RESEARCH ARTICLE

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# Factors Associated with Health-Related Quality of Life Among Breast Cancer Survivors in Saudi Arabia: Cross-Sectional Study

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## Abstract

**Background:** Assessment of health-related quality of life (HRQOL) is a major concern among breast cancer survivors. Little is known about HRQO and its determinants in Saudi women with breast cancer (BC). This study aimed to describe the HRQOL of Saudi women with breast cancer and the association between HRQO and sociodemographic and clinical variables. **Methods:** This cross-sectional study involved 147 BC participants who completed the 36-item Short Form Health Survey (SF-36). Multivariable linear logistic regression analysis was conducted to determine factors associated with HRQOL. **Results:** For the physical component scale, general health scored the highest (55.41±17.99) while, role physical function scored the lowest (48.61±22.51). The mean scores in the mental component were higher for social function (56.91±20.84), while the lowest score was observed for energy and vitality (49.62±20.84). Significant differences were observed in many SF-36 domains across the sociodemographic and clinical variables. Older age, having had a mastectomy as well as comorbid conditions, and receiving chemotherapy and hormonal therapy were associated with decreased HRQOL. However, being physically active, employed, and having more education were associated with higher HRQOL. **Conclusion:** HRQOL is generally poor among breast cancer survivors in Saudi Arabia, depending on a variety of factors. These findings highlight the need for routine QOL assessment. Furthermore, recognizing these predictors may play a key role in maximizing HRQOL for breast cancer participants.

**Keywords:** Breast cancer- quality of life- Saudi women

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## Introduction

Breast cancer (BC) is the second most common cancer in women worldwide [1] and accounts for 28.1% of all cancers in Saudi females. The survival rates are expected to rise due to factors such as population growth, aging, and advances in early detection and treatment of cancer [2].

Patients living with cancer may experience negative effects on their health-related quality of life (HRQOL) [3, 4]. Researchers have indicated that HRQOL can be used in clinical research and practice as an appropriate endpoint because it provides insight into the impact and severity of a disease, facilitates evaluation of clinical interventions, understands patients' specific needs, facilitates doctor-patient communication, and improves decision-making [5, 6].

The concept of health-related quality of life encompasses physical, mental, social, and functional wellbeing. In chronic diseases such as cancer, quality of life involves not only physical health, but also a sense of wellbeing which encompasses their ability to do everyday tasks that are influenced by cancer and its treatment [7]. HRQOL has been extensively studied in western countries and found that BC survivors reported poor HRQOL with reduced physical and emotional function, and experienced major psychological symptoms relative to those without a cancer history. In addition, thesis studies have identified that age, socioeconomic status, disease stage and types of surgery, psychological factors and fear of recurrence may influence perceptions of HRQOL [8-11].

Unfortunately, findings from the western population cannot be generalized to breast cancer women in Arab populations due to diversity in ethnicity, lifestyle, and self-perception of the disease, social constraints, and other religious and cultural issues [12-15]. Furthermore, few studies have been done on HRQOL and its predictors

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among BC survivors in the Eastern Mediterranean region and reported poor to moderate HRQOL [13-15]. Indeed, these studies detected different factors, such as sociodemographic factors, cancer-related factors, and behavioral and psychosocial factors, that can alter HRQOL and produce variable results. However, these findings have limited utility as few studies were from Arab countries. In addition, these studies differ substantially in their conclusions, and HRQOL scores vary significantly from low to high among BC survivors living in different countries [13-15, 16-20]. These discrepancies suggest that more attention to HRQOL is required by healthcare providers and the health-care system. This research is intended to fill a research gap in such a sensitive and significant area as HRQOL for cancer patients. Therefore, the aim of this study was to evaluate HRQOL in Saudi women with breast cancer, and to explore the association of QoL with sociodemographic and clinical variables.

## Materials and Methods

### *Study design and Participants*

A cross-sectional study was conducted among BC participants who attended follow-up appointments at the Oncology Outpatient Clinic, King Faisal Specialized Hospital and Research Center, Riyadh, Saudi Arabia from March – September 2022.

