Exploring the Association among Breast Cancer Risk Factors, Biomarker Profiles, and Tumor Stages: A Study from Dhaka, Bangladesh

By

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A thesis submitted to the Department of Mathematics and Natural Sciences in partial fulfillment of the requirements for the degree of Master of Science in Biotechnology

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Declaration

It is hereby declared that

1. The thesis submitted is my original work while completing degree at BRAC University.

2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.

3. The thesis does not contain material that has been accepted or submitted, for any other degree or diploma at a university or other institution.

4. I have acknowledged all of the main sources of help.

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Ethics Statement

While conducting the thesis, the following criteria are fulfilled in the manuscript “Exploring the Association among Breast Cancer Risk Factors, Biomarker Profiles, and Tumor Stages: A Study from Dhaka, Bangladesh”-

1) This content is my original work and has not been previously published.

2) All sources used are appropriately acknowledged through accurate citations and justified references.

Approval

The thesis titled "Exploring the Association among Breast Cancer Risk Factors, Biomarker Profiles, and Tumor Stages: A Study from Dhaka, Bangladesh" submitted by Adiba Hasan Prova (23176011) of Summer, 2024 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of Master of Science in Biotechnology on 5th December, 2024.

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Abstract

Breast cancer is one of the most common types of cancer worldwide and continues to be a global public health concern. According to GLOBOCAN estimates, 19% of 68.7 million new breast cancer cases were diagnosed in 2022, making it the most prevalent cancer among females in Bangladesh. Breast cancer is a life-threatening disease in females and the leading cause of mortality among women population. This study aimed to identify the potential predisposing factors and to demonstrate different breast cancer types, stages, and associated risk factors for breast cancer among women. A structured questionnaire including demographic and medical history was used to collect data on factors leading to breast cancer. Data from ninety-four breast cancer patients were collected, and statistical analyses were done by SPSS (version 30) for analysis. The study also showed the risk of breast cancer increases with increasing age. Most of the patients were in their menopausal and postmenopausal age. A potential association between having a first child before the age of 20 and increased breast cancer risk was found. Using oral contraceptive pills (OCP) correlated with higher BMI, which increases the risk of developing breast cancer in this study. Higher BMI patients tend to develop more aggressive cancer types in this study. These patients were diagnosed at an advanced stage; in this case, stage 2 is the most prevalent. In addition, triple-negative breast cancer (TNBC) was the most pervasive biomarker across all the breast cancer patients in this study and showed a tendency to appear in individuals with higher BMI. TNBC patients were diagnosed at an advanced stage, which was linked with difficult prognoses and limited treatment options. This analysis also suggests a possible correlation between oral contraceptive pill use and increased prevalence of HER2+ breast cancer. The findings of this study will help to enhance the knowledge of general people in Bangladesh, especially women, which will lead to the prevention and early diagnosis of breast cancer and thus reduce the mortality and prevalence rates.

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CHAPTER-1

INTRODUCTION

Breast cancer is a major global health issue, accounting for nearly 11.6% of all new cancer cases diagnosed annually, making it the most prevalent type of cancer and the leading cause of cancer-related death for women worldwide (Akram et al., 2017; Winters et al., 2017). According to the World Health Organization (WHO), in 2020 alone, more than 2.3 million women were diagnosed with breast cancer, with approximately 685,000 deaths attributed to the disease globally (Arnold et al., 2022). Despite advancements in medical research and treatment, the analysis of global and regional statistical data shows that low- and middle-income nations have greater death rates due to limited access to healthcare resources, lack of awareness and knowledge, and delayed diagnosis (Akram et al., 2017).

In Bangladesh, the situation is particularly concerning due to the lack of population-based breast cancer registries and insufficient public awareness regarding the disease's risk factors, symptoms, and screening protocols (Hossain et al., 2014). Women often delay seeking medical care, partly because initial symptoms, such as a lump, may not be recognized as warning signs, and non-lump symptoms may further contribute to this delay. Moreover, societal stigma and misconceptions about cancer exacerbate the problem, leading to late-stage diagnoses and poorer prognosis (Akram et al., 2017).

The incidence rate in Bangladesh has been steadily increasing, and this is linked to apparent potential risk factors that may act together or in sequence to initiate or promote carcinogenesis. This study focuses on understanding the prevalence, risk factors, and clinical characteristics of breast cancer in Dhaka, the capital city of Bangladesh. By analyzing data on demographic, reproductive, and lifestyle factors, as well as biomarker and tumor-grade analyses, this research aims to provide insights into the current breast cancer situation. By doing so, it seeks to identify patterns that contribute to the late diagnosis of breast cancer and to highlight areas where public health interventions can improve outcomes. Additionally, it emphasizes the importance of regular screening, self-breast examinations, and public awareness campaigns to combat the high mortality rates associated with breast cancer. The findings of this study could serve as a foundation for national strategies to enhance early detection, improve treatment outcomes, and ultimately reduce breast cancer mortality in Bangladesh.

CHAPTER-2

LITERATURE REVIEW

2.1 Epidemiology

Breast cancer represents a major global health issue, exhibiting considerable differences in incidence and outcomes among various regions. France exhibits the highest age-standardized incidence rate, recorded at 105.4 cases per 100,000 women (Breast Cancer Statistics, 2024). This is succeeded by the United States which exhibits one of the highest incidence rates of breast cancer, with a woman's lifetime risk of approximately 13% and around 274,375 cases reported in 2022 (25% of total cases). However, the country has a comparatively lower mortality rate than many others, attributed to advanced healthcare infrastructure and early detection programs.

With 45% of all breast cancer cases reported globally, breast cancer is the most prevalent cancer type in Asia (Elhusseiny, 2023). The greatest incidence rates of breast cancer were found in South Korea (52.1 per 100,000) and Japan (51.5 per 100,000) in eastern Asia (Fan et al., 2015). With an expected 216,108 cases by 2022, India has the highest rate of breast cancer among southern Asian nations, making up 28.2% of all female cancer cases (Sarwar, 2024). The mortality rate is concerning, with over 98,000 breast cancer-related deaths in 2022, highlighting difficulties in early diagnosis and treatment (Ferlay et al., 2014).

Global cancer incidences are projected to reach 35.3 million by 2050, reflecting a 76.6% increase from the 2022 estimate, while the deaths are anticipated to rise by 18.5 million, representing an 89.7% increase from the 2022 projection (Bizuayehu et al., 2024). This estimation highlights the need for enhanced healthcare infrastructure and global access to affordable cancer services.

2.2 Epidemiology of breast cancer in Bangladesh

Due to a lack of data on how to establish population-based cancer registries that would give complete data on a national scale, nothing is known about the frequency and incidence of breast cancer in Bangladesh (Hossain et al., 2014). However, according to GLOBOCAN predictions, 35,269 instances of breast cancer were detected throughout the 2018–2022 timeframe, with 12,989 new cases and 6,162 deaths in 2022 (Ferlay et al., 2014). However, this number is probably underestimated because many cases go unreported because of ignorance, inadequate education,

misconceptions, low socioeconomic position, limited access to healthcare, and bad governance (Hossain et al., 2014).

The hospital-based cancer registry of the National Institute of Cancer Research and Hospital (NICRH) reported that from 2018 to 2020, a total of 83,795 new patients visited the outpatient department, with 35,733 (42.6%) receiving a confirmed or provisional cancer diagnosis. Breast cancer is the second leading cancer, with the number of 4805 (13.4%) new patients (both male and female). Among them, 4747 (29.3%) patients are female (Cancer Registry Report, 2022). In addition, the hospital-based cancer registry report of Ahsania Mission Cancer & General Hospital (AMCGH) reveals the data of 7035 new cancer patients, including 1234 (17.4%) of the new breast cancer patients consisting of 99% of female patients (AMCGH Cancer Registry Report, 2022).

