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Lifestyle and Reproductive Characteristics Among Women with Breast Cancer in Pakistan: A Cross-Sectional Study with Comparison to Western Evidence

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Article

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Abstract

Background: Breast cancer is the most commonly diagnosed cancer among women worldwide and represents a major public health concern in Pakistan. Younger age at diagnosis and potentially modifiable lifestyle and reproductive characteristics may have important implications for breast cancer prevention and early detection. This study aimed to describe the prevalence of selected lifestyle and reproductive characteristics among women with breast cancer in Pakistan and to examine their distribution according to age group.

Methods: A cross-sectional observational study was conducted among women diagnosed with breast cancer at the Breast Care Unit, Rehman Medical Institute, Peshawar, Pakistan, between February 2023 and August 2024. Participants were consecutively recruited, and demographic, socioeconomic, lifestyle, and reproductive information was collected using a structured interviewer-administered questionnaire and clinical record review. Participants were categorized into younger (<40 years) and older (≥40 years) age groups. Associations between age group and selected categorical variables were assessed using Pearson's chi-square test or Fisher's exact test, as appropriate.

Results: A total of 85 women with breast cancer were included, of whom 27 (31.8%) were aged <40 years and 58 (68.2%) were aged ≥40 years. Overall, 41 (48.2%) participants were overweight and 13 (15.3%) were obese or morbidly obese. A sedentary lifestyle was reported by 52 (61.2%) participants. Nulliparity was present in 24 (28.2%), while 15 (17.6%) reported oral contraceptive use. Eight (9.4%) participants were active smokers and five (5.9%) reported passive smoking exposure. Most participants (81/85, 95.3%) reported having their first pregnancy before 35 years of age, while 48 (56.5%) reported fully breastfeeding for more than six months. No statistically significant associations were identified between age group and BMI category (p=0.561), physical activity (p=0.093), or parity (p=0.219). Delayed presentation was also common, with 63.5% of participants reporting symptoms for six months or longer before presentation.

Conclusions: Overweight, sedentary behavior, and delayed presentation were common characteristics among women with breast cancer in this Peshawar-based cohort, while smoking and oral contraceptive use were relatively uncommon. Approximately one-third of participants were younger than 40 years. These findings provide locally relevant descriptive data and highlight potentially important areas for further investigation. Larger multicenter studies incorporating non cancer control groups are needed to determine whether these characteristics are independently associated with breast cancer risk and to inform prevention and early-detection strategies tailored to the Pakistani population.

Background

Breast cancer stands as a formidable adversary, impacting millions of lives worldwide. Leading as the most common cancer in females all over the world with approximately 2.3 million new cases each year as well as one of second leading causes of death among females [1]. In Pakistan, the most frequently diagnosed cancer among females is also breast cancer, accounting for nearly one in nine female

patients. Its incidence in Pakistan is 2.5 times higher than that in neighboring countries like Iran and India [2]. The incidence of breast cancer is influenced by a myriad of factors, both intrinsic and extrinsic, of which include age, family history, early menarche, intake of combined estrogen and progestin menopausal hormones, alcohol consumption, physical inactivity, low socioeconomic status, Low Parity and lack of awareness regarding the disease [3, 4].

In Pakistan, socioeconomic factors, reproductive behaviors, and cultural practices play pivotal roles in shaping the breast cancer landscape. Limited access to healthcare facilities and delayed diagnoses further complicate the scenario. Risk factors for breast cancer in Pakistani women i.e. high BMI, lack of physical activity, smoking, and post-menopausal status. These factors are similar to those in Western countries, but the mean age at diagnosis in Pakistan is a decade earlier [5]. Conversely, in Western countries, lifestyle factors such as hormonal replacement therapy and reproductive choices have been extensively studied and western countries attain added benefit from refined screening protocols and genetic counseling. The present study aimed to characterize the frequency of potentially modifiable lifestyle factors and reproductive characteristics among women with breast cancer in Pakistan, with particular emphasis on whether these characteristics differed between women diagnosed before the age of 40 years and those aged 40 years or older. Given the increasing recognition of breast cancer among younger women in South Asian populations, the study sought to describe the distribution of these characteristics within the study population and to identify patterns that may warrant further investigation. In addition, the frequency of selected lifestyle and reproductive characteristics observed in this Pakistani cohort was compared descriptively with findings reported in Western populations to provide contextual insight into potential differences between populations. As the study included women with breast cancer without a non-cancer control group, these comparisons were intended to characterize patterns and generate hypotheses rather than establish individual factors as causal risk factors for breast cancer.

