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Reemergence of Chikungunya in Bangladesh.

Mushtaq Ahmad¹, Farial Naima Rahman²

¹Professor (Brigadier General) & Principal, Army Medical College Jashore,

²Assistant Professor, Department of Forensic Medicine & Toxicology, Army Medical College Jashore

Chikungunya fever (CF) is a viral illness caused by an arbovirus transmitted by the *Aedes aegypti* as well as *Aedes albopictus* mosquitoes¹⁻³.

The name is derived from the 'makonde' dialect which means 'that which bends up', indicating the physical appearance of a patient with severe clinical features. The fever locally also named as 'Langra Jor'⁴.

Chikungunya virus (CHIKV) is an enveloped, positive-sense, single-stranded RNA virus in the *Togaviridae* family, *Alphavirus* genus⁵.

Chikungunya virus (CHIKV) was first isolated from the blood of a febrile patient in Tanzania in 1952. Since then it has been identified repeatedly in west, central and southern Africa and many areas of Asia. Since 1960, the outbreaks of the disease in South Eastern Asia were reported from India, Sri Lanka, Myanmar, Thailand, Indonesia, Philippines and Malaysia. In Bangladesh, the first outbreak was in Poba upozilla in Rajshahi district affecting 32 people in 2008. The second outbreak was in Shathiya upazilla of Pabna in 2009^{6,7}.

After an incubation period of 4-8 days following the bite of an infected mosquito, infection with CHIKV causes symptomatic illness in most infected people that is characterized in the acute phase by fever, joint pain, and rash. Joint pain and dysfunction may persist for months to years following infection. While overall case fatality rates associated with chikungunya virus infection are low, the disease can be severe and sometimes fatal, particularly in young infants, the elderly, and patients with certain underlying medical conditions, where

cardiovascular, central nervous system and dysfunction of other organs has been documented⁸⁻¹⁰.

The *Aedes* mosquito breeds in domestic settings such as flower vases, water-storage containers, air coolers, etc. and peri-domestic areas such as construction sites, coconut shells, discarded household junk items (tyres, plastic and 4 metal cans) and bites during day time.

In humans, the bite of an infected mosquito leads to deposition of Chikungunia virus (CHIKV) in the subcutaneous tissue resulting in viremia (10 to 10 RNA copies/ml). At the early stage of the disease, the organs targeted for chikungunya virus replication were lymphoid tissues, liver, CNS, joints, muscle and the persistence of chikungunya virus could be found later in the lymphoid organs, liver, 2 joints, muscle, macrophages being the main reservoir. A febrile response signals viral replication with release of inflammatory cytokines. Replicating virus in the synovial fluid, endosteum and periosteum of the affected bones induce complement activated immune complex mediated arthritis. There is no synovial lymphocytosis, bone or cartilage destruction. CHIKV can also cause CNS manifestations in the form of encephalitis, encephalomyelitis and optic neuritis¹¹⁻¹³.

Symptoms of CHIKV infection start abruptly with fever (temperature, usually $\geq 38.90^{\circ}\text{C}$). The fever typically last from several days up to 2 weeks and can be biphasic in nature. Shortly after the onset of fever, the majority of infected persons develop severe, often debilitating polyarthralgia. Published reports suggest that rash is another common symptom. When it occurs, the rash appears after fever onset and is typically maculopapular involving the trunk and extremities but can also involve palms, soles, and the face. Additional symptoms that can occur during the acute illness include headache, fatigue, nausea, vomiting, and conjunctivitis;

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myalgia, although not specific for febrile illnesses, occur very commonly. Cervical lymphadenopathy can also occur in the acute illness¹²⁻¹⁴.

CHIKV infections can be diagnosed by direct methods, including virus isolation and RNA detection through nucleic acid amplification testing, or through indirect methods measuring IgM antibody response to recent infection. 1 Serological cross-reactivity has been documented between CHIKV and related alphaviruses including Mayaro, O'nyong Nyong, and Ross River viruses; thus, in areas where related viruses circulate, cross-neutralization testing may be needed to identify the specific infecting virus if direct viral detection cannot be achieved¹⁵.

As of December 2024, 119 countries and territories have reported local transmission. High attack rates can lead to temporary interruption of transmission in small populations, but larger populations remain at risk due to ongoing susceptibility. Surveillance and diagnostic limitations hinder accurate global tracking, and underreporting is common. The potential for re-emergence remains high in previously affected areas. In Bangladesh over 2 million suspected cases of chikungunya concurrent with dengue and Zika virus transmission was noted in 2024¹⁶.

The re-emergence of Chikungunya may be due to a variety of social, environmental, behavioral and biological factors. Lack of herd immunity may have probably led to its rapid outbreak across several states of India and also in Bangladesh¹⁷⁻¹⁸.

Currently there are no vaccines available in the market for preventing Chikungunya disease. However scientists have developed a working vaccine for Chikungunya. The vaccine looks like Chikungunya virus to the immune system which in turn produces antibodies against it. From the experiments on monkeys it was found that these antibodies can prevent Chikungunya infection. Monkeys were injected with the vaccine and then after 15 weeks they were injected with Chikungunya virus. It was found that the vaccine offered 100% protection from the 6 disease. The next step for this vaccine is human testing^{19,20}.

Minimizing vector population and vector-patient contact, reduce larval habitats in and around the houses, removing stagnant water from all junk items

lying around in the household, removing stagnate water in flower pots or similar containers, draining all water stagnating after rains, fogging and street sanitation with proper waste management, using insecticide sprays in vector areas around the house can reduce the menace of this disease²¹.

In 2022, WHO launched the Global Arbovirus Initiative to address arboviral threats through an integrated and coordinated approach, convening both governmental and non-governmental multisectoral partners (health, urban administration, environment) and building on existing disease-specific programmes to strengthen national integrated arbovirus preparedness and response¹⁶. In addition, the Global Strategic Preparedness, Readiness and Response Plan (SPRP) to tackle dengue and other Aedes-borne arboviruses aims to reduce the burden of disease, suffering and death from dengue and other Aedes-borne arboviral diseases such as Zika and chikungunya, by fostering a global coordinated response. Aligned with the principles laid out in the Initiative and SPRP, WHO continues to work with regional and national health authorities to enhance health system capacity to detect, report, and respond to the continued threat of CHIKV transmission, as well as to other Aedes-borne arboviruses and other emerging and re-emerging threats to public health.

A variety of CHIKV vaccine candidates are in development, including live-attenuated, inactivated, virus-like particles, subunit, DNA, and measles virus- and poxvirus-based vaccines. Many of these vaccine candidates have shown promising results in animal models and in phase I clinical trials in humans²². Numerous antiviral compounds, monoclonal antibodies, and immunomodulatory drugs that could be used to prevent or treat CHIKV infection are also in the early stages of investigation. Thus, the reemergence of CHIKV and the enormous scale of the CHIKV-associated outbreaks have highlighted many critical research needs. These include increased surveillance for CHIKV infection or antibodies in humans and animals, increased mosquito control programs, implementation of protocols for detecting CHIKV in donated blood, organs, and tissues for transplantation, and increased basic and translational research to enhance our knowledge of CHIKV biology, pathogenesis, treatment, and prevention.

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Compatibility Among Ultrasonographic Findings, Intraoperative Visual Inspection and Histopathological Examination Report in Perimenopausal Women with Medically Refractory Abnormal Uterine Bleeding : A Study in a Peripheral Military Hospital, Bangladesh

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Abstract

Background: Any pelvic pathology specially at perimenopausal period is alarming and requires in-depth assessment, as it may be the only clinical hallmark of malignancy. In gynecological practice, heavy menstrual bleeding is a frequent complaint during perimenopause and can be associated with structural pathology and functional abnormalities. **Objective:** The aim of this study is to compare overall diagnosis based on ultrasonography, intraoperative findings and histopathology report of the resected uterine specimens, with a view to enhance and implement effective management in a peripheral hospital. **Methodology:** This cross-sectional analytical study was carried out in the Department of Obstetrics and Gynecology at BNS Upasham, Khulna, a peripheral secondary military hospital. Total 40 women aged 39-55 years who underwent invasive procedures for abnormal uterine bleeding (AUB) were recruited over a two-year period. These women were evaluated gradually; detailed clinical history, ultrasound images, intraoperative observation and histopathology reports were correlated. The postoperative histopathological examination (HPE) findings of the specimens were objectively correlated with both preoperative imaging studies and the intraoperative observations. Finally, statistical analysis and correlation were done. **Results:** In this publication, AUB-L was the commonest type of pelvic pathology, identified by both ultrasonography and histopathology report according to the FIGO PALM-COEIN classification system. It was diagnosed in 35% cases, with a greater incidence among individuals younger than 46 years. AUB-A was reported in 15% cases, commonly above 46 years of age. AUB-O was accounted in senior age group whereas AUB-M in fewer cases. AUB-I was found in single case only. **Conclusion:** Among perimenopausal women, HPE of resected specimens and their interpretation played a decisive role in the management of abnormal uterine bleeding. As there were only minor differences between ultrasound findings and histopathology reports in the diagnosis of the conditions, we might choose an effective judicious procedure keeping down tissue injury. Health care professionals should emphasize the implementation of any safer plan of action for women to ensure the maximum benefits with minimal morbidity.

Keywords: Perimenopausal age, AUB, Ultrasonography, Histopathological examination

Introduction:

Permanent cessation of menstruation following ovarian activity depletion is menopause¹. Perimenopause is distinguished by irregularity of menstrual cycles².

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However, a better workable definition is the phase prior to the onset of menopause during which the regular pattern of cycle adapts to irregular cycle. World Health Organization (WHO) defines it as a period 2-8-years preceding menopause and 1 year after the final menses³. The perimenopausal transitional age of onset for most women is 39-51

year globally whereas average age of onset is 46 years. Adaptation period in women lasts for 2-8 years with an average duration of 5 years¹. Less attention has been focused on this "menopausal transition" period while appreciable awareness programme has been raised about menopause. Specifically, fluctuation of hormonal and physiologic changes is associated with unexpected perimenopausal heavy vaginal bleeding to certain symptoms⁴. A remarkable headway in the realizing of the normal physiology of perimenopause and also the social acceptance has led to safe medical therapies. But perimenopausal pathology of reproductive organs unresponsive to medical therapy may lead to invasive procedures even hysterectomy.

Taking place from a wide variety of causes including whether structural or not, abnormal uterine bleeding (AUB) tells of a wide spectrum of all divergent patterns of menstrual bleeding in various forms such as menorrhagia, polymenorrhea, metrorrhagia, and menometrorrhagia^{5,6}. The terminology has been changed to heavy menstrual bleeding, frequent menstrual bleeding, intermenstrual bleeding, prolonged menstrual bleeding respectively. Amidst different age groups, perimenopausal women account for more than two-thirds of all gynaecological consultations⁷. Globally, the impact of AUB is substantial but the prevalence varies in different populations depending on environmental and cultural influence, fluctuating between 3% and 30%⁸. In order to assimilate and standardize nomenclature of AUB, an international expert consensus from the International Federation of Gynaecology and Obstetrics (FIGO) Menstrual Disorders Committee introduced a new system known by the acronym PALM-COEIN in 2011, later updated in 2018. Based on etiology and pathology of disorder, where PALM denoting structural causes (polyp, adenomyosis, leiomyoma, malignancy and hyperplasia) and COEIN describing non- structural causes (coagulopathy, ovulatory disorders, endometrial factors, iatrogenic and not classified), the PALM-COEIN system acquired a universal acceptance⁹. The PALM wing could be diagnosed on imaging and or biopsy; conversely, the COEIN wing could be diagnosed by other hormonal and biochemical tests. Both premalignant and malignant neoplasms of endometrium appear more often in the

senescence age group. After excluding exogenous causes such as trauma, foreign body, sexually transmitted disease, tuberculosis (TB) etc, pathology of other pelvic organs should be considered¹⁰. Thus, quick evaluation is needed to exclude the malignancy issues in any form of vaginal bleeding, discharge or itching in the senior generation.

The specific diagnostic approach depends on the age group of the patients. Premenopausal women with normal findings most likely get the diagnosis of AUB-O¹¹. Imaging studies are also indicated as a screening tool when there is a risk of malignancy in an individual¹². Perimenopausal women with endometrial thickness >5 mm on TVUS require further evaluation with transvaginal sonography or endometrial sampling¹³. Diagnostic hysteroscopy where possible could give a better clue for the diagnosis and characterization of distinct intrauterine anomaly or any foreign body.

Many researches and write ups have been conducted globally to see the compatibility between the ultrasonographic findings with histopathological examination (HPE) in the diagnosis of abnormal uterine bleeding. However, very few triphasic studies have been conducted correlating among preoperative ultrasonogram, intraoperative findings and postoperative histopathological examination particularly in Bangladesh. Hence, our study was conducted to validate and correlate among these three-step approaches for implementing and enhancing better management in AUB cases who have undergone a surgical procedure finally after non-success of medical treatment.

Methodology

Study Setting

This analytical observational cross-sectional study was undertaken in Dept of Obs and Gynae, BNS Upasham, Khulna among 40 perimenopausal women between 39-55-years age who underwent invasive procedures after unsuccessful medical treatment for AUB over two-year period. Unwilling women were excluded.

Study Procedure

Attention was paid to outpatients with perimenopausal bleeding at booking visit; elaborate history of these patients including age, chief

complaints, detailed menstrual and past medical disorders were noted. Abdominal examination along with pelvic examination performed to assess local pathology, uterine anatomy and any adnexal disease. After provisional diagnosis of AUB, according to PALM-COEIN classification system, patients were advised to undergo ultrasonography with or without hormonal analysis. This imaging method gave the first hint of the pathology with regard to structural changes. Detailed morphological changes of the endometrium and myometrium were also noted in the TVUS imaging report. An informed consent was taken before recruiting those patients for surgery who did not respond to medical and hormonal treatment. While performing transvaginal polypectomy and therapeutic sampling, any morbidity of vulva, vagina and cervix was excluded. While performing the hysterectomy, both the ovaries, fallopian tubes and peritoneal cavity were visualized and detailed gross pathology of the uterus were checked. Afterwards, removal of the uterus or its growth was done. It is to be mentioned that, hysterectomy was done in two-thirds of the cases with or without preserving the ovaries based on the individual case. Each resected specimen was examined macroscopically to record gross morphology and any pathology (Fig 1,2 and 3). The specimens were fixed in 10% formalin and sent to affiliated pathology laboratories to get the detailed histopathology report from efficient histopathologists. Afterwards, comparison of ultrasound images, gross intraoperative morphology and HPE of clinically diagnosed, medically refractory AUB cases were done with appropriate statistical analysis.

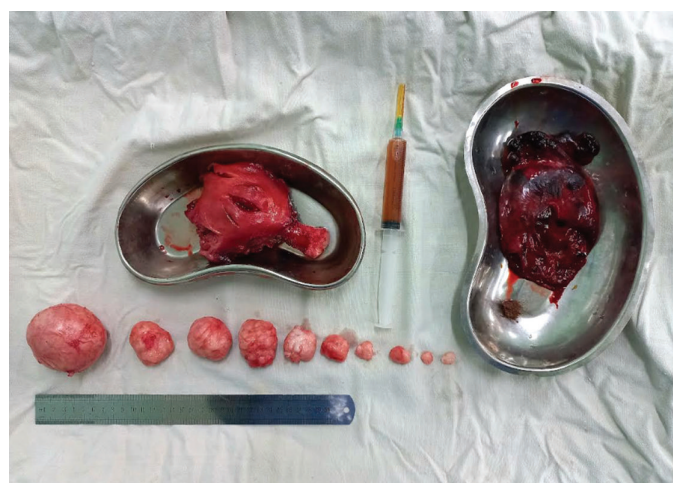


Fig 1: Multiple fibroids



Fig 2: Resected specimen showing changes

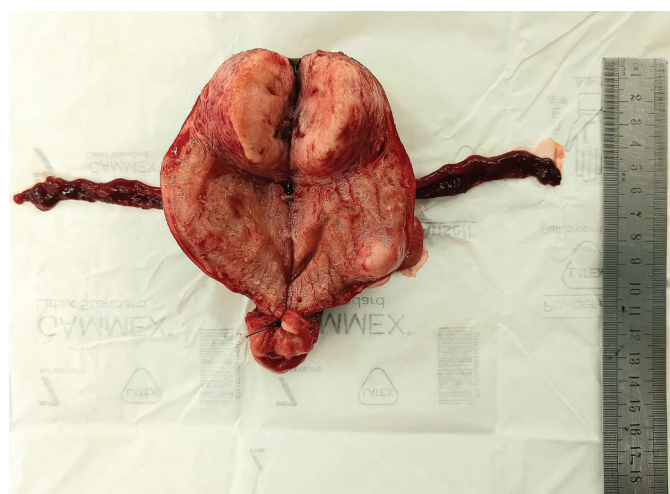


Fig 3: Resected specimen showing myomatous adenomyotic changes

Statistical Analysis

The data were processed using Microsoft Excel and SPSS software.

Ethical Clearance

Ethical clearance was obtained from the Ethical Review Committee of BNS Upasham Hospital.

