

Assessment of Sleep Quality in Women with Endometriosis in Bangladesh

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A thesis submitted to the Department of Biotechnology in partial fulfillment of the requirements
for the degree of Bachelor of Science in Biotechnology

Biotechnology
BRAC University
January, 2026

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Declaration

It is hereby declared that

1. The thesis submitted is our original work while completing my degree at BRAC University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. I have acknowledged all main sources of help.

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Abstract

Endometriosis is a chronic gynecological condition affecting approximately 10% of women of reproductive age worldwide. Emerging evidence suggests a strong correlation between endometriosis and poor sleep quality, which can significantly impact a patient's overall health and well-being. However, no such studies have been conducted in Bangladesh. This research addresses a critical gap by exploring sleep quality in Bangladeshi women diagnosed with endometriosis. A cross-sectional descriptive study was conducted from June 2024 to October 2025 at Kurmitola General Hospital in Dhaka, Bangladesh. A total of 401 reproductive-aged women (15–45 years), among whom 201 were clinically diagnosed with endometriosis and confirmed by ultrasonography or laparoscopy, were recruited based on availability. Data were gathered using a structured questionnaire developed in consultation with three gynecologists, including demographic details, clinical symptoms, and the Pittsburgh Sleep Quality Index (PSQI). Data analysis was performed using SPSS version 27, employing independent t-tests, Chi-square tests, and, with a P-value < .05, considered statistically significant. Based on the data, a significant number of women with endometriosis experience poor sleep quality. The mean global PSQI (Pittsburgh Sleep Quality Index) score indicated an overall poor sleep quality. Specific areas affected include increased sleep latency (mean = 2.06 ± 1.03) and reduced sleep duration and efficiency. Moreover, symptoms such as dyspareunia, dysmenorrhea, excessive bleeding, and pelvic pain were significantly associated with poor sleep quality. These findings suggest a strong link between endometriosis-related symptoms and impaired sleep, highlighting the importance of addressing sleep disturbances in the clinical management of endometriosis.

Keywords: Endometriosis, Reproductive Health, PSQI, Sleep Quality.

Dedication

First and foremost, I want to thank Almighty Allah, who has blessed me with everything. I also dedicate this work especially to my parents, who always supported me in difficult times and sacrificed so much for my future. I also thank my two senior sisters for their constant support and inspiration since childhood. Last but not least, to all the women who are suffering from reproductive health issues in Bangladesh

Muhammad Muztoba

June, 2024

“I would like to dedicate this work to the improvement of treatment and awareness of women's reproductive health issues in Bangladesh. Furthermore, I'd like to thank my parents for their support, and my friends who never failed to uplift and support me.”

Mubashira Marzan

September, 2024

Acknowledgement

We would like to express our profound gratitude to Dr. Munima Haque, Associate Professor and Program Director, Department of Mathematics and Natural Sciences, BRAC University, who served as our thesis supervisor, and her invaluable guidance, constructive feedback, and continuous academic support throughout the course of this research. Her encouragement and supervision played a vital role in the successful completion of this study.

We would also like to convey our deep appreciation to Dr. Sanowara Imam Lipi, an experienced specialist in Gynecology and Obstetrics, who has served at Kurmitola General Hospital (KGH) and Bangabandhu Sheikh Mujib Medical University (BSMMU). We are extremely grateful to her for her kind cooperation, expert guidance, and unwavering support during patient observation and data collection. Her professional insights, clinical expertise, and willingness to guide us throughout the study greatly enriched the quality and integrity of this research.

Finally, we would like to express our sincere appreciation to all faculty members, hospital personnel, and staff of Kurmitola General Hospital and BRAC University who directly or indirectly supported the successful completion of this thesis. Their cooperation and assistance were invaluable throughout the research process. This study significantly strengthened our research understanding and created an important impact in the research field. As students of biotechnology, this research experience was particularly meaningful as it allowed us to apply academic knowledge to a real clinical context.

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List of Acronyms

WHO - World Health Organization

AFAB - Assigned Female At Birth

BMI - Body Mass Index

rASRM - American Society for Reproductive Medicine

BSMMU - Bangabandhu Sheikh Mujib Medical University

DGO - Diploma in Gynecology and Obstetrics

KGH - Kurmitola General Hospital

PSQI - Pittsburgh Sleep Quality Index

QoL - Quality of Life

SD - Standard Deviation

CBTI - Cognitive Behavioral Therapy for Insomnia

CI - Confidence Interval

HPA Axis - Hypothalamic–Pituitary–Adrenal Axis

SDG - Sustainable Development Goals

WERF - World Endometriosis Research Foundation

Chapter 1: Introduction

Endometriosis is a complex chronic inflammatory disorder observed in women and girls of reproductive age, predominantly affecting the pelvic tissue along with the ovaries, primarily identified by the presence of endometrial tissue outside of the uterine cavity, the manifestation of which is found in the forms of chronic pelvic pain and infertility [1]. Approximately 176 million women worldwide suffer from endometriosis, about 50% of whom experience infertility because of it, making endometriosis a disease with high prevalence [2].

Although there is a high prevalence of this disease, detection of endometriosis can take between 4 to 11 years, as a consequence of initial misdiagnosis seen in the case of 65% of women [2]. There are myriad multifaceted reasons as to why the proclivity toward misdiagnosis or lack of early recognition is such a prominent factor. It needs to be noted that, in many cases, particularly pertaining to young girls or teenagers, symptoms delineating endometriosis seem to be met with skepticism, which ultimately delays the detection of the disease, making the whole diagnostic process needlessly difficult [3]. Additionally, a further challenge to early diagnosis might be posed by the requirement for surgical diagnosis to identify lesions rather than focusing on the symptoms of the individuals [2].

Endometriosis continues to be an enigmatic disease even in terms of the interrelationship between the symptoms that a patient suffers from and the severity or extent of the disease itself [4, 5]. These symptoms include dysmenorrhea, dyspareunia, pelvic pain of varying degrees, lower back pain, etc. Although, some patients might remain asymptomatic [4]. Since the understanding of the nature of this disease still remains incomplete, there is no definitive cure for endometriosis, thus providing an ample opportunity to explore the effects of other factors such as certain lifestyle choices on the state of endometriosis [6]. Some of the symptoms associated with

endometriosis such as dysmenorrhea, hormonal imbalance, and general pain may contribute to disruptions in maintaining a healthy lifestyle, including having healthy sleeping patterns [7]. One study conducted through the use of questionnaires showed that among the patients suffering from endometriosis, there seemed to be higher scores on the Insomnia Severity Index and the Epworth Sleepiness Scale [8]. As a result of sleep disturbances and insomnia, these patients suffering from endometriosis seemed to experience more fatigue, pain, and discomfort alongside facing difficulties in functioning normally during the daytime [9, 10]

The complex nature of endometriosis incentivizes the need to take a broader perspective when it comes to understanding not only the nature of the disease itself but also the types of impact it has on the individuals suffering from it. This study aims to identify the potential connection between endometriosis and sleep quality in patients, with a view to adding a nuanced aspect to understanding the disease and its effects on an individual's quality of life. Despite endometriosis being a prevalent health condition among women of reproductive age in Bangladesh, to this date, no study has been conducted to examine the association between sleep quality and its impact on endometriosis.

A cross-sectional study will be conducted on women of reproductive age with the aid of the "Pittsburgh Sleep Quality Index (PSQI)" questionnaire form. The PSQI is a standardized method of assessing the sleep quality of patients via self-reporting, and it relies on a scoring method to distinguish between the variety of sleep quality [11]. The ultimate goal of this study is to assess the interplay between sleep quality and endometriosis and to identify potential connections between these two factors. The potential connections that might be made through this assessment

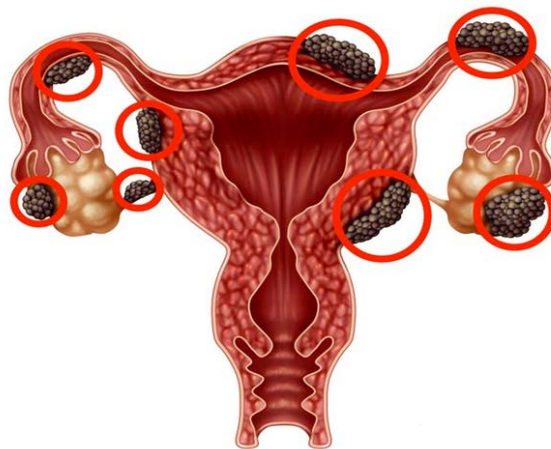
should provide us with much clarity regarding the effects of one's sleep quality on their struggle with endometriosis and thus make way for exploring the implementation of lifestyle changes when it comes to dealing with and possibly alleviating symptoms of endometriosis.

Chapter: 2

Endometriosis and its Effect on Sleeping Quality

2.1 What is Endometriosis

Endometriosis is a chronic gynecological condition where tissue composed of the lining inside the uterus, called the endometrium, starts to grow outside the uterus [12]. This unusual growth can occur on the ovaries, fallopian tubes, the exterior surface of the uterus, and other units within the pelvic area. Endometriosis is connected with significant pain, particularly during menstruation, and this can lead to some serious fertility issues. The particular cause of endometriosis is yet to be researched, but this involves a complex interaction of genetic, hormonal, and immunological factors [13, 14]. Endometriosis can start at a person's first menstrual period and last until menopause. In most cases, endometriosis patients do not have any symptoms. There is no complete cure of this disease and no certainty that it will not return after treatment.