Methods

Study design and setting

This cross-sectional observational study was conducted at the Breast Care Unit, Rehman Medical Institute, Peshawar, Pakistan, between February 2023 and August 2024. The study aimed to evaluate the prevalence of modifiable lifestyle and reproductive characteristics among women diagnosed with breast cancer and to compare these findings with evidence reported from Western populations.

Participants

A consecutive sampling technique was used. All eligible women presenting to the Breast Care Unit during the study period who met the inclusion criteria and provided informed consent were consecutively recruited. The final sample comprised 85 participants. As this was an exploratory study conducted over

a defined study period, no formal a priori sample size calculation was performed; the sample size was determined by the number of eligible participants recruited during the study period. Women aged 20–80 years presenting to the Breast Care Unit during the study period and subsequently diagnosed with breast cancer on core needle biopsy were eligible for inclusion. Patients with histopathologically confirmed breast cancer who provided informed consent were consecutively recruited into the study. Patients with incomplete clinical records, inability to provide reliable information during the interview, or refusal to participate were excluded from the study.

Data collection

Data were collected using a structured interviewer-administered questionnaire together with review of patients' clinical records. Information obtained included demographic characteristics, socioeconomic status, body mass index (BMI), dietary habits, physical activity, smoking status (active and passive), occupational history including night-shift work, previous breast disease, family history of breast cancer, reproductive history (parity and age at first pregnancy), breastfeeding history, oral contraceptive pill use, and duration of symptoms before presentation. Body mass index was categorized according to the World Health Organization classification as underweight (< 18.5), normal weight (18.5–24.9) overweight (25–29.9), and obese/morbidly obese (> 30) [6]. Physical activity was assessed through participants' verbal self-report of their usual routine daily activities. Participants were asked to describe their typical level of physical activity, including routine activities performed during daily life. Based on these self-reported responses, participants were categorized by the investigators as having predominantly sedentary/minimal daily activity or being physically active. No standardized physical activity questionnaire or formal activity classification system was used. Socioeconomic status was assessed using participants' self-reported household income together with socioeconomic indicators collected during the interview. Participants were subsequently categorized into socioeconomic groups based on the information provided. As these data were self-reported, the classification reflects the participants reported socioeconomic circumstances rather than an independently verified measure of household income or socioeconomic status. Participants were further stratified into two age groups (< 40 years and ≥ 40 years) to evaluate differences in risk factor prevalence among younger and older women with breast cancer.

Statistical analysis

Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS) software (IBM SPSS Statistics, Version 26; IBM Corp., Armonk, NY, USA). Continuous variables were summarized as mean ± standard deviation (SD) or median with interquartile range (IQR), as appropriate. Categorical variables were presented as frequencies and percentages. Associations between age group (< 40 years versus ≥ 40 years) and selected categorical variables including BMI category, physical activity, and parity were assessed using the Pearson chi-square test. Fisher's exact test was applied when expected cell

counts were less than five. A two-sided p-value of < 0.05 was considered statistically significant. No direct statistical comparison with Western populations was performed.