Results:

This study was conducted in the Department of Obstetrics and Gynaecology of a peripheral military hospital. Total number of 40 cases, age ranging from 39-55-years (mean age = 46.28 year) with abnormal uterine bleeding who underwent invasive procedures participated in this research. Among

these 40 perimenopausal women, 47.5% (n=19) belonged to age group between 39-45-years, 27.5% (n=11) belonged to age group between 46-50-years, and rest 25% (n=10) belonged to 51-55-years age group. AUB-L was the commonest type of pelvic pathology, noted in 35% cases more common in less than 46 years of age. AUB-A was reported in 15% cases commonly above 46 years of age. AUB-O was accounted in 12.5% cases more in senior age group. AUB-P was also observed in 15% cases. AUB-M was observed in 7.5% cases. AUB-I was found in a single case only. (Fig 4)

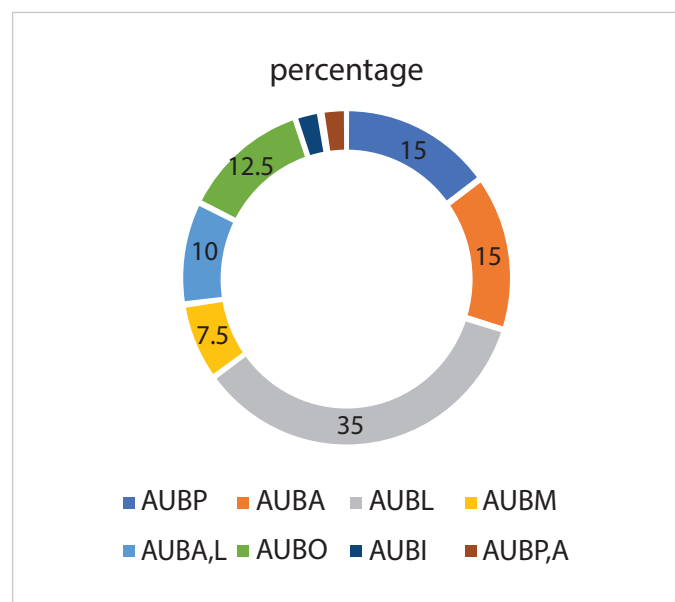


Fig 4: Distribution PALM-COEIN classification system of AUB

Invasive procedures	Frequency (n=40)	Percentage (%)
Endometrial sampling	4	10%
Polypectomy	6	15%
Myomectomy	6	15%
Hysterectomy	23	57.5%
Removal of CuT	1	2.5%

Table I: Distribution of surgery performed in cases with AUB

Out of 40 invasive procedures, 10% (n=4) patients underwent endometrial sampling only as therapeutic purpose for AUB. 15% (n=6) patients underwent polypectomy. Another 15% (n=6) patients underwent myomectomy and 57.5% (n=23) patients underwent hysterectomy with or without preservation of ovaries. AUB due to IUCD was corrected by removing the device along with endometrial sampling in a single case. (Table I)

Ultrasonographic diagnoses	Frequency (n=40)	Percentage (%)
Leiomyoma	15	37.5%
Combined fibroid and adenomyosis	3	7.5%
Adenomyosis	6	15%
Endometrial polyp	7	17.5%
Thickened endometrium	3	7.5%
Iatrogenic (displaced IUCD)	1	2.5%
No finding	4	10%
Hydrosalpinx/adnexal mass	1	2.5%

Table II: Ultrasonographic diagnosis of the patients with abnormal uterine bleeding

Among 40 USG reports, 15 cases were found to have leiomyoma, 6 cases had adenomyosis, 3 cases were found to have both leiomyoma and adenomyosis. 7 women were found to have endometrial polyps. 3 cases had thickened endometrium, only one case had displaced IUCD and another 5 cases had non-specific findings so diagnosed as ovulatory dysfunction. (Table II)

Distribution of HPE Report Finding of Resected Specimens	Frequency (n)	Percentage (%)
Myometrium (n=29)		
Normal	5	17.24%
Adenomyomatous changes	7	24.14%
Dual pathology	3	10.34%
Myomatous changes	14	51.72%
Endometrium (n=34)		
Proliferative/non-secretory phase endometrium	15	44.11%
Secretory phase endometrium	5	14.7%
Inflammatory cells	2	5.88%
Polyp	5	14.7%
Endometrial hyperplasia	3	8.82%
Endometrial carcinoma	1	2.94%
Atrophic endometrium	2	5.88%
Submucosal myoma	1	2.94%
Cervix (n=23)		
Normal	11	47.83%

Chronic cervicitis	10	43.48%
Squamous metaplasia	1	4.35%
CIN I	1	4.35%
Fallopian tube (n=24)		
Normal	19	79.17%
Inflammatory	5	20.83%

Table III: Distribution of HPE report findings of resected specimen

The study reviewed intraoperative records of hysterectomy and myomectomy specimen-morphology of 29 cases. 12 patients were diagnosed to be having leiomyoma in uterus after dissection, finally confirmed by HPE also. But among 2 cases was to be having leiomyoma, one was found to be having dual pathology of leiomyoma-adenomyosis and another one was found to be having only adenomyosis of uterus on HPE. Out of the 6 patients found to be having adenomyosis in naked eye on dissected specimen examination, 3 were found to be having adenomyosis, 1 was found to be having adenomyosis with leiomyoma, 1 case had endometrial adenocarcinoma and 1 case showed normal myometrium on HPE. Surprisingly 1 case diagnosed to be having AUB-O without any uterine pathology on clinical examination and USG was found to be having adenomyosis on HPE. 5 cases with endometrial polyp matched well with both TVUS and HPE. One case had displaced IUCD and later it was removed. Specially mentioning, HPE of endometrial tissue showed proliferative endometrium in 15 patients, secretory endometrium in 5 cases, atrophic endometrium in 2 cases, simple hyperplasia without atypia in 3 cases, chronic endometritis in 2 cases, endometrial polyp in 5 and adenocarcinoma in 1 patient. Among 23 hysterectomy specimen, 10 cases showed broad cervix with or without nabothian cysts finally diagnosed as chronic cervicitis on HPE, one case had squamous metaplasia, one case had CIN I on HPE and 11 cases were found to have normal findings on both naked eye and HPE. 5 out of 23 specimens revealed salpingitis on HPE. (Table III and IV)

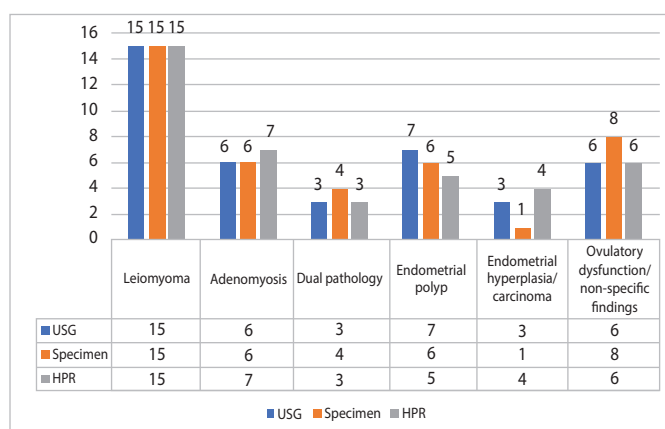


Table IV: Comparison among USG Images, Specimen Reports and HPE Diagnoses

Above mentioned table shows the compatibility among ultrasonographic findings, intraoperative visual inspection and histopathological examination reports of each uterine pathology. Out of 40 ultrasonograms, 15 cases were identified as uterine leiomyomas only. After histopathological examination, out of these 15 cases, 11 were diagnosed as leiomyomas, 1 was diagnosed as adenomyosis, 2 were diagnosed as leiomyomas with adenomyosis and 1 patient was diagnosed as having ovulatory dysfunction. Out of the 6 participants spotted to be having adenomyosis on USG, HPE showed adenomyosis in 3 cases, leiomyoma in 1 case, adenocarcinoma in 1 case and normal finding in 1 case. Among 3 cases having both leiomyoma and adenomyosis on USG, 1 was confirmed by histopathology also but another 2 showed leiomyoma only. Out of 4 women who were labelled as normal by USG, 3 patients were diagnosed with adenomyosis and one patient was diagnosed to be having endometrial hyperplasia by HPE. Out of 3 cases identified as thickened endometrium on TVUS, 2 were diagnosed as endometrial hyperplasia and 1 as poor endometrium on HPE. Among 7 cases detected with endometrial polyps on TVUS, 5 cases were confirmed by HPE, 1 case had submucosal fibroid and 1 case showed only phasic endometrium. 1 AUB case showed hydrosalpinx on TVUS, later confirmed by HPE also. And another 1 case had displaced intra uterine contraceptive device (IUCD). (Table IV)

	Leiomyoma	Adenomyosis
Sensitivity	88.89%	40%
Specificity	81.82%	61.54%
Positive predictive value	88.89%	44.44%
Negative predictive value	81.82%	57.14%

Table V: Validity of USG in diagnosing leiomyoma and adenomyosis

The validity of ultrasonography plays a significant role in diagnosing leiomyoma and adenomyosis. The sensitivity, specificity, positive predictive value and negative predictive value of USG for diagnosing leiomyoma was 88.89%, 81.82%, 88.89%, 81.82% respectively. The sensitivity, specificity, positive predictive value and negative predictive value of USG for diagnosing adenomyosis were 40%, 61.54%, 44.44%, 57.14% respectively. (Table V).

Discussion

This study on 40 cases focused on the probability of diagnosing AUB during the perimenopausal period using laparotomy or endometrial sampling in combination with USG and histopathology. Study results regarding AUB-L showed both ultrasonographic and histopathological diagnosis of leiomyoma in 15 cases which matched with intraoperative inspection also. Sensitivity of USG in diagnosing leiomyoma was 88.89% and specificity was 81.82%. Hanafi et al also showed that the corresponding sensitivity and specificity of TVS as a diagnostic test for leiomyoma was 96.38% and 96.00% respectively^{14,15}. AUB-L was the commonest type of pelvic pathology noted in 35% cases in our study. Thomas et al also pointed out that fibroid uterus was also common in their study based on clinico-histopathological and ultrasonographic correlation¹⁵.

This study also pointed out USG and clinico-histopathological correlation of adenomyosis. Study results showed, AUB-A accounted for 15% of the study population. In this study, accuracy of USG in diagnosing adenomyosis the sensitivity, specificity, PPV and NPV were 40%, 61.54%, 44.44% and 57.14% respectively. Thomas et al revealed that the accuracy of transvaginal ultrasound for adenomyosis with a sensitivity of 82.7%, specificity of 95.8%, PPV of 95.6%, and NPV of 83.6%. There was no significant difference in the number of cases

diagnosed by TVS and cases diagnosed by histopathological study in his study¹⁶. But Vercellini et al revealed that the accuracy of transvaginal ultrasound for adenomyosis with a sensitivity of 82.7%, specificity of 67%, PPV of 50%, and NPV of 90.7%¹⁷. Atri et al revealed that the accuracy of transvaginal ultrasound for adenomyosis with a sensitivity of 81%, specificity of 71%, PPV of 54%, and NPV of 90%¹⁸. However, in this study, we found low sensitivity for USG in diagnosing adenomyosis. TVS showed more accuracy than TAS in diagnosing this pathology. Due to the lack of strong positive pathogmonical clinical findings there was difficulty in diagnosis of adenomyosis. The frequency varied widely due to differences in the histological criteria and the number of blocks of sampling specimens taken.

Regarding diagnosis of endometrial polyp, hyperplasia and ovulatory dysfunction, there were not significant difference among ultrasonographic, clinical and histopathological diagnosis. Transvaginal USG showed quite similar to histopathology. Being a useful and dependable diagnostic tool in the diagnosis of uterine growths, TVS had been accurate, sensitive, and specific. In our study, transabdominal USG was less sensitive in the diagnosis of adenomyosis, but more specific. Thus, TVS was a significant diagnostic tool. As done in a peripheral hospital, the sample size may be limited to produce more conclusive results. Moreover, there may be inter-clinician inconstancy in the ultrasonographic examination and subsequent histopathological assessment. This study therefore partly related to the specific target population of medically refractory AUB cases in perimenopausal women in a single setting.

Conclusion

AUB-L was the main cause for which invasive procedure including hysterectomy was done. This write up showed a conclusive affirmation that ultrasonography has good diagnostic accuracy as well as histopathology in case of leiomyoma and polyp with abnormal uterine bleeding Nevertheless, the diagnostic procedures for adenomyosis were quite questionable, since it had a very low sensitivity amidst good specificity even with TVUS. In addition to that, patients suffering from adenomyosis should undergo more invasive treatment comparing to other

causes of AUB. Thus, multimodal approach for AUB cases can bring a good outcome with less invasive clinical management along with upgraded quality of life.

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Conflict of interest:

No conflict of interest.

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Authors' Contributions:

Nawal M conceived and designed the study, analyzed the data, interpreted the results, and wrote up the draft manuscript. Saleheen MM and Ahmad M was involved in the manuscript review and editing. All authors read, gave the final critical review of the manuscript and approved it.

Data Availability: Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethical Approval and Consent to Participate:

Ethical approval for the study was obtained from the Institutional Review Board. The written informed consents were obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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Socio Demographic Profile and Habit of Betel Leaf (*Piper betle*) Chewing Population in Selected Unions of Nachol Upazilla, Chapai Nawabganj.

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Abstract

Background: Betel leaf (*Piper betle*) chewing is known to be a prominent public health problem, which can lead to significant morbidity and mortality but could totally be abolished by preventive measures. Young adults mostly become addicted to it and the rate of consumption increases parallel to age of the users. The residents of Southeast Asia are enthusiastic consumers of betel leaf, which has significance in their traditional healing practices and cultural rituals. **Objective:** To assess socio demographic profile and habit of betel leaf (*Piper betle*) chewing population in a selective rural setting. **Methodology:** The cross-sectional study was conducted over 12 months (November 2023 to October 2024) among 1650 residents of Nachol, Nezampur, Fatehpur and Koshba union under Nachol Upazilla in Chapai Nawabganj district. Participants were selected by convenient sampling technique; data were collected by face-to-face interviewing with a semi-structured pretested questionnaire to assess socio-demographic characteristics, knowledge, attitude and habit of betel leaf (*Piper betle*) chewing. Data were analyzed by SPSS software. **Results:** Among the 1650 respondents most 837 (50.73%) were male. Maximum 648 (39.27%) belonged to age group 46-60 years and 1498(90.79%) of the respondents were married. Most of the chewers 1493 (90.49%) were Muslim and maximum had their educational qualification upto primary level 551 (33.39%). Regarding occupation 493 (29.88%) were farmer and 1093 (66.24%) belonged to lower class, 345 (20.91%) believed that betel leaf help in decision making, whereas 312 (18.91%) takes it for health benefit, 309 (18.73%) liked the taste, 652 (39.51%) chewed betel leaf lime, betel nut, jarda and khoire, 712 (43.15%) consumed 6-10 piece betel leaf per day, 521 (31.57%) had 41-50 taka expense per day, 679 (41.15%) suffered from tooth staining and 217 (13.15%) had gum problem. 369 (82.97%) have no plan for leaving this habit, only 97 (5.88%) liked to quite due to teeth staining. **Conclusion:** Awareness should be raised through national wide educational program to reduce the habit of betel leaf (*Piper betle*) chewing.

Keywords: Socio demographic profile, habit, betel leaf (*Piper betle*) chewing.

Introduction:

The betel plant (*Piper betle*) is an evergreen; shade loving perennial root climber belongs to the family Piperaceae with glossy heart shaped leaves and white catkin¹. It is available in most of South and Southeast Asia. Betel leaf is locally known as paan,

which has an important socio-cultural uses, besides having significant medicinal properties and nutritional values. In Bangladesh, about 60-70% of people usually consume betel leaf frequently².

Objective:

This study was performed to assess the socio demographic profile and habit of betel leaf (*Piper betle*) chewing population in a selective rural setting of Bangladesh.

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Materials and Method:

The descriptive cross-sectional study was conducted over 12 months (November 2023 to October 2024) among 1650 residents of Nachol, Nezampur, Fatehpur and Koshba union under Nachol Upazilla in Chapai Nawabganj district. Participants were selected by convenient sampling technique; data were collected by face-to-face interviewing with a semi-structured pretested questionnaire to assess socio-demographic characteristics, knowledge, attitude and habit of betel leaf (*Piper betle*) chewing. Data were analyzed by SPSS software. Written informed consents were taken from the participants and unwilling persons were discarded.

Results:

Table-1 showed among the 1650 respondents most 837 (50.73%) were male. Maximum 648 (39.27%) belonged to age group 46 - 60 years. Most 1498 (90.79%) of the respondents were married. Most of the chewers 1493 (90.49%) were Muslim and maximum had their educational qualification upto primary level 551 (33.39%). Regarding occupation 493 (29.88%) were farmer and 1093 (66.24%) belonged to lower class.