**Figure 1: A graphic representation of endometriosis in the Female Reproductive system
(Insider, 2020)**

2.2 Types of Endometriosis

Endometriosis can be categorized into several types based on the area and typical features of the endometrial-like tissue growth. The main types are listed below:

2.2.1 Superficial Peritoneal Endometriosis

One of the most common types of endometriosis is where the endometrial-like tissue grows on the peritoneum, the thin layer lining the pelvic cavity [15, 16]. Recent research demonstrated a more complicated genesis with prospects in the pelvic region during this backward movement, like inflammation or immune system changes per chance influencing the cells to implant and develop. Other hypotheses propose that endometriosis develops during embryonic development (Müllerian theory) or when normal cells transform into endometrial-like tissue (coelomic metaplasia). Despite these beliefs, it is considered that each incidence of endometriosis may have a distinct origin [17]. Peritoneal endometriosis can cause different types of symptoms, including deep pain in the genitals, defecation pain, chronic pelvic pain, and menstrual cramps. Symptoms can be severe and influence the ability to work or maintain a normal routine. Moreover, pelvic pain and pain experienced during sexual intercourse affect both emotional and sexual health. Multiple treatment options, including hormone therapy and surgery, are available for future aspirations for the body [18].

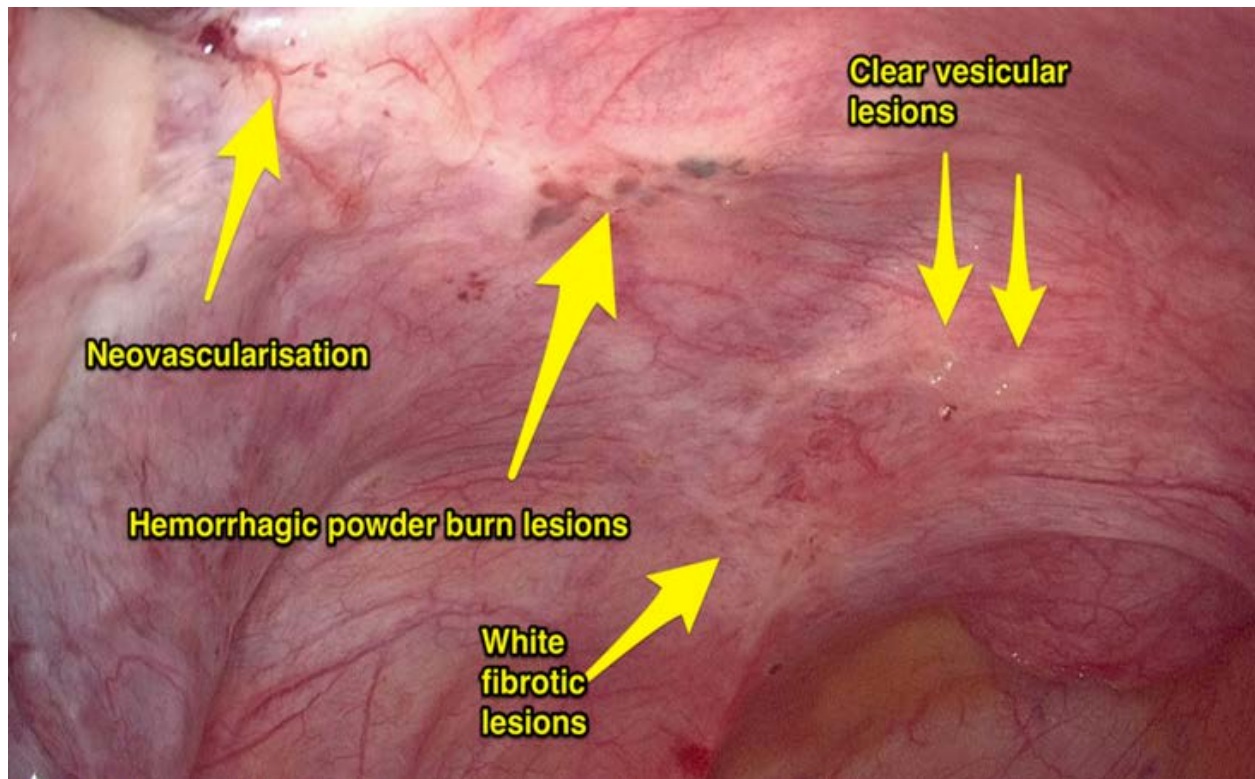


Figure 2: Different presentations of subtle peritoneal endometriosis (Endometriosis, 2020)

2.2.2 Ovarian endometriomas (Endometriotic Cysts):

Ovarian Endometriomas are cysts that form on the ovaries when endometrial tissue grows within the ovarian tissue, forming a cyst filled with old blood. This type of endometriosis is also known as a chocolate cyst [19].

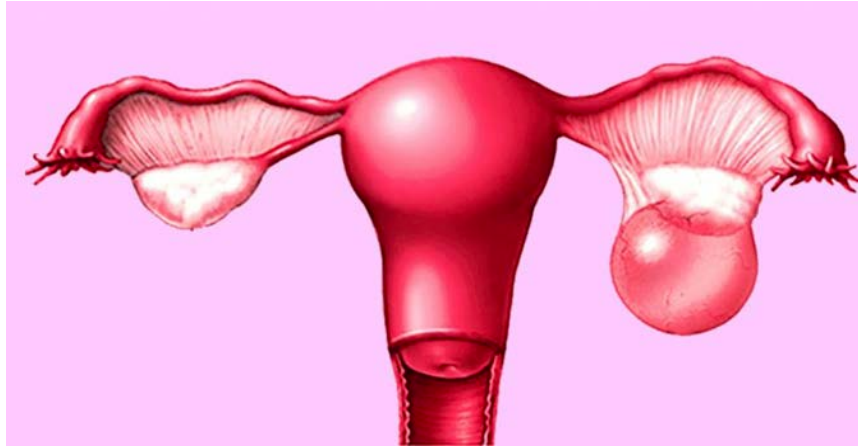


Figure 3: Illustration of a chocolate cyst. (Fertijin, 2024)

The widely-accepted idea is that endometriosis occurs when some of the endometrial-like tissue that is shed during menstruation flows backward. Instead of exiting the body through the vagina, some of the tissue returns through the fallopian tubes into the ovaries. As a result, during each menstrual cycle, when the body releases the hormones that cause the uterine lining to bleed, the foreign tissue also bleeds. Over time, the menstrual blood and the inflammatory tissue surrounding it can potentially develop into an ovarian endometrioma [20]. The size of the cyst does not influence the severity or existence of symptoms. Those with a little cyst may have symptoms; on the other hand, someone with a significantly larger cyst may not. Cysts can be 2 to 20 centimeters in size. Ovarian endometriomas have different types of symptoms, such as unpleasant and painful menstrual cramps, pelvic pain, irregular menstrual cycle, and pain during sexual intercourse. If a chocolate cyst ruptures, it can produce considerable abdominal pain on the affected side of the body. Furthermore, such a ruptured cyst might require immediate medical

attention. It is really important to get medical assistance immediately if these symptoms are shown [21].

2.2.3 Deep Infiltrating Endometriosis (DIE):

Deep Infiltrating Endometriosis is a more severe form where endometrial tissue invades deeply into the tissues of the pelvic region, like the bowel, bladder, and uterosacral ligaments [22]. Different authors offer various definitions for deep infiltrating endometriosis (DIE); some describe it as endometriotic lesions extending more than 5 mm beneath the peritoneal surface. On the other hand, others refer to it as "adenomyosis externa." The 5 mm criterion helps identify slightly deeper classic lesions. This is known as type I lesions. A more comprehensive definition of DIE could be adenomyosis externa. This is characterized by singular large lesions, typically larger than 1 cm in diameter, not only that, but also classified as type II and III lesions. A recent Cochrane meta-analysis provides another perspective, which certainly defines DIE as the infiltration of fibrous and muscular tissue in organs and anatomical structures affected by endometriosis, including endometrial tissue, without specifying the depth of lesion penetration under the peritoneum [23]. Managing deep-infiltrating endometriosis can be difficult because of its aggressive nature. As a result, determining the best treatment approach for affected women poses challenges. The management of this condition hinges on factors such as the stage of endometriosis, symptom severity, the patient's medical history, and personal preferences. Some difficulties encountered in managing deep-infiltrating endometriosis include assessing its severity and planning appropriate management strategies. Furthermore, an incorrect diagnosis could result in unnecessary or ineffective surgeries. Lastly, successfully managing deep

endometriosis necessitates the involvement of a multidisciplinary team both in and out of the operating room [24].

2.2.4 Adenomyosis:

This type of endometriosis is technically not endometriosis, but adenomyosis includes the presence of endometrial tissue within the muscular wall of the uterus, causing enlargement and painful menstrual periods [25]. Adenomyosis occurs when tissue resembling the endometrium grows into the myometrium, the muscular wall of the uterus, resulting in thickening and enlargement of the uterus, which in some cases may double or even triple in size (Leyendecker et al., 2009). Abdominal/pelvic pain, heavy or extended menstrual bleeding with clots, and painful menstrual cramps are all possible side effects of adenomyosis. Because adenomyosis doesn't often cause distinguishable symptoms, many women and those who were designated female at birth (AFAB) could be unaware that they have the disorder [26]. It is uncertain how common adenomyosis is exactly. But scientists are aware that it occurs more frequently in those who have undergone uterine surgery. are more than 40 years old.

