Observational Study

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Association of hypertension, hyperlipidemia, obesity, and demographic risk factors with breast cancer in Bangladeshi women

Diganta Islam, MSc[a], Md. Shihabul Islam, MS[b], Jesmin, PhD[a,*]

Abstract

In recent years, breast cancer incidences and related deaths have been rising among Bangladeshi women and will be a major threat by 2040. So, conducting more population-based studies is crucial. This case-control study was designed to quantitatively evaluate potential risk factors for breast cancer. In this population-based case-control study, 52 random breast cancer cases and 59 matched healthy controls, aged between 25 and 70 years, were included. The breast cancer patient samples were collected from the National Institute of Cancer Research and Hospital (NICRH), Dhaka, Bangladesh, from December 2021 to February 2022. The study was conducted fully following the Declaration of Helsinki guidelines. The collected socio-demographic data and blood samples of the study participants were analyzed. Chi-square analysis was used to compare study characteristics between cases and controls, Odds ratios (ORs) with 95% confidence intervals (CIs) were derived by univariate-logistic regression, and models were adjusted where necessary for study characteristics. Summary demographic characteristics of the 111 study participants suggested that higher age: (≥45): [OR 4.38, 95% CI (1.94–9.89), *P* value <.001], height: (<1.5 m): [OR 3.01, 95% CI (1.12–8.12), *P* value .029], low-incomes: [OR 6.83, 95% CI (2.11–22.05), *P* value .001], and illiteracy: [OR 12.65, 95% CI (3.49–45.79), *P* value .0001] showed significant correlations with breast cancer. The patient's body mass index (BMI) (≥30) indicated an association with breast cancer: [OR 3.91, 95% CI (1.00–15.31), *P* value .05]. The lipid profile: [triglycerides (TG): OR = 3.20, 95% CI (1.36–7.53), *P* value .008; TG/high-density lipid (HDL): OR = 8.82, 95% CI (2.81–27.68), *P* value <.001; and a lowered HDL: OR = 3.32, 95% CI (1.38–7.98), *P* value .007], hypertension: [systolic: OR 4.32, 95% CI (1.71–10.93), *P* value .002; and diastolic: OR 7.32, 95% CI (2.51–21.34), *P* value <.001], and gastric issues: [OR 6.07, 95% CI (2.00–18.37), *P* value .001], all showed significant association with breast cancer. The ER- breast cancer subtype was significantly associated with the overweight (OW) group (*P* value .046) whereas the PR-patients were significantly higher in the normal BMI group (*P* value .013). Results from this study might aid in the prevention, management, and raising of awareness against the specific risk factors among Bangladeshi women in near future.

Abbreviations: BMI = body mass index, CI = confidence interval, HDL = high-density lipid, LDL = low-density lipid, NICRH = National Institute of Cancer Research and Hospital, NL = normal, OB = obese, OR = odds ratio, OW = overweight, SE = standard error, TC = total cholesterol, TG = triglycerides.

Keywords: body mass index, breast cancer, dyslipidemia, hyperlipidemia, hypertension, lipid profile, obesity

1. Introduction

In 2020, there were around 2.26 million new cases and 684,996 deaths from breast cancer worldwide.[1,2] According to the Global Cancer Observatory (GLOBOCAN), the number of incidences may rise to 3 million, and breast cancer-related deaths could cross over 1 million by 2040.[3,4] Although breast cancer incidences are higher in high-income countries, the mortality rates are higher in low- and middle-income countries and the situation is estimated to get worse by 2040 when both incidence and mortality rates will be higher in the low-and middle-income countries than the high-income countries (Fig. 1A).[5,6] In 2020, there were 12,904 new cases and 6783 deaths from breast cancer in Bangladesh.[7] In the next 20 years, the expected number of incidences and mortality of breast cancer will be more than doubled (30,312 and 17,479, respectively) which is of concern for Bangladeshi women (Fig. 1B).[8,9] To counter these increases, action to reduce exposure to risk factors is critical.

Several studies have been conducted to correlate breast cancer with risk factors like obesity and BMI,[10–14] socio-demographic characteristics,[15–20] food habits,[21–24] anthropometric,[25–28]

The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.;All data generated or analyzed during this study are included in this published article [and its supplementary information files]

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[a] Department of Genetic Engineering & Biotechnology, University of Dhaka, Dhaka, Bangladesh, [b] Department of Genetic Engineering & Biotechnology, University of Rajshahi, Rajshahi, Bangladesh.

** Correspondence: Jesmin, Department of Genetic Engineering & Biotechnology, University of Dhaka, Dhaka-1000, Bangladesh (e-mail: jesmin@du.ac.bd).*