Results

A total of 85 patients with breast cancer were included in the analysis. Of these, 27 (31.8%; 95% CI: 22.8–42.3%) were aged < 40 years and 58 (68.2%; 95% CI: 57.7–77.2%) were aged ≥ 40 years. Regarding body mass index (BMI), 31 patients (36.5%; 95% CI: 26.9–47.1%) were normal weight or underweight, 41 (48.2%; 95% CI: 37.9–58.7%) were overweight, and 13 (15.3%; 95% CI: 9.2–24.4%) were obese or morbidly obese. The distribution of BMI categories did not differ significantly between age groups (Pearson χ^2=1.157, df = 2, p = 0.561), with a small overall association (Cramer's V = 0.117). Compared with patients aged ≥ 40 years, those aged < 40 years had lower odds of being overweight rather than normal/underweight (OR = 0.58, 95% CI: 0.21–1.58) and lower odds of being obese/morbidly obese rather than normal/underweight (OR = 0.70, 95% CI: 0.18–2.80); however, both estimates had wide confidence intervals and were not statistically significant. Sedentary physical activity was reported in 52 patients (61.2%; 95% CI: 50.5–70.8%), while 33 (38.8%; 95% CI: 29.2–49.5%) were classified as physically active. Sedentary behavior was more frequent among patients aged ≥ 40 years (63.8%) than among those aged < 40 years (55.6%). However, there was no statistically significant association between age group and physical activity (Pearson χ^2=2.825, df = 1, p = 0.093). Patients aged < 40 years had lower odds of being sedentary compared with patients aged ≥ 40 years (OR = 0.71, 95% CI: 0.28–1.80). With respect to socioeconomic status, 32 patients (37.6%; 95% CI: 28.1–48.3%) were classified as having poor socioeconomic status, 37 (43.5%; 95% CI: 33.5–54.1%) as middle socioeconomic status, and 16 (18.8%; 95% CI: 11.9–28.4%) as high socioeconomic status. The distribution was broadly similar across the two age groups. Most patients reported predominantly healthy/home-cooked meals (82/85, 96.5%; 95% CI: 90.1–98.8%), whereas 3 (3.5%; 95% CI: 1.2–9.9%) reported high-carbohydrate/high-calorie meals. High-carbohydrate/high-calorie meal intake was reported in 3 of 27 patients aged < 40 years (11.1%) compared with none of the 58 patients aged ≥ 40 years. Because of the zero cell, a stable conventional OR estimate could not be obtained without continuity correction; therefore, this comparison is presented descriptively. Regarding reproductive characteristics, 24 patients (28.2%; 95% CI: 19.8–38.6%) were nulliparous and 61 (71.8%) were primiparous or multiparous. Nulliparity was more frequent among patients aged < 40 years (37.0%) than among those aged ≥ 40 years (24.1%), although the association was not statistically significant (Pearson χ^2=1.513, df = 1, p = 0.219). Patients aged < 40 years had approximately 1.85-fold higher odds of being nulliparous compared with those aged ≥ 40 years (OR = 1.85, 95% CI: 0.69–4.95). Most patients (81/85, 95.3%; 95% CI: 88.5–98.2%) reported their first pregnancy before the age of 35 years, while 4 (4.7%; 95% CI: 1.8–11.5%) reported first pregnancy at ≥ 35 years. All patients aged < 40 years reported a first pregnancy before age 35, compared with 93.1% of patients aged ≥ 40 years. Given the small number of patients in the ≥ 35-year category and the resulting zero cell, an unadjusted OR was not considered sufficiently stable for meaningful inference. Regarding breastfeeding, 29 patients (34.1%; 95% CI: 24.9–44.7%) reported not breastfeeding, 8 (9.4%) reported not breastfeeding from the symptomatic breast, and 48 (56.5%; 95% CI: 45.9–66.5%) reported fully

breastfeeding for more than 6 months. The distribution of breastfeeding characteristics was broadly comparable between age groups.