2.3. Classification of Endometriosis

There are numerous ways to categorize endometriosis; most of them are now regarded as an acceptable standard. The classification used by the American Society for Reproductive Medicine (ASRM) is the most popular. In this method, the sizes of the lesions of endometriosis were calculated by summing them. This classification scheme was renamed in 1996 as the revised American Society for Reproductive Medicine (rASRM). According to rASRM, endometriosis can be classified as:

Table 1: rASRM Endometriosis Classification Table

Stage	Lesions size
Mild	1-5
Moderate	6-5
Sever	16-40
Extensive	More then 40

Austria adopted another classification of endometriosis in 2005 known as the Enzian classification. The degree of endometriosis found during surgery determines the score, considering both the existence of the lesion and the depth of the invasion. The Enzian classification specifies the degree of the lesion as well as the location of foci in various anatomical compartments [56]

Table 2: Enzian Classification Table

location of foci	Severity of the lesion:
Compartment A-has foci in the rectovaginal septum and vagina.	Grade 1: Invasiveness < 1 cm.
Compartment B-contains foci in the sacro-uterine ligaments up to the pelvic walls.	Grade 2: Invasiveness 1 to 3 cm.
Compartment C-contains foci in the sigmoid colon and rectum.	Grade 3: Invasiveness > 3 cm.

Table 2: Enzian Classification Table

2.4. Symptoms of Endometriosis:

The following symptoms are the most observed in the manifestation of the disease [57]

- Dysmenorrhea, or severe discomfort throughout the menstrual cycle
- Dyspareunia, or pain experienced during sexual intercourse
- Dyschezia, or pain during defecation during a menstrual cycle.
- Dysuria, or pain or burning sensation experienced during urination during a menstrual cycle
- Polymenorrhea, or frequent and/or heavy menstrual bleeding.
- Pelvic pain
- Pain in the lower back.
- Stress and exhaustion.

2.5. Risk factors of Endometriosis:

Although the exact cause of endometriosis is unknown, several possible risk factors have been identified:

- **Retrograde menstruation:** Instead of exiting the body, menstrual blood containing endometrial cells flows back through the fallopian tubes into the pelvic cavity. These cells stick to the pelvic organs and walls, growing thicker and bleeding with each menstrual cycle. They are called "chocolate cysts" because their color resembles chocolate [28].
- **Early menstruation or late menopause:** Starting periods at a young age or going through menopause at an older age can be a factor [58].
- **Menstrual cycle characteristics:** Having a menstrual cycle shorter than 27 days or a flow lasting more than seven days can increase risk [59].
- **History of Infertility in the Family:** Having a close relative (mother, aunt, or sister) with infertility increases the risk of endometriosis. The condition often runs in families and affects certain ethnic groups more than others [60].
- **Surgical Scar Implantation:** Endometrial cells may attach to surgical incisions after procedures like hysterectomy or C-section.
- **Extended absence of periods:** Not having a period for a long time can contribute to the risk.
- **High estrogen levels:** Elevated estrogen levels promote the growth of endometrial tissue.

- **Immune system disorders:** Problems with the immune system may prevent the body from recognizing and destroying endometrial-like tissue outside the uterus.
- **Body mass Index:** Some studies suggest that having a lean body mass or low body fat may increase the risk of endometriosis [61].

2.6 Diagnosis:

Accurate and early diagnosis is crucial to determine the most suitable treatment plan. Both underdiagnosis and overdiagnosis of endometriosis have serious repercussions: underdiagnosis can prevent patients from receiving necessary therapeutic intervention, while overdiagnosis can result in unwarranted treatments that come with considerable side effects and risks. Moreover, the term "endometriosis" carries substantial negative connotations, and an incorrect diagnosis can lead to unnecessary stigmatization of the patient. Endometriosis is rarely detected during initial history-taking or routine physical examination (Eskenazi and Warner, 1997). The primary purpose of clinical assessment is to identify people who are at high risk for endometriosis and determine who needs further testing. This approach is critical for two reasons: first, a complete examination is more relevant for patients with symptoms. Second, given the inherent limitations in diagnostic specificity, focusing on at-risk populations reduces the possibility of false-positive results [29]. A physical diagnosis is often most informative when conducted while the patient is experiencing symptoms. Therefore, examining menstruation can be optimal for identifying and localizing areas that may have endometriosis [30]. Endometriosis in non-reproductive organs can be diagnosed through a general physical examination, which is often ineffective unless the patient has cyclic symptoms that point to endometriosis. Tenderness in the abdomen may be present, but it is usually diffuse and deep. In some cases, endometriosis is sometimes associated

with ascites and in rare cases of superficial endometriosis, such as in a post-cesarean section scar, localized tenderness and swelling may be observed. Endometriomas can be detected as tender or nontender adnexal masses fixed to the uterus or pelvic side wall, as well as tender masses, nodules, and fibrous tissue. The external genitalia and vaginal surface usually appear normal during a pelvic examination, but positive findings are more commonly found during a digital examination of the pelvic structures [31]. Pelvic pain is a common symptom in women with endometriosis, but it is insufficient to identify the condition because it can be caused by a variety of gynecologic and nongynecologic disorders. Pelvic discomfort that is chronic, cyclic, persistent, or worsens with time is more likely to be caused by endometriosis. Initially, this discomfort appears as menstrual pain (dysmenorrhea), but it can progress to nonmenstrual pelvic pain, which is frequent in women with endometriosis.

Moradi et al. conducted a qualitative study in which participants consistently rated their endometriosis-related pain as "severe and progressive during both menstrual and nonmenstrual phases." Women with endometriosis are also more prone to experience dyspareunia, dyschezia, and dysuria than those without it. Although the sensitivity of dyspareunia is generally low, indicating that its presence is not specific to endometriosis, deep dyspareunia is associated with deep endometriosis [32]. Thickening and stiffness of the uterosacral ligaments, pain during the movement of the uterus, larger adnexal masses, and fixation of the adnexa or uterus in a retroverted posture are all typical gynecologic symptoms strongly associated with endometriosis. Scarring of the ipsilateral uterosacral ligament and cervical stenosis are also common causes of cervical displacement. These results, however, can be seen in other gynecologic illnesses such as pelvic inflammatory diseases, abscesses, and hematomas [33].

2.7 Treatment

Medical treatments for endometriosis often try to alter the hormonal regulation of the menstrual cycle, resulting in circumstances such as pseudo-pregnancy, pseudo-menopause, or prolonged anovulation. These treatments are expected to generate an environment less conducive to the formation and permanence of endometrial tissue, including endometriosis implants [34]. Progestational drugs are frequently given to treat endometriosis because they cause decidualization and eventual shrinkage of endometrial tissue. Common adverse effects of these medicines include irregular uterine bleeding, nausea, feeling of discomfort in the breast tissue, fluid retention, and depression, which usually go away once the prescription is stopped. Medroxyprogesterone acetate is the most commonly used progestin for the treatment of endometriosis [39]. In the United States, the normal dosage ranges from 20 to 30 mg daily for up to six months, although European trials have indicated efficacy at 100 mg daily, with a comparable side-effect profile [36]. Danazol, an isoxazole derivative of 17α -methyltestosterone, reduces the midcycle spike in luteinizing hormone secretion, inhibits enzymes in the steroidogenic pathway, and increases blood-free testosterone levels [37]. Endometriosis is often treated with a daily dosage of 600 to 800 mg. These dosages, however, can induce substantial androgenic side effects, including increased hair growth, mood changes, potentially irreversible deepening of the voice, deleterious effects on serum lipids, and, in rare circumstances, irreversible and fatal liver damage. However, studies conducted on lower doses have often been limited or lacking in control [35]. A variety of hormones and drugs have been tried for the treatment of endometriosis. Some, like estrogen and methyltestosterone, were discontinued due to their side effects. Others include tamoxifen, clomiphene, and the anti progestational drug mifepristone. Pentoxifylline, an immunomodulator, showed significant potential in animal

studies but was ineffective in a small human trial [38]. Future research is likely to focus on GnRH antagonists, selective estrogen-receptor modulators, new generations of progesterone-receptor antagonists, and aromatase inhibitors. Surgical treatment is a common approach for managing endometriosis. Conservative surgery aims to remove visible endometriosis from the abdomen and pelvis while preserving normal anatomical structures. In contrast, definitive surgery is more extensive, involving the removal of not only endometriosis but also the ovaries and sometimes the uterus [39]. When opting for conservative surgery, several decisions are necessary, including choosing the best method for accessing the affected areas, selecting appropriate instruments, and determining the technique for treating endometriosis implants. Access to the abdomen and pelvis can be achieved through either laparotomy or laparoscopy. These two methods have been compared in several hundred women across four cohort studies, all of which found no significant difference in the effectiveness of the open and endoscopic approaches [40].

