

ORIGINAL ARTICLE

Socio-Demographic and Lifestyle Predictors of Triple-Negative Breast Cancer in Bangladeshi Women

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ABSTRACT

Background (including objective): Triple-negative breast cancer (TNBC) is an aggressive molecular subtype of breast cancer with distinct epidemiology and high burden among South Asian women. **Objective:** To determine the association of socio-demographic factors, reproductive characteristics, and lifestyle patterns with TNBC. **Methods & Materials:** This cross-sectional study was conducted at Bangladesh Medical University from January to December 2023. A total of 116 female patients (58 TNBC; 58 non-TNBC) were enrolled through purposive sampling. Data on socio-demographic, reproductive, and lifestyle factors were collected using semi-structured questionnaires and clinical checklists. TNBC status was confirmed by immunohistochemistry. Statistical analyses were performed using SPSS v.26. Chi-square tests and multivariable logistic regression were used to identify predictors of TNBC ($p < 0.05$ considered significant). **Results:** TNBC-positive patients were younger than non-TNBC patients (39.79 ± 8.98 vs. 45.22 ± 11.22 years; $p = 0.005$) and more frequently resided in urban areas (43.86% vs. 22.41%; $p = 0.015$). Non-modifiable risk factors (early pregnancy, breastfeeding, early menarche, early menopause) and modifiable factors (OCP use, processed food consumption) were not significantly associated with TNBC. Moderate-intensity physical activity was more common in TNBC patients (96.6% vs. 82.8%). Multivariable logistic regression identified urban residence (OR = 2.704; 95% CI: 1.204–6.073; $p = 0.016$) and moderate-intensity physical activity (OR = 5.833; 95% CI: 1.218–27.937; $p = 0.027$) as independent predictors of TNBC. **Conclusion:** In this population, TNBC was more prevalent among younger, urban-residing women. Urban residence and lifestyle factors may play a role in TNBC pathogenesis.

Keywords: Triple-negative breast cancer; Breast malignancy; Socio-demographic factors; Estrogen receptor; Progesterone receptor.

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INTRODUCTION

Breast cancer is the most prevalent malignancy among women globally, with a rising burden in developing countries [1]. Triple-negative breast cancer (TNBC), defined by the absence of estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2), is aggressive and has limited targeted treatment options [2,3]. TNBC accounts for 10–20% of breast cancers worldwide but is more frequent in South Asia, often affecting younger women and presenting at advanced stages [4,5].

In Bangladesh, breast cancer incidence is increasing, with a shift toward earlier onset and aggressive phenotypes [6,7]. Rapid urbanization has been associated with changes in reproductive behavior, lifestyle patterns, and environmental exposures in South Asia, potentially influencing breast cancer risk distribution [8,9]. Studies from India and Pakistan suggest that

urban residence may contribute to differences in breast cancer risk patterns compared to rural populations [10,11].

Modifiable factors such as obesity, metabolic syndrome, physical activity, and dietary habits may contribute to TNBC development [14–18]. Despite advances in genomics, socio-demographic and lifestyle determinants of TNBC among Bangladeshi women remain poorly described [19,20]. Understanding these predictors is crucial for early detection and targeted public health interventions [21]. This study aimed to determine the association of socio-demographic, reproductive, and lifestyle factors with TNBC.

METHODS & MATERIALS

Study Design and Setting

This hospital-based cross-sectional study was conducted at the Department of General Surgery and Breast Clinic, Bangladesh

Medical University, Dhaka, from January to December 2023. Eligible patients were recruited during routine outpatient and inpatient services following histopathological confirmation of breast cancer.

Participants

A total of 116 female patients with histologically confirmed primary breast cancer were included, comprising 58 TNBC and 58 non-TNBC cases. Inclusion criteria were age ≥ 18 years and availability of complete immunohistochemical (IHC) reports for estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2). Patients with recurrent disease, critically ill status, or unwillingness to participate were excluded. Participants were enrolled through purposive consecutive sampling.

Variables and Data Collection

The primary outcome was TNBC status, defined as absence of ER, PR, and HER2 expression on IHC.

Socio-demographic variables included age, residence, and occupation. Reproductive factors included age at menarche, age at first pregnancy, breastfeeding history, and age at menopause. Lifestyle variables included oral contraceptive pill (OCP) use, body mass index (BMI), physical activity level, and processed food consumption.

Data were collected using semi-structured interviewer-administered questionnaires and standardized clinical checklists. Anthropometric data were obtained from clinical records. Physical activity was categorized as low or moderate intensity based on self-reported frequency and type of activity.

