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**Original Research Article**

# Prevalence of Etiologic Causes of Primary Amenorrhea among Women in a Tertiary Care Center

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## Abstract

***Background:*** Primary amenorrhea, defined as the absence of menarche by age 15 in the presence of secondary sexual characteristics or by age 13 without them, arises from various etiologic factors. Timely diagnosis and targeted interventions, including genetic counseling and reconstructive surgeries, are essential for effective management. ***Aim of the study:*** The aim of this study was to prevalence of etiologic causes of primary amenorrhea among women in a tertiary care center. ***Methods:*** This cross-sectional study was conducted in Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, during the period from June 2023 to May 2024. Total 120 women presenting with primary amenorrhea during the study period were included. ***Result:*** The study involved participants with a mean age of 17.8 ± 3.2 years, with 58.3% aged 15-20. Most were from low-income backgrounds (62.5%), and 33.3% reported parental consanguinity. Hormonal causes (41.7%) predominated, followed by structural (33.3%) and genetic causes (16.7%). Hypogonadotropic hypogonadism (60.0%) and Müllerian agenesis (62.5%) were leading subtypes, while Turner syndrome accounted for 60.0% of genetic cases. Diagnostic findings included pelvic ultrasound abnormalities (45.8%, p <0.001) and karyotype abnormalities (16.7%). Hormonal imbalances were most common (58.3%), reflecting the diversity of etiologies and the importance of advanced diagnostics in identifying underlying causes. Socioeconomic status and parental consanguinity significantly influenced etiological patterns. ***Conclusion:*** This study highlights significant associations between socio-demographic factors, such as age, consanguinity, socioeconomic status, and etiological categories were observed. Diagnostic findings underscored the importance of pelvic ultrasound, karyotyping, and hormonal evaluation in accurate classification.

**Keywords:** Prevalence, Etiologic Causes, and Primary Amenorrhea.



## INTRODUCTION

Primary amenorrhea (PA), the absence of menstruation by age 15 in the presence of secondary sexual characteristics or by age 13 without such characteristics, is a multifaceted condition with significant clinical and societal implications [1]. This condition is categorized into four primary etiological groups: hormonal, structural, genetic, and idiopathic, each of which poses distinct challenges for diagnosis and management [2]. Hormonal causes include hypogonadotropic hypogonadism, which results from deficient gonadotropin-releasing hormone or pituitary dysfunction, and hypergonadotropic hypogonadism, frequently linked to ovarian failure or Turner syndrome [3]. Structural causes such as Mullerian agenesis and imperforate hymen are congenital conditions that require advanced diagnostic imaging for accurate identification [4]. Genetic factors, including Androgen Insensitivity Syndrome (AIS) and chromosomal anomalies like Turner syndrome, account for a significant proportion of PA cases, underscoring the need for cytogenetic testing in clinical practice [5,6]. Globally, PA affects an estimated 1–5% of adolescent girls, with considerable variations across regions due to genetic, environmental, Bangladesh, experiences unique challenges in

addressing PA owing to its high prevalence of nutritional deficiencies, limited access to healthcare, and cultural stigmas surrounding reproductive health [8,9]. In particular, the prevalence of chromosomal abnormalities in PA is notably high in this region, with studies in India reporting rates as high as 40% among affected individuals [10]. Additionally, Mullerian agenesis and hormonal imbalances such as polycystic ovarian syndrome (PCOS) are increasingly recognized as prevalent causes of PA in South Asian contexts [11]. The public health implications of PA in Bangladesh are profound, given the societal emphasis on marriage and fertility [12]. Cultural norms often exacerbate the stigma associated with reproductive disorders, leading to delays in seeking medical care and underreporting of cases [13]. Women with PA frequently face social exclusion and psychological distress, as their condition is perceived as a barrier to fulfilling traditional roles as wives and mothers [14]. Moreover, limited access to diagnostic facilities, such as genetic testing, further hinders timely diagnosis and management, perpetuating cycles of health inequity [8]. Despite improvements in healthcare infrastructure, Bangladesh still faces significant barriers to addressing PA effectively. Diagnostic tools necessary for evaluating structural abnormalities and genetic conditions remain underdeveloped, particularly in rural areas [15]. Furthermore, the health system is often constrained by inadequate resources and a lack of trained specialists in reproductive endocrinology [16]. This disparity underscores the urgent need for targeted interventions to enhance diagnostic capabilities and increase awareness about PA among healthcare providers and the public. Epidemiological data underscore the importance of addressing PA in South Asia, where the condition is often complicated by malnutrition, high rates of consanguinity, and environmental stressors [9]. Studies have shown that individuals in resource-poor settings like Bangladesh are disproportionately affected by diagnostic delays, leading to increased morbidity and healthcare costs [17]. Addressing these challenges requires a multidisciplinary approach that integrates community education, healthcare infrastructure development, and culturally sensitive interventions [18]. This study aims to bridge the knowledge gap by investigating the prevalence and etiological factors of PA among women presenting to a tertiary care center in Bangladesh.