2.8 Complications

Endometriosis surgery, whether performed by laparoscopy or laparotomy, can result in a variety of intestinal problems that can occur immediately or later. Complications may include intestinal anastomotic dehiscence, rectovaginal fistula, anastomotic hemorrhage, intra-abdominal and wound infections, bowel stricture, intestinal obstruction, chronic constipation, or diarrhea [48]. Women with endometriosis are at a statistically significantly higher risk of experiencing various complications during pregnancy, including preterm birth (PTB), miscarriage, placenta previa, small for gestational age (SGA) infants, and an increased likelihood of cesarean delivery. This information is crucial for both women with endometriosis and their healthcare providers, as it

can guide the management of these pregnancies. Awareness of these heightened risks allows for more informed decision-making and potentially closer monitoring throughout the pregnancy. Given these elevated risks, it is important to consider whether standard pregnancy monitoring protocols are sufficient for women with endometriosis or if adjustments are necessary to address their unique needs. Further research is needed to determine if modifications to conventional monitoring practices could improve outcomes for these patients. This could include more frequent ultrasounds, specialized assessments, or tailored care plans that address the specific complications associated with endometriosis. Understanding these risks and implementing appropriate management strategies could ultimately enhance the safety and well-being of both the mother and the baby [49]. The most commonly reported perioperative complication was the requirement for blood transfusion, which occurred in 11 instances (0.9%). The next most prevalent concern was venous thromboembolism, which impacted four patients (0.3%). In six cases (0.5%), the surgery had to be converted to a laparotomy; two of these conversions were owing to complications, while four were caused by technical difficulties. Six of the eight problems were handled laparoscopically, with only four requiring multidisciplinary consultation [50]. In addition, endometriosis-related complications may occur during pregnancy. More frequently, this kind of event happens in the second month of pregnancy and may represent life-threatening conditions for both the mother and the fetus [8]. Other complications are copious bleeding. It was identified as either varicosities on the uterine surface, blood vessels within the parametrium, or obvious pelvic endometriotic lesions. The majority of cases (89.7%, 35/39) occurred during pregnancy, at an average gestational age of 28 weeks (standard deviation 7.1 weeks). Postpartum hemorrhage was seen in 16% of instances, usually within two weeks following delivery. Two patients who developed SH in the third trimester relapsed at 12 and 30

days postpartum. At the time of bleeding, a considerable proportion of patients (69.3%, 27/39) had signs and symptoms of hypovolemic shock. The underlying cause of the hemorrhage was typically discovered during emergency abdominal surgery. However, one hemodynamically stable patient was treated conservatively, without surgery [51].

2.9. Epidemiology:

Endometriosis is a chronic gynecological condition where endometrial-like tissue grows outside the uterus, causing inflammation, pain, and scar tissue formation. It affects about 10% of women of reproductive age worldwide, with around 176 million women globally suffering from the condition. Symptoms often start in adolescence and are most common in women in their 30s and 40s. Diagnosis is typically delayed by 7 to 10 years due to the normalization of menstrual pain and lack of awareness [12]. Risk factors include genetic predisposition, menstrual factors, nulliparity, anatomical abnormalities, and environmental factors. Symptoms include pelvic pain, chronic pain, dyspareunia, dysuria, dyschezia, and infertility. Endometriosis has a point prevalence of 10.8 per 1000 [$n = 6146$, mean age 40.4 ± 8.0 years (SD)]. Women aged 40 to 44 had the greatest prevalence rate of 18.6 per 1000 (95% CI 17.7-19.5). Infertility was reported in 37% of patients. The research comprised 6045 patients with newly diagnosed endometriosis (mean age 34.0 ± 8.1 years), with an average annual incidence rate of 7.2 per 10,000 (95% CI 6.5-8.0) [41].

Endometriosis significantly impacts the quality of life and mental health and imposes a substantial economic burden. Diagnosis involves clinical evaluation, imaging, and laparoscopy. Management includes medical treatment, surgical intervention, and a multidisciplinary approach. Due to its prevalence and impact, increased awareness, timely diagnosis, and effective

management are crucial. Ongoing research into its causes and treatments is essential for improving outcomes. Several reproductive characteristics have been consistently linked to endometriosis risk, implying that hormone variation may play a substantial role in endometriosis development. For example, early menarche age and short menstrual cycle duration are related to an elevated risk, but parity and current oral contraceptive use are associated with a lower risk. Circulating estradiol and estrone, which stimulate ectopic and eutopic endometrial tissue, are higher in women who reach menarche earlier and in nulliparous women. Though not a reproductive risk factor, a consistent inverse relationship has been identified between body mass index (BMI) and endometriosis, which could be attributed to hormonal variations between overweight and thin women [42].

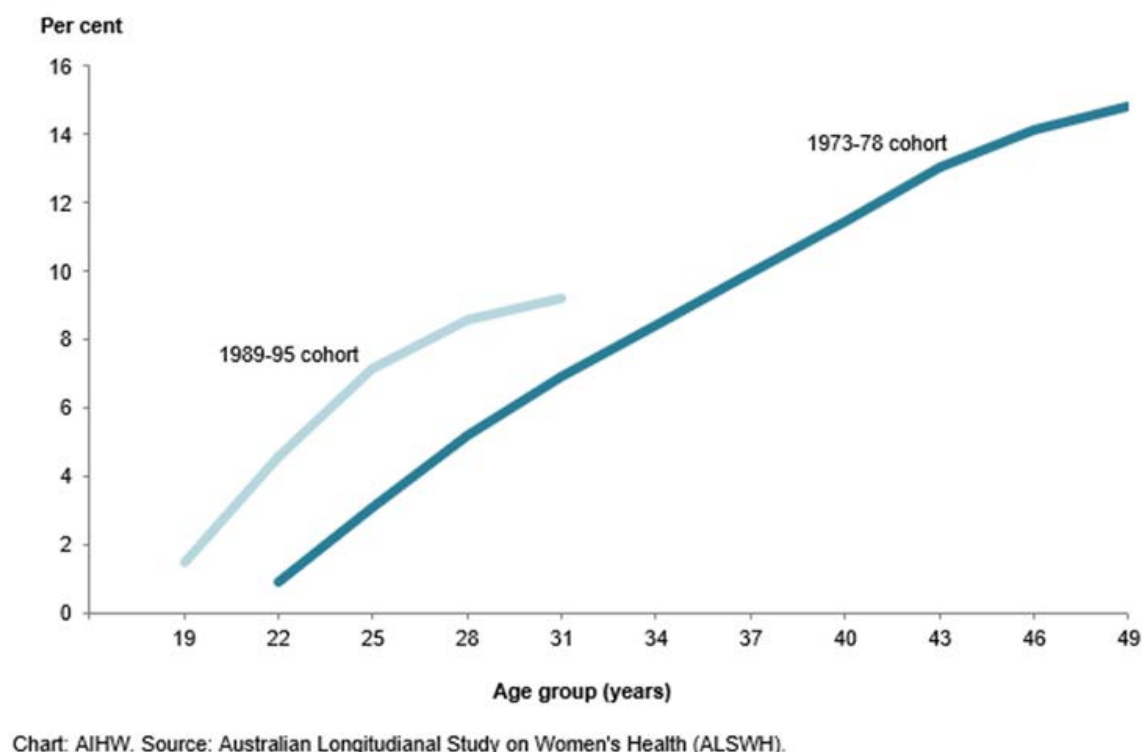


Figure 4: Cumulative incidence of endometriosis, by cohort and age

The Australian Longitudinal Study on Women's Health found that the incidence of endometriosis varies with cohort. By the ages of 44 to 49, 14% of women born between 1973 and 1978 had been diagnosed with endometriosis, with 7.6% surgically proven and 6.6% clinically suspected. In contrast, among individuals born between 1989 and 1995, 8.8% were diagnosed by the ages of 26 and 31, with 3.8% confirmed surgically and 5.0% clinically suspected. Incidence rates rise with age, indicating increased diagnostic changes over time. The younger cohort had a higher peak incidence at age 22 than the older cohort at age 25, which could be attributed to greater awareness and diagnostic techniques [43].

2.10. Sleep Quality

When it comes to sleep, quantity is crucial, but so is quality. Most adults require between seven to nine hours of sleep every night to feel well rested; however, the quality of the sleep achieved during those hours may vary greatly. The quality of sleep guarantees the necessary physical, mental, and emotional advantages of sleep. Sleep quality, like sleep duration, sleep contentment, and sleep consistency (regularity), is an important aspect of sleep health [44]. Sleep quality is an important construct for physicians and researchers because of the significant prevalence of disrupted sleep and insomnia, as well as the evident link between sleep quality and optimal health and performance. Despite its widespread use, the phrase "sleep quality" lacks a clear meaning [45]. The definition of sleep quality may certainly range from person to person. For people who have difficulty falling asleep, the sleep onset period may be the most important predictor of sleep quality. In contrast, the relative difficulty of falling asleep may be irrelevant to someone whose sleep is disturbed and interrupted by frequent awakenings. Sleep latency, which

gauges how long it takes to fall asleep after going to bed; awakenings, which indicates how often one wakes up during the night; wake after sleep onset, which measures the amount of time someone is awake after falling asleep; and sleep efficiency, which gauges how productive sleep is in relation to time spent in bed, are the four main components of assessing the quality of sleep. Sleep quality is frequently documented in sleep diaries and is regarded as a vital indicator, which is the major topic of this article. Several possible objective measurements are investigated, including polysomnography, cyclic alternating pattern, and actigraphy. The article addresses these measures' benefits and limitations, as well as the difficulties in constructing an objective measure that accurately correlates with subjective "sleep quality" assessments. These assessments may be impacted by things other than sleep, such as mood or overall health, and may represent various aspects of sleep to different people. To overcome these issues, the innovative approaches, such as: (1) integrating diverse measurement types; (2) categorizing individuals based on clinical or physiological features to produce tailored measures for each subgroup; and (3) subgrouping depending on how potential measures correlate with quality ratings over multiple nights (Krystal and Edinger, 2008). When taken as a whole, these metrics provide insightful information on a person's sleep habits and general quality of sleep, which helps with the diagnosis and treatment of sleep-related problems. The Pittsburgh Sleep Quality Index (PSQI) is a self-rated questionnaire designed to assess sleep quality and disturbances over a period of one month. It comprises 19 items that generate seven component scores related to various aspects of sleep, including subjective quality, latency, duration, efficiency, disturbances, medication use, and daytime dysfunction. Clinical evaluation of the PSQI over 18 months involved healthy individuals and psychiatric patients, demonstrating good internal consistency, reliability, and validity. A global PSQI score greater than 5 showed high sensitivity (89.6%) and

specificity (86.5%) in distinguishing between good and poor sleepers, highlighting its effectiveness in both clinical practice and research within psychiatric settings [11].

