

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 (Cls) 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% Cl (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% Cl (2.51-21.34), P value <.001], and gastric issues: [OR 6.07, 95% Cl (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]

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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]

Supplemental Digital Content is available for this article.

^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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B Estimated number of new cases of Breast Cancer from 2020 to 2040, females, ages [25-85+] Bangladesh Annual percentage change: Breast: 1.5%



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 $\ge 30 \text{ kg/m}^2$ 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, $\mu_1 =$ 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_{B} = the standard normal deviate value at a fixed power. In this study, the serum lipid profile data from Owiredu et al $^{\scriptscriptstyle [50]}$ was used as the chosen quantitative variable (where $\mu_1 = 202.00$; $\mu_2 = 174.50; \sigma_1 = 53.60; \sigma_2 = 40.50;$ taking a 95% level of significance $Z_{\alpha} = 1.96$; and a 90% power $Z_{\beta} = 0.90$) 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/m² as normal (NL), BMI: ≥ 25 and $< 30 \text{ kg/m}^2$ as OW and BMI: $\geq 30 \text{ kg/m}^2$ 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 \pm 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 (\geq 45) and height (\leq 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 ($\geq 25 \text{ kg/m}^2$). Among the 58% of breast cancer patients, 17% were OB (BMI $\geq 30 \text{ kg/m}^2$) 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 (\geq 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 agematched 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 agematched 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 \geq 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.