Oral contraceptive pill use was reported by 15 patients (17.6%; 95% CI: 11.0–27.1%), while 70 (82.4%) reported no use. OCP use was reported by 11.1% of patients aged < 40 years and 20.7% of those aged ≥ 40 years. No statistically significant association was observed between OCP use and age group. Regarding smoking status, 72 patients (84.7%; 95% CI: 75.6–90.8%) reported no smoking or passive-smoking exposure, 8 (9.4%; 95% CI: 4.8–17.5%) were active smokers, and 5 (5.9%; 95% CI: 2.5–13.0%) reported passive-smoking exposure. Active smoking was reported by 3.7% of patients aged < 40 years compared with 12.1% of those aged ≥ 40 years, while passive smoking was reported by 3.7% and 6.9%, respectively. Results are presented in the given tables below.

Overall, no statistically significant associations were identified between age group and BMI, physical activity, parity, or the other assessed lifestyle and reproductive characteristics. These findings should, however, be interpreted cautiously because of the modest sample size and the corresponding limited statistical power, as reflected by the wide 95% confidence intervals around several effect estimates.

Table 1
Distribution of lifestyle and reproductive characteristics according to age group (< 40 years vs. ≥40 years).

Characteristic	Total (N = 85), n (%)	< 40 years (n = 27), n (%)	≥ 40 years (n = 58), n (%)
Body Mass Index			
Normal/underweight	31 (36.5)	12 (44.4)	19 (32.8)
Overweight	41 (48.2)	11 (40.7)	30 (51.7)
Obese/morbidly obese	13 (15.3)	4 (14.8)	9 (15.5)
Physical Activity			
Sedentary	52 (61.2)	15 (55.6)	37 (63.8)
Active	33 (38.8)	12 (44.4)	21 (36.2)
Socioeconomic Status			
Poor	32 (37.6)	10 (37.0)	22 (37.9)
Middle	37 (43.5)	12 (44.4)	25 (43.1)
High	16 (18.8)	5 (18.5)	11 (19.0)
Eating Habit			
Healthy meals	82 (96.5)	24 (88.9)	58 (100.0)
High-carbohydrate/high-calorie meals	3 (3.5)	3 (11.1)	0 (0.0)
Parity			
Nulliparous	24 (28.2)	10 (37.0)	14 (24.1)
Primiparous or multiparous	61 (71.8)	17 (63.0)	44 (75.9)
Age at First Pregnancy			
< 35 years	81 (95.3)	27 (100.0)	54 (93.1)
≥ 35 years	4 (4.7)	0 (0.0)	4 (6.9)
Breastfeeding			
Not breastfeeding	29 (34.1)	11 (40.7)	18 (31.0)
Never breastfed in symptomatic breast	8 (9.4)	1 (3.7)	7 (12.1)
Fully breastfed > 6 months	48 (56.5)	15 (55.6)	33 (56.9)

Characteristic	Total (N = 85), n (%)	< 40 years (n = 27), n (%)	≥ 40 years (n = 58), n (%)
Body Mass Index			
Use of Oral Contraceptive Pills			
None	70 (82.4)	24 (88.9)	46 (79.3)
Used oral contraceptive pills	15 (17.6)	3 (11.1)	12 (20.7)
Smoking Status			
None	72 (84.7)	25 (92.6)	47 (81.0)
Active smoker	8 (9.4)	1 (3.7)	7 (12.1)
Passive smoker	5 (5.9)	1 (3.7)	4 (6.9)

Percentages in the age-group columns are calculated within the respective age group; percentages in the Total column are calculated using the total study population (N = 85).

Table 2
Association between BMI category and age group.

BMI category	< 40 years, n (%)	≥ 40 years, n (%)	Total, n (%)	P-value
Normal/underweight	12 (44.4)	19 (32.8)	31 (36.5)	
Overweight	11 (40.7)	30 (51.7)	41 (48.2)	
Obese/morbidly obese	4 (14.8)	9 (15.5)	13 (15.3)	
Overall	**27 (100)**	**58 (100)**	**85 (100)**	**0.561**

Statistical test

Pearson chi-square, $\chi^2(2) = 1.157$, $P = 0.561$.

Table 3
Association between physical activity and age group.