2.11 The Effect of Endometriosis on Sleep Quality

Women with endometriosis frequently experience pain, which can be caused by a variety of circumstances, including sleep difficulties. However, there is a scarcity of information on the sleep quality of women with endometriosis and how it connects to their pain levels. Endometriosis affects around 10% of women of reproductive age with symptoms of pelvic pain, dysmenorrhea, dyspareunia, dyschezia, and infertility. Current research highlights a possible relationship between endometriosis and poor sleep quality [46]. Chronic pain is the most typical way for endometriosis to interfere with sleep. Endometriosis sufferers may struggle to fall and remain asleep at night due to painful cramps, bloating, and nausea. Furthermore, many women report increased pain during their menstrual period, when they generally require rest, making it even more difficult to get enough sleep while managing the disease [47]. Endometriosis produces a variety of debilitating symptoms that have a substantial influence on women's lives, including sleeplessness; nevertheless, the link between the two has not been thoroughly researched. Endometriosis-related insomnia can worsen the disease and cause more discomfort. Sleep-related complaints are commonly missed during routine gynecological consultations, especially among patients of reproductive age. Given the rising body of data relating sleep disorders to endometriosis, practitioners must raise their awareness [7]

2.12 Overview of the Association Between Endometriosis and Sleep Quality Globally

Endometriosis affects 10–15% of women of reproductive age and is recognized as a significant gynecological issue, contributing to 35% of subfertility cases and 70% of chronic pelvic pain cases [42]. Because some individuals experience little to no symptoms, many cases remain undiagnosed, making the precise epidemiology of endometriosis uncertain [52]. The condition typically begins in early puberty but often goes undiagnosed in many patients, progressing silently. This highlights the need for educational programs to inform adolescent girls about the symptoms of the disease [53]. The primary symptom of endometriosis is pain, which can present as pelvic pain, dysmenorrhea, dyspareunia, dysuria, chronic pelvic pain, and dyschezia. This pain is thought to result from the activation of nociceptive neurons; as the saying goes, pain is perceived in the brain [54]. From May 2016 to February 2017, 156 infertile women (78 with endometriosis and 78 controls) visited the Infertility Clinic at Arash Hospital in Tehran, Iran, for a case-control survey. Women who underwent diagnostic laparoscopy were included, but those with diseases other than endometriosis, such as endometrial hyperplasia or gynecological malignancies, were omitted. The participants were separated into two groups: case (78 women with verified endometriosis) and control (78 women with normal pelvises). Controls were chosen at random to match the case group in terms of age, education level, and length of infertility [55].

To assess several elements of sleep quality during the previous month, the study employed the Persian standard version of the Pittsburgh Sleep Quality Index (PSQI), which is both valid and trustworthy. This questionnaire contains 19 questions divided into seven categories: sleep quality, sleep latency, sleep length, habitual sleep efficiency, sleep disruptions, usage of sleeping

medicine, and daytime dysfunction. Each item is scored on a scale of 0 to 3, for a total score ranging from 0 to 21. A number greater than five implies poor sleep quality, whereas a score of five or less shows a lack of serious sleep disturbances (Buysse et al., 1989).

Chapter: 3

Literature Review

3.1 Introduction

This literature review aims to offer context for research papers related to the issue of this study.

Endometriosis is a frequent problem among women worldwide.

It can be difficult to diagnose and has numerous complications. The following scholarly papers give secondary references and guidelines for research methodology. These sources also assisted in developing data collection tactics, selecting focus groups, and creating questionnaire questions. Furthermore, the research papers improved my understanding of the topic of my thesis. The summary reviews for each paper are provided below:

(1)

The article named **“Effects of endometriosis on sleep quality of women: does lifestyle factor make a difference? in Iran 2020”** is a study done by Samaneh Youseflu et al. The study aims to evaluate lifestyle factors and Sleep Quality (SQ) in women with and without endometriosis, as well as determine the impact of food intake, socio-demographics, and clinical features on SQ.

The study included 156 infertile women, 78 of whom had endometriosis, and the remaining 78 as controls. Participants first filled out a checklist with questions regarding demographics, physical activity, and reproductive/menstrual status. SQ was measured by the Pittsburgh Sleep Quality Index (PSQI). Dietary information was obtained using a validated 147-item semi-quantitative FFQ.

Endometriosis risk was found to be connected with irregular menstruation status, menorrhagia, dysmenorrhea, pelvic discomfort, history of abortion, and a family history of the condition ($P < 0.05$). Women who engage in more than 3 hours of physical exercise each week are less likely to experience endometriosis due to their high consumption of dairy products and fruits ($P < 0.05$).

The two groups had significantly different PSQI ratings, including subjective sleep quality, sleep latency, and sleep disturbance domains ($P < 0.05$). Poor SQ in women with endometriosis was linked to symptoms such as dysmenorrhea, pelvic discomfort, dyspareunia, low physical activity, and limited consumption of dairy, fruit, and nuts ($p < 0.05$). Ladies with endometriosis have lower SQ than healthy people. Lifestyle factors can impact the SQ of these individuals.

(2)

The article named **“Sleep Quality in Women with Endometriosis in Iran 2014”** is a study done by Fatemeh Davari Tanha et al. The purpose of this study was to assess sleep quality in women with endometriosis. Endometriosis is a gynecological condition that involves the implantation of endometrial tissue outside the uterine cavity. Anxiety, bipolar disorder, depressive symptoms, and reduced quality of life are some psychological symptoms. These women share a way of life. Sleep quality was not examined in these women as it should have been.

In this cross-sectional study, 61 married women with laparoscopically diagnosed endometriosis were asked to complete a valid and trustworthy Pittsburgh Sleep Quality Index (PSQI).

The mean age and education level were 31.4 ± 6.7 and 11.7 ± 3.1 years, respectively. The most commonly reported symptoms were dysmenorrhea (68.8%) and dyspareunia (40.3%). The average PSQI score was 6.1 ± 3.4 , with 45.9% scoring equal or less than 5 and 54.1 percent scoring more than 5 (indicating poor sleep). Mean PSQI There was a substantial difference between cases with and without dysmenorrhea and dyspareunia. Women suffering from endometriosis should evaluate their sleep quality.

Chapter: 4

Methodology

4.1 Introduction

"Research methodology" refers to the process of gathering data, analyzing it, and generating conclusions regarding the issue under study. A research technique is an important part of any study design. Developing and refining a technique is critical to meeting a study's objectives.

A credible and reliable research technique ensures that the findings reached are based on sound scientific data. Furthermore, the plan's particular elements help researchers keep on track, making the overall process more efficient and less intimidating. The technique utilized by a researcher reveals the thought process and methods that lead to the study's findings.

4.2 Aim of the study

The objectives set for this research are:

4.3 Research Methodology

A cross-sectional methodology is used to analyze data in a descriptive study. In a cross-sectional study, a large number of participants are recruited at a certain time and location. These studies are non-invasive, obtaining data without attempting to change any observable variables.

4.4 Ethical Statement

Patients and/or legal guardians verbally agreed to participate in the trial, including minors. They were given a full explanation of the research and its purpose. The respondent's names were likewise disguised.

4.5 Area of Study and Participants

A cross-sectional descriptive study was conducted in tertiary care hospitals in Bangladesh, namely Kurmitola General Hospital, with ethical clearance obtained from the relevant authorities. The research team was granted permission to interview the patients to gather data as required by the questionnaire used for the study. A total of 401 patients were enrolled in the study, who were recruited during outpatient consultations. Data was collected using a well-structured questionnaire, which incorporated the Pittsburgh Sleep Quality Index (PSQI). The study's inclusion criteria were reproductive-age infertile women aged 15 to 45 years who had been diagnosed with endometriosis clinically and verified by ultrasonography/laparoscopy.

4.6 Questionnaire

For collecting data, a questionnaire was prepared where the participants' age, BMI, height, weight, educational background, menstruation-related information, symptoms, and Pittsburgh Sleep Quality Index about sleep quality, Sleep latency, Sleep duration, Sleep efficiency, Sleep disturbance, etc. were included. Participants who could read and write were given copies of the questionnaires to answer and return immediately, while those who could not write and their replies were documented.

4.7 Statistical Analysis

For the data analysis, Microsoft Excel and IBM SPSS 26 were used. Descriptive statistics were used to assess the data gathered for this study. Descriptive statistics is the process of analyzing and using statistics that summarize information. Comparisons between the two groups were done using an Independent T-test, Chi-square test, and logistic regression model.