**Objectives**

Prevalence of etiologic causes of primary amenorrhea among women in a tertiary care center.

## METHODOLOGY & MATERIALS

This cross-sectional study was conducted in Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, during the period from June 2023 to May 2024. Total 120 women presenting with primary amenorrhea during the study period were included. Inclusion criteria encompassed women aged 13-30 years presenting with primary amenorrhea who provided informed consent to participate. Exclusion criteria included women with secondary amenorrhea, those with incomplete medical records or insufficient diagnostic data, and those with suspected or confirmed malignancy related to reproductive organs. Ethical approval was obtained from the institutional ethical review board, and informed consent was secured from all participants or their legal guardians. Clinical evaluations included detailed medical and menstrual history, family history focusing on consanguinity and genetic conditions, and assessment of secondary sexual characteristics such as breast development and pubic or axillary hair. Laboratory investigations included hormonal assays (luteinizing hormone, follicle-stimulating hormone, estradiol, prolactin, thyroid-stimulating hormone, and androgens), genetic testing (karyotyping for chromosomal abnormalities such as Turner syndrome and Androgen Insensitivity Syndrome), and anti-Müllerian hormone levels. Imaging studies included pelvic ultrasound for assessing reproductive organ structures and MRI for detecting structural anomalies such as Müllerian agenesis. Each case was classified into one of four etiological categories-hormonal, structural, genetic, or idiopathic-based on clinical and diagnostic findings. After collection of data, the data were entered into computer and statistical analysis of the results being obtained by using windows-based computer software devised with Statistical Packages for Social Sciences version 22. P value of less than 0.05 was considered statistically significant.

## RESULT

Table I presents the demographic characteristics of the study. The mean age of participants was 17.8 ± 3.2 years, with the majority (58.3%) falling within the 15–20 age group, followed by 20% under 15 years, 15% between 21–25 years, and only 6.7% older than 25 years. Age distribution was statistically significant, with a p-value of <0.001. The mean body mass index (BMI) was 19.2 ± 2.8 kg/m², indicating an average lean body composition among the subjects. Socioeconomic status varied, with a predominance of participants from low-income backgrounds (62.5%), while 29.2% belonged to middle-income households, and 8.3% were from high-income groups, with a significant p-value of 0.047. Parental consanguinity was reported in 33.3% of cases, reflecting the genetic predisposition prevalent in the study population. Regarding secondary sexual characteristics, 45.8% demonstrated normal development, whereas 37.5% exhibited absent development; however, this was not statistically significant (p=0.628). The etiological classification of PA in figure 1 revealed that hormonal causes were the most prevalent, accounting for 41.7% of cases, followed by structural abnormalities in 33.3%, genetic etiologies in 16.7%, and idiopathic cases in 8.3%. These findings underscore the diversity of underlying causes in the study population, with hormonal and structural factors emerging as the primary