Physical activity	< 40 years, n (%)	≥ 40 years, n (%)	Total, n (%)
Sedentary	15 (55.6)	37 (63.8)	52 (61.2)
Active	12 (44.4)	21 (36.2)	33 (38.8)
Total	**27 (100)**	**58 (100)**	**85 (100)**

Pearson $\chi^2(1) = 2.825$, P = 0.093.

Note

Data were analyzed using Pearson's chi-square test. Fisher's exact test was used where appropriate. Statistical significance was defined as $P < 0.05$.

Table 4
Association between parity and age group.

Parity	< 40 years, n (%)	≥ 40 years, n (%)	Total, n (%)
Nulliparous	10 (37.0)	14 (24.1)	24 (28.2)
Primiparous/multiparous	17 (63.0)	44 (75.9)	61 (71.8)
Total	**27 (100)**	**58 (100)**	**85 (100)**

Pearson $\chi^2(1) = 1.513$, P = 0.219.

Note

Data were analyzed using Pearson's chi-square test. Fisher's exact test was used where appropriate. Statistical significance was defined as $P < 0.05$.

Discussion

This study describes selected demographic, lifestyle, and reproductive characteristics among women with breast cancer presenting in Peshawar, Pakistan. The principal findings were that 31.8% of participants were younger than 40 years, while overweight and obesity were common, with 48.2% classified as overweight and 15.3% as obese or morbidly obese. A sedentary lifestyle with minimal daily physical activity was reported by 61.2% of participants. Most participants reported no smoking exposure, no night-shift-related duties, and predominantly home-based dietary patterns. Regarding reproductive characteristics, 28.2% were nulliparous, 68.2% had experienced their first pregnancy before the age of 35 years, and 34.1% reported that they had not breastfed their children. Delayed presentation was also common, with 63.5% reporting symptoms for six months or longer before presentation. These findings provide a descriptive overview of characteristics observed among breast cancer patients in this setting and allow comparison with patterns reported in other populations. Age is an important characteristic in the epidemiology and clinical presentation of breast cancer. European consensus guidance has used an age threshold of 40 years or younger to identify younger women with breast cancer, partly because breast cancer in this group may be associated with less favorable clinical outcomes [7, 8]. Previous studies have reported that younger patients are more likely to have aggressive tumor phenotypes and may present with larger tumors, lymph-node involvement, advanced disease, and poorer differentiation [9–11]. In the present study, 27 (31.8%) participants were younger than 40 years. Although this finding cannot be interpreted as an estimate of the population-level risk of young-onset breast cancer because the study included breast cancer patients rather than a population-based control group, the proportion of younger patients highlights the importance of considering breast cancer in women below the conventional screening age. Further population-based studies in Pakistan would be

useful to determine whether the proportion of young-onset disease differs from that reported in other populations. Overweight and obesity were common in this cohort, with 48.2% of participants classified as overweight and a further 15.3% classified as obese or morbidly obese. Previous epidemiological evidence has consistently linked increased body weight with breast cancer risk, particularly among postmenopausal women [4, 12, 13]. Several biological mechanisms have been proposed, including increased peripheral estrogen production from adipose tissue and metabolic effects associated with obesity. Similarly, regular physical activity has been associated with a lower risk of breast cancer in epidemiological studies [14]. In the present study, 57.6% of participants reported a sedentary lifestyle with minimal daily exertion. These findings indicate that excess body weight and low physical activity were common characteristics within this patient cohort. However, because this study did not include a non-cancer control group, these findings should not be interpreted as demonstrating that overweight, obesity, or physical inactivity increased breast cancer risk in this population. Nevertheless, their high prevalence supports the importance of further investigation of these potentially modifiable characteristics in Pakistani women. Smoking exposure was uncommon in this cohort. Only 9.4% of participants reported active smoking, while 84.7% reported no history of active or passive smoking. This contrasts with smoking prevalence reported among some Western populations [15]. Previous literature has examined both active and passive smoking as potential contributors to breast cancer development, although the magnitude and consistency of these associations have varied [16]. The relatively low prevalence of smoking exposure in the present cohort may therefore reflect the sociocultural characteristics of the study population rather than an absence of relevance of tobacco exposure to breast cancer.