Table-1: Distribution of betel leaf (*Piper betle*) chewers as per demographic characteristics. (n= 1650)

Demographic characters	(n=1650)	Total	Male	Female
Gender		1650(100%)	837(50.73%)	813(49.27%)
Age group	15 -25 years	120(7.27%)	68(4.12%)	52(3.15%)
	26 -35 years	165(10%)	87(5.27%)	78(4.72%)
	36 - 45 years	267(16.18%)	145(8.79%)	122(7.39%)
	46 - 60 years	648(39.27%)	305(18.48%)	343(20.79%)
	More than 60 years	450(27.27%)	232(14.06%)	218(13.21%)
Marital status	Married	1498(90.79%)	732(44.36%)	766(46.43%)
	Unmarried	152(9.21%)	105(6.36%)	47(2.85%)
Religion	Muslim	1493(90.49%)	748(45.33%)	745(45.15%)
	Hindu	140(8.48%)	78(4.73%)	62(3.76%)
	Buddhist	14(0.85%)	9(0.55%)	5(0.30%)
	Christian	3(0.18%)	2(0.12%)	1(0.06%)
Education completed	Illiterate	368(22.30%)	102(6.18%)	266(16.12%)
	Primary	551(33.39%)	301(18.24%)	250(15.15%)
	Secondary	266(16.12%)	161(9.75%)	105(6.36%)
	Higher secondary	278(16.85%)	151(9.15%)	127(7.70%)
	Graduate	187(11.33%)	122(7.39%)	65(3.94%)
Occupation	Student	147(8.91%)	85(5.15%)	62(3.76%)

	Service holder	96(5.82%)	73(4.42%)	23(1.39%)
	Business man	199(12.06%)	178(10.79%)	21(1.27%)
	Farmer	493(29.88%)	314(19.03%)	179(10.85%)
	Day labour	277(16.79%)	166(10.06%)	111(6.72%)
	House wife	391(23.70%)	-	391(23.70%)
	Others	47(2.85%)	21(1.27%)	26(1.57%)
Financial status	Lower class	1093(66.24%)	574(34.79%)	519(31.45%)
	Lower middle class	513(31.09%)	237(14.36%)	276(16.72%)
	Upper middle class	40(2.42%)	23(1.39%)	17(1.03%)
	Upper class	4(0.24%)	3(0.18%)	1(0.06%)

Table-2 showed among the 1650 respondents 345 (20.91%) believed that betel leaf help in decision making, whereas 312 (18.91%) took it for health benefit and 309 (18.73%) liked the taste.

Table-2: Distribution of respondents as per causes of betel leaf (*Piper betle*) chewing. (n= 1650)

Causes of betel leaf chewing	(n=1650)	Male	Female
		837(50.73%)	813(49.27%)
Likes the taste	309(18.73%)	166(10.06%)	143(8.66%)
Likes keeping something in mouth	279(16.91%)	178(10.79%)	101(6.12%)
As family members chew	182(11.03%)	103(6.24%)	79(4.79%)
As friends chew	70(4.24%)	47(2.85%)	23(1.39%)
Helps in decision making	345(20.91%)	169(10.24%)	176(10.66%)
Has health benefit	312(18.91%)	98(5.94%)	214(12.97%)
Exciting	45(2.73%)	24(1.45%)	21(1.27%)
Part of culture	76(4.61%)	31(1.88%)	45(2.72%)
Aristocracy	32(1.94%)	21(1.27%)	11(0.66%)

Table-3 showed among the 1650 respondents 652(39.51%) chew betel leaf with lime, betel nut, jarda and khoire, 428 (25.94%) don't take khoire.

Table-3: Distribution of respondents as per method of betel leaf (*Piper betle*) chewing. (n= 1650)

Method of betel leaf chewing	(n=1650)	Male	Female
		837(50.73%)	813(49.27%)
Chew leaf alone	79(4.79%)	30(1.82%)	49(2.97%)
Chew with lime	122(7.39%)	65(3.94%)	57(3.45%)
Chew with lime, betel nut	345(20.90%)	176(10.67%)	169(10.24%)
Chew with lime, betel nut, jarda,	428(25.94%)	227(13.76%)	201(12.18%)
Chew with lime, betel nut, jarda, khoire,	652(39.51%)	340(20.61%)	312(18.91%)
Chew with raw tobacco leaf	24(1.45%)	09(0.54%)	15(0.91%)

Table-4 showed among the 1650 respondents 712 (43.15%) consumed 6-10 piece betel leaf per day, 528 (32%) took 3-5 piece daily.

Table-4: Distribution of respondents as per amount of betel leaf (*Piper betle*) chewing per day. (n= 1650)

	(n=1650)	Male 837(50.73%)	Female 813(49.27%)
3-5 pieces	528(32%)	225(13.63%)	303(18.36%)
6-10 pieces	712(43.15%)	411(24.90%)	301(18.24%)
11-15 pieces	173(10.48%)	95(5.76%)	78(4.72%)
More than 15 pieces	237(14.36%)	106(6.42%)	131(7.94%)

Table-5 showed among the 1650 respondents 521 (31.57%) had 41-50 taka expense per day and 374 (22.67%) had expense 31-40 taka per day.

Table-5: Distribution of respondents as per expense for betel leaf (*Piper betle*) chewing. (n= 1650)

Expense for betel leaf chewing per day	(n=1650)	Male 837(50.73%)	Female 813(49.27%)
Less than 20 taka	129(7.82%)	68(4.12%)	61(3.69%)
20-30 taka	216(13.09%)	103(6.24%)	113(6.85%)
31-40 taka	374(22.67%)	198(12%)	176(10.66%)
41-50 taka	521(31.57%)	260(15.76%)	261(15.82%)
51-60 taka	53(3.21%)	30(.82%)	23(1.39%)
More than 60 taka	357(21.63%)	178(10.79%)	179(10.85%)

Table-6 showed among the 1650 respondents 679 (41.15%) suffered from tooth staining and 217 (13.15%) had gum problem.

Table-6: Distribution of participants as per health problem related to betel leaf (*Piper betle*) chewing (n=1650)

Health problem of participants related to betel leaf chewing NB: single chewer suffered from multiple types of health problem	Total (n= 1650)	Male 837(50.73%)	Female 813(49.27%)
Cough	67(4.06%)	33(2.0%)	34(2.06%)
Breathing problem	58(3.51%)	41(2.48%)	17(1.03%)
Respiratory tract infection	27(1.64%)	13(0.79%)	14(0.85%)
Peptic ulcer	21(1.27%)	12(0.73%)	09(0.54%)
Hypertension	14(0.84%)	10(0.60%)	04(0.24%)
Gum problem	217(13.15%)	114(6.91%)	103(6.24%)
Tooth staining	679(41.15%)	315(19.09%)	364(22.06%)
Distaste in tongue	712(43.15%)	397(24.06%)	315(19.09%)
Other problem	45(2.73%)	19(1.16%)	26(1.57%)

Table-7 showed among the 1650 respondents 1369 (82.97%) had no plan for leaving this habit, only 97 (5.88%) liked to quite due to teeth staining.

Table-7: Distribution of respondents as per future plan for discontinue of betel leaf (*Piper betle*) chewing. (n=1650)

Causes of future plan for discontinue of betel leaf chewing	(n=1650)	Male 837(50.73%)	Female 813(49.27%)
Fear of future illness	78(4.73%)	47(2.85%)	31(1.88%)
Doctor's Advice	21(1.27%)	12(0.72%)	09(0.54%)
Expensive	73(4.42%)	49(2.97%)	24(1.45%)
Teeth staining	97(5.88%)	44(2.66%)	53(3.21%)
Cleanliness issue	12(0.73%)	04(0.24%)	08(0.48%)
No plan for leaving this habit	1369(82.97%)	698(42.30%)	671(40.66%)

Discussion:

Betel leaf (*Piper betle*) cultivation has vast potential as it plays an important role in economics and livelihood of people in South Asia ^{3,4}. Betel leaf has been used as an important medicinal plant in the traditional treatment systems of Southeast Asian countries. Betel leaf is traditionally known to be useful for the treatment of various diseases like bad breath, boils and abscesses, conjunctivitis, constipation, headache, itches, mastitis, mastoiditis, leucorrhoea, otorrhoea, swelling of gum, rheumatism, cuts and injuries⁵.

In this study the gender of betel leaf chewers found almost equal male 837 (50.73%): female 813 (49.27%), indicating this habit is favorite among both sex. The use of betel leaf gradually increases along with ages, being 120 (7.27%) among 15-25 years, 267 (16.18%) among 36-45 years and 648 (39.27%) in 46-60 years. These findings coincide with previous studies performed by Wahab (2025), Gupta (2002) and Sabrina (2022)⁶⁻⁸.

The study place Nachol Upazilla is famous for its agricultural products cultivation. Hence most of the respondents in this study were farmers 493 (29.88%) and their 1093 (66.24%) financial status belonged to lower middle class. Considering causes of betel leaf chewing maximum respondents had some belief that it helps in decision making, while 312 (18.91%) thought it has some health benefit and 309 (18.73%) liked the taste. Habit of family member 182

(11.03%), friend 70 (4.24%) and cultural effect 76(4.61%) also influenced to take the betel leaf. The finding are familiar with previous studies of Flora (2012) and Wangdi (2020)⁹⁻¹⁰.

Betel leaf (*Piper betle*) also contain 'Chavicol' that is four times potent as antiseptic agent as compare to carbolic acid¹¹⁻¹². The leaves are the most valued part of plant that is used as a chewing agent to prevent halitosis. The leaves are also supposed to harden the gum, conserve the teeth and to prevent indigestion, bronchitis, constipation, congestion, cough and asthma¹³⁻¹⁵. Betel leaf is a second most popular daily consummation item in Asia, which alone contribute the best oral hygiene to oral cavity¹⁶⁻¹⁷. The fresh betel leaves possess antimicrobial, act against ringworm, antifungal, so it act as antiseptic and antihelminthic effects. The leaves have wound healing property¹⁸. Betel leaves extract increases the salivation which increases the amount of peroxidase, lysozyme and antibodies to combat against bacterial growth in the oral cavity. Chewing of betel leaf not only accelerating the salivation but also enhances the gastric juice, pancreatic lipase secretion which aids in digestion process. To getting these opportunity people usually consume and chewed paan after meal. The leaf has the great potency to act as natural anti-oxidant. The anti-oxidant property is correlated with different biological activities like hepatoprotective, antidiabetic, antiarthritis, anti-stroke and anticancer properties, since free radicals are involved in all these diseases¹⁹. Betel leaves may be used as a cheap, easily available, non-irritant and effective alternative of commercial appliances to protect the stomas and peristomal skin in pediatric patients. Betel leaf is a good source of calcium, carotene and iron; and also helps in digestion without any adverse effects²⁰.

In this study maximum respondents 652 (39.51%) chewed betel leaf with lime, betel nut, jarda, khoire. 712 (43.15%) took it through out the day consuming 6- 10 pieces, 237 (14.36%) took more than 15 pieces and 528 (32%) ate 3-5 pieces per day. The expense varies from 20 taka to more than 60 taka per day making it cheap but very favourite chewing food staff. Very few people suffered from health hazards among those who chew betel leaf alone. But those who had problem took betel nut and jarda along with

it. Previous studies have shown that greater risk of oral cancer persist due to combined use of betel nut, tobacco and Jarda²¹⁻²⁶. Maximum users 1369 (82.97%) showed no intention to give up the habit, only 97 (5.88%) had plan to discontinue chewing betel leaf due to tooth staining. Blackish tooth is a side effect of continuous betel leaf chewing with other ingredients^{8,9,27}.

Conclusion:

The study underscores a strong association between betel leaf chewing and health outcomes in rural Bangladesh. Single betel leaf chewing is beneficial to health but when it is taken with lime, jarda and betel nut the risk of oral cancer increases. The findings highlight the need for targeted public health interventions to raise awareness about the risks of betel leaf chewing with betel nut, jarda, tobacco and to promote oral health in these communities.

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Conflict of interest:

No conflict of interest.

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Authors' Contributions:

Ahmad M, Rahman FN designed and drafted the study, collected and analyzed the data, interpreted the results, completed literature review and wrote up the draft manuscript. Sharmin S and Rahman S were involved in data collection, the manuscript review and editing. All authors read, gave the final critical review of the manuscript and approved it.

Data Availability:

Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethical Approval and Consent to Participate:

Ethical approval for the study was obtained from the Institutional Review Board. The written informed consent was obtained from all study participants.

All methods were performed in accordance with the relevant guidelines and regulations.

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Evaluation of Airway Management in Laparoscopic Surgery under General Anaesthesia in Morbidly Obese Patients

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Abstract

Background: Morbid obesity alters upper airway anatomy through fat deposition in pharyngeal structures, reducing pharyngeal space and increasing the risk of difficult laryngoscopy. These anatomical changes present significant challenges during airway management in surgical patients under general anesthesia. **Objective:** To assess airway management challenges in morbidly obese patients undergoing laparoscopic surgery under general anesthesia. **Methods:** This observational study was conducted at the Jaber Al Ahmed Armed Forces Hospital, Kuwait. Sixty morbidly obese patients (BMI ≥ 40 kg/m²) scheduled for elective laparoscopic surgery were included via purposive sampling. Demographic data, airway assessments (Mallampati score, inter-incisor distance, upper lip bite test, thyromental distance, hyo-mental distance, neck circumference, and Cormack-Lehane grading) were recorded. Statistical analysis was performed using SPSS version 23.0. **Results:** The mean BMI of the participants was 44.3 ± 4.6 kg/m². Significant negative correlations existed between BMI and hyo-mental distance in neck extension ($r = -0.32$, $p = 0.012$) and thyromental distance ($r = -0.25$, $p = 0.048$). Neck circumference strongly correlated with BMI ($r = 0.41$, $p = 0.001$). **Conclusion:** While most morbidly obese patients had straight forward intubation, higher BMI was associated with reduced airway measurements and larger neck circumference, indicating increased difficulty. Neck circumference may serve as a practical predictor of challenging airways in this population.

Keywords: Airway management, Cormack-Lehane grading, Difficult intubation, Laparoscopic surgery, Morbid obesity.

Introduction:

Airway management in morbidly obese patients (BMI ≥ 40 kg/m²) remains a critical challenge in anesthesiology due to altered upper airway anatomy and reduced respiratory reserve¹. Excess pharyngeal fat deposition and decreased functional residual capacity predispose these patients to rapid oxygen desaturation during apnea, escalating the risk of hypoxemia during intubation attempts^{2,3}. These physiological changes are further exacerbated during laparoscopic procedures due to

pneumoperitoneum-induced reductions in lung compliance⁴. Current evidence suggests that conventional airway assessment tools (e.g., Mallampati score, thyromental distance) may have limited predictive value in morbid obesity^{5,6}. While the Cormack-Lehane grading system remains the clinical standard for evaluating laryngoscopic views, studies report significant variability in its correlation with BMI, with some morbidly obese patients exhibiting unexpectedly easy intubation^{7,8}. This unpredictability underscores the need for more reliable, obesity-specific airway assessment protocols⁹. In low-resource settings like Bangladesh, where obesity prevalence has risen by 24% since

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2010, data on airway management in this population are scarce^{10,11}. Ethnic variations in airway anatomy may further complicate the extrapolation of Western-derived guidelines¹². This study selected neck circumference (NC), thyromental (TMD), and hyo-mental distances (HMD) as they are objective, quantifiable predictors strongly validated for difficult airway management in obese populations, where subjective tests like Mallampati are less reliable¹³. This study evaluates airway parameters and intubation outcomes in patients in Kuwait, aiming to develop regionally relevant predictive models for difficult airway management.

Methodology:

This prospective observational study was conducted at the Jaber Al Ahmed Armed Forces Hospital, Kuwait, from January 2021 to December 2021 after ethical approval [KBA ref-(Memo) no.-875/2020]. Sixty morbidly obese patients (BMI ≥ 40 kg/m²; ASA-III) undergoing elective laparoscopic surgery were enrolled via purposive sampling, excluding pregnancy and cervical spine pathology. Standard preoperative airway assessments included Mallampati classification, inter-incisor distance, neck circumference, thyromental/hyomental distances, and the Upper Lip Bite Test (ULBT) to evaluate mandibular mobility¹⁴. In this study, all of the patients were assessed in the PACU room one day before the operation. However, in another study¹⁵, following standardized induction, Video laryngoscopy was performed by experienced anesthesiologists using C-MAC, with glottic views classified via Cormack-Lehane grading (Grade I: full vocal cords; Grade IV: no glottic visualization). Intubation difficulty was categorized as: easy (Grade I, single attempt), (Grade II, ≤ 3 attempts), or difficult (Grade III/IV, >3 attempts or adjuncts required). Data analysis used SPSS 23.0, with Pearson's correlation examining BMI-airway parameter relationships ($p < 0.05$).

Results:

The study evaluated airway management in 60 morbidly obese patients (BMI ≥ 40 kg/m²) undergoing laparoscopic surgery under general anesthesia. The mean age was 32.5 ± 10.2 years, with a female predominance (70%). The mean BMI was 44.3 ± 4.6 kg/m. The most common comorbidity was hypertension (HTN), affecting 30 % of patients,

followed by smoking (33.3%) and hypothyroidism (16.7%). Other important comorbidities included bronchial asthma (13.3%), obstructive sleep Apnea (10.3%) and diabetes mellitus (DM) (6.7%). Airway assessment revealed that 70% of patients had Mallampati class II, while 23.3% had class III. The mean inter-incisor distance (IID) was 5.0 ± 0.7 cm, and upper lip bite test (ULBT) findings showed that 76.7% of patients had alignment along the vermilion line (VL). Neck circumference averaged 41.2 ± 5.1 cm. Hyo-mental distance in neck extension (HMD/NE) was 5.3 ± 0.7 cm, while thyromental distance (TMD) was 7.1 ± 0.9 cm. Cormack-Lehane grading indicated that 80% of patients had Grade I laryngoscopy (easy intubation), whereas 3.3% had Grade III (difficult intubation). A significant negative correlation was observed between BMI and HMD/NE ($r = -0.32$, $p = 0.012$) as well as TMD ($r = -0.25$, $p = 0.048$). Neck circumference showed a strong positive correlation with BMI ($r = 0.41$, $p = 0.001$), suggesting its utility as a predictor of difficult airway in obese patients. This study found no statistically significant association between Mallampati score and difficult intubation ($p = 0.72$), indicating its limited predictive value in the morbidly obese surgical population.