contributors to PA. The distribution of hormonal causes among the 50 cases in table II revealed that hypogonadotropic hypogonadism was the most prevalent, accounting for 60.0% of cases, followed by hypergonadotropic hypogonadism at 40.0%. This distribution was statistically significant, with a p-value of <0.001, highlighting the critical role of hormonal dysfunction in primary amenorrhea. Table III demonstrates that among the 40 structural cases, Müllerian agenesis emerged as the leading cause, identified in 62.5% of cases, while imperforate hymen contributed to 37.5%. These structural abnormalities were also statistically significant (p <0.001), emphasizing the importance of early imaging diagnostics. Table IV shows that the genetic causes were predominantly Turner syndrome (60.0%), followed by Androgen Insensitivity Syndrome (40.0%), both contributing significantly to the genetic etiological group with a p-value of <0.001. The association of socio-demographic factors with etiological categories in table V demonstrated important trends. Participants under 15 years were most frequently diagnosed with genetic causes (40.0%), while the majority in the 15–20 age group were attributed to hormonal (60.0%) and structural (62.5%) causes. Notably, participants older than 25 years were predominantly categorized under idiopathic causes (20.0%). The mean age differed significantly across groups, with genetic cases showing the lowest mean age (16.8 ± 2.6 years, p <0.001). Parental consanguinity was reported more frequently in the hormonal (40.0%) and genetic (40.0%) categories compared to structural (25.0%) and idiopathic (20.0%) causes, with a p-value of 0.020. Socioeconomic status showed significant associations, with low socioeconomic status most prevalent in the hormonal group (80.0%), while middle-income participants were distributed more evenly across structural and genetic categories. High-income participants were rare across all groups but were slightly more represented in the idiopathic category (20.0%). Diagnostic test findings in table VI provided further insights. Pelvic ultrasound abnormalities were detected in 45.8% of cases, predominantly in structural causes, and this finding was highly significant (p <0.001). Karyotype abnormalities were observed in 16.7% of cases, correlating strongly with genetic etiologies. Hormonal imbalances were the most common diagnostic finding, identified in 58.3% of cases, spanning hormonal and idiopathic causes.

**Table-I: Demographic characteristics of the study subjects (N=120)**

| Characteristics | Frequency (n) | Percentage (%) | p-value |
|---|---|---|---|
| **Age (years)** | | | |
| <15 | 24 | 20.0 | <0.001 |
| 15-20 | 70 | 58.3 | |
| 21-25 | 18 | 15.0 | |
| >25 | 8 | 6.7 | |
| Mean ± SD | 17.8 ± 3.2 | | |
| **BMI (kg/m²)** | | | |
| Mean ± SD | 19.2 ± 2.8 | | |
| **Socioeconomic Status** | | | |
| Low | 75 | 62.5% | 0.047 |
| Middle | 35 | 29.2% | |
| High | 10 | 8.3% | |
| **Parental Consanguinity** | 40 | 33.3% | |
| **Secondary Sexual Characteristics** | | | |
| Normal development | 55 | 45.8% | 0.628 |
| Absent development | 45 | 37.5% | |

**Table-II: Distribution of Hormonal Causes (N=50)**

| Hormonal Cause | Frequency (n) | Percentage (%) | p-value |
|---|---|---|---|
| Hypogonadotropic Hypogonadism | 30 | 60.0% | <0.001 |
| Hypergonadotropic Hypogonadism | 20 | 40.0% | |

**Table-III: Distribution of Structural Causes (n=40)**

| Structural Cause | Frequency (n) | Percentage (%) | p-value |
|---|---|---|---|
| Müllerian Agenesis | 25 | 62.5% | <0.001 |
| Imperforate Hymen | 15 | 37.5% | |