Oral contraceptive use was also relatively uncommon, with 17.6% of participants reporting use. Previous studies have reported varying associations between oral contraceptive use and breast cancer, including modest increases in risk associated with recent use in some populations and potentially different associations according to formulation and duration of use[17]. Given the observational and descriptive nature of the present study, the low prevalence of oral contraceptive use should be regarded as a characteristic of the cohort rather than evidence for or against an association with breast cancer. Dietary patterns were predominantly home-based, with 95% of participants reporting home-based diets and only 3.5% reporting a high-carbohydrate, high-calorie dietary pattern. Dietary patterns and their relationship with breast cancer are complex and may interact with body weight, physical activity, socioeconomic circumstances, and reproductive factors. The relatively limited prevalence of the reported high-calorie dietary pattern in this cohort therefore warrants cautious interpretation and should not be taken to indicate that dietary factors were uncommon contributors to breast cancer risk. Reproductive factors are well-established components of breast cancer epidemiology. Nulliparity and later age at first pregnancy have been associated with breast cancer risk in both Western and East Asian populations, while increasing parity has generally been associated with a reduction in risk [18]. In this study, 28.2% of participants were nulliparous, while 68.2% had experienced their first pregnancy before the age of 35 years. These findings describe the reproductive profile of the study population but cannot establish whether parity or age at first pregnancy was associated with breast cancer because a comparison group

was not included. Breastfeeding has also been proposed as a protective reproductive factor, with possible mechanisms including greater differentiation of breast tissue, suppression of ovulatory cycles during lactation, and reduced cumulative exposure to endogenous hormones [19]. In the present cohort, 34.1% of participants reported that they had not breastfed their children. This represents a substantial proportion of patients and may be relevant when considering reproductive characteristics in this population. However, the present study cannot determine whether lack of breastfeeding was associated with breast cancer development. Future case-control or cohort studies would be required to evaluate this relationship while accounting for parity, age, socioeconomic factors, and other potential confounders. Delayed presentation was an important finding in this study, with 63.5% of participants reporting symptoms for six months or longer before presentation. This observation is particularly relevant in settings where access to organized breast cancer screening and diagnostic services may be limited. Early detection strategies include mammography, clinical breast examination (CBE), and breast self-examination (BSE), although their roles and effectiveness differ across healthcare settings [20, 21]. In resource-constrained settings, barriers including limited availability, affordability, geographic access, and health literacy may influence when patients seek evaluation. The prolonged symptom duration observed in this cohort therefore suggests a potential opportunity for earlier engagement with breast health services. Rather than implying that a particular detection strategy is universally superior, interventions in Pakistan should be adapted to local healthcare infrastructure and patient accessibility. Improving awareness of breast symptoms, strengthening referral pathways, and integrating appropriate clinical breast assessment into primary and community healthcare may be particularly relevant where access to mammographic screening remains limited. The characteristics observed in this cohort should be interpreted within the broader socioeconomic and cultural context of Pakistan. In the present study, 81.2% of participants belonged to middle- or low-income groups, while 18.8% were classified as having high socioeconomic status. This socioeconomic distribution may influence access to healthcare, health literacy, preventive practices, and the timing of presentation. In contrast, some Western literature has described associations between higher socioeconomic status and breast cancer incidence [21]. although socioeconomic gradients are highly context-dependent and may operate through different mechanisms in different healthcare systems. Several characteristics observed in this cohort also differed from patterns commonly emphasized in Western literature. Smoking and oral contraceptive use were relatively uncommon, whereas overweight, sedentary behavior, and delayed presentation were frequent. These differences illustrate why breast cancer prevention and early-detection strategies developed from Western populations may require contextual adaptation before being applied to Pakistani populations. Importantly, the present findings are descriptive and do not allow direct estimation of the relative contribution of individual factors to breast cancer risk.