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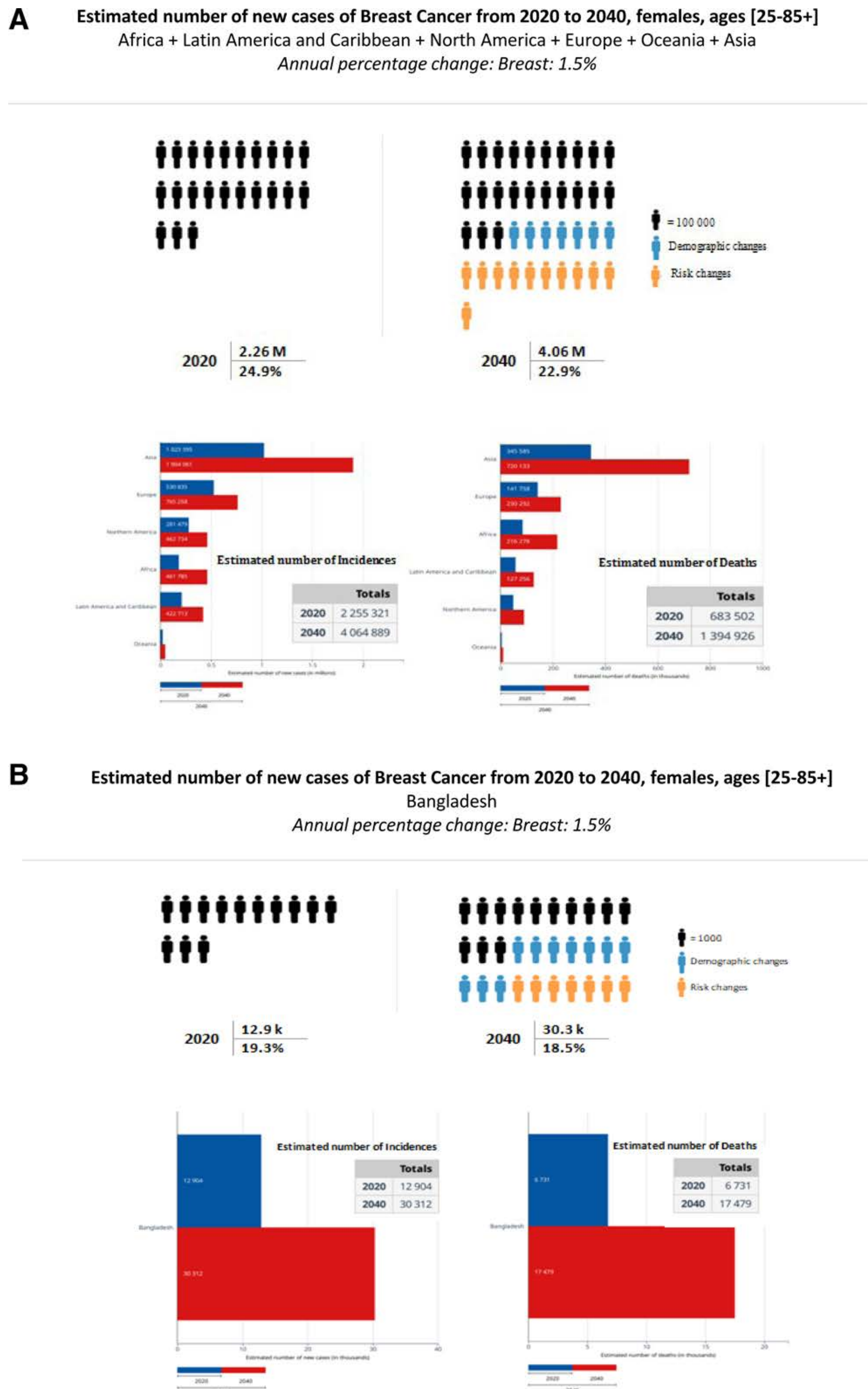

Figure 1. Estimated number of new cases of breast cancer from 2020 to 2040. (A) Global view and (B) Bangladesh perspectives (GLOBOCAN).

dyslipidemia, hyperlipidemia and hypertension,[29–32] obstetric factors,[33–38] hormonal regulations,[39–43] genetic factors,[44,45] and others. Obesity is the state of excess body fat in terms of body mass index (BMI).[11] People with a BMI ≥ 30 kg/m^2 are considered obese (OB) and they have a higher tendency of suffering from chronic diseases like cancer and especially breast cancer.[11,46] Among women, being overweight (OW) and OB are linked with a higher risk of getting breast cancer, especially for those who have gone through menopause.[47,48] The high level of cholesterol, triglyceride, low-density lipid (LDL), and low level of high-density lipid (HDL) are significantly associated with breast cancer risk.[49]

Although some studies were conducted on risk factors and breast cancer development and/or progression, most of which were conducted on American or European women and only a few on Asian women. Moreover, there are ambiguities in data and study outcomes. Breast cancer incidences and related deaths have been rising among Bangladeshi women in recent years and are projected to be a major threat by 2040. So, more population-based studies are crucial to evaluate the risk factors associated with breast cancer, to better manage, and develop strategies to combat it. Hence, this study was designed to conduct on Bangladeshi women including both breast cancer cases and healthy controls to quantitatively evaluate various risk factors (like socio-demographic, obstetric, anthropometric, eating habits, obesity, hyperlipidemia, and hypertension) and breast cancer development. Results from this study might aid in the prevention, management, and raising of awareness against the specific risk factors among Bangladeshi breast cancer patients in near future.

2. Methods

2.1. Study participants, and sample size

For this study, samples from breast cancer patients were collected from the National Institute of Cancer Research and Hospital (NICRH), Mohakhali, Dhaka, during the period from December 2021 to February 2022. The criteria for inclusion were: adult females between 25 and 70 years of age, confirmed breast cancer patients (based on medical reports), not currently pregnant or in severe condition, and voluntarily agreed to participate. The sample size was determined using the following formula:

$$n = \frac{(z_\alpha + z_\beta)^2 \times (\sigma_1{}^2 + \sigma_2{}^2)}{(\mu_1 - \mu_2)^2}$$

Where, n = the estimated sample size, μ_1 = mean of the chosen quantitative variable in women with breast cancer (Case); μ_2 = mean of the same quantitative variable in healthy females without breast cancer (Control); σ_1 = standard deviation of the chosen quantitative variable in women with breast cancer, σ_2 = standard deviation of the same quantitative variable in healthy women without breast cancer, Z_α = standard normal deviate value of Z at a fixed level of significance, and Z_β= the standard normal deviate value at a fixed power. In this study, the serum lipid profile data from Owiredu et al[50] was used as the chosen quantitative variable (where μ_1 = 202.00; μ_2 = 174.50; σ_1 = 53.60; σ_2 = 40.50; taking a 95% level of significance Z_α = 1.96; and a 90% power Z_β = 0.90) to measure the sample size for each group. From the calculation, the study sample size was 48.81. Thus, a total of 111 subjects, comprising 52 breast cancer patients were considered as cases and matched 59 healthy Bangladeshi women of the same age group were included as controls, in this study. The study was approved by the Ethics Committee of the NICRH and written informed consent was taken from all study participants before inclusion.