| App (Prig) -46 30 (8) 14 (20) -4001 Hoght (m) -1.5 37 (71) 52 (80) -46 (75) Weight (m) -5.6 26 (50) 38 (64) .125 Bill (gm') -5.0 26 (50) 38 (64) .125 Bill (gm') -3.0 06 (17) 03 (55) .009 Weist Hig Ratio (MAR) -3.0 06 (17) 03 (55) .009 Most Hig Ratio (MAR) -3.0 06 (17) 03 (55) .009 .001 Boto pressure (Settin) -1.10 31 (80) .018 (81) .001 | Characteristics | Reference value | Cases n (%) | Controls n (%) | <i>P</i> value |
|--|--------------------------------------|-----------------|------------------------------|--------------------|----------------|
| -45 ? (2) 45 (76) -15 15 (28) 77 (12) 288 Weight (q) -50 26 (50) 21 (26) 30 (30) Bull (q)m1) -50 26 (50) 21 (26) 30 (30) Weight (q) -50 26 (50) 21 (26) 30 (30) Weight (q) -50 21 (26) 30 (30) 30 (30) Weight (q) -50 21 (20) 21 (20) 30 (30) Weight (q) -50 21 (20) 21 (20) 30 (30) Blod pressure (systelic) -170 21 (40) 05 (12) -40 (13) Blod pressure (systelic) -78 46 (87) 30 (30) -40 (30) Cacalino (rog d1) -78 46 (87) 30 (30) -40 (30) Cacalino (rog d1) -78 46 (87) 30 (30) -40 (30) Cacalino (rog d1) -61 (2) 36 (50) -40 (13) -40 (13) Cacalino (rog d1) -61 (2) 36 (51) -40 (13) -40 (13) Cacalino (rog d1) <td< td=""><td>Age (Yrs)</td><td>≥45</td><td>30 (58)</td><td>14 (24)</td><td><.001**</td></td<> | Age (Yrs) | ≥45 | 30 (58) | 14 (24) | <.001** |
| Height (mh 1.5 37 (7) 52 (28) Waight (gal) 84 26 (20) 21 (20) .75 Boll (kg/m) 84 26 (20) 21 (20) .75 Boll (kg/m) 80 26 (20) 21 (20) .75 Boll (kg/m) 80 26 (20) 21 (20) .75 Boll (kg/m) 80 21 (20) .71 (2) .75 Boll (kg/m) 12 (20) 31 (80) .51 (80) .40 (80) Bood pressure (Statule) 12 (20) 31 (80) .54 (80) .40 (80) Bood pressure (Statule) 12 (20) .56 (20) .21 (20) .21 (20) Bood pressure (Statule) 12 (20) .21 (20) .21 (20) .21 (20) Bood pressure (Statule) 12 (20) .21 (20) .21 (20) .21 (20) .21 (20) Bood pressure (Statule) 12 (20) .21 (20) .21 (20) .21 (20) .21 (20) .21 (20) .21 (20) .21 (20) .21 (20) .21 (20) .21 (20) .21 (20) .21 (20)< | | <45 | 22 (32) | 45 (76) | |
| cl.5 15 (29) 07 (12) 0257 Bull (sgint) 299 26 (50) 21 (80) 0257 Bull (sgint) 200 04 (17) 0.0.0.0.0 0009 Wats: Hip Retio (WHP) 200 04 (17) 0.0.0.0.0 0.009 Biod prossure (black(s) -120 21 (40) 05 (16) -0001 Biod prossure (black(s) -200 21 (40) 05 (16) -0011 Biod prossure (black(s) -200 21 (40) 05 (16) -0011 Biod prossure (black(s) -27 (20) 21 (20) 06 (12) 0.00 (12) 0.00 (12) Biod prossure (black(s) -27 (20) 27 (20) 27 (20) 0.00 (12) | Height (m) | ≥1.5 | 37 (71) | 52 (88) | |
| Weight figh Sabe 25 (b) 38 (c) 37.5 BM (grm) 200 00 (17) 0.0 (05) 0.009 Waist-Hip Ratio (WHR) 20.3 48 (82) 0.2 (86) 3.17 Bood pressure (Syntolc) 21.0 31 (80) 48 (82) 0.2 (86) 0.001 Bood pressure (Syntolc) 21.0 31 (80) 56 (80) 0.001 Bood pressure (Syntolc) 21.0 31 (80) 56 (80) 0.001 Bood pressure (Distolc) 26.0 21.4 (40) 56 (80) 0.001 Bood pressure (Distolc) 27.8 0.6 (15) 0.50 (80) 0.001 Bood pressure (Distolc) 26.3 31 (80) 49 (80) 0.001 Bood pressure (Distolc) 27.8 0.010 49 (80) 0.001 Bood pressure (Distolc) 26.3 10.013 0.001 0.001 Bood pressure (Distolc) 26.12 11 (3) 21 (80) 0.001 Bood pressure (Distolc) 26.12 11 (3) 21 (80) 0.001 Bood pressure | | <1.5 | 15 (29) | 07 (12) | .025* |
| -59 26 (6) 21 (26) 20 (26) 20 (26) Wats+Hip Ratio (WHF) 20 44 (23) 56 (26) 33 (7) Bood pressure (Statid) 210 21 (40) 06 (10) 001 (10) 001 (10) Bood pressure (Statid) 210 21 (40) 06 (12) 03 (16) 400 (11) 001 (11) 001 (11) Bood pressure (Statid) 20 21 (40) 06 (12) 03 (16) 214 (11) 001 (11) | Weight (kg) | ≥59 | 26 (50) | 38 (64) | .125 |