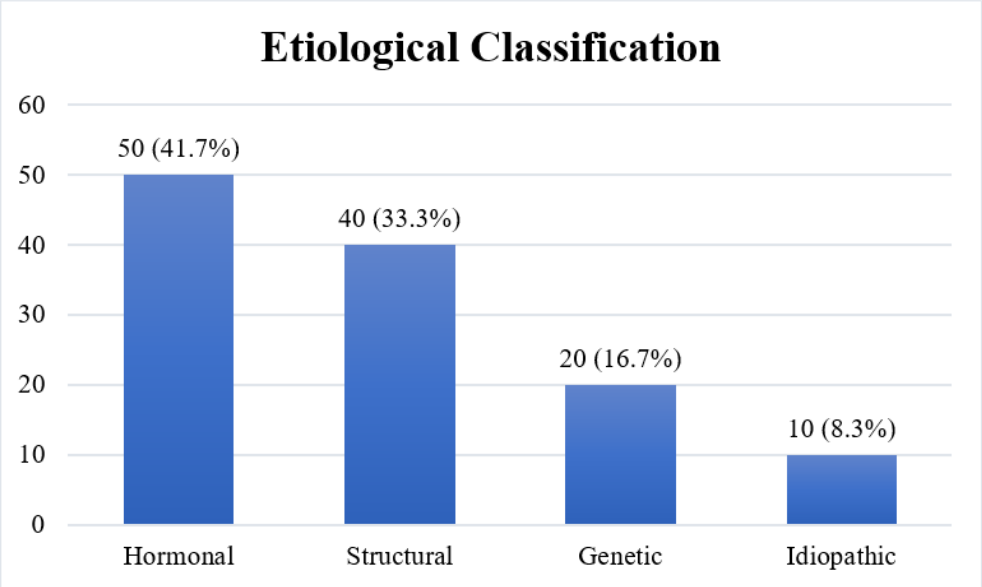


**Figure 1: Etiological Classification of Primary Amenorrhea (N=120)**

**Table-IV: Distribution of Genetic Causes (n=20)**

| Genetic Cause | Frequency (n) | Percentage (%) | p-value |
|---|---|---|---|
| Turner Syndrome | 12 | 60.0% | <0.001 |
| Androgen Insensitivity Syndrome | 8 | 40.0% | |

**Table-V: Association of socio-demographic factors with etiological categories among the study subjects (N=120)**

| Variable | Hormonal (n=50) | Structural (n=40) | Genetic (n=20) | Idiopathic (n=10) | p-value |
|---|---|---|---|---|---|
| **Age (years)** | | | | | |
| <15 | 10 (20.0%) | 5 (12.5%) | 8 (40.0%) | 1 (10.0%) | <0.001 |
| 15–20 | 30 (60.0%) | 25 (62.5%) | 10 (50.0%) | 5 (50.0%) | |
| 21–25 | 7 (14.0%) | 7 (17.5%) | 2 (10.0%) | 2 (20.0%) | |
| >25 | 3 (6.0%) | 3 (7.5%) | 0 (0.0%) | 2 (20.0%) | |
| **Mean ± SD** | 18.2 ± 3.0 | 17.5 ± 2.9 | 16.8 ± 2.6 | 17.0 ± 3.4 | <0.001 |
| **BMI (kg/m²)** | | | | | |
| **Mean ± SD** | 18.9 ± 2.5 | 19.1 ± 2.8 | 19.4 ± 2.9 | 19.5 ± 2.7 | 0.314 |
| **Parental Consanguinity** | 20 (40.0%) | 10 (25.0%) | 8 (40.0%) | 2 (20.0%) | 0.020 |
| **Socioeconomic Status** | | | | | |
| Low | 40 (80.0%) | 20 (50.0%) | 10 (50.0%) | 5 (50.0%) | <0.001 |
| Middle | 8 (16.0%) | 15 (37.5%) | 8 (40.0%) | 3 (30.0%) | |
| High | 2 (4.0%) | 5 (12.5%) | 2 (10.0%) | 2 (20.0%) | |

**Table-VI: Diagnostic Test Findings (N=120)**

| Test | Positive Cases (n) | Percentage (%) | p-value |
|---|---|---|---|
| Pelvic Ultrasound Abnormality | 55 | 45.8% | <0.001 |
| Karyotype Abnormality | 20 | 16.7% | |
| Hormonal Imbalance | 70 | 58.3% | |

## DISCUSSION

This cross-sectional study was conducted in Department of Obstetrics and Gynaecology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh, during the period from June 2023 to May 2024. The present study provides a comprehensive analysis of the etiological and diagnostic spectrum of primary amenorrhea (PA) among 120 women. The mean age of participants in this study was 17.8 ± 3.2 years, with the majority (58.3%) aged 15–20 years. Genetic causes were most prevalent among participants under 15 years (40.0%), consistent with studies showing early presentation of chromosomal abnormalities such as Turner syndrome [10,19]. Conversely, participants over 25 years were predominantly categorized under idiopathic causes (20.0%), possibly reflecting delayed diagnosis in resource-limited settings [20]. Low socioeconomic status was most prevalent among those with hormonal causes (80.0%), paralleling findings that financial constraints often delay access to diagnostic