2.2. Data collection

A semi-structured data sheet was prepared to collect information from the study participants. Information was collected through interviews and checking their medical reports, verbal and written consent from all participants was also obtained before including in the study. Data collected from participants were socio-demographic and diagnostic reports of breast cancer, physiological parameters, and participants' personal information like menstrual history, menarche age, food habits, lifestyle, family history of the disease, and medical history of the participants. Breast cancer stage, type, and hormonal status were also collected for some patients from their medical records. All collected data were stored both digitally and manually in different record files. The study was conducted fully ensuring the privacy and anonymity of the study participants and following the guidelines of the Declaration of Helsinki throughout the process.

2.3. Physiological data collection

A digital weight machine was used to collect data about weight (in kilograms) while the participants were wearing light clothes. The height (in meters), and circumferences of the hip and waist were measured while the participants were in standing positions. Then, BMI and waist-to-hip ratio were calculated using the standard formula.[51] The WHO recommended criteria for BMI ranges used in this study were BMI: $<25\,kg/m^2$ as normal (NL), BMI: ≥ 25 and $<30\,kg/m^2$ as OW and BMI: $\geq 30\,kg/m^2$ as OB.[51] The blood pressure was measured using a sphygmomanometer when the participants were sitting. The normal range for systolic and diastolic blood pressure was 90 to 120 mmHg and 60 to 80 mmHg, respectively. Values above normal were considered as high blood pressure/ hypertension for this study participants. The clinical history of the participants was collected from the hospital with the consent of the patients and approval by the hospital authority.

2.4. Clinico-pathological assay

The venous blood samples of the study participants were collected into BD Vacutainer® tubes by trained authorized personnel. Analysis of the blood samples was carried out at the Department of Biochemistry and Molecular Biology, Bangabandhu Sheikh Mujib Medical University for characteristics like random plasma glucose, HbA1c, and Creatinine, and their reference values were used to evaluate the study characteristics. Serum lipid measures were analyzed using an automated analyzer (Atellica, Siemens Germany) for lipid profiles: Triglycerides (TG), Total Cholesterol (TC), HDL, and Low-Density Lipid (LDL) following the National Cholesterol Education Programme (NCEP) Adult Treatment Panel III (ATP III) guidelines where TC >200 mg/dL and TG >150 mg/dL was considered as hypercholesterolemia and hyperglyceridemia respectively. The LDL >130 mg/dL was considered as high and HDL <40 mg/dL, was considered as low compared to the reference value.[52] The ratio for TC, TG, and LDL with HDL was also considered for this study. Dyslipidemia for the study participants was considered if any of the stated values were found outside of the normal range. Subjects were classified as Hyperlipidemic when the TG and/or TG/ HDL ratio was higher than the normal values.

2.5. Ethical approval

The study protocol was approved and ethical clearance was provided by the Institutional review board of the NICRH (Reference number: of this NICRH/Ethics/2021/323). All participants were well informed about the purpose and procedures of this study and written consent was taken beforehand for inclusion.

2.6. Statistical analysis

All data were analyzed using the statistical programs: SPSS Statistics 20 (Version 27.0. Armonk, NY: IBM Corp.2020), and Microsoft Excel (2013). In this study, values were expressed as absolute numbers, mean ± standard deviation, and in percentages. A Chi-square test was conducted for continuous and categorical data respectively. Odds ratios (ORs) were calculated using unconditional regression analysis, with 95% confidence intervals (CIs). A P value <.05 was considered statistically significant.

3. Results and discussion

3.1. Study participants and sociodemographic characteristics

In this study, a total of 111 Bangladeshi women aged between 25 and 70 years participated, of which 52 were breast cancer patients (cases) and 59 were healthy individuals (controls). The majority of the study participants were educated (>60%), belonged to the middle-income group (>66%), and lived a sedentary lifestyle (>60). However, the socio-economic status of the breast cancer patients was in the low-income group (*P* value <.001) compared to the controls (Table 1). Comparison analysis between the 2 groups indicated that the healthy controls were significantly more educated (*P* value <.00001) than the breast cancer patients. Significantly more breast cancer patients (85%) had a sedentary lifestyle (*P* value <.00001) compared to the control (31%). Also, fatigue and deprivation of sound sleep were significantly associated (*P* value <.00001) with 75% and 66% of breast cancer cases respectively than in healthy controls (Table 1). However, no significant differences were observed in the standing, walking, and exercise durations between the 2 groups (Table 1).

3.2. Anthropometric measures, eating habits, and breast cancer

The anthropometric data analysis suggested that higher age (≥45) and height (≤1.5 m) were significantly associated with breast cancer patients (*P* value <.001 and *P* value .025 respectively). The comparison data of cases versus controls indicated that higher levels of blood pressure (systolic and diastolic with *P* value .001 and *P* value <.001 respectively), thyroid problem (*P* value .015), and gastric issues (*P* value .001) were significantly correlated with breast cancer than healthy controls (Table 1). The BMI indicated that obesity was more prevalent in the cases (*P* value <.05) than in the controls. However, no such significant correlation was observed between the 2 groups in weight, random blood sugar, HbA1c, and creatinine levels. Incidences like a family history of cancer (*P* value <.05) and antibiotic intake (*P* value <.00001) were more prevalent among breast cancer patients than in controls (Table 1).