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| $\begin{array}{c c c c c c c c c c c c c c c c c c c $ | BMI (kg/m ²) | ≥30 | 09 (17) | 03 (05) | .039* |
| Waist-Fing Data (WHF) -0.8 -48 (82) 52 (88) -317 Biod pressure (Systolic) -120 21 (40) 08 (14) 001' Biod pressure (Distolic) -360 21 (40) 08 (48) -400' Biod pressure (Distolic) -360 21 (40) 08 (48) -400' Biod pressure (Distolic) -36 14 (27) 09 (15) .130 Caratinic (my dt) -66 & -12 7 (76) 10 (16) .054 Loc (s) -63 14 (27) 09 (15) .130 Caratinic (my dt) -63 16 (67) 16 (68) | | <30 | 43 (83) | 56 (95) | |
| clas L4 L4 U4 | Waist-Hip Ratio (WHR) | ≥0.8 | 48 (92) | 52 (88) | .317 |
| about pressure (bjeck) > 1/2 (10) (10) (10) (10) (10) Blood pressure (blestolic) > 502 21 (60) (65) <00 | Diand pressure (Custalia) | <0.8 | 04 (08) | 07 (12) | 001* |
| Blood 31 (20) 31 (20) 36 (20) 4001 Rendern blood sugar (BS) 27 8 66 (7.2) 43 (20) 2.14 HbA1c (%) -5.3 14 (27) 99 (15) 1.30 Creatinine (mg/tl) -6.6 & -1.2 7 (25) 10 (15) .064 Education -6.6 & -1.2 37 (56) 49 (65) .061 Education Yes 31 (60) 56 (56) .001* Scoce economic status Middle 33 (66) 53 (30) .001* Scoce economic status Middle 33 (67) 15 (42) .000* Standing (fvd) -3 12 (28) 14 (39) .906 Standing (fvd) -3 12 (28) 14 (39) .906 Standing (fvd) -3 12 (28) 14 (30) .906 | Blood pressure (Systolic) | >120 | 21 (40) | 08 (14) | .001 |
| Dack probability 2 00 2 100 Color Rendom blood sugar (RBS) 2-7.8 06 (12) 06 (6) 214 HBATC (%) -6.8 1427) 08 (6) 130 Creatinine (ingrid1) -6.8 3873) 50 (6) | Rlood proceuro (Diastolio) | ≤ 120 > 80 | 31 (60) | DT (00) | < 001*** |
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| Landsmone of the set | Bandom blood sugar (BBS) | >7.8 | 06 (12) | 03 (05) | 214 |
| HbA ic (%) >6.3 14 (27) 09 (15) | nandom blood odgar (nbo) | <7.8 | 46 (88) | 56 (95) | |
| s6.3 38 (73) 50 (85) Creating (mg/d) 0.6 8.> 1.2 37 (65) 49 (85) Education No 21 (40) 33 (55) 49 (85) Life style Sectorary 28 (85) 11 (31) <001" | HbA1c (%) | >6.3 | 14 (27) | 09 (15) | .130 |
| Creating (mg/dL) -0.6 81 2 77 (58) 49 (85) Education Yes 31 (60) 65 (95) Education No 21 (40) 03 (05) <0011 | | ≤6.3 | 38 (73) | 50 (85) | |
| Control Yes 33 (60) 56 (65) Lie skyle No 21 (40) 03 (65) $<$ 000" Lie skyle 26 (66) 11 (31) $<$ 000" Scole-economic status Moffiel 33 (60) 53 (89) Cole-economic status Moffiel 33 (60) 53 (89) Desk jab 21 (80) 41 (30) 21 (60) Desk jab 21 (80) 15 (47) 15 (42) 666 Standing (hv) -3 21 (80) 14 (30) 906 Standing (hv) -3 15 (47) 15 (42) 666 Fatgue/Restess/Shortness of treath No 28 (87) 21 (88) 660 Steeping (hv) -3 15 (47) 16 (11) .001" Steeping (hv) -3 17 (53) 28 (89) .001" Steeping (hv) -6 17 (53) 28 (81) .001" Steeping (hv) -6 17 (53) 28 (81) .001" Steeping (hv) -6 16 (50) 10 (13) .0 | Creatinine (mg/dL) | <0.6 & >1.2 | 17 (35) | 10 (15) | .054 |
| Education Yes 31 (60) 56 (95) $< < 001^{\circ}$ Life style Sedentary 28 (85) 11 (31) $< 001^{\circ}$ Socie-concomic status Middle 33 (66) 55 (83) $< 001^{\circ}$ Desk job Yes 04 (13) 21 (80) $< 001^{\circ}$ Standing (h/d) >3 12 (38) 14 (39) .906 Standing (h/d) >3 12 (38) 14 (39) .906 Valking (h/d) >3 16 (47) 15 (42) .666 Standing (h/d) >3 15 (47) 15 (42) .666 Valking (h/d) >3 17 (53) 21 (53) | | 0.6-1.2 | 35 (65) | 49 (85) | |
| No214030 $< < 00^{11}$ $Active< 28(85)11< < 00^{11}Active< 65(5)> 25(6)< 00^{11}Active< 05(5)> 25(6)< 00^{11}Active< 05(5)< 00^{11}Active< $ | Education | Yes | 31 (60) | 56 (95) | |
| Life style Seder-example 28 (8) 11 (31) <.001" Active 05 (15) 25 (69) 3 5 5 3 5 | | No | 21 (40) | 03 (05) | <.001*** |