2.3 Types of breast cancer

2.3.1 According to site

- **Non-Invasive Breast Cancer:** Non-Invasive Breast Cancer cells are confined to the ducts and do not spread to the surrounding fatty and connective tissues of the breast (Sharma et al., 2010).
- **Invasive Breast Cancer:** Invasive breast cancer cells penetrate the surrounding fatty and connective tissues of the breast after breaking through the duct and lobular wall. Cancer can be invasive without spreading (non-metastatic breast cancer) to the lymph nodes or other organs (Sharma et al., 2010) or can be extended to different organs (metastatic breast cancer) such as the brain, bones, lungs, and liver (Akram et al., 2017).

2.3.2 Frequently occurring Breast cancer

- **Infiltrating ductal carcinoma (IDC):** IDC is invasive ductal carcinoma that begins in the milk ducts and spreads to the duct wall, invading surrounding breast tissue and other parts

of the body (Akram et al., 2017), which is the most common type of breast cancer, accounting for 80% of breast cancer diagnoses (Sharma et al., 2010).

- **Ductal carcinoma in situ (DCIS):** Ductal carcinoma in situ (DCIS) is the most common form of non-invasive breast cancer, accounting for about 20-25% of the new breast cancer diagnosed, which is found in the milk ducts, however, does not spread beyond your milk ducts to invade other parts of the breast tissue (Akram et al., 2017; Van Seijen et al., 2019).
- **Infiltrating lobular carcinoma (ILC):** This invasive lobular breast cancer begins in the milk glands (lobules) of the breast, but often spreads (metastatic) to other regions of the body. It accounts for 10% to 15% of breast cancers (Sharma et al., 2010).
- **Lobular carcinoma in situ (LCIS):** This non-invasive breast cancer begins in the milk-producing glands (lobules) in the breast and cannot spread to surrounding breast tissue (Akram et al., 2017). It is less common and considered a marker for increased breast cancer risk (Breast Cancer, 2023; Sharma et al., 2010).

2.3.3 Less common breast cancer types include:

- **Medullary carcinoma:** Medullary carcinoma, accounting for less than 5% (Limaiem and Mlika, 2023), is an invasive breast cancer characterized by a distinct boundary between tumor and normal tissue, which is readily identifiable under a microscope since these cancer cells are often larger than those in other breast cancer kinds (Sharma et al., 2010). They manifest in younger women and in those with a hereditary defective BRCA1 gene (Limaiem and Mlika, 2023).
- **Mucinous carcinoma/ Colloid carcinoma:** Mucinous carcinoma develops by the mucus-producing cancer cells and thus has a more favorable prognosis (Akram et al., 2017; Sharma et al., 2010). The percentage of medullary breast cancers is relatively low, around 1-2% (breastcancercare.org.uk, 2023).
- **Tubular carcinoma:** Tubular carcinomas are a rare type of invasive breast carcinoma, accounting for only 2% (Sharma et al., 2010). They generally exhibit a more favorable prognosis and also have a lower likelihood of recurrence post-treatment (breastcancercare.org.uk, 2023).

- **Inflammatory breast cancer (IBC):** When cancer cells obstruct lymph vessels or channels in the skin covering the breast, the result is inflammatory breast cancer (IBC), which manifests as red, heated breasts with dimples and/or broad ridges due to lymph vessels blockage (Akram et al., 2017). This rare but extremely fast-growing cancer accounts for only 1% of breast cancers (Sharma et al., 2010).
- **Paget's disease of the breast:** Paget's disease is characterized by red, itchy rashes on the skin surrounding the nipple, which may occasionally extend to adjacent skin areas. If it remains within the ducts or nipple of the breast, the prognosis is favorable. Breast lumps, nipple flattening or inversion, bleeding, and discharge, are warning signs of these conditions. About 1% to 3% of breast cancers are Paget's disease (Akram et al., 2017; Sharma et al., 2010).
- **Phylloides tumor:** Phylloides tumors which can be classified as either malignant (cancerous) or benign (non-cancerous) develop in the connective tissues of the breast. Phylloides tumors can be surgically removed. Less than ten women in the US lose their lives to Phylloides tumors (Akram et al., 2017; Sharma et al., 2010), making them extremely uncommon cancers.
- **Angiosarcoma**: Angiosarcoma which is a very rare form of cancer that represents only 0.1% to 0.2% (Angiosarcoma of the Breast, 2021) occurs primarily in the breast but may subsequently invade the inner walls of lymphatic and blood vessels, which are essential for immune system function. Angiosarcoma exhibits rapid growth and dissemination within the body (breastcancercare.org.uk, 2023).

2.4 Breast cancer subtypes

Analysis of estrogen and progesterone hormone receptors in cancerous cells helps plan breast cancer treatment. Breast cancer is also classified into subtypes by receptor cell ER and PR status and expression of the HER2 oncogene.

Subtypes include:

- **Hormone Receptor-Positive Breast Cancer:** Hormone Receptor-Positive Breast Cancer is characterized by the presence of estrogen receptors (ER+) and/or progesterone receptors (PR+) on the cancer cells, which facilitate tumor proliferation. Cancers of this type typically exhibit a favorable response to hormone-blocking therapies, such as anti-estrogen or anti-progesterone treatments (Millard, 2024). About 70% of breast cancers exhibit hormone receptor positivity (Ferlay et al., 2024).
- **Hormone Receptor-Negative Breast Cancer:** Hormone Receptor-Negative Breast Cancer cells do not have estrogen and progesterone receptors and are difficult to treat with hormone therapies (Millard, 2024).
- **HER2-Positive Breast Cancer**: The HER2 protein, which stimulates cell proliferation, is abundant in HER2-positive breast tumors. TP53 gene mutations or overexpression of other genes in the HER2 amplicon, such as GRB7 and PGAP3, cause HER2 to be overexpressed (Dai et al., 2014). This subtype, which makes up about 20% of all cases of breast cancer, has the lowest overall survival rate and a tendency to grow more aggressively. Though, Patients with these tumors have a poor prognosis but frequently react favorably to targeted treatments such as pertuzumab and trastuzumab (herceptin) (Mercogliano et al., 2023).
- **Triple-Positive Breast Cancer (TPBC):** TPBC breast cancer cells, which account for 10% of all breast cancer diagnoses, express estrogen and progesterone receptors as well as abundant amounts of the human epidermal growth factor 2 (HER2) protein (Millard, 2024).
- **Triple-negative breast cancer (TNBC):** Triple-negative breast cancer (TNBC) is an invasive malignancy that does not overexpress the human epidermal growth factor receptor-2 (HER2) protein and does not have estrogen or progesterone receptors. Compared to other forms of breast cancer, this one is more aggressive and spreads faster. Triple-negative breast cancer accounts for about 10–15% of all cases, and it is more prevalent in younger women and those with mutations in the BRCA1 gene. As hormone treatments don't work, it is more difficult to treat (Akram et al., 2017).
- **Basal-Like Breast Cancer:** Triple-negative breast tumors are classified as basal-like when they exhibit low BRCA1 expression, TP53 mutations, and high expression of basal markers (such as cytokeratins CK5,6,14, or 17 and EGFR). (Sotiriou et al., 2003; El-Rehim et al., 2005).

- **Luminal Subtypes (A and B)**

  Luminal A: Luminal-A tumors have higher expression of estrogen (ER+) and progesterone (PR+), but are HER2-negative, with a low proliferation rate. They are less aggressive and have a favorable prognosis, responding well to hormone therapy (Susan G. Komen®, 2022).

  Luminal B: Luminal-B tumors have expression ER+ and/or PR+, can be HER2-positive or negative, and have a higher proliferation rate. They tend to be more aggressive than Luminal A and may require a combination of chemotherapy and hormone therapy (Susan G. Komen®, 2022).

2.5 Stages

When determining where breast cancer stage is, the AJCC staging system is now the most appropriate one. In the past, breast cancer staging solely relied on TNM classification, which is based on anatomic findings (anatomic stage) such as primary tumor size, nodal status, and distant metastases (Giuliano et al., 2018; Teichgraeber et al., 2021). The most recent AJCC staging update (eighth edition) considers both anatomical and biologic factors, including tumor grade, hormone receptor and oncogene expression (ER, PR, HER2, etc.), and multigene panel testing, to accurately define prognostic stage groups and therapies (Kalli et al., 2018; Teichgraeber et al., 2021). To correctly estimate a patient's prognosis, the breast cancer stage is determined by combining the anatomic stage with the prognostic stage.