Table 1: Demographic and Physical characteristics of the study population (n=60)

Variable	Mean $\pm$ SD / n (%)
Age (years)	32.5 ± 10.2
Gender distribution	
Male	18 (30%)
Female	42 (70%)
Weight, height, and BMI	
Weight (kg)	120.4 ± 22.5
Height (cm)	165.2 ± 9.8
BMI (kg/m ²)	44.3 ± 4.6

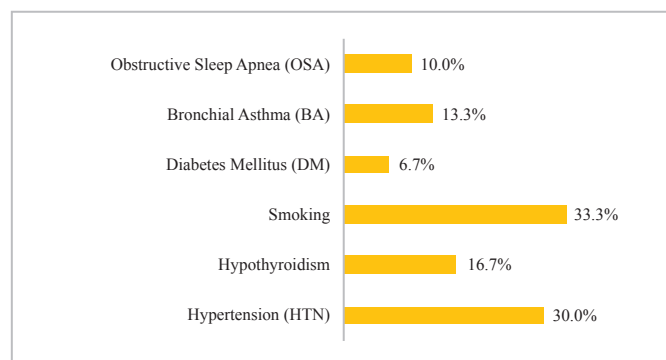


Figure 1: Comorbidities distribution

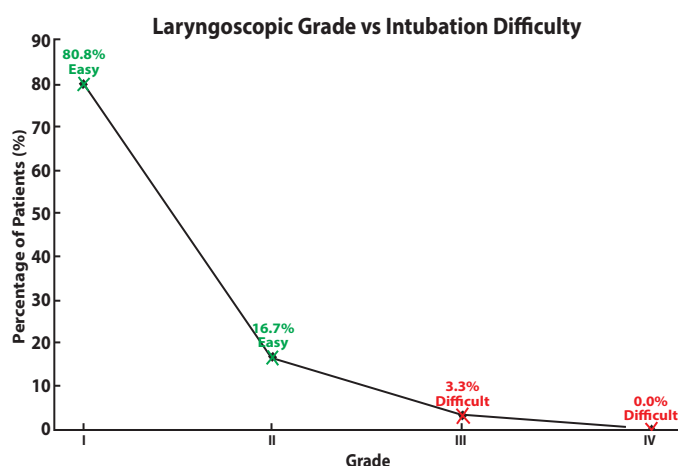
Table 2: Airway assessment parameters

Parameter	Mean $\pm$ SD / n (%)
MMS (Mallampati Score)	32.5 $\pm$ 10.2
I	4 (6.7%)
II	42 (70%)
III	14 (23.3%)
IV	0 (0%)
IID (cm)	5.0 $\pm$ 0.7
ULBT (Upper Lip Bite Test)	
Along the VL	120.4 $\pm$ 22.5
Above the VL	165.2 $\pm$ 9.8
Below the VL	44.3 $\pm$ 4.6
Neck Circumference (cm)	41.2 $\pm$ 5.1

IID: Inter-incisor distance**Table 3: Airway management measurements (cm)**

Measurement	Mean $\pm$ SD	Range
HMD/NE	5.3 $\pm$ 0.7	4.0–6.5
HMD/NN	4.2 $\pm$ 0.6	3.25–5.0
TMD	7.1 $\pm$ 0.9	6.0–8.75
SMD	16.8 $\pm$ 2.1	12.0–19.0

HMD: Hyomental distance, NE: Neck extension, NN: Neck normal, TMD: Thyromental distance, SMD: Sternomental distance

**Figure 2: Correlation between Cormack Lehane grade and intubation difficulty****Table 4: Correlation between BMI and airway parameters**

Parameter	r	p-value
HMD/NE	-0.32	0.012*
TMD	-0.25	0.048*
Neck Circumference	0.41	0.001**

r: Correlation coefficient, *p: < 0.05, **p: < 0.01

Table 5: Correlation between Mallampati score and incidence of difficult intubation

Class	Difficult Intubation		p-value
	Yes	No	
n (%)			
I	0 (0.0%)	4 (100.0%)	p = 0.721
II	5 (11.9%)	37 (88.1%)	
III	2 (14.3%)	12 (85.7%)	

χ^2 test for trend; p > 0.05, not statistically significant

Discussion:

This study provides critical insights into airway management for morbidly obese patients undergoing laparoscopic surgery in the population of Kuwait. Three principal findings emerge: (1) despite high BMIs (mean 44.3 kg/m²), 80% of patients had Cormack-Lehane Grade I video laryngoscopy, (2) neck circumference demonstrated the strongest correlation with difficult airway predictors (r=0.41, p=0.001), and (3) traditional screening tools like Mallampati classification showed limited predictive value in this cohort. These observations challenge the conventional assumption that obesity uniformly predicts difficult intubation¹⁶, while highlighting the importance of specific anatomical measurements for risk stratification¹⁷.

The predominance of Grade I laryngoscopic views contrasts with earlier reports suggesting 15-20% difficult intubation rates in obese surgical populations¹⁸. This discrepancy may reflect several factors: improved preoperative assessment protocols, the expertise of attending anesthesiologists, or potential ethnic variations in airway anatomy among South Asian populations¹⁹. Finding of this study that only 3.3% of patients had Grade III laryngoscopy suggests that blanket predictions of airway difficulty based solely on BMI may be inappropriate in this demographic, supporting calls for region-specific airway management guidelines²⁰. Neck circumference emerged as the most robust predictor of challenging airways, aligning with recent meta-analyses identifying it as superior to BMI for risk assessment^{17,21}. The significant negative correlations between BMI and both hyomental distance (r=-0.32) and

thyromental distance ($r=-0.25$) reinforce that fat distribution patterns—particularly cervical and submental deposition—have a greater impact on airway geometry than total body weight²². These measurements, when combined with functional tests like the Upper Lip Bite Test¹⁴, could enhance preoperative airway evaluation protocols for obese patients. The limited discriminative power of Mallampati scoring (70% Class II) in our study mirrors growing skepticism about its reliability in obese populations. While current guidelines still recommend it as a screening tool⁹, data of this study suggest that objective measurements like neck circumference and thyromental distance may provide more consistent predictive value. This is particularly relevant for laparoscopic procedures, where pneumoperitoneum-induced respiratory changes demand accurate preoperative risk assessment.

From a clinical perspective, these findings suggest three key practice modifications: First, neck circumference >40 cm should prompt preparation for potential difficult intubation, including availability of advanced airway devices. Second, airway assessment protocols should integrate both anatomical measurements (thyromental distance, neck circumference) and functional tests (Upper Lip Bite Test) for comprehensive evaluation. Third, in resource-limited settings, simple anthropometric measurements may offer more practical and cost-effective risk stratification than complex imaging or scoring systems.

The strong correlation between neck circumference and difficult airway predictors ($r=0.41$) particularly supports its use as a bedside screening tool. Recent video laryngoscopy studies suggest this measurement may have even greater predictive value when combined with newer technologies. While this analysis focused on NC, TMD, and HMD, the Upper Lip Bite Test (ULBT) remains a well-validated tool recommended for comprehensive airway assessment, particularly for evaluating mandibular mobility and predicting difficulty²³. No significant correlation was observed between Mallampati classification and difficult airway incidence in morbidly obese patients, demonstrating its poor predictive utility for this demographic.

Limitations:

This single-center study had a limited sample size. Purposive sampling may introduce selection bias. Generalizability to non-laparoscopic procedures or other ethnic groups requires caution. Future multicenter studies with advanced airway devices could validate these findings.

Conclusion:

This study demonstrates that while most morbidly obese patients had straightforward intubation, neck circumference strongly predicted airway difficulty. Traditional Mallampati scoring showed limited utility, whereas anthropometric measurements like thyromental distance provided better risk stratification. These findings emphasize the need for obesity-specific airway assessment protocols, particularly in South Asian populations where cervical fat distribution patterns may differ from Western cohorts. Simple measurements like neck circumference offer practical, cost-effective preoperative screening in resource-limited settings.

Recommendation:

- Incorporate neck circumference >40 cm as a difficult airway predictor
- Combine anthropometric measurements with functional tests like ULBT
- Develop regional airway guidelines for South Asian obese populations
- Prioritize simple, cost-effective measurements in resource-limited settings

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None.

Conflict of interest:

No conflict of interest.

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Authors' Contributions:

Akhter S designed and drafted the study, collected and analyzed the data, interpreted the results, completed literature review and wrote up the draft manuscript. Patwary A, Rahman MN and Nipa UH were involved in data collection, the manuscript review and editing. All authors read, gave the final critical review of the manuscript and approved it.

Data Availability:

Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethical Approval and Consent to Participate:

Ethical approval for the study was obtained from the Institutional Review Board. The written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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Comparison of Forced Vital Capacity, Forced Expiratory Volume in 1st Second and Their Ratio between Yogic and Sedentary Population in Rajshahi City

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Abstract

Background: The forced expiratory volume in one second (FEV₁) and forced vital capacity (FVC) are two crucial pulmonary function tests (PFT) that are also somewhat predictive of life survival. In primary care practice, spirometry is being promoted more and more as a tool for respiratory disease screening, diagnosis and monitoring. In healthy individuals, yoga improves respiratory efficiency and can be an essential part of a healthy lifestyle. **Methods:** This cross-sectional comparative study was carried out in the Department of Physiology, Rajshahi Medical College, Rajshahi from July 2022 to June 2023 on male and female residents in Rajshahi City who were between the ages of 30 to 50 years. A semi-structured questionnaire and a Spirometer were utilized to gather information from 260 participants. Of these, 130 were yoga practitioners and 130 were sedentary workers. **Results:** Out of 260 respondents, yogic respondents had higher FVC and FEV₁ value than the sedentary worker and they were statistically highly significant ($p < 0.001$ for FVC and FEV₁). But FEV₁/FVC was lower in yogic respondents than sedentary workers and statistically highly significant ($p < 0.001$). **Conclusion:** According to the study, sedentary workers performed worse on PFT than yogic workers. Another use for yoga would be as a supplement or substitute for traditional treatment of respiratory conditions.

Keywords: Yoga, Sedentary workers, FVC and FEV₁.

Introduction:

The Sanskrit root YUJ, meaning "union" or "bringing together," is where the word yoga originates¹. A system of physiology that was developed in this subcontinent thousands of years ago is referenced in yoga practice, which consists of asana and pranayama. Research has been done on the physiological effects of yoga poses, breathing techniques, pranayama, and meditation^{2,3}. The scientific community has become much more interested in yoga in recent years. Not just yogis can

benefit from yoga; regular people can also do it⁴. Yoga is thought to be a more effective way to develop physical fitness than other training methods. It is not just about holding your breath while bending or twisting your body. It is a method to enter a state where one perceives and feels reality just as it is. Yoga in all its forms, when done consistently, has a positive impact on the body's systems, particularly the lungs⁵. The voluntary and involuntary respiratory muscles are strengthened by regular, prolonged, forceful inspiration and expiration during yoga practice, which could explain this. This promotes ideal lung deflation and inflation. Prostaglandin and lung surfactant are released into

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the alveolar spaces in response to the physiological stimulus of maximum inflation and deflation, respectively, increasing lung compliance and decreasing bronchial smooth muscle tone^{6,7}. Yoga is the best way to maintain lung health. It is believed that yoga lowers stress levels and strengthens the lungs, increasing their effectiveness. Bow pose and other yoga poses strengthen and expand the lungs' capacity. Doing yoga can help clear the airways of mucus. One yoga technique that improves respiratory efficiency is pranayama. All of the exercises are performed through the nostrils, which provide resistance through reduced cross sectional area and turbulence. These exercises include forceful inspiration to total lung capacity (TLC) and forceful exhalation to residual volume. Anulom vilom pranayama further increases the resistance by breathing through one nostril. Yoga helps to strengthen the respiratory muscles, which raises FEV₁ and peak expiratory flow rates. Increased forced vital capacity (FVC) is a measure of how well the respiratory system is emptied and filled during yoga practice^{8,9}. During inspiration, yogic breathing increases the negative pressures in the thoracic and abdominal cavities. It also causes the diaphragm to move more than it normally does, which improves vital capacity. Yoga poses that relieve excessive tension in the skeletal muscles promote better thoracic relaxation. It appears that all of these procedures raise expiratory reserve volume (ERV), which raises vital capacity^{10,11}. Although yoga had a number of beneficial effects on lung function, there were not many studies done in Bangladesh on the subject. In contrast to sedentary people, the purpose of this study was to evaluate the effects of Yogic exercise on pulmonary function tests (FVC, FEV₁ and their ratio).

Methods:

This cross-sectional comparative study was carried out from July 2022 to June 2023 in the Department of Physiology at Rajshahi Medical College in Rajshahi to evaluate FVC, FEV₁, and their ratios in yogic and sedentary individuals. Participants in this study included both men and women in their 30 to 50 years who practiced yoga and those who did not. A semi-structured questionnaire in accordance with the study's goals was created prior to its execution

and it was used to gather data. One group consisted of 130 adult respondents between the ages of 30 to 50 who practiced yoga while another group was purposefully made up of a similar number of sedentary workers in the same age range. Respondents had at least 30 minutes to rest prior to the FVC and FEV₁ measurements. Sociodemographic information, smoking history, recent illness in the respiratory system, medications taken, family history of bronchial asthma and systemic disorders were gathering points. The FVC and FEV₁ measurements were performed in a large, well-ventilated room with an ambient temperature between 28°C and 35°C. In order to prevent diurnal fluctuations in pulmonary functions, the measurement was conducted between 8 am and 12 pm. A qualified physician with experience using a digital spirometer conducted the test after thoroughly explaining the device and test methodology to each respondent. We used the "Statistical Package for Social Sciences (SPSS)" software, version 26 was used to analyze the data. A p-value of less than 0.05 was considered statistically significant for each test.

Results:

In both yogic and sedentary worker groups, graduation completed respondents were proportionately higher (Figure-I).

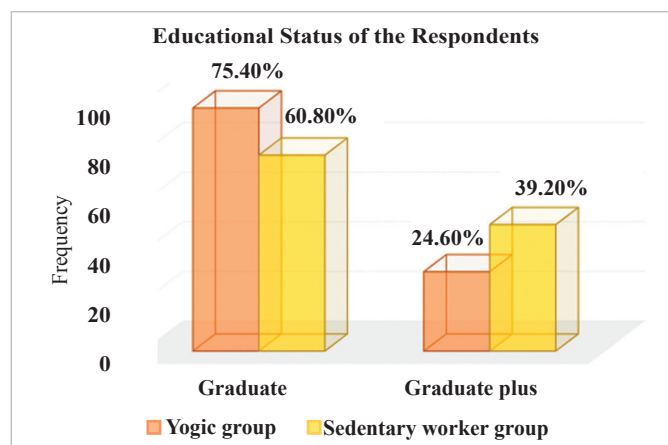


Figure-I: Distribution of the respondents by educational status (n=130 in each group).

In both yogic and sedentary worker groups, Govt. service holder respondents were proportionately higher (Table-01).

Table-01: Distribution of the respondents by their occupational status (n=130 in each group).

Occupational status	Frequency (%)	
	Yogic group	Sedentary worker group
Govt. service	89 (68.50%)	95 (73.10%)
Housewife	17 (13.00%)	6 (4.60%)
Businessman	9 (6.90%)	1 (0.80%)
NGO worker	7 (5.40%)	2 (1.50%)
Doctor	4 (3.10%)	22 (16.90%)
Others	4 (3.10%)	4 (3.10%)
Total	130 (100.00%)	130 (100.00%)

Table-02: Comparison of measured FVC between the yogic and sedentary worker respondents.

Variables	Measured FVC (L) (mean $\pm$ SD)		t-value	p-value
	Yogic group	Sedentary worker group		
Male respondents (n=65 in each group)	4.27 $\pm$ 0.51	3.22 $\pm$ 0.53	11.49	< 0.001
Female respondents (n=65 in each group)	2.99 $\pm$ 0.26	2.44 $\pm$ 0.33	10.62	< 0.01
All respondents (n=130 in each group)	3.63 $\pm$ 0.75	2.83 $\pm$ 0.59	9.56	< 0.001

(Data were analyzed by **Unpaired t-Test** and were presented as **mean $\pm$ SD**. P value < 0.05 was considered as significant.)

FEV1 was significantly higher in yogic respondents than sedentary worker respondents ($p < 0.001$), also male ($p < 0.001$) and female ($p < 0.05$) separately (Table-03).

Table-03: Comparison of measured FEV₁ between the yogic and sedentary worker respondents.