Study Size

Sample size was calculated using a two-sided Z-test with 80% power and 5% level of significance to detect differences between TNBC and non-TNBC groups.

Statistical Analysis

Data were analyzed using SPSS version 26. Continuous variables were expressed as mean $\pm$ standard deviation and compared using Student's t-test. Categorical variables were analyzed using Chi-square or Fisher's exact tests as appropriate.

Multivariable logistic regression was performed to estimate adjusted odds ratios (ORs) with 95% confidence intervals (CIs) for predictors of TNBC. Variables with clinical relevance and those significant in univariable analysis were included in the regression model to control for potential confounding. Statistical significance was set at $p < 0.05$.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board of Bangladesh Medical University (approval number and date to be provided). Written informed consent was obtained from all participants prior to enrollment.

RESULTS

A total of 116 female patients were included, with 58 TNBC-positive and 58 TNBC-negative cases.

Socio-demographic Characteristics

TNBC patients were younger than non-TNBC patients (39.79 ± 8.98 vs. 45.22 ± 11.22 years; $p = 0.005$). The 31–40-year age group had the highest TNBC proportion (44.83%). Urban residence was more frequent among TNBC patients (43.86% vs. 22.41%; $p = 0.015$). Occupation showed no significant difference (Table I).

Table I: Socio-demographic characteristics ($n = 116$)

Variables	TNBC +ve n (%)	TNBC -ve n (%)	p-value*
Age 20–30	7 (12.1)	2 (3.5)	0.046†
31–40	26 (44.8)	21 (36.2)	
41–50	18 (31.0)	17 (29.3)	
51–60	7 (12.1)	12 (20.7)	
61–70	0 (0.0)	5 (8.6)	
71–80	0 (0.0)	1 (1.7)	
Mean $\pm$ SD	39.79 ± 8.98	45.22 ± 11.22	0.005**
Residence: Rural	32 (56.1)	45 (77.6)	0.015†
Urban	25 (43.9)	13 (22.4)	
Occupation: Housewife	57 (98.3)	57 (98.3)	0.368†
Job holder	1 (1.7)	0 (0.0)	
Teacher	0 (0.0)	1 (1.7)	

*Fisher's exact test; †Chi-square test; **Student's t-test

Non-modifiable Risk Factors

No significant differences were observed in early pregnancy, breastfeeding, early menarche, or early menopause ($p > 0.05$; Table II).

Table II: Non-modifiable risk factors ($n = 116$)

Risk Factor	TNBC +ve n (%)	TNBC -ve n (%)	p-value*
Early pregnancy: Yes	28 (48.3)	35 (60.3)	0.192
Breastfeeding: Yes	46 (79.3)	50 (86.2)	0.326
Early menarche: Yes	17 (29.3)	16 (27.6)	0.837
Early menopause: Yes	25 (43.1)	22 (37.9)	0.570

*Chi-square test.

Modifiable Risk Factors

OCP use and duration were similar in both groups (55.2%; Table III). Smoking, alcohol, and chemical exposure were

absent. Processed food intake was comparable (17.2% vs. 13.8%; $p = 0.608$; Table IV).

Table III: OCP and drug exposure (n = 116)

Risk Factor	TNBC +ve n (%)	TNBC -ve n (%)	p-value*
OCP use: Yes	32 (55.2)	32 (55.2)	1.000
Mean OCP duration (years)	7.79 ± 6.68	7.47 ± 4.29	–
HRT	0 (0.0)	0 (0.0)	–
Diethylstilbestrol	0 (0.0)	0 (0.0)	–

*Chi-square test.

Table IV: Modifiable lifestyle factors (n = 116)

Risk Factor	TNBC +ve n (%)	TNBC -ve n (%)	p-value*
Smoking	0 (0.0)	0 (0.0)	–
Alcohol	0 (0.0)	0 (0.0)	–
Processed food: Yes	10 (17.2)	8 (13.8)	0.608
Chemical exposure	0 (0.0)	0 (0.0)	–

*Chi-square test.

Predictors of TNBC

Multivariable logistic regression identified urban residence (OR = 2.704; 95% CI: 1.204–6.073; $p = 0.016$) and moderate-intensity physical activity (OR = 5.833; 95% CI: 1.218–27.937;

$p = 0.027$) as independent predictors. Age <40 years increased odds but was not significant (OR = 2.006; $p = 0.065$; Table V). Other factors showed no significant associations.