| Active 05 (15) 25 (06) Sole-econne status Middle 33 (66) 53 (33) Desk job No 28 (87) 15 (42) <001 Standing (r/d) -33 20 (82) 22 (61) | Life style | Sedentary | 28 (85) | 11 (31) | <.001*** |
| Sacie-sconomic status Middle 33 (6) 53 (9) Low 17 (34) 04 (07) <001" | | Active | 05 (15) | 25 (69) | |
| $\begin{array}{c c c c c c } \begin{tabular}{ c c c c } $1 & [24] & [$ | Socio-economic status | Middle | 33 (66) | 53 (93) | |
| Lesk job Yes U4 (13) 21 (18) Sanding fiv(d) >3 12 (38) 14 (39) .906 Sanding fiv(d) >3 12 (38) 14 (39) .906 Walking (h/d) >3 15 (47) 15 (42) .666 Fatigue/Restless/Shortness of breath Yes 24 (75) 06 (17) $<$.001* kercise Yes 13 (41) 07 (19) .056 Seeping (h/d) >6 15 (47) 04 (11) .001* cercise Yes 13 (41) 22 (9) .061 Sound sleep Yes 13 (41) 22 (9) .001* Vater intake (Glass/d) >2 24 (75) 06 (11) .001* Vater intake (Glass/d) >2 40 (77) 35 (61) .03 .03 Carbohydrates (Meals/d) >2 46 (92) 47 (82) .22 .23 Vegetables/Fruits (Meals/d) >2 46 (92) 47 (82) .246 Vegetables/Fruits (Meals/d) >2 46 (92) .47 (82) </td <td></td> <td>Low</td> <td>17 (34)</td> <td>04 (07)</td> <td><.001**</td> | | Low | 17 (34) | 04 (07) | <.001** |
| No $26 [67]$ $15 [42]$ 4.001^{+1} Starding (h'd) -3 $22 (62)$ $22 (61)$ Starding (h'd) -3 $15 (47)$ $15 (42)$ 666 Fatigue/Restless/Shortness of breath Yes $17 (53)$ $21 (58)$ $66 (75)$ $60 (17)$ 4.001^{+1} Exercise Yes $13 (41)$ $07 (19)$ $.056$ $.06 (17)$ $.001^{+1}$ Steeping (h'd) -36 $.77 (53)$ $.22 (89)$ $.066$ $.06 (17)$ $.001^{+1}$ Steeping (h'd) -36 $.17 (53)$ $.28 (89)$ $.01 (66)$ $.04 (11)$ $.001^{+1}$ Sound sleep Yes $.11 (34)$ $.32 (89)$ $.01 (10)$ $.001^{+1}$ $.001^{+1}$ Vater intake (Glass/d) $.28$ $.17 (53)$ $.28 (72)$ $.103$ carbohydrates (Meals/d) $.22$ $.40 (77)$ $.36 (61)$ $.06 (17)$ $.001^{+1}$ Vegetables/Fruits (Meals/d) $.22$ $.40 (89)$ $.01 (18)$ $.01 (18)$ $.01 (18)$ $.01 (18)$ $.01 (18)$ $.01 (13)$ $.01 (14)$ $.01 (16)$ $.01 ($ | Desk jod | Yes | 04 (13) | 21 (58) | 001** |
| Sala Jing (Pd) >3 12 (28) 14 (28) 14 (28) | Ctanding (h(d) | NO | 28 (87) | 15 (42) | <.001*** |
| Walking (h/d) 33 $210(27)$ $220(17)$ $15(42)$ $.666$ Falgue/Restless/Shortness of breath Yes $217(53)$ $06(17)$ $<$ 001" Exercise Yes $13(41)$ $07(19)$ $.056$ Sileeping (h/d) 26 $17(53)$ $32(89)$ $.001"$ Sound sleep Yes $11(54)$ $32(89)$ $.001"$ Sound sleep Yes $11(54)$ $32(89)$ $.001"$ Water intake (Glass/d) 28 $17(53)$ $226(72)$ $.103$ Carbohydrates (Meals/d) >2 $40(77)$ $.35(61)$ $.081$ Carbohydrates (Meals/d) >2 $.40(77)$ $.35(61)$ $.081$ Carbohydrates (Meals/d) >2 $.40(82)$ $.47(82)$ $.22(3)$ Proteins (Meals/d) >2 $.40(82)$ $.47(82)$ $.22(9)$ $.22(3)$ Upstain Advertise Yes $.16(51)$ $.16(31)$ $.22(9)$ $.22(3)$ Proteins (Meals/d) $.22$ $.36(69)$ | Standing (n/u) | >3 | 12 (30) | 14 (39) | .900 |
| | Walking (b/d) | ≤5 \3 | 20 (02) 15 (<i>I</i> /7) | 15 (12) | 666 |
| Fatigue/Restless/Shortness of breath Yes 24 (75) 06 (17) $<$ 001" Exercise Yes 13 (41) 07 (19) .056 No 19 (59) 29 (61) .061" Sleeping (Vd) -6 17 (53) 32 (89) -6 16 (47) 04 (11) .001" Sound sleep Yes 11 (34) 32 (89) -6 16 (60) 04 (11) .001" Sound sleep Yes 11 (34) 32 (89) | Waiking (ind) | <3 | 17 (53) | 21 (58) | .000 |