Workflow

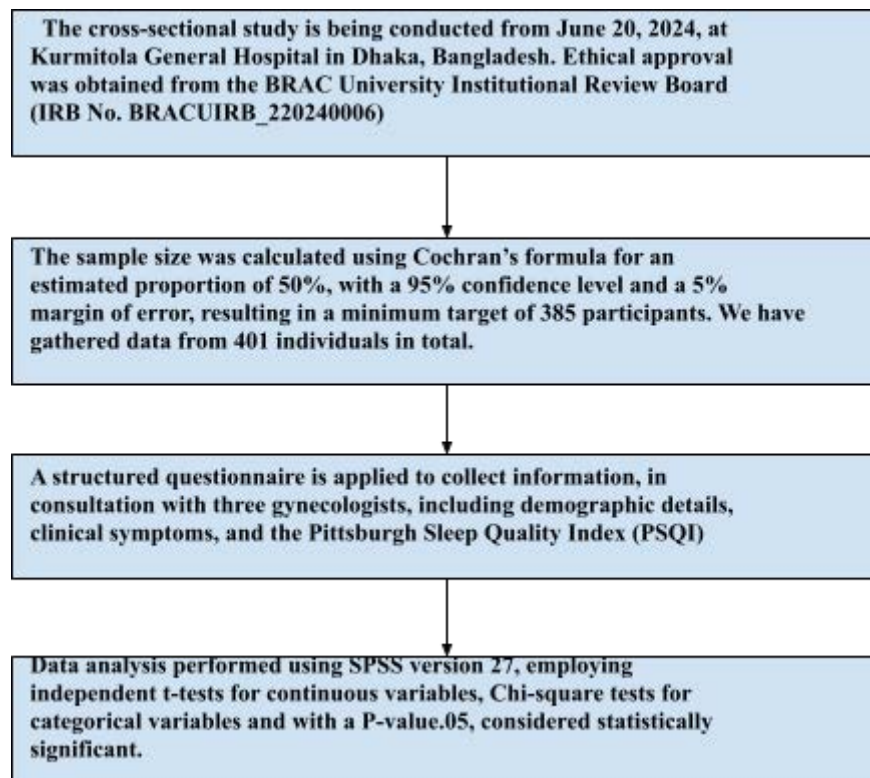


Figure 5 - Methodology Flowchart

Chapter 5: Results

The total number of patients interviewed for the study was 401. The summarization and the analysis of the data collected from them are as follows:

5.1. Overall Distribution of the Participants

In this study, a total of 401 participants were interviewed spanning across various socio-demographic sectors and with a varying range of symptoms. A summary of the overall distribution of the participants in the study is as follows:

Table 3: Distribution of Participants

Variable	Frequency	Percent	Valid percent	Cumulative Percent
Case	201	50.1	50.1	50.1
Control	200	49.9	49.9	100.0
Total	401	100.0	100.0	

In Table 3, the participants of the study have been divided into two distinct groups for comparison and analysis of the collected data. Among the 401 participants, 201 participants were patients who were afflicted with endometriosis, who were assigned to the case group, and the remaining 200 participants were not suffering from endometriosis and were thus assigned control group. In total, 50.1% of the participants were assigned to the case group, while 49.9% of them were part of the control group.

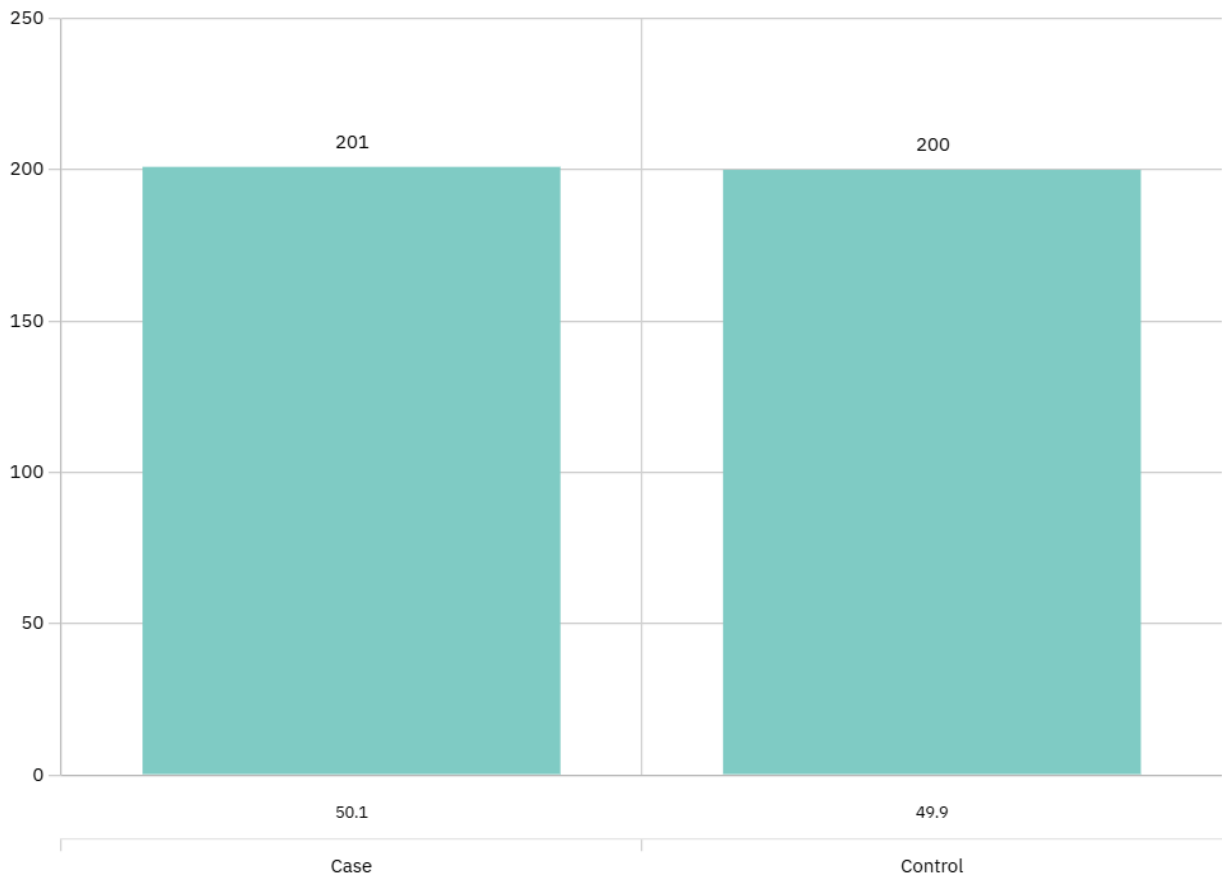


Figure 6: Bar-Chart of the Distribution of Participants

5.2. Distribution of Participants based on Age and Body Mass Index (BMI)

Table 4: Distribution of Participants based on Age and Body Mass Index (BMI)

Variable	Age	BMI
Case	30.43±8.46	22.55±4.11
Control	28.66±9.30	22.74±3.73

As illustrated in Table 4, the average age of the participants in the case group was 30.43 years, with a standard deviation of 8.46 years. Similarly, the participants in the control group had a mean age of 28.66 years with a standard deviation of 9.30 years. A similar trend is seen in the analysis of the Body Mass Index (BMI) of both the case and control groups, the average BMI of

the former being 22.55 with a standard deviation of 4.11, and the average BMI of the latter group was found to be 22.74 with a standard deviation of 3.73, respectively. This indicates that on average, the participants in both groups were of healthy body weight.

5.3. Distribution of the Educational Qualifications of the Endometriosis Patients

Table 5: Distribution of the Educational Qualifications of the Participants

Variable	N	Percent
University	25	6.2
Non University	176	43.9
Total	201	50.1

From Table 5, it can be seen that among the 201 patients suffering from endometriosis, i.e., the case group, 176 of them had an education level below university, and 25 of the patients had an educational level above university level.

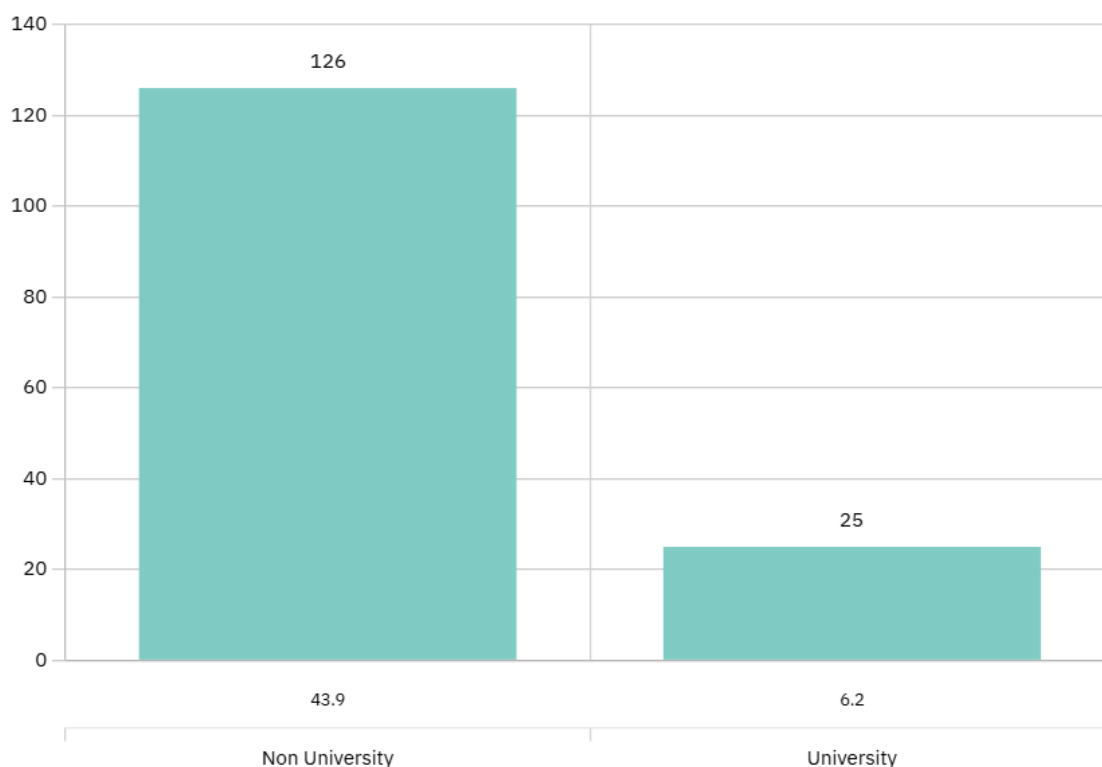


Figure 7: Bar-chart representing the educational qualifications of the participants