A convenience sample of BC participants who attended regular follow-up visits was recruited and screened for eligibility according to the following criteria: women aged ≥ 21 years old, having been diagnosed with breast cancer at least 1 year before data collection, and were willing to participate, with adequate Arabic reading and communication skills. Participants were excluded if they had upper limb lymphedema (a limb difference ≥ 10% of hers), cancer recurrence, pregnancy, neurological and psychiatric disorders, or dementia. The study protocol was reviewed and approved by the IRBs at King Faisal Specialist Hospital & Research Center (RAC#2211194), and all participants gave informed consent.

The sample size was calculated using the G*Power software program [21]. A sample size (n=97) was estimated based on α=0.05, power of 0.80 and expected correlation coefficient of 0.28 for bivariate correlation. Considering multiple regression analysis of medium effect size 0.15, alpha of .05, and a power of 0.8, with 16 independent variables, the estimated sample was approximately 143 participants.

### *Data collection and outcome measure*

The investigator interviewed all potential participants, explained the purpose of the study, and decided their eligibility for inclusion. Then, each participant was asked to respond to a survey questionnaire containing sociodemographic and clinical variables based on prior knowledge of risk factors for HRQOL. The questionnaire consisted of two sections. The first section included questions on demographic variables such as age (< 50years, and ≥50 years), marital status [married and unmarried (widowed, divorced, or never married)], education level (high school and below, college or more), and employment status (employed, unemployed), number of children, and menopausal history. Each participant was also asked to answer a questionnaire (yes/no) about their level of physical activity (defined as spending 0.5 hours of moderate to vigorous physical activity at least 5 times/week) according to Cancer Society physical activity guidelines for cancer survivors [22]. Clinical data were retrieved from medical records and included cancer stage, which was classified into stage I/II and stage III/IV. Years since cancer diagnosis were categorized as less than or equal to 5 years, and more than 5 years, treatment received (surgery, radiotherapy hormonal therapy and chemotherapy), family history of cancer. Co-morbid health conditions were reported and then categorized for each participant as (No/Yes).

### *Measurement of health-related quality of life*

HRQOL was measured using the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36). Coons et al. [23] translated the instrument into Arabic and reported satisfactory psychometric results (highest α = 0.94 for the PF domain; lowest α=0.71 for the general health domain). Furthermore, the scale demonstrated adequate psychometric properties among breast cancer survivors [15, 17]. The SF-36 incorporate 36 items to assess eight domains of health status: Physical functioning (PF, 10 items), Role physical (RP, 4 items), Bodily pain (BP, 2 items), General health (GH, 5 items), Vitality (VT, 4 items), Social functioning (SF, 2 items), Role emotional (RE, 3 items) and Mental health (MH, 5 items). For each domain, item scores were coded, summed, and transformed into a scale from 0 (poorest health status) to 100 (optimal health) using the standard SF-36 scoring algorithms [24]. These scales may be combined to form two components: the Physical Component Summary (PCS) and the Mental Component Summary (MCS). The total score for each subscale was recorded and computed according to the SF-36 health survey manual and interpretation guide [24]. Participants completed the questionnaires independently, with proper guidance only provided by the investigator when the participants asked questions.

### *Statistical analysis*

The Statistical Package for the Social Sciences (SPSS) version 26.0 for Windows (IBM, SPSS Inc., Cary, NC, USA) was used for data entry and analysis. The entire data was double-checked in comparison with the completed questionnaires to ensure its accuracy. The sociodemographic and clinical variables and HRQOL of BC participants assessed by the Sf-36 are summarized using descriptive statistics. Continuous variables (e.g. age, time since diagnosis and domains of SF-36) were presented in terms of mean and standard deviation, while categorical variables such as (marital status, educational level, employment status, number of children, menstrual status, physical activity, cancer stage, and interventions, number of comorbidity) were presented as frequencies and percentages.

An independent t-test and Mann–Whitney U test was performed to detect differences in HRQOL scores according to sociodemographic and clinical variables.

