 | **<0.001** |
| ≤12 | 172(70.8%) | 71(29.2%) | | |
| 13~16 | 1226(79.1%) | 323(20.9%) | | |
| ≥17 | 362(88.7%) | 46(11.3%) | | |
| **Parity [b]** | | | 13.10 | **0.001** |
| 0~1 | 87(71.3%) | 35 (28.7%) | | |
| 2~3 | 1476(79.7%) | 376(20.3%) | | |
| ≥4 | 197(87.2%) | 29(12.8%) | | |
| **Primiparous age [b]** | | | 13.11 | **0.001** |
| ≤20 | 313(75.4%) | 102(24.6%) | | |
| 21~25 | 1177(80.0%) | 295(20.0%) | | |
| ≥26 | 270(86.3%) | 43(13.7%) | | |
| **Vaginitis [c]** | 469(64.2%) | 262(35.8%) | 171.70 | **<0.001** |
| **Pelvic inflammation [c]** | 200(78.7%) | 54(21.3%) | 0.285 | 0.594 |

| | | | | |
|---|---|---|---|---|
| **Endometriosis** [c] | 5 (17.2%) | 24 (82.8%) | 72.53 | **<0.001** |
| **Ovarian cyst** [c] | 15 (32.6%) | 31 (67.4%) | 66.14 | **<0.001** |
| **Menstrual disorder** [c] | 12 (31.6%) | 26 (68.4%) | 56.83 | **<0.001** |
| **Dysmenorrhea** [c] | | | 1.36 | 0.507 |
| No | 1041(80.1%) | 259(19.9%) | | |
| Mild | 602(80.6%) | 145(19.4%) | | |
| Severe | 117(80.0%) | 36(23.5%) | | |

Values(P<0.05) in bold mean they are statistically significant.

[a] Including workers, businessmen, and waitress and so on.

[b] Belong to female physiology characteristic

[c] Female reproductive diseases

**Table2:** Risk factors for uterine fibroids in demographic characteristics

| ariables | Total sample n (%) | Uterine fibroids n (%) | OR (95%CI) |
|---|---|---|---|
| **omen's age** | | | |
| ≤25 | 45(2.0%) | 8(1.8%) | 1.25(0.56-2.81) |
| 26~35 | 442(20.1%) | 65(14.8%) | Ref. |
| 36~45 | 1424(64.7%) | 300(68.2%) | **1.55(1.16-2.07)** |
| ≥46 | 289(13.1%) | 67(15.2%) | **1.75(1.20-2.56)** |
| **thnic** | | | |
| Han ethnicity | 2190(99.5%) | 8(99.5%) | Ref. |
| Minority | 10(0.5%) | 2(0.5%) | 1.00(0.21-4.73) |
| **ccupation** | | | |
| armer | 2062(73.7%) | 404(91.8%) | Ref. |
| thers[a] | 138(6.3%) | 36(8.2%) | 1.45(0.98-2.15) |
| **lucation** | | | |
| Primary school | 1569(73.1%) | 293(66.6%) | 0.8(0.63-1.01) |
| Middle school | 574(26.1%) | 128(29.1%) | Ref. |
| Middle school | 57(2.6%) | 19(4.3%) | 1.74(0.97-3.13) |
| **arital status** | | | |
| Married | 2144(97.5%) | 435(98.9%) | Ref. |
| Unstable marriage status | 56(2.5%) | 5(1.1%) | 0.39(0.15-1.03) |
| **early family income** | | | |
| Less than 4999 RMB | 398(18.1%) | 79(15.8%) | 0.80(0.59-1.09) |
| 000–9999 RMB | 787(36.0%) | 160(36.6%) | 0.98(0.78-1.23) |
| More than 10,000 RMB | 1004(45.9%) | 208(47.6%) | Ref. |

OR: odds ratio; CI: confidence interval.

Values(P<0.05) in bold mean they are statistically significant.

[a]Including workers, businessmen, and waitress and so on.

**Table3**. Risk factors for uterine fibroids in physiological characteristics and reproductive diseases.

| Variables | Total sample n (%) | Uterine fibroid | |
|---|---|---|---|
| | | n (%) | OR (95%CI) |
| **Age of menarche** [b] | | | |
| ≤12 | 243(11.0%) | 71(16.1%) | **1.57(1.16-2.12)** |
| 13~16 | 1549(70.4%) | 323(73.4%) | Ref. |
| ≥17 | 408(18.5%) | 46(10.5%) | **0.48(0.35-0.67)** |
| **Parity** [b] | | | |
| 0~1 | 122(5.5%) | 35(8.0%) | **1.58(1.05-2.37)** |
| 2~3 | 1855(84.3%) | 377(85.7%) | Ref. |
| ≥4 | 223(10.2%) | 28(6.3%) | **0.56(0.37-0.85)** |
| **Primiparous age** [b] | | | |
| ≤20 | 415(18.9%) | 102(23.2%) | **1.36(1.05-1.75)** |
| 21~25 | 1472(66.9%) | 295(67.0%) | Ref. |
| ≥26 | 313(14.2%) | 43(9.8%) | **0.59(0.42-0.85)** |
| **Vaginitis** | | | |
| No | 1469(66.8%) | 178(40.5%) | Ref. |
| Yes | 731(33.2%) | 262(59.5%) | **4.05(3.26-5.04)** |
| **Pelvic inflammation** | | | |
| No | 1946(88.45%) | 386(87.73%) | Ref. |
| Yes | 254(11.55%) | 54(12.27%) | 1.09(0.79-1.50) |
| **Endometriosis** | | | |
| No | 2171(98.7%) | 416(94.5%) | Ref. |
| Yes | 29(1.3%) | 24(5.5%) | **20.3(7.68-53.4)** |
| **Ovarian cyst** | | | |
| No | 2153(97.9%) | 408(92.9%) | Ref. |
| Yes | 46(2.1%) | 31(7.1%) | **8.84(4.73-16.53)** |
| **Menstrual disorder** | | | |
| No | 2161(98.3%) | 413(94.1%) | Ref. |
| Yes | 38(1.7%) | 26(5.9%) | **9.17(4.59-18.33)** |
| **Dysmenorrhea** | | | |
| No | 1300(59.0%) | 259(58.8%) | Ref. |
| Mild | 747(34.0%) | 145(33.0%) | 0.97(0.77-1.21) |
| Severe | 153(7.0%) | 36(8.2%) | 1.24(0.83-1.84) |

OR: odds ratio; CI: confidence interval.

Values(P<0.05) in bold mean they are statistically significant.

[b] Belong to physiological characteristics

## Supplementary Files

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