2.5.1 TNM Classification System

The TNM system describes the tumor size and the extent to which cancer has migrated to nearby lymph nodes or other parts of the body. The TNM system describes the tumor as follows (Giuliano et al., 2018; Kalli et al., 2018; Hortobagyi et al., 2017):

T: Tumor size and location.

- TX: Primary tumor cannot be assessed.
- T0: No indication of a breast primary tumor
    - Tis: Tis (DCIS): abnormal cells are found only in the breast duct lining (Tis (DCIS)), or in the nipple skin cells and may spread to the areola (Tis (Paget)).
- T1: The tumor is 20 millimeters or smaller.
    - T1mi: The tumor is 1 millimeter or smaller.
    - T1a: The tumor is 1-5 millimeters.
    - T1b: The tumor is 5-10 millimeters.
    - T1c: The tumor is 10-20 millimeters.
- T2: The tumor is 20 to 50 millimeters.
- T3: The tumor is larger than 50 millimeters.
- T4: Tumor extended to the chest wall and/or the skin
    - T4a: The tumor has spread into the wall of the chest.
    - T4b: The tumor has grown into the skin—an ulcer or small tumor on the surface of the breast skin.
    - T4c: The tumor has spread into the chest wall and the skin.
    - T4d: Inflammatory breast cancer when one-third or more of the skin on the breast is red and swollen

N: Lymph Node. The size and location of lymph nodes where cancer has spread.

- cNX: The lymph nodes cannot be assessed (if previously removed).
- cN0: No indication of cancer in the lymph nodes.
- cN1: Metastases to ipsilateral axillary nodes at level I and/or level II.

    - cN1mi: Micro-metastases as malignancy within 0.2 to 2 millimeters and has migrated to the lymph nodes in the axillary.
    - cN1a: Cancer has spread to one to three axillary lymph nodes.
    - cN1b: Cancer has spread to lymph nodes close to the breastbone on the same side of original tumor.
- cN2: Metastases to ipsilateral internal mammary nodes without axillary metastases, or to ipsilateral level I and/or level II axillary nodes.
    - cN2a: Cancer has spread to 4 to 9 axillary lymph nodes at fixed or matted ipsilateral level.
    - cN2b: Cancer has progressed to the ipsilateral internal mammary nodes close to the breastbone.
- cN3: Ipsilateral lymph node involvement or spread to ipsilateral supraclavicular nodes, ipsilateral level III axillary nodes, or ipsilateral internal mammary nodes with or without level I and/or level II axillary metastases.
    - N3a: cancer has spread to axillary lymph nodes or lymph nodes below the collarbone.
    - N3b: Cancer has also spread to lymph nodes near the armpit and behind the breastbone.
    - N3c: Cancer has spread to lymph nodes above the collarbone.

M: Metastasis. The spread of cancer to other parts of the body.

- M0: There is no sign that cancer has spread to other parts of the body.
- cM1: Metastatic breast cancer where cancer has spread to other body parts of the body (bones, lungs, liver, or brain). Metastases is larger than 0.2 millimeters.

2.5.2 Tumor Grade

Tumor grade is a key assessment of tumor differentiation, which is essential for prognostic purposes. The grading evaluates the differences between cancer cells and normal cells during division, offering insights into the aggressiveness of the cancer (Giuliano et al., 2018). Grading is classified into three categories: Grade 1 tumors exhibit characteristics similar to normal cells, indicating slower growth and are considered well-differentiated; Grade 2 tumors display moderate differentiation; whereas Grade 3 tumors are markedly abnormal and demonstrate rapid growth, categorizing them as poorly-differentiated (Hortobagyi et al., 2017; Zhu & Doğan, 2021). Higher grades are associated with a greater degree of malignancy.

2.5.3 Hormone receptors

Receptor testing can determine cancer cell growth in response to estrogen and progesterone. Furthermore, independent of nodal status, a poorer prognosis is linked to the amplification or overexpression of HER2, a protein that promotes cell proliferation and is an oncogene. HER2-positive malignancies, as shown by Giuliano et al. (2018) and Hortobagyi et al. (2017), are associated with faster tumor growth.

2.5.4 Multigene panel testing

The Oncotype DX Breast Recurrence Score test, which evaluates 21 genes (Hortobagyi et al., 2017), is the most validated multigene panel and is currently incorporated into the prognostic staging of the manual (Giuliano et al., 2018; Kalli et al., 2018). The AJCC 8th edition states the crucial role of multigene assays in prognosis. The multigene panels assess the expression levels of multiple genes in breast cancer tissue by measuring the quantity of RNA present in the tumor. Gene expression analyses predict recurrence likelihood, provide refined prognostic data, and assist in assessing the necessity of chemotherapy (Hortobagyi et al., 2017).

These factors collectively influence breast cancer treatment by categorizing the cancer into stages ranging from Stage 0 to Stage IV. Integrating TNM staging tumor grade, biomarker status, and multigene testing yields a comprehensive profile that enhances treatment guidance and prognosis prediction.

2.6 Risk Factors of Breast Cancer

Table 1: Risk factors of breast cancer

Non modifiable Factors	Modifiable Factors
Gender	Weight (obesity)
Age	Physical activity
Genetic mutations	Hormone Replacement Therapy (HRT)
Family history of breast cancer	Oral contraceptive pills (OCP)
Previous history of breast disease	Alcohol consumption
Density of Breast Tissue	Tobacco smoking
Parity	Insufficient Vitamin Supplementation
Early Menarche and Late Menopause	Exposure to Artificial Light
Exposure to therapeutic ionizing radiation	Exposure to Chemical

2.6.1 Gender

A higher risk of breast cancer is related to being female, mostly due to the greater hormonal stimulation that comes with being a woman. Breast cells in women are extremely sensitive to hormones, especially estrogen and progesterone, in contrast to males, who show negligible estrogen levels. The risk of breast cancer is strongly correlated with circulating estrogens and androgens. According to Łukasiewicz et al. (2021), breast cancer is more likely to occur in women due to changes in the body's endogenous sex hormone levels. Breast cancer is approximately 100 times more common in women than in males, making a woman's gender the primary risk factor for the disease (Feng et al., 2018). Men account for less than one percent of all breast cancer cases (Łukasiewicz et al., 2021).

2.6.2 Age

The most significant risk factor for developing breast cancer in females is age. The risk of breast cancer in women over the age of 60 is five times higher than in women under the age of 60, according to Eriksson et al. (2022). At present, about 60% of breast cancer patients are older than

65 years old, and 80% of these patients are above the age of 50 (Łukasiewicz et al., 2021). According to Cancer Facts for Women (2023), the lifetime risk might reach 1 in 8 women in some high-resource environments where the life expectancy is high.

2.6.3 Genetic Mutations

Breast cancer is one of several malignancies for which genetic predisposition is known to be involved. BRCA1 and BRCA2 are tumor suppressor genes that aid in DNA repair (Eriksson et al., 2022). The BRCA1 and BRCA2 genes, which are found on chromosomes 17 and 13, respectively, are the most often inherited causes of breast cancer (Feng et al., 2018; Mehrgou & Akouchekian, 2016). Although most mutations in these genes are passed down through generations in an autosomal dominant fashion, a small percentage of breast cancers are associated with inherited mutations (Feng et al., 2018; Łukasiewicz et al., 2021). According to Feng et al. (2018), mutation in either the BRCA1 or BRCA2 gene increases 55-65% chance of having breast cancer by the age of 70 for BRCA1 and 45-47% chance for BRCA2.