facilities for endocrine disorders (Jabbar, 2004). Parental consanguinity was reported in 33.3% of cases, particularly in hormonal (40.0%) and genetic (40.0%) etiologies, supporting evidence that consanguinity increases the risk of inherited genetic disorders [21,22]. Hormonal causes accounted for 41.7% of cases in this study, with hypogonadotropic hypogonadism (60.0%) emerging as the most common subtype. These results align with findings from Al Kharusi *et al.,* [23], who emphasized the role of hypogonadotropic hypogonadism in delayed puberty and amenorrhea. Hypergonadotropic hypogonadism was identified in 40.0% of hormonal cases, echoing studies reporting its association with premature ovarian failure [24]. Structural abnormalities were observed in 33.3% of cases, with Müllerian agenesis (62.5%) as the predominant cause, followed by imperforate hymen (37.5%). This distribution aligns with studies identifying Müllerian agenesis as a leading structural anomaly, diagnosed through imaging [11,25]. Genetic causes constituted 16.7% of cases, with Turner syndrome (60.0%) and Androgen Insensitivity Syndrome (40.0%) as the major contributors, comparable to findings from Sah *et al.,* [5] and Pourafkari *et al.,* [26], highlighting the need for karyotyping in suspected cases. Pelvic ultrasound abnormalities were detected in 45.8% of cases, predominantly among those with structural causes, with a highly significant p-value (<0.001). This underscores the role of ultrasound as a primary diagnostic modality in detecting anomalies like Müllerian agenesis, as emphasized by Teo & Ong [25]. Karyotype abnormalities were found in 16.7% of cases, correlating strongly with genetic etiologies such as Turner syndrome. This finding aligns with studies reporting a 16.4% prevalence of chromosomal abnormalities in PA cases [20]. Hormonal imbalances, the most common diagnostic finding in this study (58.3%), spanned hormonal and idiopathic causes, consistent with Klein *et al.,* [27], who emphasized the critical role of endocrine evaluation in PA management. The prevalence of Müllerian agenesis (20.8% of total cases) aligns with reports by Folch *et al.,* [11] and Malla *et al.,* [10], confirming it as a major structural cause of PA globally. Genetic etiologies such as Turner syndrome (10.0% of total cases) and Androgen Insensitivity Syndrome (6.7%) align with findings from Pourafkari *et al.,* [26], who identified similar rates of chromosomal anomalies among PA patients. The high prevalence of hormonal imbalances (58.3%) in this study corresponds to findings from Al Kharusi *et al.,* [23] and Jabbar [28], highlighting the need for early intervention in endocrine-related amenorrhea. The association between socio-demographic factors and etiological categories in this study offers valuable insights. For instance, the predominance of low-income participants with hormonal causes reflects broader trends in low-resource settings, where financial barriers hinder timely diagnosis and treatment [20,22]. Similarly, the significant association of parental consanguinity with genetic etiologies underscores the need for genetic counseling in high-risk populations, as observed by Maimoun *et al.,* [21]. The findings of this study reinforce the importance of a multidisciplinary diagnostic approach to PA, integrating imaging, genetic testing, and hormonal evaluation. The high prevalence of Müllerian anomalies and chromosomal disorders highlights the need for advanced diagnostic tools like 3D ultrasound and comprehensive karyotyping in tertiary care settings [11,25]. Additionally, the significant association between socio-demographic factors and PA etiology underscores the importance of addressing health inequities to improve access to reproductive healthcare in low-resource settings [20].

**Limitations of the study**

In our study, there was small sample size and absence of control for comparison. Study population was selected from one center in Dhaka city, so may not represent wider population. The study was conducted at a short period of time.

## CONCLUSION AND RECOMMENDATIONS

This study highlights the diverse etiological and diagnostic spectrum of primary amenorrhea, with hormonal and structural causes predominating. Significant associations between socio-demographic factors, such as age, consanguinity, and socioeconomic status, and etiological categories were observed. Diagnostic findings underscored the importance of pelvic ultrasound, karyotyping, and hormonal evaluation in accurate classification. These findings emphasize the need for advanced diagnostic facilities and targeted public health interventions to improve early detection, management, and health equity for women with primary amenorrhea in resource-limited settings.

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