Strengths and limitations

This study provides a locally relevant description of demographic, lifestyle, and reproductive characteristics among breast cancer patients in Peshawar, an area for which population-specific data remain limited. The assessment of multiple potentially relevant characteristics including BMI, physical

activity, smoking exposure, dietary pattern, night-shift work, reproductive history, breastfeeding, and healthcare presentation allows a broad characterization of the study population.

Several limitations should nevertheless be considered. First, the study included breast cancer patients without a non-cancer control group; consequently, associations between the measured characteristics and breast cancer risk cannot be established. Second, the sample size was relatively small, limiting statistical power and the precision of subgroup comparisons. Third, several variables, including physical activity, dietary pattern, smoking exposure, and duration of symptoms, were based on participant reporting and may therefore be affected by recall or reporting bias. Fourth, the study was conducted in a specific clinical setting in Peshawar, which may limit generalizability to other regions of Pakistan. Finally, potential confounding between demographic, socioeconomic, reproductive, and lifestyle factors could not be fully addressed. An additional limitation is that several baseline characteristics requested for further characterization including mean age, menopausal status, educational level, marital status, occupation, cancer stage, and histological subtype were not systematically collected as part of the original study questionnaire. Consequently, these variables could not be reliably reconstructed retrospectively and were not included in the present analysis. Future studies should incorporate these demographic and clinical characteristics into the study instrument to allow more comprehensive characterization of the study population and assessment of potential associations with breast cancer outcomes.

Implications and future research

Future studies should use larger, multicenter populations and preferably include appropriate non-cancer controls to determine whether the characteristics identified in this study are independently associated with breast cancer. Prospective cohort and well-designed case-control studies could further examine the contributions of BMI, physical activity, reproductive history, breastfeeding, socioeconomic status, and healthcare access while accounting for important confounding variables. Population-based research is also needed to better characterize the burden of breast cancer among women younger than 40 years in Pakistan. In parallel, studies evaluating barriers to timely presentation and access to diagnostic services could help identify practical interventions for earlier diagnosis. Such evidence would provide a stronger basis for developing breast cancer awareness, prevention, and early-detection strategies tailored to the Pakistani healthcare and sociocultural context.

Overall, this study identifies a high prevalence of overweight, sedentary behavior, and delayed presentation among breast cancer patients in Peshawar, alongside distinctive reproductive, smoking, dietary, and contraceptive characteristics. These findings should be viewed primarily as descriptive observations that generate hypotheses for larger comparative studies rather than as evidence that individual characteristics independently cause breast cancer. Addressing delayed presentation while investigating potentially modifiable lifestyle factors may represent important areas for future breast cancer research and public-health planning in Pakistan.

Abbreviations

BC
Breast cancer
BMI
Body mass index
BSE
Breast self-examination
CBE
Clinical breast examination
OCP
Oral contraceptive pill
SES
Socioeconomic status
WHO
World Health Organization

Declarations

Ethics approval and consent to participate

The study was approved by the Rehman Medical Institute Research Ethics Committee, Peshawar, Pakistan (Approval No: [RMI/RMI-REC/Article Approval/133]). Written informed consent was obtained from all participants prior to enrolment in the study. All procedures were performed in accordance with the ethical principles of the Declaration of Helsinki and its subsequent amendments.

Consent for publication

Not applicable.

Availability of data and materials

All data generated or analyzed during this study are included in this article.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Khadija Bilal conceived and designed the study, collected the data, performed the literature review, interpreted the findings, and drafted the manuscript. Sadia Nazeem supervised the study, contributed to the study design, critically revised the manuscript for important intellectual content, and approved the final version. Wasif Farman contributed to the study methodology, data interpretation, and critical revision of the manuscript. Muhammad Kamran assisted with data interpretation and critically reviewed the manuscript. Muhammad Usman Sami performed the statistical analysis, interpreted the results, contributed to manuscript writing and editing, and critically revised the manuscript. All authors read and approved the final manuscript.

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