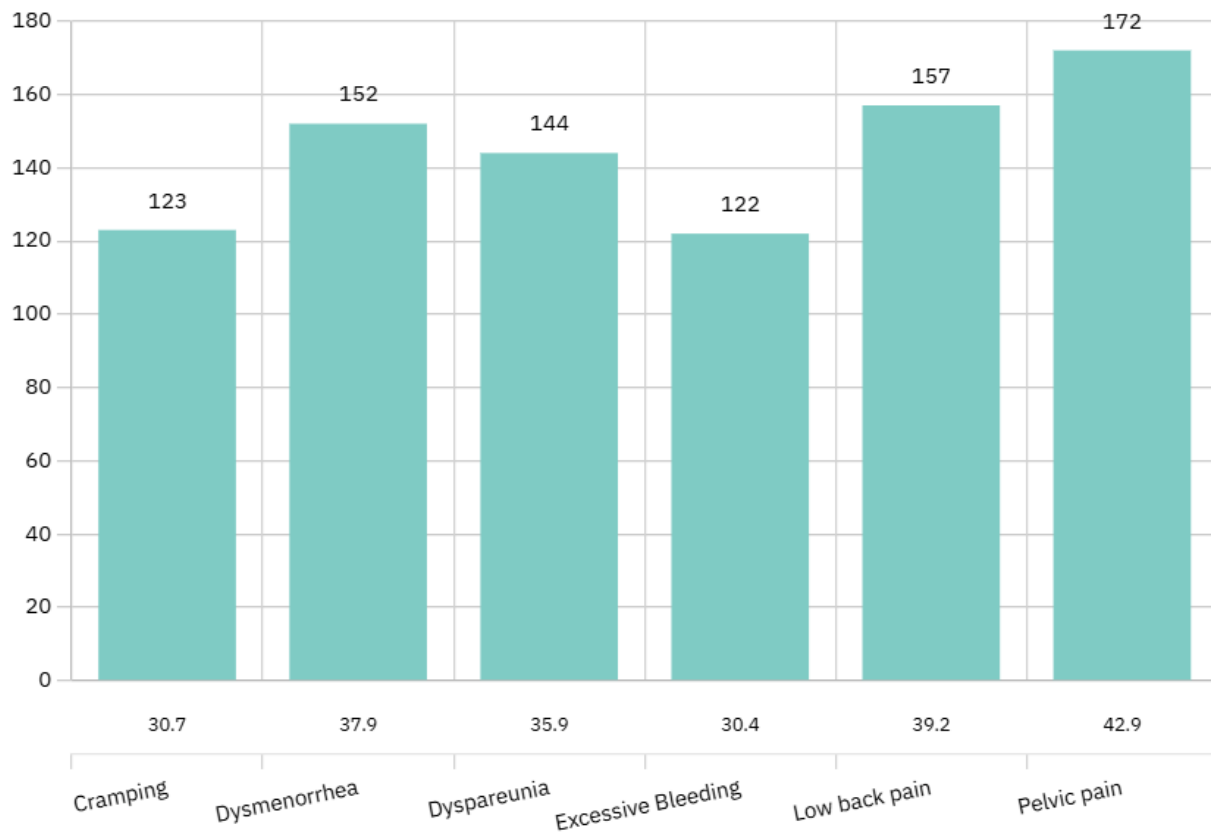
5.4. Distribution of Endometriosis Patients Based on the Symptoms

Table 6: Frequency Distribution Table of Endometriosis Patients Based on Symptoms

Symptoms	N	Percent
Dyspareunia		
Yes	144	35.9
No	57	14.2
Dysmenorrhea		
Yes	152	37.9
No	49	12.2
Excessive Bleeding		
Yes	122	30.4
No	79	19.7
Pelvic pain		
Yes	172	42.9
No	29	7.2

Lower back pain		
Yes	157	39.2
No	44	11.0
Cramping		
Yes	123	30.7
No	78	19.5

The varying range of symptoms that are experienced by patients suffering from endometriosis has been illustrated in Table 6. It can be observed that among 201 patients in the case group, 35.9% of them i.e., 144 of them suffer from symptoms of dyspareunia, 37.9% of them experience dysmenorrhea, 30.4% experiencing excessive bleeding during menstrual periods, 42.9% suffering from symptoms of pelvic pain, 39.2% experiencing lower back pain, and finally 30.7% of them suffering from cramping. To summarize, a significant majority of the patients suffering from endometriosis in the case group experience the above mentioned symptoms.



**Figure 8: Bar-chart of the Frequency Distribution Table of the Endometriosis Patients
Based on Symptoms**

5.5. Distribution of Overall Sleep Quality among Patients with Endometriosis

Table 7: Distribution of Overall Sleep Quality among the Endometriosis Patients

Sleep Quality	N	Percent
Good Sleeper	63	15.7
Poor Sleeper	138	34.4
Total	201	50.1

In Table 7, the case group consisting of 201 endometriosis patients was further divided into two distinct groups, namely, good sleepers and bad sleepers, on the basis of their total PSQI score. The majority of the patients in the case group were observed to be bad sleepers, with 138 among them falling in this group, and only 63 of the 201 patients were observed to be good sleepers.

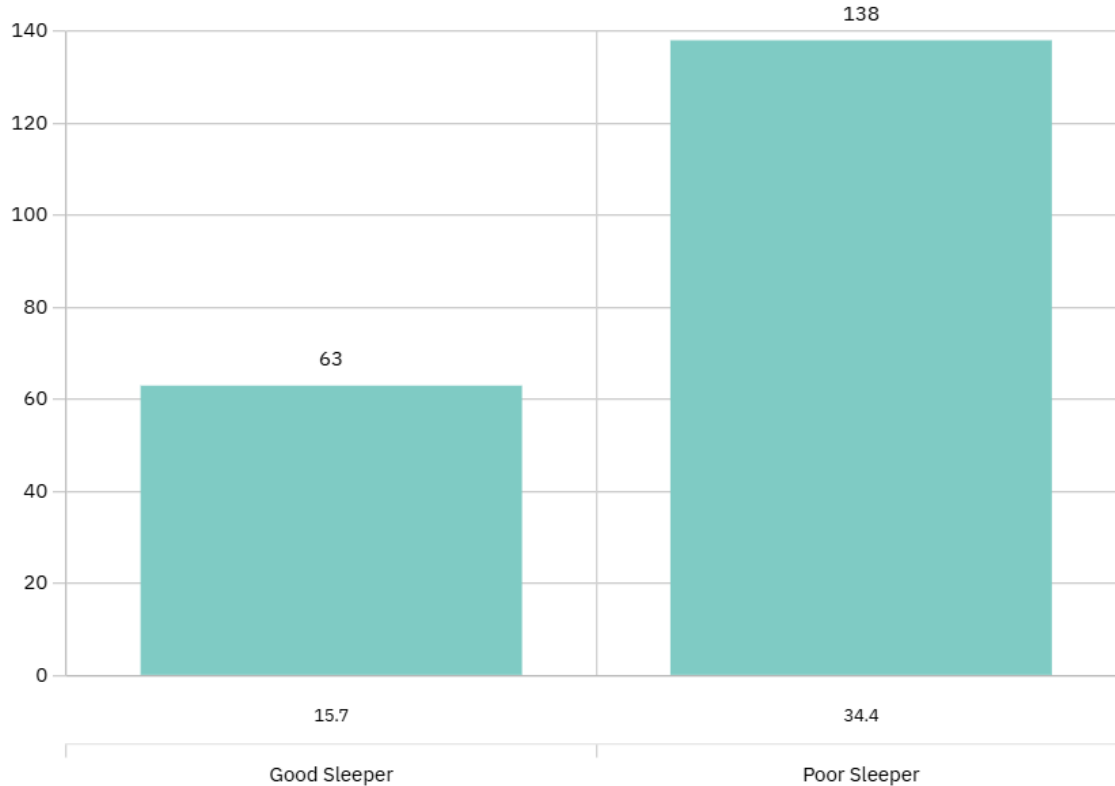


Figure 9: Bar-chart of the distribution of overall sleep quality among patients with endometriosis

5.6. The Association between the Quality of Sleep among Women with Endometriosis by Socio-demographic and Clinical Characteristics

Table 8: Quality of sleep among endometriosis women by socio-demographic and clinical characteristics

Variable	Good sleeper (PSQI≤5) (N=63)	Poor sleeper (PSQI> 5) (N=138)	<i>P</i> -value
Age	31.03±8.72	30.15±8.36	.496
BMI	22.55±4.07	22.55±4.15	.995
Education			.940
University	8(17)	17(8.5)	
Non University	55(27.4)	121(60.2)	
Dyspareunia			<.001
Yes	56(27.9)	88(43.8)	
No	7(3.5)	50(24.9)	
Dysmenorrhea			<.001
Yes	38(18.9)	114(56.7)	
No	25(12.4)	24(11.9)	
Excessive Bleeding			.03
Yes	45(22.4)	77(38.3)	
No	18(9.0)	61(30.3)	
Pelvic pain			.03
Yes	49(24.4)	123(61.2)	
No	14(7.0)	15(7.5)	
Low back pain			.05
Yes	44(21.9)	113(56.2)	
No	19(9.5)	25(12.4)	
Cramping			.02
Yes	46(22.9)	77(38.3)	
No	17(8.5)	61(30.3)	

Table 8 illustrates the association between several factors, such as socio-demographic factors and clinical symptoms experienced by the patients suffering from endometriosis, and their quality of sleep. It can be observed that, based on the computation of the *P-value* factors such as clinical

symptoms experienced by the patients, e.g., dyspareunia, dysmenorrhea, excessive bleeding, pelvic pain, lower back pain, and cramping are highly associated with the quality of sleep of both good and poor sleepers in the case group consisting of 201 endometriosis patients.