Table V: Logistic regression of TNBC predictors (n = 116)

Variable	OR	95% CI	p-value
Age < 40	2.006	0.959–4.208	0.065
Urban residence	2.704	1.204–6.073	0.016*
Early pregnancy	0.613	0.294–1.281	0.193
Breastfeeding	0.613	0.230–1.634	0.328
Early menarche	1.088	0.486–2.439	0.837
Early menopause	1.240	0.590–2.605	0.571
Obesity	0.356	0.105–1.208	0.097
Moderate-intensity physical activity	5.833	1.218–27.937	0.027*

*Significant at $p < 0.05$; OR = Odds Ratio; CI = Confidence Interval.

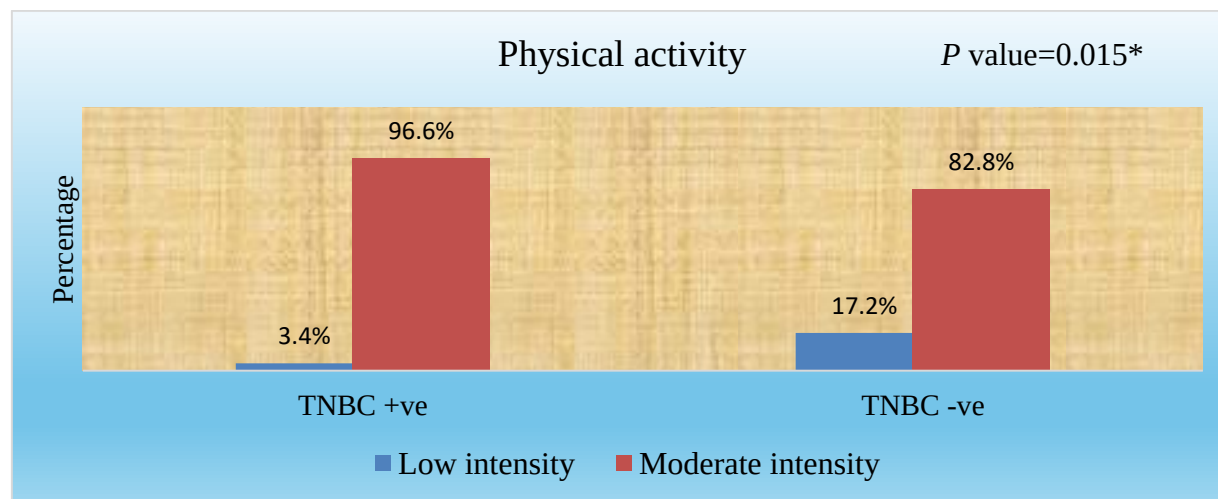


Figure 1*Pearson chi-square test was done. Values were expressed as frequency with percentage.

Figure 1: Physical activity among TNBC-positive and TNBC-negative patients

Physical activity among TNBC-positive and TNBC-negative patients, (TNBC +ve: Low 3.4%, Moderate 96.6%, TNBC -ve: Low 17.2%, Moderate 82.8%) Figure 1.

Physical Activity and Obesity

Moderate-intensity physical activity was more common in TNBC patients (96.6% vs. 82.8%; Figure 1). Obesity was present in 6.9% of TNBC and 17.2% of non-TNBC patients (Figure 2).

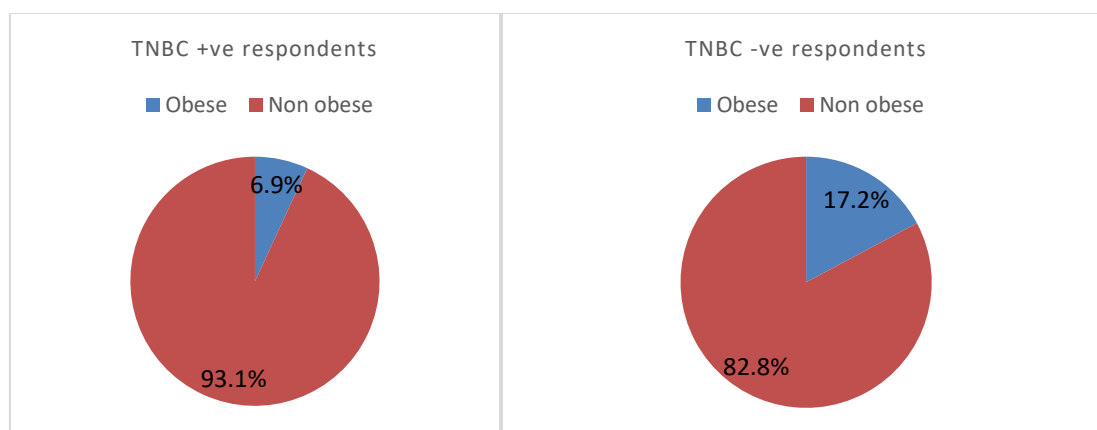


Figure 2: Obesity status among TNBC-positive and TNBC-negative patients

Figure 2 shows obesity among TNBC-positive and TNBC-negative patients. (TNBC +ve: Obese 6.9%, TNBC -ve: Obese 17.2%)