Furthermore, a mutation in one of the four uncommon and highly penetrant genes—PTEN, TP53, CDH1, and STK11—can impart up to 80% lifetime risk of breast cancer; this accounts for approximately 25% of heritable cases. In addition, a mutation in a moderate-penetrance gene (such as CHEK2, BRIP1, ATM, or PALB2) accounts for 2% to 3% of cases. The risk is doubled for each of these genes (Khalid et al., 2024).

2.6.4 Family history of breast cancer

One important component substantially linked to an elevated risk of breast cancer is the familial history of the disease. Approximately 13–19% of breast cancer patients have a first-degree relative with the same diagnosis. The risk of breast cancer markedly escalates with a greater number of afflicted first-degree relatives, particularly when such relatives are under 50 years of age (Łukasiewicz et al., 2021). Having a first-degree family (mother, sister, or daughter) with breast cancer about doubles a woman's risk while having two first-degree relatives with the illness raises her risk around thrice (Feng et al., 2018).

2.6.5 Personal history of breast disease

Women with a prior history of breast cancer exhibit an increased likelihood of developing a second breast cancer, with estimates indicating a 4% increase over 7.5 years (Anderson et al., 2017). Furthermore, a history of non-cancerous alterations in the breasts, including atypical hyperplasia, carcinoma in situ, and various proliferative lesions such as ductal hyperplasia, fibroadenoma, sclerosing adenosis, and papillomatosis (Feng et al., 2018), as well as non-proliferative lesions, significantly elevates the risk (Łukasiewicz et al., 2021).

2.6.6 Density of Breast Tissue

Both premenopausal and postmenopausal women are more likely to develop breast cancer if their breast tissue density is high. According to Łukasiewicz et al. (2021), evaluating the density of breast tissue might be an effective way to monitor women who are at a higher risk of cancer in a non-invasive and efficient way.

2.6.7 Parity

Breast cancer rates are associated with the age of first childbirth and the number of children. A lower risk of breast cancer is linked to having a first full-term pregnancy in one's early twenties) and to have more children. According to Feng et al. (2018) and Łukasiewicz et al.(2021), the overall risk of breast cancer is somewhat greater for women who have never had children or who have their first child beyond the age of 30, particularly. This impact might be because breastfeeding lowers a woman's estrogen exposure, which in turn lowers her menstrual cycle frequency and, thus, her risk of breast cancer (Łukasiewicz et al., 2021). Nonetheless, parity is not linked to HER2-positive, triple-negative, or BRCA1/2 mutant malignancies (Eriksson et al., 2022).

2.6.8 Early Menarche and Late Menopause

Due to the prolonged exposure to female sex hormones, an earlier menarche or first menstrual period, particularly before the age of 12 (Feng et al., 2018), raises the risk of breast cancer in later life. Compared to ER-negative and BRCA2-mutated malignancies, the chance of acquiring ER-

positive cancers and BRCA1-mutated tumors is higher (Łukasiewicz et al., 2021; Eriksson et al., 2022).

On the other hand, menopause frequently happens around age 50 due to a decrease in the ovaries' synthesis of progesterone and estrogen (Fletcher, 2024). Therefore, menopause, particularly after age 55, raises the risk of breast cancer because of the extended exposure to female sex hormones (Feng et al., 2018 ; Eriksson et al., 2022).

2.6.9 Weight (obesity)

Research has shown conflicting findings on the link between obesity and breast cancer risk; however, fat cells may contribute to hormone levels in the blood and other variables (Eriksson et al., 2022). After menopause, when ovarian estrogen production ceases, most of the woman's estrogen is derived from adipose tissue. This is because estrogen levels in women are dependent on menopausal status. Consequently, estrogen levels rise, and the risk of breast cancer increases with increasing adipose tissue following menopause (Feng et al., 2018). According to Łukasiewicz et al. (2021), women over the age of 50 who have a higher Body Mass Index (BMI) are more likely to get cancer than women with a lower BMI.

2.6.10 Physical activity

It was only during the postmenopausal era that physical exercise was linked to a decreased risk of cancer among women with a family history of breast cancer, according to an observation by Chen et al. (Bernstein & Ross, 1993). Anderson et al. (2017) found that rising physical activity levels and decreasing weight gain might prevent nearly 20% of breast cancer incidences.

2.6.11 Hormone Replacement Therapy (HRT)

In order to alleviate menopausal symptoms, prevent osteoporosis, and restore normal bodily functions, hormone replacement therapy is used to replace the female hormones that a woman's body is no longer making due to menopause (Asad & Jamal, 2019; Feng et al., 2018). However, hormone replacement treatment (estrogen-progesterone) can raise a woman's risk of breast cancer

after menopause (Beral, 2003; Greiser et al., 2005; Asad & Jamal, 2019). The risk of breast cancer is higher in women who use hormone replacement therapy for an extended period of time beyond menopause, particularly more than five to seven years (Anderson et al., 2017). A woman's breast cancer risk appears to revert to that of the general population after five years of ceasing HRT, however the increased risk with combined HRT is reversible and only pertains to current and recent users (Feng et al., 2018).

2.6.12 Oral contraceptive pills (OCP)

Women utilizing oral contraceptives, comprising estrogen and progestin, exhibit a marginally elevated risk of breast cancer compared to those who have never employed these methods (Feng et al., 2018).

A population-based study of women under 45 years revealed that breast cancer risk escalated with either higher estrogen dose or higher progestin or estrogen potency pills within 5 years, with more pronounced effects observed in women younger than 35 years. Nonetheless, the risk appears to return to normal over time after discontinuing the exogenous hormone (Asad & Jamal, 2019).

2.6.13 Alcohol consumption

The consumption of alcohol is associated with an increased likelihood of breast cancer, with the degree of risk proportional to the quantity of alcohol ingested (Feng et al., 2018). Evidence suggests that excessive alcohol consumption may increase the risk of malignancies in the gastrointestinal tract; additionally, it is associated with an elevated risk of breast cancer (Łukasiewicz et al., 2021). Substantial reduction or elimination of harmful alcohol consumption could prevent up to 15% of breast cancer cases (Liu et al., 2015). Women consuming two to three alcoholic beverages daily exhibit an approximately 20% increased risk of breast cancer relative to non-drinkers (Feng et al., 2018).

2.6.14 Tobacco smoke

Polycyclic aromatic hydrocarbons (PAHs), a compound found in tobacco, have previously been linked to an increased incidence of breast cancer. Premenopausal women were shown to have an elevated risk of breast cancer when exposed to either active or passive smoking, according to population-based prospective research (Asad & Jamal, 2019; Łukasiewicz et al., 2021).

2.6.15 Exposure to therapeutic ionizing radiation

Exposure to ionizing therapeutic radiation of the chest during youth, particularly between the ages of 10 and 14 when breast development occurs, significantly elevates risk. Conversely, the risk substantially diminishes when radiation is administered after age 40 (Feng et al., 2018). Therapeutic radiation administered during youth for Hodgkin lymphoma treatment correlates with a heightened risk of developing breast cancer. Mammography and chest X-rays do not seem to elevate the risk of breast cancer (Łukasiewicz et al., 2021).

2.6.16 Insufficient Vitamin Supplementation

Elevated serum 25-hydroxyvitamin D levels correlate with a reduced incidence of breast cancer in both premenopausal and postmenopausal women. The higher expression of vitamin D receptors correlates with reduced mortality rates from breast cancer. Nonetheless, additional assessment is necessary since the mechanism has not been completely clarified (Łukasiewicz et al., 2021).

2.6.17 Exposure to Artificial Light

Prolonged exposure to artificial light at night (ALAN) to an increased risk of breast cancer, perhaps as a result of epigenetic changes brought on by the disruption of the body's natural melatonin cycle. So far, research has shown that those whose ALAN exposure is high are far more likely to develop breast cancer than those whose exposure is low (Łukasiewicz et al., 2021). Łukasiewicz et al. (2021) also urged for more assessment to validate the results.