Variables	Measured FEV ₁ (L) (mean $\pm$ SD)		t-value	p-value
	Yogic group	Sedentary worker group		
Male respondents (n=65 in each group)	3.51 $\pm$ 0.54	2.74 $\pm$ 0.44	8.89	< 0.001
Female respondents (n=65 in each group)	2.21 $\pm$ 0.28	2.09 $\pm$ 0.28	2.28	< 0.05
All respondents (n=130 in each group)	2.86 $\pm$ 0.78	2.42 $\pm$ 0.49	5.44	< 0.001

(Data were analyzed by **Unpaired t-Test** and were presented as **mean $\pm$ SD**. p value < 0.05 was considered as significant.)

FEV₁/FVC was significantly higher in yogic respondents than sedentary worker respondents ($p < 0.001$), also male ($p < 0.05$) and female ($p < 0.001$) separately (Table-04).

Table-04: Comparison of measured FEV₁/FVC between the yogic and sedentary worker respondents.

Variables	Measured FEV ₁ /FVC (%) (mean $\pm$ SD)		t-value	p-value
	Yogic group	Sedentary worker group		
Male respondents (n=65 in each group)	82.40 $\pm$ 8.91	85.80 $\pm$ 9.67	2.09	< 0.05
Female respondents (n=65 in each group)	73.98 $\pm$ 8.85	86.58 $\pm$ 8.96	8.06	< 0.001
All respondents (n=130 in each group)	78.19 $\pm$ 9.80	86.19 $\pm$ 9.30	6.75	< 0.001

(Data were analyzed by **Unpaired t-Test** and were presented as **mean $\pm$ SD**. p value < 0.05 was considered as significant.)

Discussion:

In this study, measured FVC in the yogic male group was 4.27 $\pm$ 0.51 L and the sedentary worker male group was 3.22 $\pm$ 0.53 L and highly significant ($p < 0.001$). Same findings were found with the study done by Akhani et al¹². where FVC in yogic males was 4.30 $\pm$ 0.71 L and in sedentary males was 4.07 $\pm$ 0.66 L and highly significant ($p < 0.01$).

In the present study, measured FVC in the yogic female group was 2.99 $\pm$ 0.26 L and the sedentary worker female group was 2.44 $\pm$ 0.33 L and it was statistically highly significant ($p < 0.001$). In line findings were found with the study done by Akhani et al¹². where FVC in yogic females was 3.25 $\pm$ 0.85 L and in sedentary females was 3.13 $\pm$ 0.63 L and statistically significant ($p < 0.05$).

In this study, measured FVC in the yogic group was 3.63 $\pm$ 0.75 L and the sedentary worker group was 2.83 $\pm$ 0.59 L and highly significant ($p < 0.001$).

Resembled findings were also found with the studies done by Vedala et al.¹³, Prakash and Meshram⁶, Stuart and Collings¹⁴, Khurde et al.¹⁵, Birkel and Edgren⁹, Manaspure et al.¹⁶, Chakraborty et al.¹⁷, Mason et al.¹⁸ and Akhani et al.¹² But different findings were found in a study done by Peter et al.¹⁹ where among the yogic respondents FVC was $86.80 \pm 16.08\%$ and among the sedentary worker respondents FVC was $89.38 \pm 15.55\%$ and statistically not significant ($p > 0.05$).

In the present study, measured FEV₁ among the yogic males was 3.51 ± 0.54 L and the sedentary worker males was 2.74 ± 0.44 L and highly significant ($p < 0.001$). Same findings were found with the study done by Akhani et al.¹² where FEV₁ in yogic males was 3.46 ± 0.59 L and in sedentary males was 3.25 ± 0.57 L and highly significant ($p < 0.01$).

In the current study, measured FEV₁ in the yogic female group was 2.21 ± 0.28 L and the sedentary worker female group was 2.09 ± 0.28 L and significant ($p = 0.02$). In line findings were found with the study done by Akhani et al.¹² where FEV₁ in yogic females was 2.62 ± 0.71 L and in sedentary females was 2.50 ± 0.52 L and statistically significant ($p < 0.05$).

In the study, measured FEV₁ among the yogic respondents was 2.86 ± 0.78 L and the sedentary worker respondents was 2.42 ± 0.49 L and highly significant ($p < 0.001$). Nearly similar findings were found in a study done by Peter et al.¹⁹ where among the yogic respondents FEV₁ was $94.20 \pm 14.25\%$ and among the sedentary worker respondents FEV₁ was $87.92 \pm 20.67\%$ and statistically significant ($p = 0.04$). Same findings were also found with the studies done by Vedala et al.¹³, Makwana et al.²⁰, Khanam et al.²¹, Akhani et al.¹², Khurde et al.¹⁵, Prakash and Meshram⁶, Birkel and Edgren⁹, Manaspure et al.¹⁶, Chakraborty et al.¹⁷ and Mason et al.¹⁸.

In the current study, measured FEV₁/FVC among the yogic respondents was $78.19 \pm 9.80\%$ and the sedentary worker respondents was $86.19 \pm 9.30\%$ and it was statistically highly significant ($p < 0.001$). There was no statistically significant difference of

FEV₁/FVC between the yogic and sedentary group with the studies done by Lakhera and Kain²², A Oa²³, Moovenathan and Khode²⁴ and Hagberg and Yerg²⁵. But dissimilar findings were found in a study done by Peter et al.¹⁹ where among the yogic respondents FEV₁/FVC was $109.08 \pm 9.69\%$ and among the sedentary worker respondents FEV₁/FVC was $99.42 \pm 21.58\%$ and highly significant ($p = 0.001$). Contradictory findings were also found with the studies done by Vedala et al.¹³, Akhani et al.¹², Birkel and Edgren⁹, Manaspure et al.¹⁶, Chakraborty et al.¹⁷ Those who practiced yoga had higher maximum pulmonary function parameters than those who were normally sedentary. Regular exercise is therefore crucial for assessing and enhancing lung functions.

The study had certain limitations, including being a cross-sectional comparative study conducted in a single community with a relatively small sample size. The technique of purposive sampling was utilized. Thus, it was impossible to prevent selection bias. The results of the study may not accurately reflect the situations in the entire nation because there were only four yoga centres located in Rajshahi city.

Conclusion:

Regular yoga practice helps sedentary people experience positive physical, psychological, and physiological changes. People who lead sedentary life styles are more likely to develop restrictive lung function. Consequently, compared to yoga practitioners, sedentary workers have the lowest pulmonary function values.

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Authors' Contributions:

Rahman F designed and drafted the study, collected and analyzed the data, interpreted the results,

completed literature review and wrote up the draft manuscript. Parvin M, Rahman MAU, Zohura FT, Ahmad M, Munni AJ, Ferdous R and Khan MJM were involved in data collection, the manuscript review and editing. All authors read, gave the final critical review of the manuscript and approved it.

Data Availability:

Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethical Approval and Consent to Participate:

Ethical approval for the study was obtained from the Institutional Review Board. The written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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Diagnosis and Pharmacological Management of Migraine: A Clinical Overview

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Abstract

Introduction: Migraine is a common and disabling primary headache disorder characterized by recurrent episodes of moderate-to-severe head pain, often accompanied by nausea, vomiting, and sensory sensitivities such as photophobia and phonophobia. It affects a substantial proportion of the global population, particularly women, and has significant impacts on quality of life.

Objective: This study aims to evaluate the clinical profile, triggers, and treatment patterns among migraine patients. **Methods:** This cross-sectional observational study was conducted in BNS Upasham and Islami Bank Hospital, Khulna in Bangladesh, over 1 year, including 60 patients aged 18 years and above who were diagnosed with migraine. Descriptive statistics were analyzed using SPSS version 25.0. **Result:** Unilateral headache, photophobia, and nausea were frequent clinical features, while stress and sleep disturbances were the leading triggers. NSAIDs and triptans were the most commonly used acute therapies, and beta-blockers and antiepileptics were the primary preventive agents. Overall, over 60% of patients experienced a significant reduction in attack frequency, and 70% reported satisfaction with their treatment. **Conclusion:** Effective diagnosis and individualized pharmacological management, using acute therapies (NSAIDs, triptans) and preventive agents (beta-blockers, antiepileptics), significantly reduce migraine attacks and disability, highlighting evidence-based strategies for optimal care.

Keywords: Diagnosis, Pharmacological Management, Migraine, NSAIDs

Introduction:

Migraine is a common, disabling primary headache condition with recurrent episodes of moderate to severe headache pain, typically unilateral and pulsating, accompanied by nausea, photophobia, phonophobia, and in some instances, transient neurologic aura. Today's diagnostic framework utilizes the International Classification of Headache Disorders (ICHD-3), which normalizes attack length, symptom cluster, and the differentiation between migraine, tension-type, and secondary headache criteria-facilitating reproducible diagnosis

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in research and clinical environments¹. Correct diagnosis begins with targeted history: onset age, headache frequency and duration, typical attack phenotype, aura presence and nature, autonomic or brainstem symptoms that accompany the headache, menstrual correlation, and triggering factors. Red-flag symptoms (sudden onset "thunderclap" headache, progressive neurological deficit, first severe headache at advanced age, immunosuppression or systemic abnormalities) necessitate urgent neuroimaging and referral to rule out secondary aetiology. Structured clinical tools and algorithm guidelines enable triage of investigations and reduction in unnecessary imaging by generalists and neurologists^{2,3}. Treatment is pharmacological, bipartite: acute (abortive) to abort attacks and regain function and

preventive (prophylactic) to reduce frequency, severity, and resulting disability of attacks. Acute treatment traditionally concerns simple analgesics and triptans -serotonin (5-HT_{1B/1D}) receptor agonists-and they are still first-line in moderate-to-severe attacks when non-opioid analgesics fail; triptans have well- established efficacy and some contraindications (e.g., cardiovascular disease)⁴. The past decade has seen revolutionary pharmacologic advances on the basis of pathophysiologic insight. CGRP pathway-directed therapies - prevention with large-molecule monoclonal antibodies and treatment for acute and preventive uses with small-molecule receptor antagonists ("gepants") -provided disease-specific options with favorable tolerability on top of several repurposed oral preventives. Ditans (e.g., lasmiditan) provide a non-vasoconstrictive acute alternative for cardiovascular risk patients in whom triptans cannot be used. Randomized controlled trials and guideline updates soon incorporated these medications into practice, expanding options but also apprehension about sequencing, long-term safety, cost, and access⁵⁻⁸. Individualized care is now the focus of clinical practice: allocating mechanism and risk profile to patient comorbidities, response to previous treatment, attack frequency, and patient preference. Consensus guidelines and expert society practice recommendations have recommended CGRP-targeting monoclonal antibodies and gepants as useful options in patients with an unsatisfactory response or intolerance to traditional preventives, and new position statements went so far as to place CGRP-targeting treatments as first-line consideration in well-chosen patients with disabling migraine. Yet, firmly entrenched oral medications (beta-blockers, topiramate, antidepressants), onabotulinumtoxin A for chronic migraine, and non-pharmacological treatments (healthy sleep, trigger management, behavioural therapy) remain cornerstones of overall management^{4-6,9}.

Methods:

This cross-sectional observational study was conducted in BNS Upasham and Islami Bank Hospital, Khulna, Bangladesh, over a 1-year period, in 60 patients aged ≥ 18 years with migraine according to ICHD-3 criteria. Secondary headaches, chronic systemic disease affecting headache patterns, and partial records were excluded.

Participants were recruited via convenience sampling, and data were collected using a structured case record form for demographics, clinical presentation (type, frequency, intensity, laterality, and associated symptoms), precipitating factors (hormonal changes, sleep disturbance, stress, diet and environmental triggers), drug treatment (acute medications such as NSAIDs, triptans, and antiemetics, and prophylactics such as beta-blockers, antiepileptics, antidepressants, and CGRP monoclonal antibodies), and treatment response, in the form of frequency reduction and patient satisfaction. Descriptive statistics were explored using SPSS software version 25.0, reporting categorical variables as frequencies and continuous variables as mean $\pm$ standard deviation. The study was in accordance with the Declaration of Helsinki, obtaining informed consent from participants, and ensuring confidentiality and voluntary participation.

Results:

Table I. Age and Gender Distribution of Study Population (n = 60)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
18–25	14	23.3
26–35	21	35.0
36–45	16	26.7
>45	9	15.0
Gender		
Male	18	30.0
Female	42	70.0

Most patients (35.0%) were between 26–35 years, followed by 36–45 years (26.7%). Females accounted for 70% of the study population, reflecting the known higher prevalence of migraine in women, particularly during reproductive age.

Table II. Clinical Characteristics of Migraine Attacks (n = 60)

Characteristics	Frequency (n)	Percentage (%)
Type of migraine		
With aura	17	28.3
Without aura	43	71.7
Pain location		
Unilateral	39	65.0

Bilateral	21	35.0
Associated symptoms		
Nausea/Vomiting	44	73.3
Photophobia	48	80.0
Phonophobia	46	76.7

Migraine without aura (71.7%) was more common than migraine with aura (28.3%). Most patients reported unilateral headache (65.0%), and associated symptoms such as photophobia (80.0%) and phonophobia (76.7%) were highly prevalent, consistent with typical migraine features.

Table III. Trigger Factors Reported by Patients (n = 60)

Trigger	Frequency (n)	Percentage (%)
Stress	32	53.3
Sleep disturbance	28	46.7
Certain foods (e.g., cheese, chocolate)	20	33.3
Hormonal changes (in females)	18	30.0
Weather changes	15	25.0

Stress (53.3%) and sleep disturbance (46.7%) were the most commonly reported migraine triggers. Dietary factors, hormonal changes, and weather fluctuations were also noted as significant contributors in a proportion of patients.

Table IV. Acute Pharmacological Management (n = 60)

Acute therapy used	Frequency (n)	Percentage (%)
NSAIDs/paracetamol	40	66.7
Triptans	28	46.7
Combination therapy (NSAID + triptan)	15	25.0
Antiemetics	30	50.0

NSAIDs and paracetamol were the most widely used acute treatments (66.7%), followed by triptans (46.7%). Half of the patients used antiemetics, while 25.0% reported combination therapy with NSAIDs and triptans for better relief.

Table V. Preventive Pharmacological Therapy (n = 60)

Preventive therapy	Frequency (n)	Percentage (%)
Beta-blockers (propranolol)	22	36.7
Antiepileptics (topiramate, valproate)	18	30.0
Antidepressants (amitriptyline)	12	20.0
CGRP monoclonal antibodies	8	13.3

Preventive therapy was most frequently prescribed as beta-blockers (36.7%), followed by antiepileptics (30.0%) and antidepressants (20.0%). A smaller

proportion (13.3%) used newer CGRP monoclonal antibodies, reflecting limited accessibility despite their proven efficacy.

Table VI. Treatment Response and Satisfaction (n = 60)

Outcome	Frequency (n)	Percentage (%)
Significant reduction in attack frequency (>50%)	38	63.3
Moderate reduction (30–50%)	12	20.0
Minimal/no improvement	10	16.7
Patient satisfaction with treatment	42	70.0

A significant reduction in migraine frequency (>50%) was reported by 63.3% of patients, while 20.0% experienced moderate improvement. Only 16.7% had minimal or no response. Overall, 70.0% of patients expressed satisfaction with their treatment outcomes.

Discussion:

In this cohort of 60 migraine patients, the female predominance (70%) reflects a widely reported global trend; for instance, a study found that approximately 70–75% of migraine sufferers were women¹⁰. This aligns closely with our findings and reinforces the biological and hormonal underpinnings of migraine's gender disparity. Age distribution in this cohort echoed global patterns as well: most patients fell within the third and fourth decades of life. The Global Burden of Disease (GBD) 2016 Headache Collaborators reported that migraine ranks among the top causes of years lived with disability, particularly in the 25–39 age group¹¹, reflecting the high socio-economic impact of migraine in this active age range.

Regarding migraine subtypes, our finding that migraine without aura comprised roughly 72% of cases is consistent with epidemiological observations. For example, Buse et al. reported in the AMPP study that approximately 19% of migraineurs experience aura, implying that non-aura cases dominate (i.e., >80%)¹². Though our percentage is slightly lower, the predominance remains. Triggers in our study—chiefly stress (53%) and sleep disturbance (47%)—are broadly in line with prior surveys. In a large cross-sectional study by Kelman, stress was cited as a trigger by 79% of respondents, and sleep-related problems by about 60%¹³. While number of this study are somewhat

lower, the relative ordering of triggers is comparable, suggesting similar environmental and lifestyle influences. When evaluating acute treatment, 47% of patients in this study used triptans, and 67% relied on NSAIDs or paracetamol. A meta-analysis revealed that triptans (e.g., sumatriptan) achieve a two-hour pain-free response in around 60–70% of attacks, while NSAIDs such as ibuprofen provide moderate relief in about 50% of patients¹⁴.