| No 08 (25) 30 (83) Exercise Yes 13 (41) 07 (19) .056 Sleeping (h/d) ≥ 6 17 (53) 32 (89) .001* Sound sleep Yes 11 (34) 32 (89) .001* Water intake (Glass/d) ≥ 8 17 (53) 26 (72) .103 Carbohydrates (Meals/d) ≥ 8 17 (53) 26 (72) .103 Carbohydrates (Meals/d) ≥ 2 40 (77) 35 (61) .081 ≤ 2 12 (23) 22 (39) .001** Proteins (Meals/d) ≥ 2 04 (08) 10 (18) ≤ 2 48 (92) 47 (82) .125 Vegetables/Fruits (Meals/d) ≥ 2 04 (08) 10 (18) ≤ 2 36 (69) 45 (80) .001** ≤ 2 36 (69) 45 (80) .001** ≤ 2 36 (69) 45 (80) .001** < 2 36 (69) 45 (80) .001** < 5 16 (50) 13 (86) .001** <td>Fatique/Restless/Shortness of breath</td> <td>Yes</td> <td>24 (75)</td> <td>06 (17)</td> <td><.001***</td> | Fatique/Restless/Shortness of breath | Yes | 24 (75) | 06 (17) | <.001*** |
| Exercise Yes 13 (41) 07 (19) .056 No 19 (59) 29 (81) | | No | 08 (25) | 30 (83) | |
| No19 (59)29 (81)Sleeping (h'd)2617 (53)32 (89)-615 (47)04 (11)001*Sound sleepYes11 (34)32 (89)Water intake (Glass/d)2817 (53)26 (72).103*-817 (53)26 (72).103*Carbohydrates (Meals/d)>240 (77)35 (61).88-212 (23)22 (39).84.84Proteins (Meals/d)>204 (80)10 (18).22-224 (892)47 (82).125.246-236 (69)45 (80).246.22Vegetables/Fruits (Meals/d)>2.36 (69).46 (80)-236 (69)45 (80).400**-236 (69).46 (80).400**-236 (69).31 (41).30 (83).400**Fast-food/Soft drinks intakeYes16 (50).31 (86).647-216 (50).31 (86).647.644.644Tea/Coffee intakeYes.73 (35).61 (3).001*Jarda intakeYes.73 (35).61 (3).016*-10.00.65 (35).39 (87).61 (3).001*-10.00.00 (8).26 (72).00 (13).001*-10.00.66 (19).21 (28).001*.60 (15)-11.01.01 (80).61 (13).001*.60 (15)-12.02 (19).01 (103).00 (15).00 (15).00 (15) <tr<< td=""><td>Exercise</td><td>Yes</td><td>13 (41)</td><td>07 (19)</td><td>.056</td></tr<<> | Exercise | Yes | 13 (41) | 07 (19) | .056 |
| Sleeping (h/d) 26 17 (53) 32 (89) 6 15 (47) 04 (11) 001* Sound sleep Yes 11 (34) 32 (89) Water intake (Glass/d) 28 17 (53) 26 (72) .103 Water intake (Glass/d) 28 17 (53) 26 (72) .103 Carbohydrates (Meals/d) 22 40 (77) 35 (61) .081 22 12 (23) 22 (39) .081 Proteins (Meals/d) -2 48 (92) 47 (82) .125 Vggtables/Fruits (Meals/d) -2 36 (69) 45 (80) .001* Stood/Soft drinks intake Yes 19 (59) 06 (17) <.001* | | No | 19 (59) | 29 (81) | |
| < -6 $15 (47)$ $04 (11)$ 001^* Sound sleepYes $11 (34)$ $32 (89)$ Water intake (Glass/d) 8 $17 (53)$ $26 (72)$ 1003 Carbohydrates (Meals/d) -2 $40 (77)$ $35 (61)$ 081 -2 $22 (23)$ $22 (39)$ -22 $40 (77)$ $35 (61)$ 081 -2 $22 (23)$ $22 (39)$ -22 $48 (92)$ $47 (82)$ 125 Vegetables/Fruits (Meals/d) -2 $46 (81)$ $12 (20)$ 246 -2 $24 (89)$ $47 (82)$ 125 246 Vegetables/Fruits (Meals/d) -2 $16 (31)$ $12 (20)$ 246 -2 $26 (69)$ $45 (80)$ -2 $66 (9)$ $66 (7)$ $-20 (66)$ Vitamins/Minerals intakeYes $19 (59)$ $06 (17)$ -001^* $-50 (Soft drinks intake)$ Yes $16 (50)$ $16 (44)$ -001^* Tea/Coffee intakeYes $16 (50)$ $31 (86)$ -001^* $-50 (Soft drinks intake)$ Yes $17 (35)$ $06 (13)$ 001^* $-50 (Soft drinks intake)$ Yes $77 (35)$ $06 (13)$ 001^* $-50 (Soft drinks intake)$ Yes $77 (35)$ $06 (13)$ 001^* $-50 (Soft drinks intake)$ Yes $77 (35)$ $06 (13)$ 001^* $-50 (Soft drinks intake)$ Yes $77 (35)$ $06 (13)$ 001^* $-50 (Soft drinks intake)$ Yes $77 (35)$ $06 (13)$ 001^* $-50 (Soft drinks)$ Yes <td>Sleeping (h/d)</td> <td>≥6</td> <td>17 (53)</td> <td>32 (89)</td> <td></td> | Sleeping (h/d) | ≥6 | 17 (53) | 32 (89) | |
| Sound sleep Yes 11 (34) 32 (89) No 21 (66) 04 (11) <.001** | | <6 | 15 (47) | 04 (11) | .001* |