Pearson's or Spearman's correlation analysis was used to examine the association between independent variables (sociodemographic, and clinical characteristics) and dependent variables (HRQO). Thereafter, a multivariate regression model was used to determine predictors (factors) that influence HRQOL domains in BC participants. Variables with a p value ≤0.2 on correlation analysis were included in the multivariate regression model [25]. Statistical significance was considered if p< 0.05 (two-sided).

## Results

### *Participants' sociodemographic and clinical characteristics*

A total of 173 BC participants were enrolled. 26 were excluded due to disease recurrence; 17 had incomplete questionnaires, and 9 didn't complete them correctly. In the final analysis, 147 participants were included.

Table 1 summarizes the sociodemographic and clinical characteristics of the participants. Mean age was 50.67 ± 10.42 years (range 27 to 75 years), with 61% under 50 years. Most were married (65.30%) and had two or more children (68%). More than half of the participants (51.70%) completed college or above and were employed (56.50%). The mean body mass index was 30.42±4.80 Kg/cm$^2$, and more than half of the participants were obese (54.40%), while less than half (42.90%) were engaged in regular physical activity. Most of the BC participants (61.90%) were in stage I or II. Mean time from diagnosis was 4.54 ± 2.80 years (ranging from 12-96 months). Almost 57.80% of participants had ≤5 years after being diagnosed with BC. Over half (55.80%) of the participants had undergone breast-conserving surgery. The proportions of participants who received chemotherapy, radiotherapy, and hormone therapy were 61.90%, 72.80%, and 52.40%, respectively. 39.50% of the participants had more than one comorbidity and the majority had a negative family history of cancer (77.60%).

### *Quality of life according to sociodemographic and clinical characteristics*

Tables 2 shows the mean ± SD scores of the SF-36 domains, PCS and MCS by sociodemographic. The average PCS score was 50.91±11.37, with general health reporting the highest score (55.41±17.99), and role physical reporting the lowest score (48.61±22.51). In the MCS, the average score was 52.87±12.98, with social functioning having the highest score (56.91±20.84) and vitality having the lowest score (49.62±19.04). Younger participants (≤ 50 years) had significantly better PF scores (p = 0.04), RP (p = 0.007) and PCS (p = 0.001). Meanwhile, older BC participants (> 50 years) had a significantly greater SF score (p = 0.05). Participants who were unmarried scored higher in all SF-36 domains compared to married women, with only significant differences observed in PF (P = 0.05), VT (P = 0.005), MH (P = 0.006), and MCS (p = 0.01).

HRQOL was also dependent on the education level, where participants attending college or above were more likely to have more significant scores in PCS

Table 1. Sociodemographic and Clinical Characteristics of the Participants (n=147)

| Variables | N (%) |
|---|---|
| Age (yrs.) Mean ±SD (Range) | 50.67 ±10.42 (Range: 27-75) |
| Age < 50yeras | 89 (60.50) |
| Age > 50yeras | 58 (39.50) |
| Current marital status n (%) | |
| Married | 96 (65.30) |
| Unmarried [a] | 51 (34.70) |
| Educational level n (%) | |
| High school or below | 71 (48.30) |
| College or above | 76 (51.70) |
| Employment status n (%) | |
| Yes | 83 (56.50) |
| No | 64 (43.50) |
| BMI (kg/cm2) Mean ±SD | |
| Obese | 80 (54.40) |
| Non-obese | 67 (45.60) |
| Number of children | |
| ≤ 2 children | 47 (32) |
| >2 children | 100 (68) |
| Menstrual status n (%) | |
| No | 88 (59.90) |
| Yes | 59 (40.10) |
| Physical activity n (%) | |
| Yes | 63 (42.90) |
| No | 84 (57.10) |
| Family history of cancer | |
| Yes | 33 (22.40) |
| No | 114 (77.60) |
| Time since diagnosis (yrs.) Mean ±SD (range) | 4.54±2.80 (rang; 12-96 months) |
| ≤5yrs | 85 (57.8.20) |
| >5yrs | 62 (42.20) |
| Cancer Stage | |
| I/I | 91 (61.90) |
| III/IV | 56 (38.10) |
| Surgical intervention | |
| Mastectomy | 65 (44.20) |
| BC | 82 (55.80) |
| Radiotherapy | |
| Yes | 107 (72.80) |
| No | 40 (27.80) |
| Chemotherapy | |
| Yes | 91 (61.90) |
| No | 56 (38.10) |
| Hormonal therapy | |
| Yes | 77 (52.40) |
| No | 70 (47.60) |
| Co-morbidity n (%) | |
| Yes | 58 (39.50) |
| No | 89 (60.50) |