The use patterns of this study correlate with these efficacy profiles—patients often begin with NSAIDs, escalating to triptans for more severe episodes. In the realm of prevention, approximately 37% of the study patients used beta-blockers (e.g., propranolol), and 30% used antiepileptics (e.g., topiramate). The American Headache Society guidelines advocate these first-line preventive agents, noting they achieve a $\geq 50\%$ reduction in attack frequency in ~40–50% of users¹⁵. The outcomes of this study—over 60% of patients reporting significant reduction—suggest favorable efficacy and patient adherence in our setting. Notably, only 13% of our patients used newer CGRP monoclonal antibodies, which may reflect accessibility and cost barriers. Clinical trials (e.g., those reviewed in the European Headache Federation 2022 guideline) indicate these agents yield $\geq 50\%$ reduction in monthly migraine days in about 50–60% of patients, often outperforming oral preventives⁷. This gap in use highlights real-world constraints despite proven effectiveness. Lastly, overall patient satisfaction in this study was around 70%. This proportion is reminiscent of the satisfaction rates reported in a real-world registry: Argyriou et al. found that 65–75% of patients on tailored therapy regimens express satisfaction with control of migraine frequency and intensity¹⁶.

Conclusion:

Effective diagnosis and individualized pharmacological management, using acute therapies (NSAIDs, triptans) and preventive agents (beta-blockers, antiepileptics), significantly reduce migraine attacks and disability, highlighting evidence-based strategies for optimal care.

Recommendation:

It is recommended to implement early and accurate diagnosis of migraine, tailor pharmacological therapy to individual patient profiles, and combine

acute and preventive treatments to effectively reduce attack frequency and associated disability, while also promoting patient education on trigger management and lifestyle modifications.

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No conflict of interest.

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Authors' Contributions:

Akram MS designed and drafted the study, collected and analyzed the data, interpreted the results, completed literature review and wrote up the draft manuscript. Rahman MM, Ahmad M, Nawal M and Sharmin S were involved in data collection, the manuscript review and editing. All authors read, gave the final critical review of the manuscript and approved it.

Data Availability:

Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethical Approval and Consent to Participate:

Ethical approval for the study was obtained from the Institutional Review Board. The written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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Therapeutic Outcomes and Safety Profile of Fluoxetine in Major Depressive Disorder: A Prospective Observational Study in a Tertiary-Care Setting in Bangladesh

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Abstract

Background: Major depressive disorder (MDD) is characterized by persistent depressed mood, loss of interest or pleasure in previously enjoyable activities, recurrent thoughts of death, and physical and cognitive symptoms. Fluoxetine, a selective serotonin reuptake inhibitor (SSRI), is often used to treat it. **Objectives:** The study aimed to explore the therapeutic outcomes and safety profile of Fluoxetine in the treatment of MDD. **Methodology:** This prospective, observational 12-week study enrolled 77 subjects (>18 years of age) with MDD at the Department of Psychiatry, Rajshahi Medical College, between January and June 2022. Participants were selected by systematic random sampling. Data were collected through face-to-face interviews using a semi-structured questionnaire. The DSM-5 diagnostic criteria for MDD were used to identify depression. To assess the severity of depression, the Montgomery-Asberg Depression Rating Scale (MADRS) was used. **Results:** The mean ($\pm$ SD) MADRS total score at baseline was 21.64 ($\pm$ 5.72), which decreased significantly at the 12-week follow-up to 13.66 ($\pm$ 4.78). A paired-sample t-test was conducted to assess the level of significance. The statistical analysis revealed a statistically significant difference ($p < 0.001$). Dizziness 69 (89.60%), headache 65 (84.4%), and weight gain 45 (58.4%) were the common adverse effects. **Conclusion:** Fluoxetine was effective and well-tolerated, reducing the baseline MADRS score by approximately 36.88% after 12 weeks of treatment, and may be considered a suitable antidepressant for the management of major depressive disorder.

Keywords: Fluoxetine, Major Depressive Disorder, Montgomery-Asberg Depression Rating Scale, Bangladesh.

Introduction:

Migraine is a common, disabling primary headache Major Depressive Disorder (MDD) is a mood disorder characterized by the occurrence of one or more major depressive episodes without a history of any manic, hypomanic, or mixed episodes. These

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experiences often include diminished self-esteem, persistent guilt or self-blame, withdrawal from interpersonal contact, and somatic symptoms such as changes in appetite and sleep patterns. Worldwide, MDD has a prevalence of approximately 10-15% of the population¹. The National Mental Health Survey Bangladesh 2018–2019 reported that depressive disorders affect 6.7% of the population, with a notable gender difference: women experience a higher prevalence

(7.9%) compared to men (5.4%). This highlights the disproportionate burden of depression among women in the country. The Selective Serotonin Reuptake Inhibitors (SSRIs) are one of the most commonly prescribed classes of antidepressant medications. Among the SSRIs, Fluoxetine, one of the first new generation antidepressants, is an extremely popular drug treatment for depression². Fluoxetine's key advantage over previously available antidepressants (TCAs) was its good safety profile, which lowered the incidence of early drop-outs and improved patient compliance, while also providing comparable efficacy against depressive symptoms³. However, there is limited information on the efficacy and safety profile of Fluoxetine among the Bangladeshi population, underscoring the need for further research to better understand its therapeutic benefits and potential adverse effects in this context. Therefore, the present study evaluated the efficacy and safety profile of Fluoxetine by assessing clinical improvement and adverse effects, respectively, during the treatment of MDD. The findings may provide insights into the therapeutic profile of Fluoxetine and assist psychiatrists in selecting an appropriate medication for managing Major Depressive Disorder.

Materials and Methods:

This prospective, observational 12-week follow-up study was conducted at the Department of Psychiatry, Rajshahi Medical College, from January to June 2022, involving patients with MDD. Inclusion criteria were: age ≥ 18 years, having sustained mild to severe depression symptoms, meeting DSM-5 criteria for a diagnosis of MDD, and a Montgomery-Asberg Depression Rating Scale (MADRS) score of ≥ 7 . Patients with suicide risk, episodes of mania or hypomania, schizophrenia, bipolar disorder, substance abuse or dependence, cognitive impairment, hepatic impairment, pregnancy, and current use of antidepressant drugs and lipid-lowering agents, and refusal to consent were excluded.

The sample size was calculated using the formula below:

$$n = \frac{[P_1(100-P_1)+P_2(100-P_2)]/(P_1-P_2)^2}{(P_1-P_2)^2} \times (Z_{\alpha}+Z_{\beta})^2$$

Of all attending MDD patients in the Department of

Psychiatry, a total of 77 participants were selected via systematic random sampling using a lottery method. Data were collected through face-to-face interviews using a semi-structured questionnaire. Cap. Fluoxetine 20 mg once daily was initiated in patients with MDD. Clinical improvement and tolerability of Fluoxetine were evaluated after 12 weeks of treatment. Study objectives were explained to participants, and written informed consent was obtained. The study was approved by the Institutional Review Board (IRB) of Rajshahi Medical College, Rajshahi. The collected data were subjected to appropriate descriptive statistics for the variables, including frequency and percentage, mean, and standard deviation. Paired sample t-test was used for quantitative data, and a p-value of <0.05 was considered statistically significant. The Statistical Package for the Social Sciences (SPSS) version 28 was used to analyze the data.

Results:

Table I: Age distribution of the respondents (n=77)

Age in years	Frequency	Percentage (%)
< 30	36	46.75
30-40	20	25.98
> 40	21	27.77
Mean $\pm$ SD	31.95 $\pm$ 9.40	

Table I shows that the majority of respondents (46.75%) were younger than 30 years, whereas the fewest respondents were in the 30-40 years age group (25.98%).

Table II: Gender distribution of the respondents (n=77)

Gender of the respondents	Frequency	Percentage (%)
Male	26	33.80
Female	51	66.20

Table II shows that female respondents (66.20%) outnumbered male respondents (33.80%).

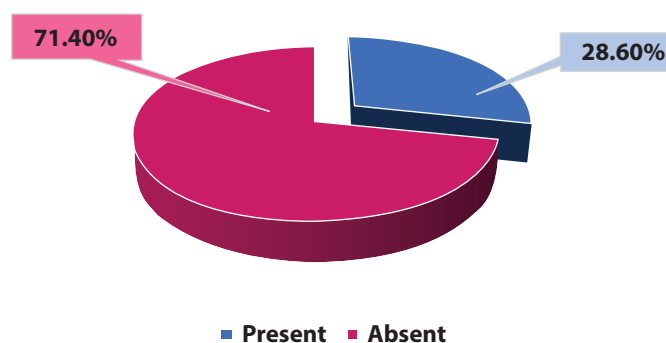


Figure I: Distribution of the respondents by their smoking history (n=77)

The pie chart shows that 22 (28.60%) respondents had a positive smoking history (Figure I).

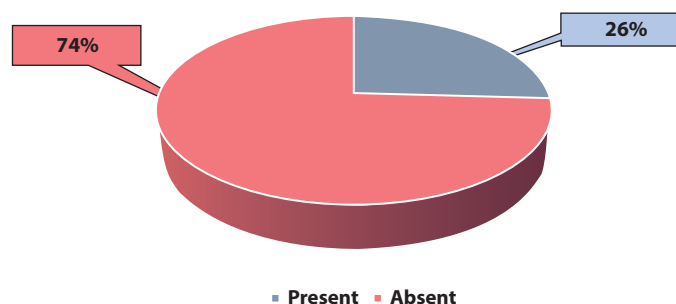


Figure II: Distribution of the respondents by their previous history of depression (n=77)

The pie chart shows that 20 (26%) respondents had a positive previous history (Figure II).

Table III: Mean baseline and follow-up (after 12 weeks) MADRS score difference of the respondents (n=77)

Montgomery-Asberg Depression Rating Scale (MADRS) score	Mean	Standard Deviation (SD)	t	p
Baseline score	21.64	5.72	21.73	<0.001
Follow-up (after 12 weeks) score	13.66	4.78		

Table III shows that the mean baseline MADRS score was 21.64 (± 5.72), and the 12-week follow-up score was 13.66 (± 4.78) (Table III). The reduction in MADRS score was statistically highly significant ($p < 0.001$).

Table IV: Adverse effects in the respondents following treatment with Fluoxetine (n=77)

Adverse effects	Present (%)	Absent (%)
Headache	65 (84.4%)	12 (15.6%)
Dizziness	69 (89.6%)	08 (10.4%)
Nausea	42 (54.5%)	35 (45.5%)
Weight gain	45 (58.4%)	32 (41.6%)
Sexual dysfunction	27 (35.1%)	50 (64.9%)
Diarrhea	05 (6.5%)	72 (93.5%)
Dry mouth	09 (11.7%)	68 (88.3%)
Weakness	19 (24.7%)	58 (75.3%)
Restlessness	04 (5.2%)	73 (94.8%)
Somnolence	14 (8.7%)	63 (81.8%)
Insomnia	20 (26.0%)	57 (74.0%)

Table IV shows that the predominant adverse effect following treatment with Fluoxetine was dizziness

(89.6%), followed by headache (84.4%), and weight gain (58.4%). Other adverse effects are shown in Table IV.

Discussion:

In this study, the majority of patients (46.75%) were younger than 30 years. The mean age of the Fluoxetine-treated group was 31.95 (± 9.40) with a range of 18-51 years. In a study in China, the mean age was 40.7 (± 13.9) for the Fluoxetine-treated group with a minimum and maximum ages of 18 and 65 years, respectively, which was quite similar to the findings of the present study. In this study, more than half (66.20%) of the respondents were female. A study conducted by Huang in 12 countries found that females accounted for 64.70% of respondents in the Fluoxetine-treated group, which was nearly identical with this study⁴.

This present study revealed that among the participants, almost 1/4th (26.00%) of the respondents had a previous history of depression. In a study in India, it was reported that 14.7% of the participants had a previous history of depression, which differs from the findings of the present study⁵. The present study showed that among the respondents, nearly 1/3rd (28.60%) had a smoking history (OR = 1.347). A study in Malaysia revealed that depression and anxiety were significantly associated with smoking (OR = 1.347), which is different from our study findings⁶. This present study showed the mean ($\pm$ SD) MADRS baseline score was (21.64 $\pm$ 5.72), and the second follow-up (after 12 weeks) visit score was (13.66 $\pm$ 4.78). A study conducted in China found that the mean MADRS baseline score was (31.2 $\pm$ 5.1) and the 2nd follow-up (after 8 weeks from baseline) score was (10.8 $\pm$ 9.9) for those treated with Fluoxetine⁴. The findings were largely similar to those of this study.

In this study, dizziness, headache, weight gain, nausea, sexual dysfunction (loss of libido), insomnia, and weakness were the most common side effects. A study in the United States reported that sexual dysfunction (loss of libido) was the most common adverse effect related to Fluoxetine, which coincides with this study⁷. Another study in India found that headache, dizziness, breathlessness, nausea, and loss of appetite were the most frequent adverse effects, findings that are similar to those of the present study⁸. Therefore, this present study demonstrated the advantages of Fluoxetine in both efficacy and tolerability. Hence, this study might postulate that Fluoxetine could help to reduce the depressive

symptoms of patients with Major Depressive Disorder (MDD) effectively with relatively fewer adverse effects.

Conclusion:

Major Depressive Disorder (MDD) is a disabling disorder associated with considerable comorbidities, risk of suicide & consequences. The study provided an overview of Fluoxetine, focusing on its efficacy and adverse effects in the management of MDD. In terms of efficacy, Fluoxetine reduced the baseline score by approximately 36.88% after 12 weeks of treatment. Fluoxetine was also well tolerated, with adverse events generally less common. So, this study concluded that Fluoxetine could be used as an effective and well-tolerated antidepressant drug for the treatment of MDD.

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Conflict of Interest:

The authors declare no conflict of interest.

Author's contributions:

Hassan KMR reviewed the relevant literature, conducted the observation, interpreted the findings, and participated in writing the manuscript. Tuly SJ provided the intellectual foundation of the study design. Ahmad M, Dip RI, Islam M, Rahman MM, and Rahman T contributed to data acquisition, interpretation of the findings, and statistical analysis. Any OH contributed to manuscript preparations. All authors read, gave the final critical review of the manuscript and approved it.

Data Availability:

Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

Ethical Approval and Consent to Participate:

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of Rajshahi Medical College (Ref: RMC/IRB/2022/37 and Date:

02-03-2022).. The written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

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A Comparative Study Between Low-Cost Digital Eyepiece Camera and Multi-Headed Microscope in Undergraduate Histology Teaching

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Abstract:

Background: Histology is a core component of undergraduate medical education, but effective teaching is often limited by large class sizes, high equipment costs, and infrastructure constraints. Multi-headed microscopes enable synchronized viewing but are expensive and difficult to maintain, especially in resource-limited settings. Low-cost digital eyepiece cameras offer a potential alternative by enabling whole-class microscopic display using standard microscopes. **Objectives:** To compare low-cost digital eyepiece camera-assisted histology teaching with multi-headed microscope-assisted teaching in terms of learning outcomes, operational feasibility, and cost. **Methods:** This comparative cross-sectional analytical study was conducted between October 2025 and January 2026 at Army Medical College Jashore and Jashore Medical College. A total of 200 first- and second-year MBBS students participated, with 100 students taught using a low-cost digital eyepiece camera and 100 students taught using a 10-headed teaching microscope. Learning outcomes were assessed using a structured Objective Structured Practical Examination (OSPE). Feasibility indicators included setup time, teaching capacity per session, and technical interruptions. Cost data were obtained from institutional procurement and verified commercial sources. Independent sample t-tests were used for statistical analysis. **Results:** The mean OSPE score was significantly higher in the digital eyepiece camera group (15.79 ± 2.39) than in the multi-headed microscope group (13.79 ± 2.89 ; $p < 0.001$). The digital eyepiece camera demonstrated significantly shorter setup time (3.4 ± 0.6 vs 9.8 ± 1.4 minutes; $p < 0.001$) and fewer technical interruptions (0.7 ± 0.5 vs 2.3 ± 0.8 per session; $p = 0.002$). It allowed 100 students to be taught simultaneously, compared with 9 students per session using the 10-headed microscope, requiring 11 sessions to cover 100 students. The purchase cost of the digital eyepiece camera was BDT 44,500, whereas a 10-headed teaching microscope costs approximately BDT 24–25 lakh. **Conclusion:** Low-cost digital eyepiece camera-assisted histology teaching provides superior learning outcomes while offering markedly greater operational efficiency and far lower cost than multi-headed microscopes. As the first comparative study from Bangladesh, these findings support the adoption of digital eyepiece cameras as a practical and sustainable alternative for undergraduate histology education in resource-limited settings. **Running Title:** Digital Eyepiece Camera versus Multi-Headed Microscope in Histology Teaching

Keywords: Histology education; Digital microscopy; Eyepiece camera; Multi-headed microscope; Undergraduate medical education; Resource-limited settings;

Introduction:

Histology is a core component of undergraduate medical education, where students learn to

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recognize and interpret microscopic structures of normal and pathological tissues. Effective histology teaching requires clear visualization, repeated exposure, and guided interpretation of microscopic slides. These requirements are often difficult to meet in large undergraduate classes due

to limited infrastructure, equipment availability, and teacher–student ratio¹.