The eating and drinking habits of the study participants were analyzed. A significantly higher proportion of breast cancer patients (59%) were found to intake vitamins and minerals supplements than the healthy controls (*P* value <.001) (Table 1). However, a significantly higher proportion (*P* value .001) of healthy controls (86%) had the habit of drinking tea/coffee than the participants with breast cancer (50%). In contrast, a significantly higher proportion of breast cancer patients (35% and 18% respectively) had betel nuts (*P* value .016) and jarda (*P* value .036) respectively than the healthy controls (Table 1).

3.3. Obesity, hypertension, and breast cancer

The BMI and elevated blood pressure were analyzed to assess the conditions of obesity and hypertension among the study participants. Based on the BMI measurements, 58% of the breast cancer patients and 49% of the healthy controls respectively showed elevated BMI levels (≥25 kg/m^2). Among the 58% of breast cancer patients, 17% were OB (BMI ≥30 kg/m^2) whereas only 5% were OB among the 49% of the healthy controls, and the analyzed data showed a significant association between obesity with breast cancer patients (*P* value .011) compared to the healthy controls (Table 1 and Fig. 2A).

Similarly, analysis of both systolic and diastolic blood pressures of the study participants indicated that 31% of the breast cancer patients and 5% of the healthy controls respectively had high blood pressure. Hypertension was significantly higher in breast cancer patients than in healthy controls (*P* value <.0001) (Table 1 and Fig. 2B). Also, the age-matched stratified data comparison of cases versus controls indicated significant associations between higher BMI (≥30) and/or hypertension with breast cancer (see Supplemental File Table, http://links.lww.com/MD/H898 which showed the comparison of study characteristics in chi-square test among age-matched groups in study participants). Further, based on BMI breast cancer patients were sub-grouped into OW and OB. Subgroup analyses showed that among 31% of breast cancer cases with hypertension: 19% had OW and 8% were OB and a significant association was found between hypertension and OW (*P* value .034) (Fig. 2B).

3.4. Serum lipid profile analyses and breast cancer

The lipid profile analysis of the study participants demonstrated that TG, HDL, TG/HDL, and TC/HDL levels were significantly higher among breast cancer patients (*P* values of .006, .006, <.0001, and <.014 respectively) than in controls (Table 2). However, no significant variation was observed for TC, LDL, and/or LDL/HDL ratio among the breast cancer patients and healthy controls. The magnitudes of hyperlipidemia that is having high TGs, and TC, high levels of "bad" LDL cholesterol, and low levels of "good" HDL cholesterol were 42%, 37%, 35%, and 40%, respectively, among breast cancer patients. Overall, high TC/HDL 98% and TG/HDL 92% ratios were observed among breast cancer patients (Table 2). The prevalence of hyperlipidemia was significantly higher in breast cancer patients than in controls (for elevated TG levels *P* value was .003 and TG/ HDL: *P* value .006 respectively) (Fig. 2C). Also, the age-matched stratified data for lipid profile analysis of cases versus controls indicated significant associations between hyperlipidemia and/or dislipidemia with breast cancer (see Supplemental Table, http://links.lww.com/MD/H898 which showed the comparison of study characteristics in chi-square test among age-matched groups in study participants). For further analysis, breast cancer cases were sub-grouped into: OW and OB based on BMI. Subgroup analyses showed that among 92% of breast cancer cases with elevated TG/ HDL levels: 33% had OW and 15% were OB and showed a significant association with hyperlipidemia (*P* value .009) (Fig. 2C). However, subgroup analyses for the 42% of breast cancer cases with elevated TG levels, where 13% had OW and 6% were OB, showed no significant association with hyperlipidemia (*P* value .108) (Fig. 2C). A significantly higher prevalence of dyslipidemia was also observed in breast cancer patients compared to healthy controls (*P* value .002). Further, subgroup analyses showed among 81% of breast cancer cases, 38% had OW and 17% were OB and dyslipidemia was significantly associated with OB breast cancer patients compared to the controls (*P* value .0003) (see Supplemental Figure, http://links.lww.com/MD/H899, which illustrates the frequency of dyslipidemia for overall and group-specific study participants). High TG level in breast cancer patients were also correlated with obesity (BMI ≥30) and high blood pressure (Tables 1–2 and Fig. 2A and B).

3.5. Obstetric characteristics of the study participants

The obstetric characteristics analyses showed that post-menopausal women were significantly higher in breast cancer patients (66%) than in healthy controls (24%) (*P* value .005). Among the study participants who had their first child <18 years were significantly more breast cancer patients (67%) than healthy controls (20%). Comparison analyses showed that 56% of the breast cancer patients had >4 years of breastfeeding compared to only 15% of the healthy controls (*P* value .012) (Table 3A). However, no significant variations were observed in parity and menarche age between the breast cancer patients and healthy controls (Table 3A).

The regulations of reproductive hormones like estrogen, progesterone, and HER2 have a vital impact on breast cancer development. The participating breast cancer patients were subtyped based on the combination of hormonal phenotypes: estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2). All subtypes of cancer patients were then analyzed based on

Table 1

Socio-demographic, anthropometric, and food intake characteristics of the study participants.