2.6.18 Exposure to Chemical

Chronic exposure to chemicals can enhance breast carcinogenesis by influencing the tumor microenvironment, which subsequently leads to epigenetic changes and the initiation of pro-carcinogenic processes. Chronic exposure of females to chemicals such as dichlorodiphenyltrichloroethane (DDT), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), synthetic fibers, organic solvents, oil mist, and insecticides is associated with a significantly increased risk of breast cancer (Łukasiewicz et al., 2021).

2.7 Symptoms

- Lump/mass in breast

  Lumps that exhibit hardness or deviate from normal breast tissue should be evaluated, as they may indicate breast cancer or a benign breast condition, such as a cyst or fibroadenoma. Cancerous lumps typically present as hard, painless formations with irregular edges but may also exhibit softness and tenderness. Lumps may also develop under the armpit and can be carcinogenic (Prusty et al., 2020; Centers for Disease Control and Prevention, 2023).

- Change in size/shape of breast

  Changes in the breast including swelling, shrinking, or significant asymmetry, may suggest the possibility of breast cancer, particularly when only one breast is involved (Fletcher, 2024).

- Breast or nipple pain

  Although breast cancer is often painless, some may experience discomfort or pain in the affected breast (Fletcher, 2024).

- Nipple Abnormalities

Abnormalities in the nipple, such as nipple inversion, scaly or pitted skin on the nipple, unusual discharge (often bloody or clear), discomfort in the nipple area, or alterations in the size or shape of the nipple are also indications of breast cancer (Prusty et al., 2020).

- Change in breast skin

  Changes in breast skin, including dimpling, redness, scaling, or thickening, may present an "orange peel" texture. These symptoms are particularly linked to inflammatory breast cancer, a rare but aggressive form (American Cancer Society, 2022).

- Swelling or Lumps in Lymph Nodes

  Swollen lymph nodes under the arm or near the collarbone could indicate that cancer has spread beyond the breast (Fletcher, 2024).

- In the advanced stage (metastatic) of the disease, underarm lymph nodes are observed alongside additional symptoms, including bone pain (indicative of bone metastases), shortness of breath (associated with lung metastases), decreased appetite (linked to liver metastases), unintentional weight loss (also related to liver metastases), headaches, and neurological pain or weakness (Prusty et al., 2020).

Recognizing breast cancer symptoms is essential, as the treatment and recovery rate of this disease significantly depends on early diagnosis. Approximately 20% to 30% of women exhibiting breast symptoms delay consulting a specialist for at least three months due to a lack of symptom recognition. Delayed presentation of symptomatic breast cancer for three months or longer correlates with reduced survival rates from the disease (Burgess et al., 2001). Every woman needs to possess adequate knowledge regarding these symptoms.

CHAPTER-3

METHODOLOGY

3.1 Clinicopathological Data Collection and Statistical Analysis of Bangladeshi Breast Cancer Patients

The clinical and demographical characteristics and outcomes of pathologically confirmed Breast Cancer patients were collected from the Ahsania Mission Cancer Hospital, Dhaka.

Documents and medical records from December 2023 to May 2024 were collected for this study. Data from about ninety-four patients were collected using a structured pretested questionnaire form. Informed consent was obtained from each patient before the study onset. Patients diagnosed with any stage of breast tumors (primary or metastatic; histology type: invasive ductal carcinomas or lobular carcinomas) were included. Other inclusion criteria included:

Demographic Data

- Age
- Weight
- Height
- Marital Status

Menstrual and Reproductive History

- Parity
- Age of first child birth
- Breast feeding history
- Menopause age

Risk Factors

- Oral Contraceptive Pills
- Hormone Replacement Treatment
- Tobacco

Medical History

- First symptoms
- Self breast-screening
- Previous breast disease history
- Family history of breast disease
- Biomarker analysis
- Tumor grade stage
- Diagnosis, treatment and surgical history

3.2 Statistical Analysis

Data analysis was done using the IBM Statistical Package for Social Sciences (SPSS) version 30 for data coding, entry, and analysis and descriptive statistics and Pearson's chi square correlation was done.

CHAPTER-4

RESULT

4.1 Observed Pattern in Demographic Data of Bangladeshi Breast Cancer Patients

A total of 94 female breast cancer patients were enrolled in the study. The results finding revealed that the age at diagnosis ranged between 27 and 75 years, with a mean age of 47.29 years and a mode age of 50 years. Most of the patients are in their menopausal (56.4%) and postmenopausal age (10.6%), with 7.78% the case is going through their late menopausal period (Table 2). In addition, the majority of participants were overweight (42.9%), and 11.9% of the patients were obese. However, more than half of the patients have a weight crossing the normal borderline, so the result may not lead us to any conclusion alone (Table 2).

Almost 99% of the patients are married, and almost half of them have their first child before their twenties, indicating a potential association between having a first child before their 20s and increased breast cancer risk. 78.2% of them had multiple children. Only 10% of them did not go through the breastfeeding process due to not having any children (Table 2).

Furthermore, half of the subjects had a history of taking oral contraceptive pills, but the cancer development risk shows an association with taking the oral contraceptive pills for a longer time, e, more than 18% of the increased risk in this study who took longer than 5 years (Table 2). In addition, hormone replacement therapy is relatively less in Bangladesh (Dhaka), constituting only 6% of the test results, indicating no impact of developing breast cancer in this study (Table 2). Moreover, there is no significant correlation observed between the occurrence of breast cancer and the individual's history of tobacco smoking, where more than 96% of the subjects did not have a smoking habit (Table 2).

Table 2. Distribution of demographic data of breast cancer patients

Variables		Frequency	Percentage (%)
Age	Mean	47.29	
	Median	48	
	Mode	50	
BMI	Underweight	4	4.8%
	Normal weight	34	40.5%
	Overweight	36	42.9%
	Obese	10	11.9%
Parity	Nulliparous	8	9.2%
	Uniparous	11	12.6%
	Multiparous	68	78.2%
First childbirth age	11-20	51	54.3%
	21-30	22	23.4%
	31-40	5	5.3%
Breast-Feeding	Yes	84	89.4%
	No	10	10.6%
Menopause	No	49	48.0%
	Yes	44	43.1%
OCP	No	39	46.4%
	Yes	45	53.6%
HRT	No	86	84.3%
	Yes	6	5.9%
Smoking	Yes	3	3.2%
	No	88	96.8%

4.2 Medical History Data of Bangladeshi Breast Cancer Patients

Family history of breast cancer did not have any correlation with developing breast cancer in the lifetime, as 92.6% of the patients who developed breast cancer did not have any family history of breast disease (Table 3). Moreover, lump/Mass is the most common primary initial symptom among the patients, accounting for 37.3%. However, it is alarming that more than 78.70% of the patients did not do the self-breast examination, even due to their lack of knowledge about the concept of self-breast examination.

When biomarker analysis results were examined, TNBC (31.7%) and HR+ (27.0%) were the most common subtypes, followed by TPBC (20.6%) and HER2+ (11.1%) (Table 3). Moreover, the majority were diagnosed at Stage 2 (65.6%), followed by Stage 3 (29.7%) and Stage 1 (4.7%) (Table 3).

Table 3. Distribution of medical history of breast cancer patients

Variables		Frequency	Percentage (%)
Family history	yes	3	3.2%
	No	87	92.6%
Initial symptoms	Lump / Mass	38	37.3%
	Pain	2	2.0%
	Cyst	6	5.9%
	Nipple discharge	1	1.0%
	Tumor	2	2.0%
Self-Breast Examination	Yes	19	21.30%
	No	70	78.70%
Biomarker Analysis	TPBC	13	17.3%
	TNBC	26	34.7%
	HER2+	9	12.0%
	HR+	21	28.0%
	HR+, HER2+	6	8.0%
Tumor Grade stage	Stage1	3	4.7%
	Stage2	42	65.6%
	Stage3	19	29.7%

4.3 Association of BMI with OCP and Tumor Grade on Breast Cancer

4.3.1 BMI vs Tumor Grade

Obesity is one of the risks of developing breast cancer. There is a weak linear association observed between BMI and tumor grade ($p = 0.019$), demonstrating higher BMI correlates with aggressive cancer types. It is observed that most participants with Stage 2 tumors were overweight (29.7%) (Figure 1).