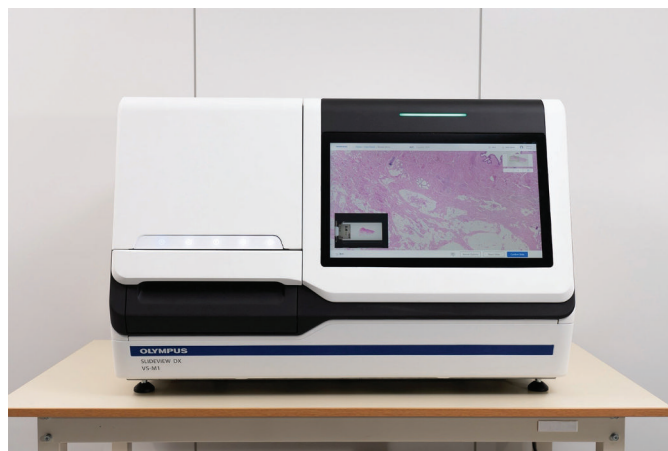
Traditionally, histology practical teaching relies on single-user binocular compound light microscopes, where students independently search for key microscopic features while teachers move among students to provide guidance. This approach often leads to differences in learning experiences, inefficient use of teaching time, and difficulty in ensuring that all students observe the same microscopic features simultaneously². To solve these problems, multi-headed (multi-viewer) microscopes were introduced, so that several students can view the same microscopic field at the same time under direct supervision of the teacher³. Although multi-headed microscopes allow synchronized viewing and interactive discussion, their use is limited by high cost, space requirements, limited portability, and maintenance demands (Photograph 1)⁴. These issues are especially relevant in low- and middle-income countries, where medical colleges have limited budgets and large classes. Consequently, many institutions are unable to provide adequate numbers of multi-headed microscopes for regular undergraduate teaching⁵.



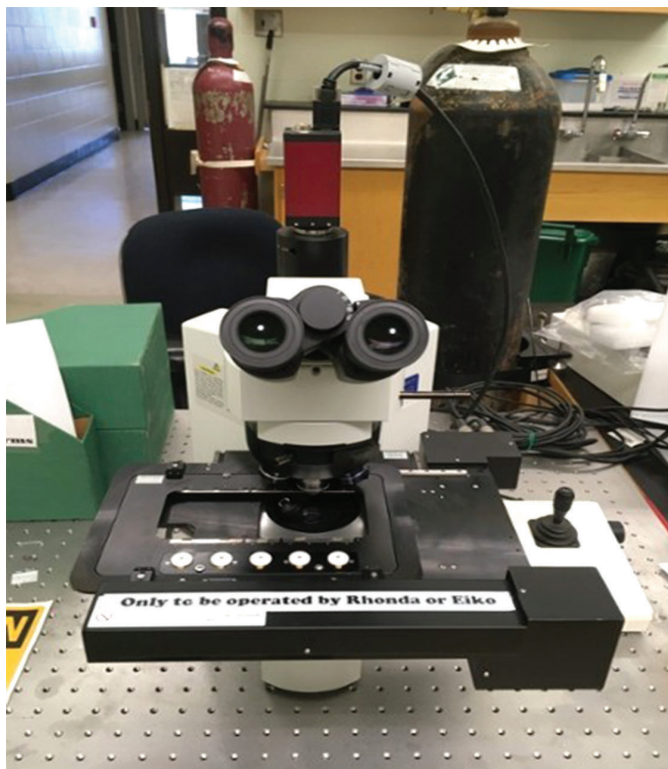
Photograph 1: Ten-headed (multi-headed) teaching microscope used for undergraduate histology teaching at Jashore Medical College.

Recent advances in digital technology have introduced alternative approaches to microscopy-based teaching. Digital microscopy, such as whole-slide imaging (Photograph 2) and virtual microscopy (Photograph 3), improves accessibility and learner engagement, with studies reporting comparable or improved learning outcomes compared to conventional microscopy^{6–8}. However, these systems require high initial costs,

specialized equipment, and reliable internet access, limiting their use in many institutions⁹.



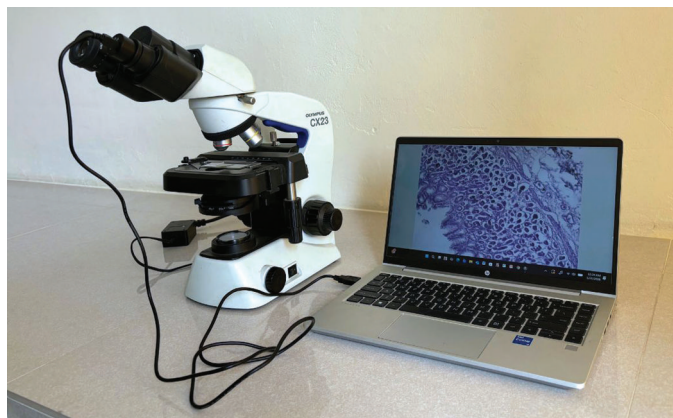
Photograph 2: Whole slide imaging system used for digitization of histological slides¹⁰.



Photograph 3: Virtual microscopy setup for digitization of histological slides¹¹.

A more practical and cost-effective alternative is the use of low-cost digital eyepiece cameras attached to standard light microscopes (Photograph 4). These cameras allow live projection of microscopic images onto monitors, televisions, or smartboards, enabling entire student groups to view the same field at the same time. This improves control over field selection, saves teaching time, and allows histology teaching in lecture galleries or other teaching spaces

without the need for a fixed laboratory setup¹²⁻¹⁴. Although multi-headed microscopes may also be equipped with live projection systems, their use is generally restricted to fixed laboratory settings due to their size and installation requirements. Additionally, digital eyepiece cameras allow image capture for revision and assessment purposes¹⁵.



Photograph 4: Digital eyepiece camera setup used for microscopic slide visualization at Army Medical College Jashore.

In Bangladesh, there is growing interest in digital and virtual methods for teaching histology because of increasing student numbers and limited infrastructure^{16,17}. However, most published studies focus on virtual slides or online histology platforms. Comparative evidence between low-cost digital eyepiece cameras and multi-headed microscopes is limited both locally and internationally. To date, no published study from Bangladesh has systematically compared these two modalities in undergraduate histology teaching. Therefore, this study was designed to compare low-cost digital eyepiece camera-assisted histology teaching with multi-headed microscope-assisted teaching using objective educational and operational measures. The comparison will focus on learning outcomes, feasibility indicators (setup time, class capacity per session, and technical interruptions), and economic implications (capital and maintenance costs). The findings are intended to support evidence-based decisions on procurement and teaching strategies in resource-limited undergraduate settings.

Materials and Methods:

This comparative cross-sectional analytical study was conducted over a period of four months in the Department of Anatomy at Army Medical College

Jashore (AMCJ) from October 2025 to January 2026. The study included first- and second-year MBBS students attending routine histology practical classes. Data were collected from Army Medical College Jashore, where histology teaching was conducted using a low-cost digital eyepiece camera attached to a standard single-user binocular compound light microscope, and from Jashore Medical College, where a multi-headed microscope was routinely used for histology teaching. A total of 200 first- and second-year medical students were enrolled using convenient sampling. Students from Army Medical College Jashore (n= 100) received histology teaching using a low-cost digital eyepiece camera, while students from Jashore Medical College (n= 100) were taught using a multi-headed microscope. Prior permission was obtained from the Head of the Department of Anatomy before data collection and informed consent was obtained from all participants before inclusion in the study. Both cohorts were taught selected histology topics using their respective teaching modalities following the same syllabus content, learning objectives, and session duration. Learning outcomes were assessed using a structured Objective Structured Practical Examination (OSPE), developed according to a pre-designed format and an identical marking scheme for both teaching modalities. Feasibility indicators, including setup time, class capacity per session, and number of technical interruptions, were recorded using a structured observation checklist. Cost-related data were collected independently from institutional procurement records and verified sources, including equipment purchase price and maintenance costs. Ethical clearance was obtained from the Institutional Ethical Review Board (IERB) of Army Medical College Jashore prior to initiation of the study. Data entry and statistical analysis were performed using IBM SPSS version 26.0. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used where appropriate. Independent sample t-tests were applied for comparison of numerical variables, and a p-value of less than 0.05 was considered statistically significant.

Results:

A total of 200 first- and second-year medical students participated in the study, with 100 students from Army Medical College Jashore (Digital

eyepiece camera group) and 100 students from Jashore Medical College (Multi-headed microscope group). All enrolled participants completed the scheduled teaching sessions and were included in the final analysis. The learning outcomes, assessed by structured OSPE scores, showed that students taught using the digital eyepiece camera achieved a significantly higher mean score (15.79 ± 2.39) compared with those taught using the multi-headed microscope (13.79 ± 2.89). The difference between the two groups was highly statistically significant ($p < 0.001$), indicating superior learning performance with digital eyepiece camera-assisted histology teaching (Table 1).

Table 1: Comparison of OSPE scores between digital eyepiece camera and multi-headed microscope groups

Parameter	Digital eyepiece camera group (n=100)	Multi-headed microscope group (n=100)	p value
OSPE score (mean $\pm$ SD)	15.79 ± 2.39	13.79 ± 2.89	< 0.001

Feasibility analysis demonstrated significant operational differences between the two teaching modalities. The average setup time per teaching session was 3.4 ± 0.6 minutes for the digital eyepiece camera and 9.8 ± 1.4 minutes for the multi-headed microscope, a difference that was statistically significant ($p < 0.001$) (Table 2). The mean number of technical interruptions per session was 0.7 ± 0.5 in digital eyepiece camera and 2.3 ± 0.8 in multi-headed microscope, which was also statistically significant ($p = 0.002$), indicating greater operational stability of the digital eyepiece camera system (Table 2).

Table 2: Feasibility and operational comparison between the two teaching modalities

Parameter	Digital eyepiece camera	Multi-headed microscope	p value
Setup time (min)	3.4 ± 0.6	9.8 ± 1.4	< 0.001
Technical interruptions per session	0.7 ± 0.5	2.3 ± 0.8	0.002

Both modalities supported live projection of microscopic fields; however, the digital eyepiece camera could be directly connected to televisions, smartboards, laptops, or monitors and could be easily transported for use in different teaching

venues. This enabled 100 students to be taught simultaneously through class-wide display, whereas the multi-headed microscope accommodated only 9 students per session through its viewing heads, requiring 11 repeated sessions to cover 100 students (Figure 1 & 2, Photograph 5 & 6).

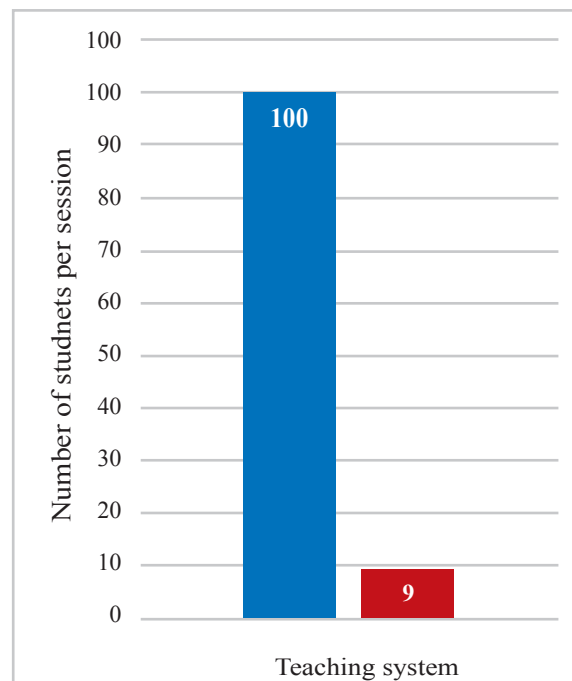


Figure 1: Teaching capacity per session of digital eyepiece camera and multi-headed microscope.

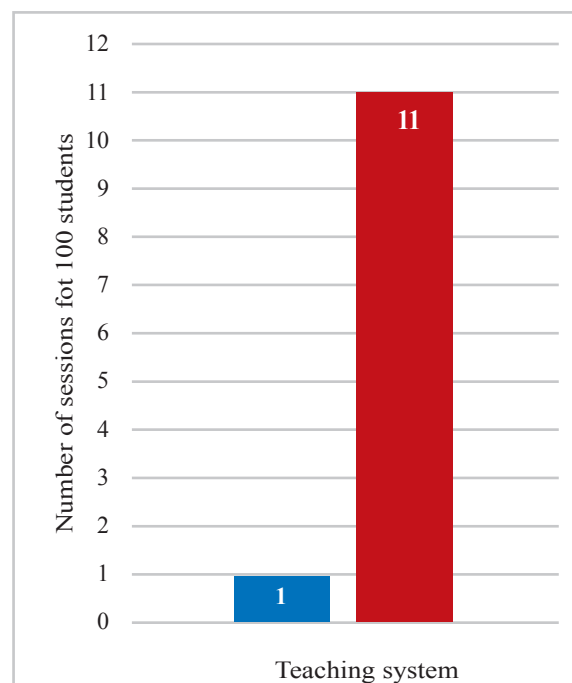


Figure 2: Number of sessions required to teach 100 students using digital eyepiece camera and multi-headed microscope.



Photograph 5: Whole-class visualization of histology slides using a digital eyepiece camera at Army Medical College Jashore.



Photograph 6: Multi-headed microscope teaching session at Jashore Medical College.

In terms of instructional flexibility, the digital eyepiece camera facilitated teaching in both laboratory and lecture-gallery environments through rapid setup and direct display integration, whereas the multi-headed microscope, despite having projection capability, remained largely restricted to fixed laboratory settings due to its size and installation requirements. Image capture for revision and assessment preparation was readily available in the digital eyepiece camera group but was less frequently utilized in the multi-headed microscope group. Cost analysis revealed substantial differences between the two modalities. The initial capital investment for the digital eyepiece camera system at AMCJ was BDT 44,500, based on the institutional procurement voucher for the digital microscope eyepiece camera. In contrast, the market price of a standard ten-headed teaching microscope system

such as an Olympus configured for 10 viewing heads with LED illumination, is listed at approximately USD 28,500 ($\approx$ BDT 24–25 lakh) in commercial offerings.¹⁸ Annual maintenance requirements were minimal for the digital eyepiece camera, whereas multi-headed microscopes require regular optical and mechanical servicing (Table 3).

Table 3: Cost comparison of the two histology teaching modalities

Parameter	Digital eyepiece camera	Multi-headed microscope
Purchase price	BDT 44,500	Approximately BDT 24–25 lakh
Annual maintenance	Minimal (routine cleaning)	Higher (optical & mechanical servicing)

Overall, the low-cost digital eyepiece camera demonstrated clear advantages in portability, scalability through direct display integration, and economic feasibility, while the multi-headed microscope remained effective for synchronized small-group viewing. Statistically significant differences were observed in key operational parameters, including setup time and frequency of technical interruptions ($p < 0.05$), supporting the use of digital eyepiece camera–assisted teaching as a practical and sustainable alternative for undergraduate histology education in resource-limited settings.

Discussion:

This study demonstrated that low-cost digital eyepiece camera–assisted histology teaching achieved learning outcomes superior to those obtained using a multi-headed microscope. The mean OSPE score was significantly higher in the digital camera group, with the difference being statistically significant, indicating that digital eyepiece camera–assisted teaching resulted in better learning performance. These findings are consistent with previous studies showing that digital and virtual microscopy provide educational outcomes comparable to conventional light microscopy^{6–8,15}. The absence of dependence on expensive optical hardware is particularly important because it indicates that high-cost optical systems are not essential to achieve effective histology learning. Several authors have reported that digital microscopy improves consistency of field selection, facilitates instructor guidance, and enhances student

engagement without compromising assessment performance^{12,13,19}. The digital eyepiece camera used in this study offers these advantages while retaining the familiarity of conventional light microscopy, which may facilitate acceptance by both students and teachers. In addition to better learning outcomes, this study demonstrated significant operational advantages of the digital eyepiece camera. Setup time was significantly shorter and the frequency of technical interruptions was significantly lower than with the multi-headed microscope. This reflects the simpler design of digital camera-based systems, which rely on electronic connections rather than complex optical bridges and mechanical alignment. In contrast, 10-headed teaching microscopes are prone to optical misalignment, illumination imbalance, and mechanical wear, all of which can disrupt teaching sessions^{4,20}. Reduced technical interruptions contribute to more efficient use of class time and less frustration for both students and instructors. The ability to teach large groups simultaneously is another major advantage of the digital eyepiece camera. In the present study, 100 students could observe the same microscopic field at once using large displays, whereas the 10-headed microscope accommodated only 9 students per session, necessitating 11 repeated sessions to cover the full class. Previous studies have emphasized that synchronized viewing of the same field improves clarity of instruction and reduces variation in learning experience^{3,12}. The digital eyepiece camera extends this benefit to an entire class, making it particularly suitable for large undergraduate cohorts common in low- and middle-income countries⁵. Economic feasibility is a critical factor in the adoption of educational technology in resource-limited settings. The institutional purchase cost of the MD500A digital eyepiece camera was BDT 44,500, whereas the price of a standard 10-headed teaching microscope system (Olympus) is approximately USD 28,500 ($\approx$ BDT 24–25 lakh)¹⁹. This difference represents a cost gap of more than 500-fold when calculated on a per-student teaching-capacity basis. In addition, digital eyepiece cameras require minimal maintenance, whereas multi-headed microscopes require periodic optical and mechanical servicing, increasing long-term costs. These financial considerations are especially important for medical colleges in developing

countries, where constrained budgets limit investment in expensive laboratory equipment^{5,16,17}. In Bangladesh, there is increasing interest in digital approaches to histology teaching due to rising student numbers and limited laboratory infrastructure^{16,17}. Although virtual microscopy and online histology platforms have shown promise, their dependence on high-speed internet, dedicated servers, and expensive slide scanners limits widespread implementation^{9,21}. The digital eyepiece camera offers a practical intermediate solution that combines the advantages of digital display with the simplicity and low cost of conventional microscopy. This study has some limitations. It was conducted in two institutions and included a limited number of students. Long-term knowledge retention and learner satisfaction were not evaluated. Future multicenter studies incorporating qualitative feedback and longer follow-up would provide a more comprehensive assessment of the educational impact of digital eyepiece camera–assisted teaching. Despite these limitations, this is the first documented comparative study from Bangladesh to directly evaluate low-cost digital eyepiece camera–assisted teaching versus multi-headed microscopy in undergraduate histology education. The findings indicate that digital eyepiece camera–assisted teaching is not only educationally effective but also operationally efficient and economically sustainable, supporting its adoption as a practical alternative in resource-limited medical education settings.