| No $21 (66)$ $04 (11)$ $<.001^{**}$ Water intake (Glass/d) ≥ 8 $17 (53)$ $26 (72)$ 103 Carbohydrates (Meals/d) ≥ 2 $40 (77)$ $35 (61)$ 0.81 ≤ 2 $12 (23)$ $22 (39)$ $22 (39)$ $22 (39)$ Proteins (Meals/d) ≥ 2 $04 (08)$ $10 (18)$ 22 ≤ 2 $48 (92)$ $47 (82)$ 1.25 Vegetables/Fruits (Meals/d) ≥ 2 $36 (69)$ $45 (80)$ ≤ 2 $36 (69)$ $45 (80)$ $00 (17)$ ≤ 2 $36 (69)$ $16 (50)$ $06 (17)$ ≤ 2 $36 (69)$ $16 (50)$ $16 (44)$ Fast-food/Soft drinks intakeYes $16 (50)$ $31 (86)$ $= 10 \text{ Intake}$ Yes $90 (18)$ $02 (04)$ 000^* $= 10 \text{ Intake}$ Yes $90 (18)$ $02 (04)$ 000^* $= 10 \text{ Intake}$ Yes $90 (18)$ $02 (04)$ 000^* $= 10 \text{ Intake}$ Yes $26 (81)$ $15 (42)$ 001^* $= 10 \text{ Intake}$ Yes $26 (81)$ $15 (42)$ 001^* $= 10 \text{ Intake}$ Yes $26 (81)$ $15 (42)$ 001^* $= 10 \text{ Intake}$ Yes $26 (81)$ $15 (42)$ | Sound sleep | Yes | 11 (34) | 32 (89) | |
| Water intake (diass/d) ≥ 8 17 (53) $\geq 26 (72)$.103 < | | No | 21 (66) | 04 (11) | <.001*** |
| Carbohydrates (Meals/d)>215 (47)10 (28)Carbohydrates (Meals/d)>240 (77)35 (61).081 42 12 (23)22 (39)10 (18)12 (20).246 42 48 (92)47 (82).125.246.22Vegetables/Fruits (Meals/d)>216 (31)12 (20).246 42 36 (69)45 (80).246.22.26 (69).20 (66)Vitamins/Minerals intakeYes19 (59)06 (17).001*Fast-food/Soft drinks intakeYes16 (50).20 (56).647Tea/Coffee intakeYes16 (50).31 (86).001*Tea/Coffee intakeYes16 (50).31 (86).001*Jarda intakeYes.00 (18).00 (13).001*No16 (50).39 (87).001*.001*Jarda intakeYes.07 (22).01 (03).015*No.00 (82).39 (87).001*.001*Mo.00 (82).35 (97).001*.001*Gastric problemYes.07 (22).01 (03).015*No.06 (19).21 (58).001**.001**No.06 (19).21 (58).001**.001**Family history with cancer.06 (17).52 (88).05 (77)No.07 (71).52 (88).07 (71).02 (71)No.07 (71).07 (71).02 (78).02 (78).00 (77).05 (77).07 (72).02 (77).01 (75) | Water Intake (Glass/d) | ≥8 | 17 (53) | 26 (72) | .103 |
| $\begin{array}{c ccccccccccccccccccccccccccccccccccc$ | | <8 | 15 (47) | 10 (28) | 0.01 |
| 12 12 (20) 22 (30) Proteins (Meals/d) >2 $40(08)$ $10(18)$ 42 $48(92)$ $47(82)$ $.125$ Vegetables/Fruits (Meals/d) >2 $16(31)$ $12(20)$ $.246$ 42 $36(69)$ $45(80)$ $.22$ $.266$ $.262$ $.36(69)$ $.45(80)$ Vitamins/Minerals intake Yes $19(59)$ $.06(17)$ 001^* Fast-food/Soft drinks intake Yes $16(50)$ $20(56)$ 647 No $16(50)$ $20(56)$ 647 600^* 600^* Tea/Coffee intake Yes $16(50)$ $.016^*$ 60^* 60^* Jarda intake Yes $7(35)$ $6(13)$ 016^* Jarda intake Yes $7(22)$ $01(03)$ 015^* Mo $025(78)$ $036(97)$ 001^* 001^* Gastric problem Yes $02(78)$ 025^* 001^* No $.$ | Carbonydrates (meais/d) | >2 | 40 (77) | 35 (01) | .081 |
| Free (weaks d) 22 36 (60) 10 (10) ≤ 2 48 (92) 47 (82) $.125$ Vegetables/Fruits (Meals/d) >2 16 (31) 12 (20) $.246$ ≤ 2 36 (69) 45 (80) $$ | Protains (Maals/d) | >2 | 04 (08) | 10 (18) | |
| Vegetables/Fruits (Meals/d) >2 16 (31) 12 (20) .246 ≤ 2 36 (69) 45 (80) | | <2 | 48 (92) | 47 (82) | 125 |
| Section of the (relative) Se | Vegetables/Fruits (Meals/d) | >2 | 16 (31) | 12 (20) | .246 |
| Vitamins/Minerals intake Yes 19 (59) 06 (17) <.001** No 13 (41) 30 (83) | | ≤2 | 36 (69) | 45 (80) | |
| No 13 (41) 30 (83) Fast-food/Soft drinks intake Yes 16 (50) 20 (56) .647 No 16 (50) 16 (44) .001* Tea/Coffee intake Yes 16 (50) 31 (86) .001* Betel nut intake Yes 16 (50) 05 (14) .001* Jarda intake Yes 17 (35) 06 (13) .016* Jarda intake Yes 09 (18) 02 (04) .036* Mo 40 (82) 43 (96) .01* Thyroid problem Yes 07 (22) 01 (03) .015* No 25 (78) 35 (97) .001* .001* Antibiotic intake Yes 26 (81) 15 (42) .001* No 25 (78) 35 (97) .001* .001* Antibiotic intake Yes 17 (53) 01 (03) .001* No 06 (19) 21 (58) .001* .001* Family history with cancer Yes 15 (47) 35 (97) .001* | Vitamins/Minerals intake | Yes | 19 (59) | 06 (17) | <.001** |