4.3.2 BMI vs OCP

A significant association was noted between OCP use and BMI ($p = 0.035$), suggesting link between contraceptive use and BMI distribution. Although a slight majority (53.6%) of participants reported OCP use, 22.62% of the users were overweight (Figure 2).

4.4 Association of Biomarkers with BMI, Breast-feeding, OCP and Tumor Grade on Breast Cancer

4.4.1 Biomarker vs BMI

Triple-negative breast cancer (TNBC) was the most prevalent biomarker across all the breast cancer patients in this study. Triple-negative breast cancer (TNBC) was most appeared among overweight participants (15.94%) and obese people (5.80%). Hormone receptor-positive (HR+) breast cancers were almost evenly distributed across normal-weight (14.4%) and overweight (11.6%) groups. Human epidermal growth factor receptor 2 (HER2+) was the highest observed in overweight people (5.80%) (Figure 3). This analysis reveals the dominance of TNBC in all the participants regardless of weight. However, TNBC shows a tendency to appear in individuals with higher BMI.

4.4.2 Biomarker vs Breast-Feeding

Triple-negative breast cancer (TNBC) was the most frequent subtype among breastfeeding participants. 99% of the participants had gone through the breastfeeding process, and TNBC was the most common among them (32%), followed by HR+ (22.67%) and TPBC (17.33%). Among non-breastfeeding patients, HR+ is the most prevalent (5.33%) (Figure 4).

4.4.3 Biomarker vs Tumor Grade

HR+ was overrepresented in Stage 2 tumors, accounting for almost 20.63%. TPBC and TNPC were evenly presented in Stage 2 patients (19.05%). But, TNBC was also the most common in Stage 3 (11.11%). In addition, HER2+ was most dominant in Stage 3 (7.94%). So, TNBC was overrepresented in both Stage 2 and Stage 3 tumors, reinforcing its link with advanced-stage diagnoses, difficult prognosis, and limited treatment options (Figure 5).

4.4.3 Biomarker vs OCP

TNBC is the most common subtype in OCP users and non-users, accounting for almost 17%. The consistent frequency in both groups suggests no apparent difference in the prevalence of TNBC based on OCP usage. HR+ is mostly presented in OCP non-user participants (17.81%). The HER2+ subtype is more frequent in OCP users (more than 9.59%) than non-users and showed distinct differences among the users and non-users. So, this finding suggests a possible correlation between OCP use and increased prevalence of HER2+ breast cancer (Table 6).

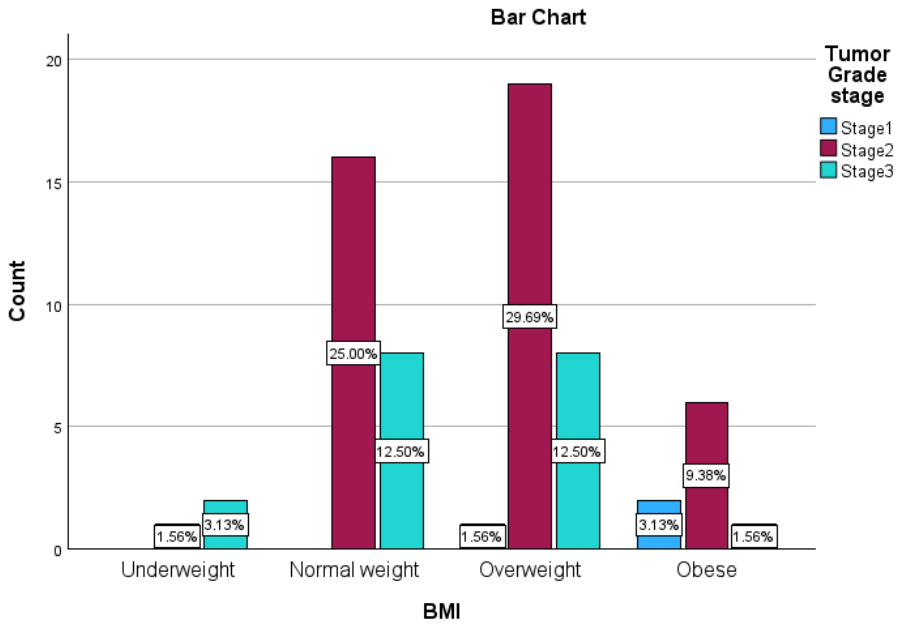

Figure 1. Association of BMI and tumor grade among breast cancer patients. This analysis reveals that the majority of the participants are overweight and diagnosed at Stage 2 (29.69%), and 12.50% are in Stage 3. 25% of normal-weight people are also diagnosed at Stage 2. Most obese people have their diagnosis at an early stage, 3.13% at stage 1 and 9.38% at stage 2.

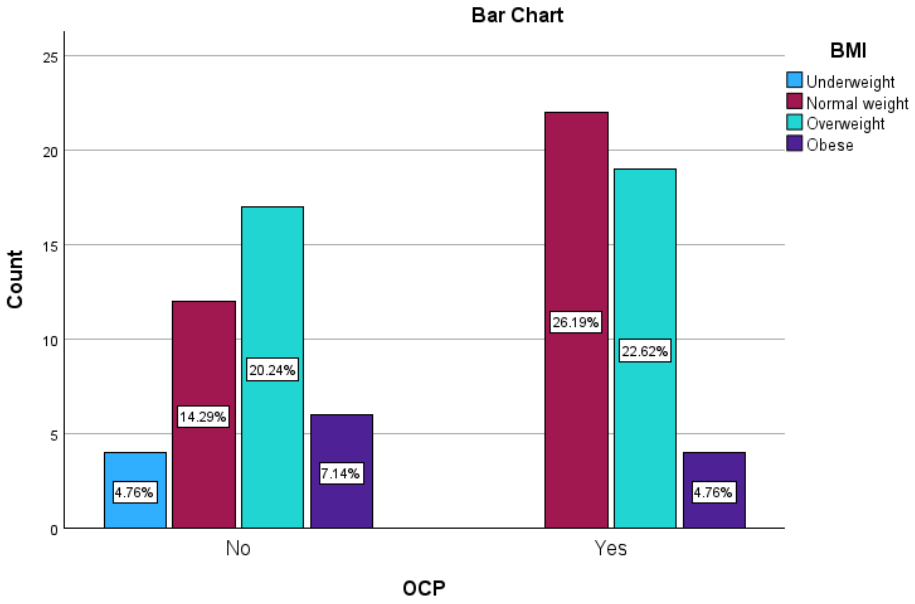

Figure 2. Association of BMI and OCP among breast cancer patients. 22.62% of overweight and 26.19% of normal-weight people who had used OCP developed breast cancer.

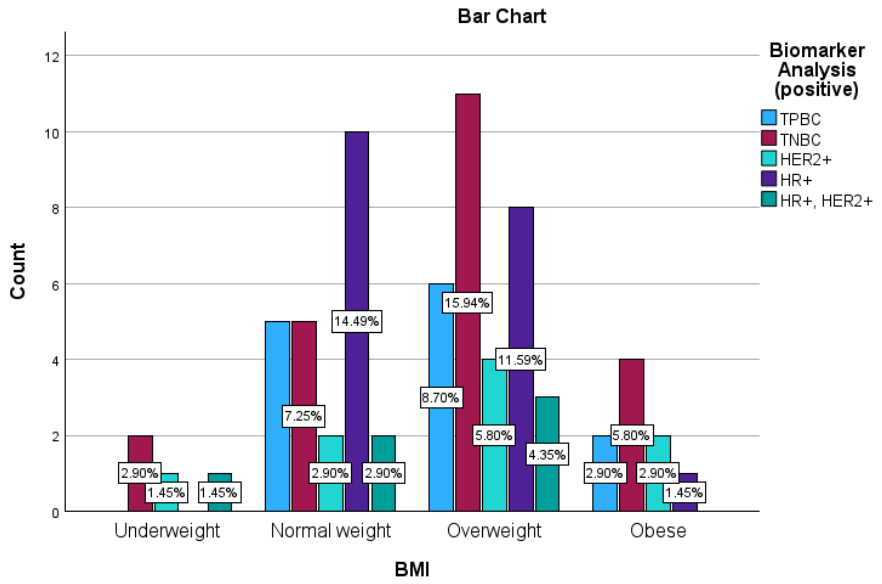

Figure 3. Association of BMI and biomarker among breast cancer patients. TNBC was most prevalent among overweight participants (15.94%) and obese people (5.80%). HR+ was most prevalent among people of normal weight (14.49%) and overweight people (11.59%). HER2+ was the highest observed in overweight people (5.80%).