Conclusion:

This study shows that low-cost digital eyepiece camera–assisted histology teaching achieves superior learning outcomes compared to multi-headed microscopes while providing clear advantages in operational efficiency and cost. The ability to teach large groups simultaneously with fewer technical interruptions and lower financial burden makes this technology particularly suitable for medical colleges in resource-limited settings. As the first comparative study from Bangladesh, these findings provide important local evidence to guide institutional decisions on histology teaching methods and equipment procurement.

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Ethical Approval and Consent to Participate:

Ethical approval for the study was obtained from the Institutional Ethical Review Board (IERB) of Army Medical College Jashore. The written informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

Conflict of Interest:

The author declares no conflict of interest.

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Authors' Contributions:

Moin S conceived and designed the study, coordinated all phases of data collection, supervised OSPE examinations, performed statistical analysis, and drafted the manuscript. Ahmad M provided overall academic supervision and institutional facilitation. Paul P facilitated access to the 10-headed microscope, and supported data collection at that site. Faisal F conducted the OSPE examinations, collected the primary data from both Army Medical College Jashore and Jashore Medical College and managed OSPE data entry. Zahan R contributed to statistical analysis and interpretation of results. Any OH, Munira FT, Chowdhury S, and Rahman FN contributed to literature review, critical revision, and editing of the manuscript. All authors read and approved the final manuscript.

Data Availability:

Any inquiries regarding supporting data availability of this study should be directed to the corresponding author and are available from the corresponding author on reasonable request.

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Alteration of Serum Calcium and Magnesium by Deferiprone Iron Chelator in Transfusion Dependent Thalassemia Patients

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Abstract

Background: Transfusion dependent thalassemic (TDT) patients are required repeated blood transfusion and iron chelator to continue life. Iron chelator changes serum zinc and copper level in TDT patients. For identifying the effect of Deferiprone (DFP) iron chelator on serum total calcium and magnesium level in patients of transfusion dependent thalassemia. **Objective:** To evaluate the effect of Deferiprone (DFP) on serum total calcium and magnesium level in transfusion related thalassemic patients. **Methods:** This cross-sectional study was conducted in the Department of Physiology, Bangladesh Medical University (BMU), Dhaka between September 2017 to February 2019. 30 patients of TDT, aged 5-40 year were comprised in the study group. 30 healthy subjects with similar age and sex were taken as control. All patients were preferred from outpatient Department of Hematology and Transfusion Medicine, BMU, Dhaka. Serum total calcium, serum magnesium and ferritin level were calculated by colorimetric method. For statistical analysis independent sample t-test, Pearson correlation coefficient test and Chi-square test were used. **Results:** Mean serum total calcium and magnesium level were non-significantly ($p>0.05$) low in study group contrasted to control. Constantly, serum ferritin level was significantly ($p<0.001$) high in study groups compared to control. Additionally, serum total calcium level was positively and serum magnesium level was negatively correlated with serum ferritin level. Again, serum total calcium level was positively and magnesium levels was negatively correlated with duration of iron chelation therapy. Entire correlations were statistically non-significant. **Conclusion:** This study suggests that serum total calcium and magnesium level was low in TDT patients taking DFP medicine. Thus, earlier identification of these micronutrient changes might be useful for the specialist to avoid adverse effect of changes of this micronutrient level in TDT patients taking DFP iron chelation.

Keywords: Transfusion dependent thalassemia (TDT), Zinc, Copper and iron chelator, Deferiprone (DFP).

Introduction:

Thalassemia is a hereditary blood disorder characterized by abnormal production of either the alpha or beta globin subunit of hemoglobin,

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following an autosomal recessive pattern^{1,2}. This condition involves gene abnormalities characterized by a single mutation or deletion in either the alpha or beta globin gene located on chromosome 16 (alpha) and 11 (beta). Approximately 150 million individuals worldwide carry the thalassemia gene^{2,3}.

This condition is predominantly found in regions

including the Mediterranean, Middle East, parts of Africa, Central Asia, the Indian subcontinent, Southern China, and extending to the Pacific Islands^{3,4}. The World Health Organization reports that approximately 3% of the community in Bangladesh carry the beta thalassemia gene, while around 4% carry the Hb-E gene^{5,6}.

The primary therapy for thalassemia involves blood transfusions to manage anemia¹. However, frequent transfusions can lead to the accumulation of excess iron in the body. The surplus iron leads to oxidative stress, resulting in damage to organs^{4,5}. Cardiac failure due to iron overload is a common cause of death. Consequently, various iron chelators have been employed to eliminate excess iron from the body, facilitating its excretion through urine and stool³. At present, there are three iron chelators that are commercially approved and available: deferoxamine (DFO), deferiprone (DFP) and deferasirox (DFX)^{7,8}.

Ferritin is an intracellular protein that binds with iron and stores excess iron within the cell⁹. The concentration of serum ferritin is directly correlated with total iron store in the body. So, iron overload causes high concentration of serum ferritin. That's why estimation of serum ferritin is the most commonly used, easy and in-expensive test to evaluate iron overload in patients with thalassemia¹⁰.

Calcium is the main component of the body. More than 99% is stored in the bones and teeth. Less than 1% is found in extracellular fluid. Calcium is required for vascular contraction and vasodilation, muscle function, nerve transmission, intracellular signaling and hormonal secretion. Calcium deficiency causes fatigue, neuromuscular instability, numbness and tingling, sensation of extremity, muscle cramp, chest pain, irritability¹¹⁻¹⁵.

Magnesium play an essential role in the activity of many enzymes involved cellular metabolism. It act as a modulator in cell volume regulation, immune system, cardiovascular system and musculoskeletal system. Deficiency of magnesium causes fatigue, muscle cramp, irregular heart beat, neuromuscular instability, hypertension, diabetes^{11,13}. Data on these minerals in TDT patients treated with iron chelator is

vary few. Therefore, this study has been designed to evaluate calcium, magnesium and ferritin levels in TDT patients with iron chelator.

Materials and Methods:

The present cross sectional study was carried out in the department of Physiology, BMU, Dhaka between September 2017 to February 2019 and protocol of this study involving human subjects was approved by Institutional Review Board, BMU, Shahbag, Dhaka. Serum total calcium, magnesium, ferritin and Hb levels of 30 TDT patients, age ranged from 5-40 years were assessed. For comparison age and sex matched 30 healthy controls were also studied. TDT patients were selected from outpatient Department of Hematology and Transfusion Medicine, BMU and control were selected from among the relatives and attendants of the patients, hospital staffs and subjects available in the BMU campus and also personal contact. Subjects with history of renal disease, any acute and chronic disease, vitamin and minerals supplementation were excluded from the study. After selection of the subjects, the purpose of the study was explained to each subjects. When they agreed for participation, then an informed written consent was taken. Detailed family and medical history were taken. Anthropometric measurement and thorough clinical examinations were done and recorded. Then 6 mL of venous blood was collected from ante-cubital vein under aseptic precaution from each subjects and serum was prepared for biochemical tests. Serum total calcium, serum magnesium and ferritin was measured by colorimetric method. Data were expressed as Mean±SE. Data analysis was done with SPSS version 16. For statistical analysis, independent sample t-test, Pearson correlation coefficient test and Chi-square test were performed.

Results:

Table-I: Age, BMI and Hb in both groups of subjects (n=60)

Parameter	Control (n=30)	TDT (n=30)
Age (years)	19.86±1.57	18.23±1.89
Male no(%)Female no(%)	15(50%) 15(50%)	15(50%) 15(50%)
BMI (Kg/m ²)	21.87±0.89	18.06±0.64***
Hb (g/dl)	13.75±0.19	8.18±0.24***

Data are expressed as Mean±SE. Statistical analysis was done by independent sample t-test and Chi-square test. BMI-Body mass index;

Hb-Hemoglobin; TDT-Transfusion dependent thalassemia; *** $p < 0.001$.

Table-I shows in this study, all the groups were matched for age and sex but BMI ($p < 0.001$) and Hb ($p < 0.001$) were significantly lower in study group compared to that of control.

Table-II: Serum total calcium, magnesium and ferritin levels in both groups (n=60)

Parameter	Control (n=30)	TDT (n=30)
Serum total calcium (mg/dl)	9.1 $\pm$ 0.08	8.87 $\pm$ 0.06
Serum magnesium (mg/dl)	1.91 $\pm$ 0.02	1.83 $\pm$ 0.02
Serum ferritin (μ g/L)	40.39 $\pm$ 7.68	4186.61 $\pm$ 728.14***

Data are expressed as Mean $\pm$ SE. Statistical analysis was done by independent sample t-test; TDT-Transfusion dependent thalassemia; *** $p < 0.001$.

Table-II shows mean serum ferritin was also significantly ($p < 0.001$) higher in TDT patients compared to that of control. But there was no significant difference in mean serum total calcium, magnesium between TDT and control subjects.

In addition serum total calcium level was positively correlated and serum magnesium level was negatively correlated with serum ferritin level in study group (Figure-1,2). Again, serum total calcium level was positively and serum magnesium level was negatively correlated with duration of iron chelation therapy (Figure-3,4). All these correlations were statistically non-significant.

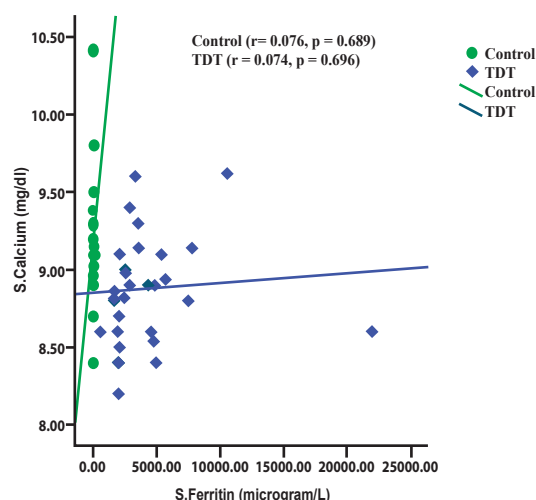


Figure-1: Serum total calcium was positively correlated with serum ferritin (n=60)

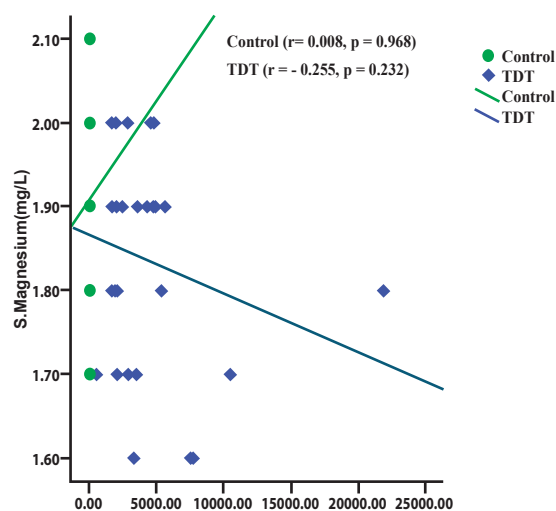


Figure-2: Serum magnesium was negatively correlated with serum ferritin (n=60)

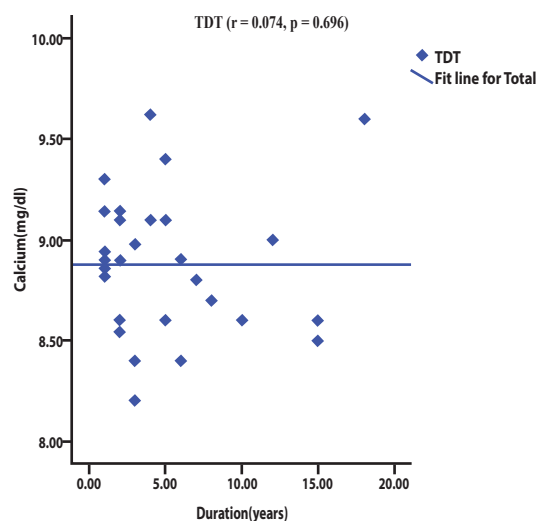


Figure-3: Serum total calcium was positively correlated with duration of iron chelation (n=30)

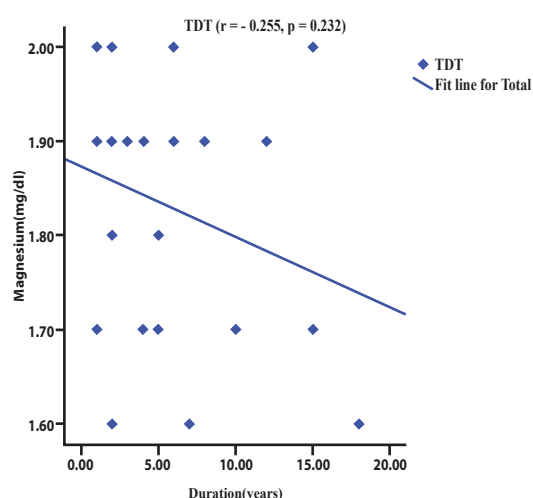


Figure-4: Serum magnesium was negatively correlated with duration of iron chelation (n=30)

Discussion:

In this study to exclude the effect of age and sex, both of the groups (study and control) were matched accordingly. Total 60 subjects aged 5-40 years, 30 patient (15 female & 15 male) and 30 control (15 female & 15 male) were included.

The present study assessed the effect of DFP iron chelator on serum total calcium and magnesium level in TDT patients to find out any alteration of this minerals level in TDT patient treated with DFP iron chelator. In addition, correlation of serum total calcium and magnesium with serum ferritin level and duration of iron chelation in TDT patients were also studied.

In present study Hb level and BMI was significantly lower in TDT patients compared to healthy control^{8,12}. The result of this study also showed non-significantly lower serum total calcium level and magnesium level in all cases of TDT patients treated with DFP iron chelator than control. On the other hand, Salva found significantly lower and Either et al. found non-significantly lower serum calcium level in TDT patient treated with DFP and DFO iron chelator separately^{16,17}. Again, Genc et al. found significantly lower serum magnesium level in TDT patient treated with DFO iron chelator⁸.

Again, in correlation analysis, non-significant positive correlation of serum total calcium and negative correlation of serum magnesium with serum ferritin level was observed. Genc et al. found negative correlation of serum magnesium with serum ferritin in TDT patient with DFP iron chelator⁸. In addition, serum total calcium level was positively and magnesium levels was negatively correlated with duration of iron chelation therapy.

Though explanation of this change in serum calcium and magnesium is not known but some possible explanations were proposed by different investigators to explore the linked between alteration of minerals and iron chelators. It has also been suggested that binding of iron chelator with metal depend on stability constant, relative concentration of metal cation in blood and

heterocyclic ring formation. In our body fluid calcium is readily available that is why calcium may first bind with chelator than other higher stability constant of metal such as iron and lead¹⁸. Magnesium may form more number of heterocyclic ring with iron chelator. For this iron chelator may remove magnesium from the body along with iron^{18,19}.

Moreover, minerals alteration in TDT patients may be due to oxidative stress, excessive hemolysis, dietary deficiency, psychological problems (such as depression), metabolic and endocrine complications^{12,20,21}.

Conclusion:

From the result of the study, it may be concluded that lower serum total calcium and magnesium level may occur in TDT patients treated with DFP iron chelator. So, routine estimation of serum total calcium and magnesium levels may be useful to prevent the harmful effect of alteration of these micronutrient concentration in TDT patients treated with DFP iron chelator.

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Conflict of Interest:

No conflict of interest.

Financial Disclosure:

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Author's Contributions:

Munira FT conceptualized, reviewed relevant literature, conducted experimentation, interpreted the findings and participated in writing the manuscript, data collection and statistical analysis. Ahmad M involved in manuscript review, data analysis and editing. Begum S jointly formulated hypothesis, provided the intellectual foundation of the study design and overall supervision during

study period. Rahman FM, Chowdhury AA and Urmi SFH were involved in data collection, laboratory testing and editing. All authors read and approved the final manuscript.

Data Availability:

The corresponding author can be contacted with any question about the availability of the study's supporting data, which are available upon reasonable request.

Ethical Approval and Consent to Participate:

Ethical approval for the study was obtained from the Institutional Review Board. The written informed consent was obtained from all study participants. All methods were performed following the relevant guidelines and regulations.

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