Characteristics	Reference value	Cases n (%)	Controls n (%)	*P* value
Age (Yrs)	≥45	30 (58)	14 (24)	**<.001****
	<45	22 (32)	45 (76)	
Height (m)	≥1.5	37 (71)	52 (88)	
	<1.5	15 (29)	07 (12)	**.025***
Weight (kg)	≥59	26 (50)	38 (64)	.125
	<59	26 (50)	21 (36)	
BMI (kg/m^2)	≥30	09 (17)	03 (05)	**.039***
	<30	43 (83)	56 (95)	
Waist-Hip Ratio (WHR)	≥0.8	48 (92)	52 (88)	.317
	<0.8	04 (08)	07 (12)	
Blood pressure (Systolic)	>120	21 (40)	08 (14)	**.001***
	≤ 120	31 (60)	51 (86)	
Blood pressure (Diastolic)	>80	21 (40)	05 (08)	**<.001*****
	≤80	31 (60)	54 (92)	
Random blood sugar (RBS)	≥7.8	06 (12)	03 (05)	.214
	<7.8	46 (88)	56 (95)	
HbA1c (%)	>6.3	14 (27)	09 (15)	.130
	≤6.3	38 (73)	50 (85)	
Creatinine (mg/dL)	<0.6 & >1.2	17 (35)	10 (15)	.054
	0.6–1.2	35 (65)	49 (85)	
Education	Yes	31 (60)	56 (95)	
	No	21 (40)	03 (05)	**<.001*****
Life style	Sedentary	28 (85)	11 (31)	**<.001*****
	Active	05 (15)	25 (69)	
Socio-economic status	Middle	33 (66)	53 (93)	
	Low	17 (34)	04 (07)	**<.001****
Desk job	Yes	04 (13)	21 (58)	
	No	28 (87)	15 (42)	**<.001****
Standing (h/d)	>3	12 (38)	14 (39)	.906
	≤3	20 (62)	22 (61)	
Walking (h/d)	>3	15 (47)	15 (42)	.666
	≤3	17 (53)	21 (58)	
Fatigue/Restless/Shortness of breath	Yes	24 (75)	06 (17)	**<.001*****
	No	08 (25)	30 (83)	
Exercise	Yes	13 (41)	07 (19)	.056
	No	19 (59)	29 (81)	
Sleeping (h/d)	≥6	17 (53)	32 (89)	
	<6	15 (47)	04 (11)	**.001***
Sound sleep	Yes	11 (34)	32 (89)	
	No	21 (66)	04 (11)	**<.001*****
Water intake (Glass/d)	≥8	17 (53)	26 (72)	.103
	<8	15 (47)	10 (28)	
Carbohydrates (Meals/d)	>2	40 (77)	35 (61)	.081
	≤2	12 (23)	22 (39)	
Proteins (Meals/d)	>2	04 (08)	10 (18)	
	≤2	48 (92)	47 (82)	.125
Vegetables/Fruits (Meals/d)	>2	16 (31)	12 (20)	.246
	≤2	36 (69)	45 (80)	
Vitamins/Minerals intake	Yes	19 (59)	06 (17)	**<.001****
	No	13 (41)	30 (83)	
Fast-food/Soft drinks intake	Yes	16 (50)	20 (56)	.647
	No	16 (50)	16 (44)	
Tea/Coffee intake	Yes	16 (50)	31 (86)	
	No	16 (50)	05 (14)	**.001***
Betel nut intake	Yes	17 (35)	06 (13)	**.016***
	No	32 (65)	39 (87)	
Jarda intake	Yes	09 (18)	02 (04)	**.036***
	No	40 (82)	43 (96)	
Thyroid problem	Yes	07 (22)	01 (03)	**.015***
	No	25 (78)	35 (97)	
Gastric problem	Yes	26 (81)	15 (42)	**.001***
	No	06 (19)	21 (58)	
Antibiotic intake	Yes	17 (53)	01 (03)	**<.001*****
	No	15 (47)	35 (97)	
Family history with cancer	Yes	15 (29)	07 (12)	**.025***
	No	37 (71)	52 (88)	

Data expressed as number n (%), *P* value was determined by Chi-square test.
The significant level of *P* value was expressed at: (<.05 to ≥.001) as *P**; (<9E-04 to ≥1E-05) as *P***, and (<9E-05 to ≥1E-06) as *P****.