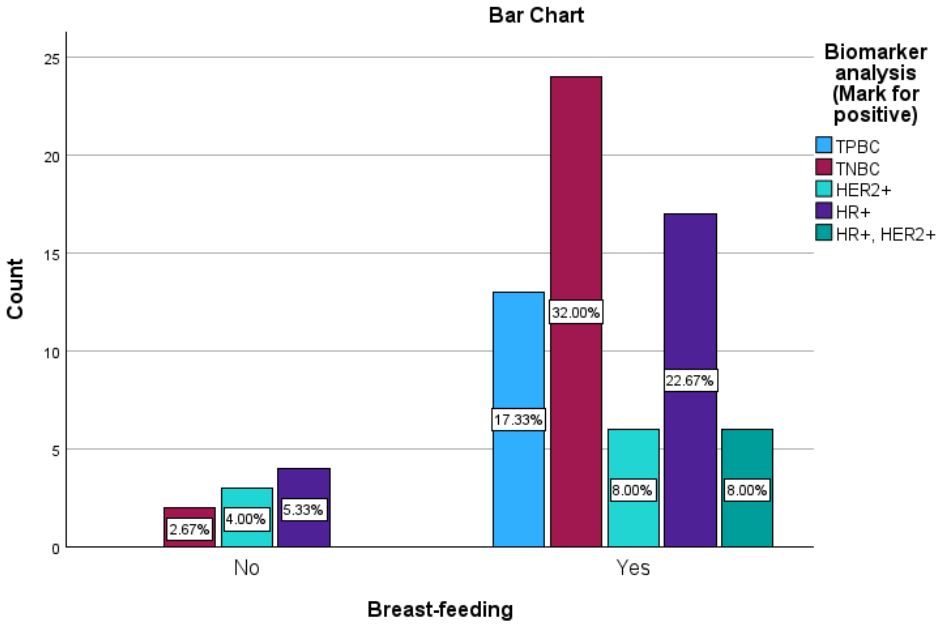

Figure 4. Association of biomarker and breastfeeding among breast cancer patients. TNBC was most common among them (32%), followed by HR+ (22.67%) and TPBC (17.33%). Among non-breastfeeding patients, HR+ is the most prevalent (5.33%).

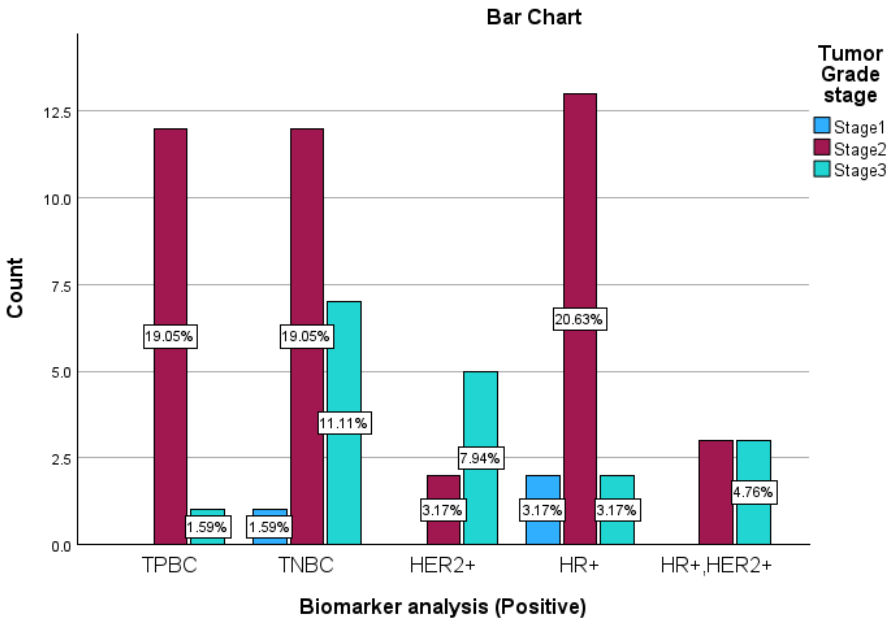

Figure 5. Association of biomarker and grade among breast cancer patients. HR+ (20.63%) was the most common in Stage 2 patients. TPBC and TNPC were evenly presented in stage 2 patients (19.05%). Her2+ was most prevalent in stage 3 (7.94%).

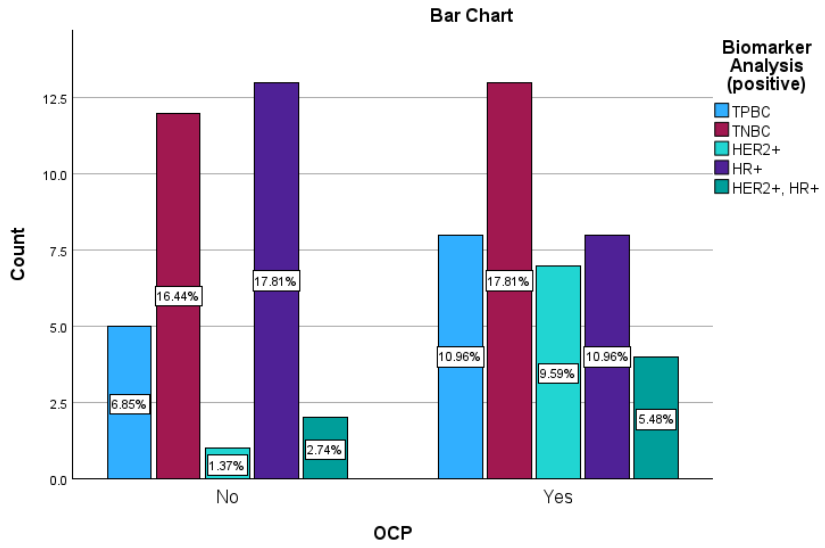

Figure 6. Association of biomarker and OCP among breast cancer patients. TNBC is most common and evenly represented in both OCP users (11.81%) and non-users (16.44%). HR+ is mostly presented in OCP non-user participants (17.81%).

CHAPTER-5

DISCUSSION

Most of the patients are in their menopausal and postmenopausal age, with a mean age of 47.29 years. Approximately 5% of diagnoses in France, 11% in the USA, and 7% worldwide with breast cancer are diagnosed before the age of 40 years (Moriarty, 2024). The mean age at diagnosis in India was 47.7 years, ranging from 24 to 80 years. Most patients (54%) were diagnosed between 40 and 60 years. Twenty percent were over 60, and around 26 percent were under 40 (Surakasula et al., 2014).

In contrast to a UK study that found women who had their first-term pregnancy before the age of 21 had a lower incidence of cancer (Evans et al., 2017), our study suggested a possible link between having a first child before the age of 20 and an increased risk of breast cancer as nearly half of them have their first child before the age of 20. In addition, 78.2% of breast cancer patients had numerous children. However, research found that women who become pregnant for the first time before the age of 20 had a 50% lower chance of getting breast cancer than women who become pregnant for the first time after the age of 30 (Bernstein, 2002). Compared to nulliparous women, women who experience at least one full-term pregnancy before the age of 30 have an average 25% lower chance of developing breast cancer. Multiparity's protective impact seems to grow with the number of deliveries (Zoure et al., 2016).