| 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) .01e* Jarda intake Yes 09 (18) 02 (04) .03e* Jarda intake Yes 09 (18) 02 (04) .03e* Thyroid problem Yes 07 (22) 01 (03) .015* No 25 (78) 35 (97) .001* Antibiotic intake Yes 26 (81) 15 (42) .001* No 26 (81) 15 (42) .001* .001* No 06 (19) 21 (58) .001* .001* No 06 (19) 21 (58) .001* .001* No 15 (47) 35 (97) .001** .001** No 15 (47) 35 (97) .001** .001** No 1 | | No | 13 (41) | 30 (83) | |
| No16 (50)16 (44)Tea/Coffee intakeYes16 (50)31 (86)No16 (50)05 (14).001*Betel nut intakeYes17 (35)06 (13).016*No32 (65)39 (87).016*Jarda intakeYes09 (18)02 (04).036*No40 (82)43 (96).015*Thyroid problemYes07 (22)01 (03).015*Gastric problemYes26 (81)15 (42).001*Antibiotic intakeYes17 (53)01 (03)<.001*No06 (19)21 (58).001*Family history with cancerYes15 (29)07 (12).025*No37 (71)52 (88).015 | Fast-food/Soft drinks intake | Yes | 16 (50) | 20 (56) | .647 |
| 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) .036* .036* Jarda intake Yes 09 (18) 02 (04) .036* No 40 (82) 43 (96) .015* Thyroid problem Yes 07 (22) 01 (03) .015* Gastric problem Yes 26 (81) 15 (42) .001* No 25 (78) 35 (97) .001* .001* Antibiotic intake Yes 17 (53) 01 (03) .001* No 06 (19) 21 (58) .001* .001** Family history with cancer Yes 15 (29) 07 (12) .005* No 37 (71) 52 (88) .001** .001** | | No | 16 (50) | 16 (44) | |
| No 16 (50) 05 (14) .001* Betel nut intake Yes 17 (35) 06 (13) .016* No 32 (65) 39 (87) .001* .006* .001** .001** .001** .001** .001** .001** .006 .001** | Tea/Coffee intake | Yes | 16 (50) | 31 (86) | |
| Betel nut intake Yes 17 (35) 06 (13) .016* No 32 (65) 39 (87) .036* | | No | 16 (50) | 05 (14) | .001* |
| No 32 (b5) 39 (87) Jarda intake Yes 09 (18) 02 (04) .036* No 40 (82) 43 (96) .015* Thyroid problem Yes 07 (22) 01 (03) .015* Sastric problem Yes 26 (81) 15 (42) .001* Gastric problem Yes 26 (81) 15 (42) .001* No 06 (19) 21 (58) .001** Antibiotic intake Yes 17 (53) 01 (03) <.001** | Betel nut intake | Yes | 17 (35) | 06 (13) | .016* |
| Jarda Intake Yes 09 (18) 02 (04) .036 No 40 (82) 43 (96) .015* Thyroid problem Yes 07 (22) 01 (03) .015* No 25 (78) 35 (97) .001* Gastric problem Yes 26 (81) 15 (42) .001* No 06 (19) 21 (58) .001** Antibiotic intake Yes 17 (53) 01 (03) <.001** | lavda jakalka | No | 32 (65) | 39 (87) | 000* |
| Invo 40 (02) 43 (90) Thyroid problem Yes 07 (22) 01 (03) .015* No 25 (78) 35 (97) .001* Gastric problem Yes 26 (81) 15 (42) .001* No 06 (19) 21 (58) .001* Antibiotic intake Yes 17 (53) 01 (03) <.001* | Jarua Intake | res | U9 (18) | U∠ (U4) 43 (06) | .036^ |
| Instant problem Instant pr | Thuroid problem | | 40 (02) 07 (22) | 43 (90) 01 (03) | 016* |
| Gastric problem Yes 26 (81) 15 (42) .001* No 06 (19) 21 (58) .001* Antibiotic intake Yes 17 (53) 01 (03) .001** No 15 (47) 35 (97) .001** Family history with cancer Yes 15 (29) 07 (12) .025* No 37 (71) 52 (88) .001** | וואַזטע אַנטטפווו | No | 25 (78) | 35 (97) | .013 |
| No 06 (19) 21 (58) Antibiotic intake Yes 17 (53) 01 (03) <.001** | Gastric problem | Yes | 26 (81) | 15 (42) | .001* |
| Antibiotic intake Yes 17 (53) 01 (03) <.001** No 15 (47) 35 (97) 35 (97) .025* Family history with cancer Yes 15 (29) 07 (12) .025* No 37 (71) 52 (88) .001** | | No | 06 (19) | 21 (58) | |
| No 15 (47) 35 (97) Family history with cancer Yes 15 (29) 07 (12) .025* No 37 (71) 52 (88) 52 (88) 52 (88) | Antibiotic intake | Yes | 17 (53) | 01 (03) | <.001*** |
| Family history with cancer Yes 15 (29) 07 (12) .025* No 37 (71) 52 (88) | | No | 15 (47) | 35 (97) | |
| No 37 (71) 52 (88) | 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 \ge .001) as P*; (<9E-04 to \ge 1E-05) as P**, and (<9E-05 to \ge 1E-06) as P***.