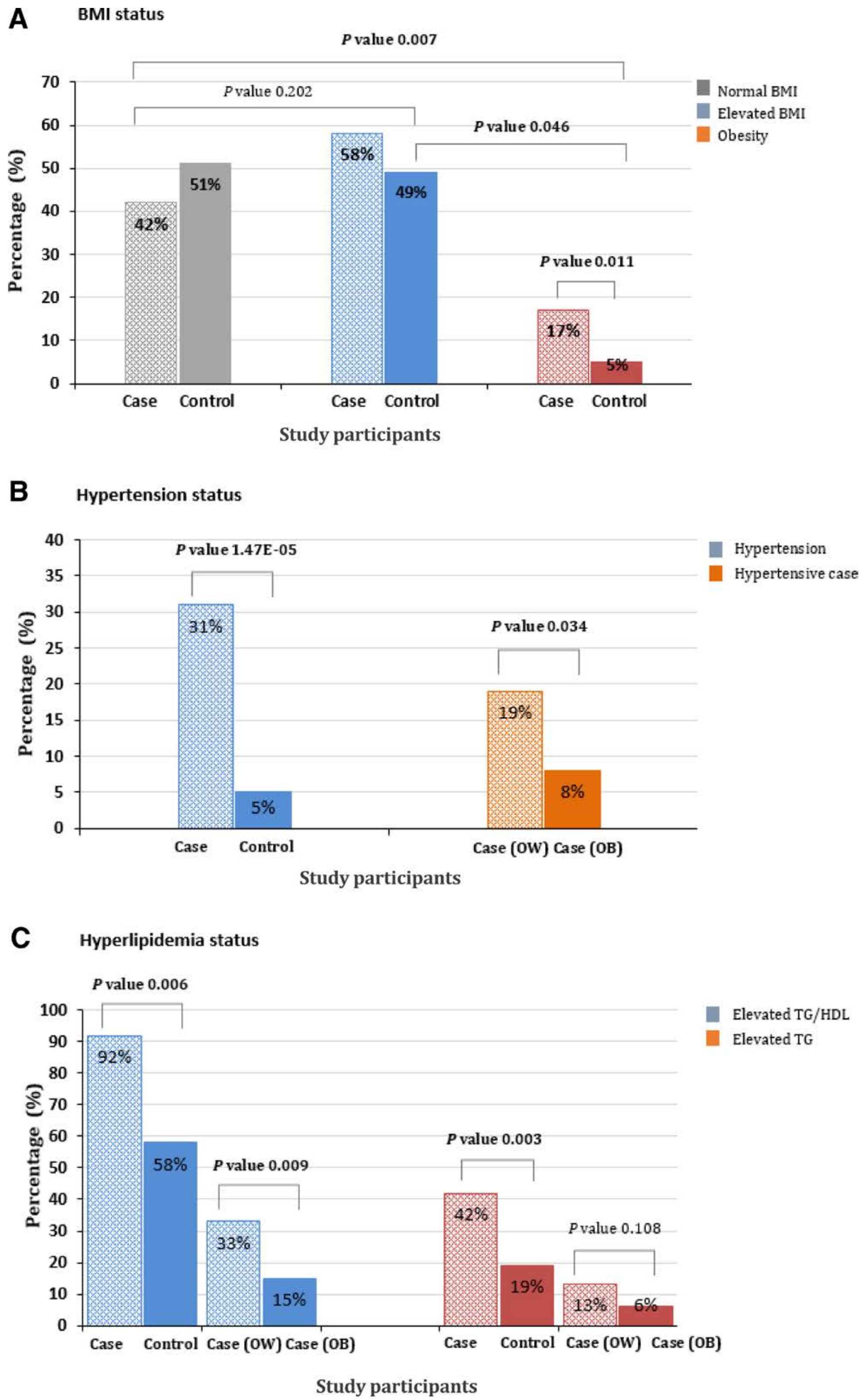

Figure 2. The Bangladeshi breast cancer participants' status: (A) Body Mass Index (BMI), (B) Hypertension, and (C) Hyperlipidemia profiles.

BMI (NL: normal, OW, and OB) (Table 3B). Hormonal phenotype analyses showed that the ER-breast cancer patients were significantly associated (*P* value .046) with the OW group: (OW 28%) than in the OB (3%) (Table 3B). Also, the PR- patients were significantly higher (*P* value .013) in the normal (NL: 34%) compared to the obese patients (OB: 7%) (Table 3B).

3.6. Association of the study characteristics with breast cancer

Overall, the regression analyses of study characteristics indicated a significant association with an increased breast cancer risk. Analyzed data on age (≥45 years) [OR 4.38, 95% CI (1.94–9.89), *P* value <.001], height (<1.5 m) [OR 3.01, 95%

Table 2

Serum lipid profile of the study participants of this study.

Variables	Reference value	Cases n (%)	Controls n (%)	*P* value
BMI (kg/m^2)	≥30	09 (17)	03 (05)	**.039***
	<30	43 (83)	56 (95)	
Waist circumference (cm)	≥80	39 (75)	45 (76)	.876
	<80	13 (25)	14 (24)	
Waist-Hip Ratio (WHR)	≥0.8	48 (92)	52 (88)	.317
	<0.8	04 (08)	07 (12)	
TC (mg/dL)	≥200	19 (37)	13 (22)	.092
	<200	33 (63)	46 (78)	
LDL (mg/dL)	≥130	18 (35)	13 (22)	.140
	<130	34 (65)	46 (78)	
HDL (mg/dL)	≥40	31 (60)	49 (83)	
	<40	21 (40)	10 (17)	**.006***
TG (mg/dL)	≥150	22 (42)	11 (19)	**.006***
	<150	30 (58)	48 (81)	
LDL/HDL ratio	≥2.5	29 (56)	30 (51)	.604
	<2.5	23 (44)	29 (49)	
TC/HDL ratio	≥3	51 (98)	50 (85)	**.014***
	<3	01 (02)	09 (15)	
TG/HDL ratio	≥2	48 (92)	34 (58)	**<.001*****
	<2	04 (08)	25 (42)	

HDL = high-density lipid, LDL = low-density lipid, TC = total cholesterol, TG = triglycerides.
Data expressed as number n (%), *P* value was determined by Chi-square test.
The significant level of *P* value was expressed at: (<.05 to ≥.001) as *P**; (<9E-04 to ≥1E-05) as *P***, and (<9E-05 to ≥1E-06) as *P****.

Table 3

Study characteristics of the participants (A) Obstetric data analysis, (B) Comparison of hormonal phenotypes between normal (NL), overweight (OW), and obese (OB) breast cancer patients and evaluation of subtypes based on hormonal receptors.

A.

Variables	Categories	Cases n (%)	Controls n (%)	*P* value
Age (Yrs)	≥ 45	30 (58)	14 (24)	**<.001****
	< 45	22 (32)	45 (76)	
Menarche age (Yrs)	≥ 12	28 (88)	16 (94)	
	< 12	04 (12)	01 (06)	.466
Menopause status	Pre	11 (34)	13 (76)	
	Post	21 (66)	04 (24)	**.005***
First child-bearing age (Yrs)	≥ 18	10 (33)	12 (80)	
	< 18	20 (67)	03 (20)	**.003***
Parity (Numbers)	> 2	18 (56)	05 (33)	.143
	≤ 2	14 (44)	10 (67)	
Breastfeeding (Yrs)	> 4	18 (56)	02 (15)	**.012***
	≤ 4	14 (44)	11 (85)	

B.