One crucial factor is the family history of breast cancer. About 3–10% of instances of breast cancer are inherited, with BRCA1 and BRCA2 mutations being linked to 85% of these cases. The degree of association between the family member with a history of breast cancer and the disease is crucial in cases of breast cancer (Ozsoy et al., 2017). Based on the study's findings, there is no chance of developing hereditary breast cancer. According to certain research conducted in the USA, UK, and Sweden, women without a family history of breast cancer account for 80% to 85% of all cases. Women with and without a family history should not receive different therapeutic care due to a lack of evidence (Haber et al., 2012; Melvin et al., 2016). However, according to UTAH research, women who have a family history of breast cancer are more likely to have the condition, even if the closest relative has the disease (Slattery & Kerber, 1993).

In this study, only 21.30% of patients did the self-breast examination. The majority of them (78.70%) did not do even due to their lack of knowledge about the self-breast examination concept. 96.5% of students in Gaza (Al-Shiekh et al., 2021) and 93.9% of study participants in India

(Mehanathan et al., 2023) have knowledge about the self-breast examination, but only 31.4% and 38.5% of participants, respectively, practice it regularly. On the contrary, more than half of the UK women (56%) check their breasts regularly, according to a 2023 analysis (Breast Cancer Now, 2023).

Even though smoking is linked to a higher risk of breast cancer, this study found no significant correlation, which is consistent with a comparable study that found women who had ever smoked had a 14% higher chance of developing breast cancer than those who had never smoked (Rosenberg, 2020).

A weak linear association between BMI and tumor grade indicated a possible trend but not a strong correlation, and the majority of people with Stage 2 tumors were overweight. Nonetheless, it is in line with research that indicates aggressive cancer types in postmenopausal women are correlated with higher BMIs (Petrelli et al., 2021). Adult women of reproductive age who take combination oral contraceptives are twice as likely to be overweight or obese, which ultimately raises their risk of cancer (Endalifer et al., 2020). Additionally, this study found a strong correlation between OCP usage and BMI.

According to the study, triple-negative breast cancer (TNBC) is more common in overweight and obese persons, which is consistent with its aggressive character and propensity to manifest in those with higher BMI (Pastena et al., 2024). However, with more cases, the outcome will be easier to see. Between 2011 and 2030, there will likely be a 64% increase in breast cancer incidence in the US due to a shift in the age of diagnosis to women aged 70–84 and a rise in the proportion of ER-positive in situ tumors. Significant progress has been made in increasing survival rates after a diagnosis of invasive breast cancer during the past 30 years despite this alarming rise in numbers (Winters et al., 2017). Additionally, study shows that women in their forties to sixties are more likely than other women to have ER-positive instances. Breast cancer prognosis is highly predicted by biomarker positivity, particularly about HER2, progesterone receptor (PR), and estrogen receptor (ER) statuses. Hormonal treatment usually works better for ER-positive tumors. However, triple-negative breast tumors (TNBC) are linked to worse outcomes and more aggressive disease because they do not have ER, PR, or HER2 (Akram et al., 2017; Millard, 2024). However, TNBC accounts for up to 31% of all cancers in Indian women, making it the most common kind and contributing to increased death rates (Kulkarni et al., 2020; Thakur et al., 2017).

Hormone receptor-negative breast tumors have an unfavorable relationship with breastfeeding (Fortner et al., 2019). As breastfeeding length increased, the risk of TNBC was reduced. Compared to parous women who had never nursed, those who had done so for at least a year had a 31% decreased incidence of TNBC (Ma et al., 2017; ElShamy, 2016). Furthermore, breastfeeding is linked to a reduced incidence of breast cancer, which is HER2+ (Abraham et al., 2023).

Even though nearly every participant had breastfed, breast cancer nonetheless struck them. With more cases, this outcome will have more noticeable outcomes. However, women with hormone-receptor-positive and HER2-negative cancer benefited most from breastfeeding in terms of recurrence risk (Breastcancer.org, 2022). Despite the extremely low incidence of the HER2+ subtype, most of the parents in this research have more than one kid. This result is consistent with research that found that parous women, regardless of nursing, had a greater incidence of HER2-enriched illness than nulliparous women (Fortner et al., 2019).

Thus, this study's results demonstrated a few key risk factors for breast cancer. On the other hand, more thorough case data analysis has become a vital field of research to investigate the connection between factors affecting breasts for precise interpretations.

Outcome

This study aims to provide a comprehensive understanding of the current status of breast cancer in Dhaka and to offer valuable insights into the overall situation of breast cancer in Bangladesh. At present, there is a lack of hospital-based breast cancer registry data, as well as a comprehensive population-based breast cancer database in the country. This gap in population-based study is attributed mainly to insufficient awareness regarding the significance of knowing breast cancer risk factors, screening methods, diagnostic, and the treatment process and how the ignorance of these aspects contributes to delayed diagnoses, which negatively impacts the prognosis of the disease.

This study intends to show the importance of proper knowledge of symptom recognition, risk factors, and self-breast examination. Early detection can significantly lower breast cancer mortality rates by allowing for timely and effective treatment options. In addition, taking oral contraceptive pills (OPC) for a long time without properly consulting with health specialists is also a leading

cause of developing breast cancer in Dhaka. If the public is informed about the benefits of screening, self-examination, and risk factors, and the adverse effects of taking oral contraceptive pills (OPC) for a long time, it is likely to lead to more proactive health behaviors, resulting in earlier diagnoses, better treatment outcomes, and improved survival rates.

So, with better access to education and screening, we can work towards minimizing breast cancer-related deaths and improving the health and well-being of women in Bangladesh.

Limitations

- This study is an ongoing work. More data are required for comprehensive analysis to draw more definitive conclusions. Comprehensive analysis would benefit from a larger sample size and more diverse data sources, ensuring that findings are representative of the broader population. Additional research can help refine the recommendations and increase the accuracy of the conclusions.
- The selection of respondents for this study was based on convenience sampling, meaning participants were chosen due to their availability rather than through a proper selection process. This approach may introduce bias, as it does not ensure that the sample reflects the demographics of the general female population in Dhaka. As a result, the findings may not be fully representative of all women, particularly those from different socioeconomic backgrounds, rural areas, or those with limited access to healthcare.
- As the survey questionnaire is based on multiple-choice, some respondents might provide socially desirable responses to some questions, particularly to sensitive topics like health behaviors, rather than reflecting their actual experiences or knowledge. This social desirability bias can affect the validity of the results.

Prospect

This study on breast cancer in Dhaka, Bangladesh, holds significant potential to contribute to the understanding, prevention, and management of breast cancer in the region.

- Enhanced Understanding of Risk Factors:

The study provides a comprehensive analysis of the association between reproductive, lifestyle, and genetic factors and breast cancer. Identifying these associations helps to understand better the etiology of breast cancer in the Bangladeshi population.

- Improved Awareness and Early Detection

  This study underscores the importance of early detection by highlighting the relationship between initial symptoms, tumor grades, and biomarker positivity. The findings can be used to develop awareness campaigns about self-breast examinations and the need for regular screening, ultimately leading to earlier diagnoses and improved survival rates. In addition, Highlighting gaps in self-breast examination practices offers an opportunity to design community-based initiatives focused on empowering women to take charge of their health.

- Establishing Baseline Data for Bangladesh

  With limited population-based breast cancer data in Bangladesh, this study provides a valuable dataset that can serve as a foundation for future research and cancer registry development.

Recommendation

The study finds OCP is a leading cause of breast cancer in Bangladesh. Given the potential link between oral contraceptive pill (OCP) use and an increased risk of breast cancer, it is important to explore alternative contraceptive methods. Discussions with clinicians and experts in reproductive health highlighted “Tubal Ligation (permanent method of contraception)” and “Copper T (temporary method of contraception)” as safer alternatives to OCPs for women in Bangladesh. Increased public awareness and accessibility of these alternative contraceptive methods should be prioritized through national health programs.

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