DISCUSSION

This study demonstrates a distinct epidemiological pattern of triple-negative breast cancer (TNBC) among Bangladeshi women, characterized by younger age and urban residence. TNBC patients were significantly younger than non-TNBC patients, with a mean age of 39.79 years. This finding is consistent with evidence indicating a higher burden of early-onset breast cancer and aggressive subtypes in South Asian populations compared to Western settings [4,6,13]. TNBC has been reported to occur more frequently among younger women and is associated with more aggressive clinical behavior [2,3].

A significant association between urban residence and TNBC was observed (OR = 2.704; $p = 0.016$). Urbanization in South Asia has been linked to rapid transitions in lifestyle, reproductive behavior, and environmental exposures [8,9]. Studies from India and Pakistan suggest that urban-rural differences may influence breast cancer risk patterns [10,11]. Urban environments are often characterized by greater exposure to air pollution and environmental stressors, which have been implicated in cancer development [22]. Although causality cannot be inferred due to the cross-sectional design, the association observed in this study suggests that environmental and lifestyle transitions accompanying urbanization may contribute to TNBC risk.

Traditional reproductive factors, including early menarche, early pregnancy, breastfeeding, and early menopause, were not significantly associated with TNBC in this cohort. While hormonal factors are established determinants of overall breast cancer risk, subtype-specific associations may differ, particularly for TNBC [2,3,14]. This finding suggests that classical reproductive risk models may not fully explain TNBC patterns in this population.

Moderate-intensity physical activity was associated with higher odds of TNBC in multivariable analysis (OR = 5.833; $p = 0.027$). Existing literature generally supports a protective role of physical activity against breast cancer risk [16,23]. Therefore, this unexpected finding may reflect residual confounding, measurement limitations, or reporting differences. It is possible that self-reported leisure-time activity differs between urban and rural women, or that behavioral changes occurred following early symptom development.

Obesity was less common among TNBC patients compared to non-TNBC patients. Although obesity is a recognized risk factor for breast cancer overall [14,15], its association with TNBC remains inconsistent across studies. Some evidence suggests that inflammatory pathways related to obesity may influence TNBC biology [15], but findings vary across populations. Given the small proportion of obese participants in this study, this observation should be interpreted cautiously.

Overall, the findings indicate that TNBC among Bangladeshi women may be associated more strongly with urban environmental and lifestyle transitions than with traditional reproductive factors. Further longitudinal and mechanistic studies are needed to clarify subtype-specific risk pathways in this population.

CONCLUSION

This study identified significant socio-demographic and lifestyle predictors of Triple-Negative Breast Cancer (TNBC) among Bangladeshi women. The findings demonstrate that TNBC in Bangladesh is predominantly an early-onset disease and is strongly associated with urban residence. This pattern differs from commonly reported Western epidemiological profiles, suggesting a context-specific risk distribution. The higher occurrence among younger women highlights an important clinical and public health concern, given the aggressive nature and limited targeted treatment options for TNBC. The association with urban residence may reflect rapid lifestyle transitions, reproductive changes, and environmental exposures accompanying urbanization.

These findings emphasize the need for age-appropriate screening strategies and focused awareness programs targeting younger, urban women. Strengthening early detection services and improving access to diagnostic facilities are essential.

Further large-scale, multicenter, and prospective studies are needed to validate these results and to explore underlying biological, environmental, and gene-environment interactions contributing to early-onset TNBC in Bangladesh.

AUTHOR CONTRIBUTIONS

Conception and design, or design of the research; or the acquisition, analysis, or interpretation of data: Mst. Azmira Khatun, Mohammed Arafat Bin Hossain, Azizur Rahman,

Drafting the manuscript or revising it critically for important intellectual content: Mst.Azmira Khatun, Rasel Ahmad, Md. Ibrahim Siddique, Final approval of the version to be published: Mst. Azmira Khatun, Md. Ibrahim Siddique, Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved: Mst. Azmira Khatun, Mira Pervin, Krisna Rani Majumder, Md. Ibrahim Siddique

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

ETHICAL APPROVAL

The protocol was approved by IRB. Provide with the approval memo number and date (not required for routine hospital data). All data supporting the findings of this study are included in the manuscript and supplementary files.

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