Phenotype	Number of cases (%)			*P* value			
	NL	OW	OB	NL vs OW	NL vs OB	OW vs OB	NL + OW vs OB
ER+	04 (14)	04 (14)	05 (17)				
ER–	07 (24)	08 (28)	01 (03)	.879	.064	**.046***	**.033***
PR+	01 (03)	03 (10)	04 (14)				
PR–	10 (34)	09 (31)	02 (07)	.315	**.013***	.087	**.016***
HER2+	03 (12)	03 (12)	02 (08)				
HER2–	08 (32)	07 (28)	02 (08)	.890	.409	.480	.400

Phenotype	Number of cases (%)				Breast cancer subtype
	Total	NL	OW	OB	
ER+/PR+/HER2+	02 (08)	00 (00)	00 (00)	02 (08)	Triple (+ve)
ER+/PR+/HER–	03 (12)	01 (04)	01 (04)	01 (04)	Luminal A
ER+/PR–/HER2+	02 (08)	02 (08)	00 (00)	00 (00)	Luminal B
ER+/PR–/HER–	02 (08)	01 (04)	01 (04)	00 (00)	ER+
ER–/PR–/HER2+	04 (16)	01 (04)	03 (12)	00 (00)	HER2+
ER–/PR–/HER–	12 (48)	06 (24)	05 (20)	01 (04)	Triple (–ve)

OB = BMI ≥ 30, ER = estrogen receptor, HER2 = human epidermal growth factor receptor 2, NL = BMI < 25, OW = 25 ≤ BMI < 30, PR = progesterone receptor. Data expressed as number n (%), *P* value was determined by Chi-square test. The significant level of *P* value was expressed at: (<.05 to ≥.001) as *P*
; (<9E-04 to ≥1E-05) as *P***, and (<9E-05 to ≥1E-06) as *P****.

CI (1.12–8.12), *P* value .029], low-incomes [OR 6.83, 95% CI (2.11–22.05), *P* value .001], and illiteracy [OR 12.65, 95% CI (3.49–45.79), *P* value .0001] showed significant correlations with breast cancer (Table 4).

The BMI (≥30) analyzed data indicated an association with breast cancer [OR 3.91, 95% CI (1.00–15.31), *P* value .05] (Table 4). High blood pressure [Systolic: OR 4.32, 95% CI (1.71–0.93), *P* value .002; and Diastolic: OR 7.32, 95% CI (2.51–21.34), *P* value <.001], thyroid problem [OR 9.80, 95% CI (1.13–84.75), *P* value .038], and gastric issues [OR 6.07, 95% CI (2.00–18.37), *P* value .001], all showed significant associations with breast cancer (Table 4). The lipid profile analyze of the breast cancer patients showed highly significant association with an elevated TG [OR 3.20, 95% CI (1.36–7.53), *P* value 0.008], TG/ HDL ratio [OR 8.82, 95% CI (2.81–27.68), *P* value <.001], TC/ HDL ratio [OR 9.18, 95% CI (1.12–75.15), *P* value .038], and a lower HDL [OR 3.32, 95% CI (1.38–7.98), *P* value .007] (Table 4).

Regression analysis data indicated that a sedentary lifestyle [OR 12.73, 95% CI (3.88–41.70), *P* value <.0001], fatigue [OR 15.00, 95% CI (4.58–49.15), *P* value <.0001] and lack of sound sleep [OR 15.27, 95% CI (4.29–54.38), *P* value <.0001] were the high risk factors associated with breast cancer (Table 4). Furthermore, regression analyses on eating habits like not drinking tea/coffee were found to be significantly associated with breast cancer [OR 6.20, 95% CI (1.92–20.01), *P* value .002]

Table 4

Regression analysis of the study variables in association with breast cancer cases in comparison to controls.