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 (\geq 45 years) [OR 4.38, 95% CI (1.94–9.89), *P* value <.001], height (<1.5 m) [OR 3.01, 95%

| 1 | r – 1 | |
|-------|----------|--|
| 1.5.4 | 1 | |

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) | |

 $\mathsf{HDL} = \mathsf{high}\mathsf{-density} \ \mathsf{lipid}, \ \mathsf{LDL} = \mathsf{low}\mathsf{-density} \ \mathsf{lipid}, \ \mathsf{TC} = \mathsf{total} \ \mathsf{cholesterol}, \ \mathsf{TG} = \mathsf{triglycerides}.$

Data expressed as number n (%), P value was determined by Chi-square test.

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

| Α. | | | | |
|-------------------------------|------------|-------------|----------------|---------|
| 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) | |
| В. | | | | |

| Phenotype | 1 | lumber of cases | (%) | | <i>P</i> v | alue | |
|---------------|---------|-----------------|---------|----------|------------|-----------|-------------------|
| | 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 | 1 | lumber of cases | (%) | | | | |
| | Total | NL | OW | | OB | Breas | st cancer subtype |
| 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) |

 $OB = BMI \ge 30$, ER = estrogen receptor, HER2 = human epidermal growth factor receptor 2, NL = BMI < 25, $OW = 25 \le BMI < 30$, 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 \ge .001) as P

; (<9E-04 to \geq 1E-05) as $P^{\star\star}$, and (<9E-05 to \geq 1E-06) as $P^{\star\star\star}.$

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 (\geq 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* |
| Holgin (III) | ≥1.5 | 37 (71) | 52 (88) | | |
| Education | No | 21 (40) | 03 (05) | 12.65 (3.49-45.79) | <.001** |
| Laddalon | Yes | 31 (60) | 56 (95) | 12100 (0110 10110) | |
| Socio-economic status | Low | 17 (34) | 04 (07) | 6.83 (2.11-22.05) | .001* |
| | Middle | 33 (66) | 53 (93) | | |
| BMI (ka/m²) | >30 | 09 (17) | 03 (05) | 3.91 (1.00-15.31) | .050* |
| (.g) | <30 | 43 (83) | 56 (95) | | |
| HDL (ma/dL) | >40 | 31 (60) | 49 (83) | | |
| hbe (mg/de) | <40 | 12 (40) | 10 (17) | 3 32 (1 38-7 98) | 007* |
| TG (ma/dL) | >150 | 22 (42) | 11 (19) | 3 20 (1 36–7 53) | 008* |
| | ~150 | 30 (58) | /8 (81) | 0.20 (1.00 7.00) | .000 |
| TC/HDL ratio | ~3 | 51 (08) | 50 (85) | 0 18 (1 12-75 15) | 038* |
| TG/TIDE Tatlo | ~3 | 01 (02) | 00 (15) | 9.10 (1.12-73.13) | .050 |
| TC/UDL ratio | ~ 2 | 49 (02) | 24 (59) | 0 00 (0 01 07 60) | < 001** |
| TG/HDL Tallo | <2 | 40 (92) | 34 (36) 25 (42) | 0.02 (2.01-27.00) | <.001 |
| Blood propouro (Custolio) | <2 | 04 (00) | 23 (42) | 4.22 (1.71, 10.02) | 000* |
| Biood pressure (Systolic) | >120 | 21 (40) | 00 (14) | 4.32 (1.71–10.93) | .002 |
| Placed processor (Picetalia) | ≤120 × 00 | 31 (00) | 51 (66) | | . 001** |
| Blood pressure (Diastolic) | >80 | 21 (40) | 05 (08) | 7.32 (2.51–21.34) | <.001*** |
| T I 11 11 | ≤8U | 31 (60) | 54 (92) | | 000* |
| I hyroid 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) | | |
| Fatique/Restless/ Shortness of breath | Yes | 24 (75) | 06 (17) | 15.00 (4.58-49.15) | <.001*** |
| 5 | 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) | 0.00 (1.00 0 1.00) | 1000 |
| Breastfeeding (Vears) | <u></u> | 18 (56) | 02 (15) | 7 07 (1 34-37 22) | 021* |
| | <4 | 14 (44) | 11 (85) | 1.01 (1.07 01.22) | .021 |
| Family history with cancer | ב− Voc | 15 (20) | 07 (12) | 3 01 (1 12-8 12) | 020* |
| r anniy motory with calleel | No | 37 (71) | 52 (88) | 0.01 (1.12-0.12) | .025 |
| | INU | 51 (11) | 52 (00) | | |

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

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