However, the analysis of the association between socio-demographic factors and clinical characteristics with sleep quality was not performed for the control group which consisted of participants who were not suffering from endometriosis, since the focus of this study was to examine and analyse the factors associated with the sleep quality of women suffering from the condition of endometriosis.

5.7. The Analysis of the Association of Sleep Quality among Participants with and without Endometriosis

Table 9: Comparison of Sleep Quality among participants with and without endometriosis

	Case(N=201) mean±SD	Control(N=200) mean±SD	<i>P</i> -value
Subjective sleep quality	0.72±0.90	1.27±0.88	<.001
Sleep latency	2.06±1.03	1.03±0.93	<.001
Sleep duration	1.42±0.94	1.05±1.06	<.001
Sleep efficiency	1.19±1.21	0.71±1.09	<.001
Sleep disturbance	1.22±0.55	0.69±0.60	<.001
Use of sleep medication	0.20±0.67	0.13±0.46	.232
Daytime dysfunction	0.80±0.94	0.57±0.85	.014

The above Table 9 illustrates the comparison of the overall quality of sleep observed among the two groups: case and control, with 201 and 200 participants, respectively. It can be observed here that the subjective sleep quality, sleep latency, sleep duration, sleep efficiency, and sleep disturbance have a significant impact on the symptoms experienced by the endometriosis patients based on their *P*-value

Chapter 6: Discussion

This research explored sleep quality among women with endometriosis and examined how socio-demographic and clinical characteristics, particularly pain-related symptoms, are associated with poor sleep. Overall, the findings indicate that sleep disturbance is highly prevalent among women with endometriosis and is significantly influenced by symptom burden rather than basic demographic factors. When compared with women without endometriosis, affected women demonstrated markedly poorer sleep across almost all domains of the Pittsburgh Sleep Quality Index (PSQI). This highlights that sleep disturbance is an important but often under-recognized component of endometriosis-related morbidity [63, 65]. In the present study, a large proportion of women with endometriosis were classified as poor sleepers. This finding is consistent with earlier studies reporting that 50–70% of women with endometriosis experience clinically significant sleep disturbances [66]. Poor sleep in endometriosis is increasingly viewed as part of a broader symptom cluster that includes chronic pain, fatigue, and reduced quality of life rather than an isolated complaint [64]. The high proportion of poor sleepers observed in this study reinforces the idea that sleep disturbance should be considered a core feature of endometriosis-related burden. Age and body mass index (BMI) were not significantly associated with sleep quality among women with endometriosis in this study. This suggests that sleep problems are not primarily driven by aging or body composition but are more closely related to disease-specific characteristics. Similar observations have been found in previous research, where demographic variables such as age, BMI, and educational status showed minimal or no

association with PSQI scores once clinical symptoms were considered [65]. The lack of association with education further suggests that sleep disturbance affects women with endometriosis across different socio-educational backgrounds, emphasizing the biological and clinical underpinnings of the problem. Pain-related symptoms showed a strong and consistent association with poor sleep quality. In this study, women experiencing dyspareunia, dysmenorrhea, pelvic pain, low back pain, cramping, and excessive menstrual bleeding were significantly more likely to report poor sleep. Among these symptoms, dyspareunia and dysmenorrhea showed particularly strong associations with sleep disturbance. These findings are biologically plausible, as chronic and cyclic pain can directly interfere with sleep initiation and maintenance, which leads to prolonged sleep latency, fragmented sleep, and reduced sleep efficiency. Pain-related activation of stress and inflammatory pathways may further disrupt the normal sleep cycle [63]. In a study where Facchin et al. (2015) reported that pain severity was one of the strongest predictors of poor sleep quality in women with endometriosis, independent of psychological distress. Similarly, Nnoaham et al. (2011) demonstrated that women with severe dysmenorrhea and chronic pelvic pain had significantly higher odds of sleep-related problems compared to those with milder symptoms. Excessive menstrual bleeding was also significantly associated with poor sleep quality in this study. Heavy bleeding may contribute indirectly to sleep disturbance through fatigue, discomfort, and anxiety related to nighttime bleeding, as well as through anemia-related symptoms. Although fewer studies have focused specifically on menstrual bleeding and sleep. Women with heavy menstrual bleeding experience greater fatigue and poorer overall sleep quality, supporting the present findings [66].

When sleep quality was compared between women with endometriosis and healthy controls, women with endometriosis demonstrated significantly worse outcomes in nearly all PSQI

components, including subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, and daytime dysfunction. These results indicate that endometriosis negatively affects both nighttime sleep and daytime functioning.

Chen et al. (2017) reported significantly higher global PSQI scores among women with endometriosis compared to controls, with notable impairments in sleep latency and sleep disturbance. Similarly, Marinho et al. (2018) observed reduced sleep efficiency and increased daytime dysfunction among women with endometriosis, highlighting the pervasive impact of the disease on sleep and daily life. Interestingly, the use of sleep medication did not differ significantly between women with endometriosis and controls in this study. This may reflect under-recognition or under-treatment of sleep problems in this population. Despite experiencing substantial sleep disturbance, many women may not seek medical care for sleep-related complaints, or clinicians may prioritize gynecological symptoms over sleep health. Comparable trends have been noted in previous studies where high levels of sleep disturbance coexisted with low rates of sleep medication use [65].

Dysmenorrhea and pelvic pain were among the most frequently reported symptoms consistent with large multicenter studies conducted by the World Endometriosis Research Foundation. These symptoms have repeatedly been associated with impaired sleep quality, fatigue, and reduced health-related quality of life [63]. The overall pattern of associations between pain symptoms and sleep disturbance in this study closely mirrors findings from studies conducted in high-income countries. This suggests that the relationship between endometriosis-related pain and poor sleep is robust across different cultural and healthcare contexts. However, disparities in

healthcare access and pain management strategies may influence the severity and management of sleep problems, particularly in low-and middle-income settings [64]. The findings of this study underscore the importance of adopting a holistic approach to endometriosis management. Addressing pain alone may be insufficient, as poor sleep can exacerbate pain perception, emotional distress, and functional impairment, creating a vicious cycle of symptom worsening. Routine assessment of sleep quality using validated tools such as the PSQI may help identify women at risk of significant sleep disturbance. Multidisciplinary interventions that integrate pain management, psychological support, and sleep-focused therapies—such as cognitive behavioral therapy for insomnia may offer greater benefits than symptom-specific treatment alone [66].

Chapter 7: Limitations & Future Prospects

In order to conduct this particular study, the data was collected for one year only from Kurmitola General Hospital, which is situated in Dhaka. As a result of that, our sample size was restricted to a single geographical location and therefore may not represent the condition of endometriosis patients across other districts in Bangladesh. Consequently, the findings of this research work may not represent a global scenario. Moreover, the sampling method that was employed can be considered as convenience sampling, and therefore, there might be an increase in sample bias and error rates and less precision. Moreover, since conditions such as endometriosis and the topic of women's reproductive health in general are considered taboo by many in Bangladeshi society, many patients showed restraint and hesitation while answering questions, including displaying reluctance in disclosing their personal information. Furthermore, the questionnaire that was finally adopted for this study had been modified to make it understandable and legible to the general population and adapted according to the scope of this study, which may be limited the number of aspects considered in this study, such as the use of medication, nutritional intake, daily exercise level, presence of other underlying health conditions and risk factors, etc.

In the future, this particular study can be expanded to include other districts of Bangladesh, increasing the sample size manifold, and providing a sample consisting of a diverse setting. The questionnaire can be modified to include multiple risk factors that are associated with endometriosis, such as menstrual cycle irregularity, consumption of oral contraceptive medication, hormonal imbalance, etc.

Chapter 8: Conclusion

The prevalence of endometriosis among Bangladeshi women has long been a topic that has not gained the level of importance and notice that a debilitating and life-altering health condition such as this requires. Despite its increasing rate of prevalence and the physical and psychological impact it imparts to the patients, many remain undiagnosed due to the lack of awareness or the availability of proper treatment and diagnostic measures. The complex nature of the disease and the many ways it can manifest in a patient's life are not only something that is poorly understood by the scientific world currently, but also something that has not entirely reached the general consciousness of the people in Bangladesh. It is incredibly important to raise awareness about the many ways chronic health conditions, such as endometriosis, can affect an individual's life, which will in turn help the evolution and development of better diagnostic tools and disease management methods that can make a patient's life much more comfortable and reduce their burdens.

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