Variables	Reference value	Cases n (%)	Controls n (%)	Odds ratio (95% CI)	*P* value
Age (Years)	≥45	30 (58)	14 (24)	4.38 (1.94–9.89)	**<.001****
	<45	22 (32)	45 (76)		
Height (m)	<1.5	15 (29)	07 (12)	3.01 (1.12–8.12)	**.029***
	≥1.5	37 (71)	52 (88)		
Education	No	21 (40)	03 (05)	12.65 (3.49–45.79)	**<.001****
	Yes	31 (60)	56 (95)		
Socio-economic status	Low	17 (34)	04 (07)	6.83 (2.11–22.05)	**.001***
	Middle	33 (66)	53 (93)		
BMI (kg/m^2)	≥30	09 (17)	03 (05)	3.91 (1.00–15.31)	**.050***
	<30	43 (83)	56 (95)		
HDL (mg/dL)	≥40	31 (60)	49 (83)		
	<40	12 (40)	10 (17)	3.32 (1.38–7.98)	**.007***
TG (mg/dL)	≥150	22 (42)	11 (19)	3.20 (1.36–7.53)	**.008***
	<150	30 (58)	48 (81)		
TC/HDL ratio	≥3	51 (98)	50 (85)	9.18 (1.12–75.15)	**.038***
	<3	01 (02)	09 (15)		
TG/HDL ratio	≥2	48 (92)	34 (58)	8.82 (2.81–27.68)	**<.001****
	<2	04 (08)	25 (42)		
Blood pressure (Systolic)	>120	21 (40)	08 (14)	4.32 (1.71–10.93)	**.002***
	≤120	31 (60)	51 (86)		
Blood pressure (Diastolic)	>80	21 (40)	05 (08)	7.32 (2.51–21.34)	**<.001****
	≤80	31 (60)	54 (92)		
Thyroid problem	Yes	07 (22)	01 (03)	9.80 (1.13–84.75)	**.038***
	No	25 (78)	35 (97)		
Gastric problem	Yes	26 (81)	15 (42)	6.07 (2.00–18.37)	**.001***
	No	06 (19)	21 (58)		
Antibiotic intake	Yes	17 (53)	01 (03)	39.67 (4.83–325.74)	**<.001****
	No	15 (47)	35 (97)		
Vitamins/Minerals intake	Yes	19 (59)	06 (17)	7.31 (2.37–22.51)	**<.001****
	No	13 (41)	30 (83)		
Tea/ Coffee intake	No	16 (50)	05 (14)	6.20 (1.92–20.01)	**.002***
	Yes	16 (50)	31 (86)		
Betel nut intake	Yes	17 (35)	06 (13)	3.45 (1.22–9.78)	**.020***
	No	32 (65)	39 (87)		
Jarda intake	Yes	09 (18)	02 (04)	4.84 (0.98–23.76)	.052
	No	40 (82)	43 (96)		
Life style	Sedentary	28 (85)	11 (31)	12.73 (3.88–41.70)	**<.001*****
	Active	05 (15)	25 (69)		
Desk job	No	28 (87)	15 (42)	9.80 (2.84–33.85)	**<.001****
	Yes	04 (13)	21 (58)		
Fatigue/Restless/ Shortness of breath	Yes	24 (75)	06 (17)	15.00 (4.58–49.15)	**<.001*****
	No	08 (25)	30 (83)		
Sleeping (hours/day)	<6	15 (47)	04 (11)	7.06 (2.02–24.64)	**.002***
	≥6	17 (53)	32 (89)		
Sound sleep	No	21 (66)	04 (11)	15.27 (4.29–54.38)	**<.001*****
	Yes	11 (34)	32 (89)		
Menopause	Post	21 (66)	04 (24)	6.21 (1.63–23.63)	**.007***
	Pre	11 (34)	13 (76)		
Age at first childbirth	<18	20 (67)	03 (20)	8.00 (1.83–34.98)	**.006***
	≥18	10 (33)	12 (80)		
Breastfeeding (Years)	>4	18 (56)	02 (15)	7.07 (1.34–37.22)	**.021***
	≤4	14 (44)	11 (85)		
Family history with cancer	Yes	15 (29)	07 (12)	3.01 (1.12–8.12)	**.029***
	No	37 (71)	52 (88)		

Data expressed as number n (%), *P* value was determined by univariate regression test.

The significant level of *P* value was expressed at: (<.05 to ≥.001) as *P**; (<9E-04 to ≥1E-05) as *P***, and (<9E-05 to ≥1E-06) as *P****.

whereas intake of betel nuts [OR 3.45, 95% CI (1.22–9.78), *P* value .020], antibiotics [OR 39.67, 95% CI (4.83–325.75), *P* value .0001], and vitamins/ minerals [OR 7.31, 95% CI (2.37–22.51), *P* value .001) were significantly associated with breast cancer (Table 4).

The regression data in breast cancer patients post menopause status [OR 6.21, 95% CI (1.63–23.63), *P* value .007], age at first childbirth <18 years [OR 8.00, 95% CI (1.83–34.98), *P* value .006], >4 years breastfeeding [OR 7.07, 95% CI (1.34–37.22), *P* value .021], and family history with cancer [OR 3.01, 95% CI (1.12–8.12), *P* value .029] were all significantly associated (Table 4).

4. Conclusion

In conclusion, results from this study indicated a significant association between breast cancer and high BMI, hyperlipidemia (high levels of TG, HDL, TC/HDL, and TG/HDL ratio), and hypertension. Demographic and anthropometric analyzed data suggested that age, education, socioeconomic status, a sedentary lifestyle, and sleeping hours significantly correlate with breast cancer in Bangladeshi women. Also, family history with cancer, thyroid, and gastric problems, food habits like tea/coffee, betel nuts, and/or jarda intake: analyses showed significant association with breast cancer. Obstetric factors like post-menopausal status, first childbearing age, and breastfeeding frequency also demonstrated significant association with breast cancer in Bangladeshi women. Though a limitation of the present study was including a comparatively small dataset and further investigations are crucial to draw any finite conclusions. Nonetheless, the initial findings from this extensive quantitative analysis would be of importance in the treatment of Bangladeshi breast cancer patients with obesity, hyperlipidemia, and hypertension. In the future, long-term follow-ups and working with a larger sample size would be necessary to confirm the results. Taken together, all analyzed data, suggested that changing into an active lifestyle, losing weight, and assuring a good lipid profile by lowering cholesterol and elevating HDL levels could aid in Bangladeshi breast cancer patients' better management and treatment.

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Author contributions

Jesmin conceptually designed the research; MSI and DI collected, screened, and analyzed the data. Jesmin, MSI, and DI validate the interpretation and drafted and revised the manuscript. All authors have read and approved the final manuscript.
Conceptualization: Jesmin.
Data curation: Diganta Islam, Md. Shihabul Islam.
Formal analysis: Diganta Islam, Md. Shihabul Islam.
Investigation: Diganta Islam, Md. Shihabul Islam, Jesmin.
Methodology: Diganta Islam, Md. Shihabul Islam, Jesmin.
Project administration: Jesmin.
Supervision: Jesmin.
Validation: Diganta Islam, Md. Shihabul Islam, Jesmin.
Visualization: Diganta Islam, Md. Shihabul Islam, Jesmin.
Writing – original draft: Diganta Islam, Md. Shihabul Islam, Jesmin.
Writing – review & editing: Diganta Islam, Md. Shihabul Islam, Jesmin.

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