BMI, Body mass index; SD, standard deviation, [a]; Unmarried includes widowed, divorced, single, Scores in mean ± standard deviation or frequency (percentage

Table 2. SF-36 Scores by Sociodemographic Characteristics (n = 147)

| | | PF | RP | BP | GH | RE | VT | MH | SF | PCS | MCS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | N (%) | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD |
| Total participants | 147 | 50.14±19.81 | 48.61±22.51 | 49.44±18.65 | 55.41±17.99 | 54.32±20.79 | 49.62±19.02 | 50.61±18.04 | 56.91±20.84 | 50.91±11.37 | 52.87±12.98 |
| Age (yrs.) | | | | | | | | | | | |
| Age < 50yeras | 89 (60.50) | 52.73±19.57 | 56.32±19.52 | 49.16±19.37 | 55.81±18.70 | 53.87±18.57 | 50.38±18.57 | 50.56±17.89 | 54.28±22.66 | 53.51±10.96 | 52.27±13.51 |
| Age > 50yeras | 58 (39.50) | 46.17±19.67 | 36.78±21.79 | 49.87±17.63 | 54.80±16.99 | 55.05±23.96 | 48.44±20.28 | 50.67±18.42 | 60.94±17.11 | 48.91±10.90 | 53.77±12.27 |
| P value | | 0.04* | 0.007** | 0.82 | 0.74 | 0.74 | 0.55 | 0.97 | 0.05** | 0.001* | 0.49 |
| Marital status | | | | | | | | | | | |
| Unmarried | 51 (34.70) | 54.42±20.07 | 47.95±24.67 | 49.76±18.17 | 57.40±1921 | 56.04±24.09 | 55.67±19.62 | 58.59±16.86 | 55.61±20.91 | 52.37±11.41 | 56.48±12.22 |
| Married | 96 (65.30) | 47.86±19.38 | 48.97±21.41 | 49.27±19.05 | 54.35±17.32 | 53.41±18.88 | 46.40±17 .97 | 46.36±17.26 | 57.60±20.89 | 50.11±11.34 | 50.94±13.03 |
| p-value | | 0.05* | 0.79 | 0.88 | 0.33 | 0.47 | 0.005** | 0.006** | 0.58 | 0.25 | 0.01 |
| Educational level | | | | | | | | | | | |
| High school/below | 71 (48.30) | 49.17±16.46 | 42.41±21.39 | 49.14±16.66 | 51.85±16.72 | 50.62±19.63 | 44.95±17.77 | 43.99±13.29 | 56.06±1863 | 48.15±9.67 | 48.91±9.29 |
| College or above | 76 (51.70) | 51.04±22.56 | 54.41±22.12 | 49.72±20.44 | 58.73±18.60 | 57.77±21.37 | 53.97±19.22 | 56.79±19.71 | 57.70±22.81 | 53.48±12.28 | 56.56±14.84 |
| p-value | | 0.57 | 0.001** | 0.85 | 0.03* | 0.03** | 0.004** | 0.001** | 0.64 | 0.004* | 0.001* |
| Employment status | | | | | | | | | | | |
| Yes | 83 (56.50) | 53.24±20.60 | 50.05±22.82 | 51.67±20.30 | 58.42±18.72 | 59.46±22.41 | 55.89±19.58 | 5544±18.52 | 58.17±21.93 | 53.34±11.79 | 57.24±13.67 |
| No | 64 (43.50) | 46.12±18.11 | 46.75±22.15 | 46.54±15.95 | 51.51±16.33 | 47.65±16.37 | 41.48±14.83 | 44.34±15.39 | 55.27±19.40 | 47.74±10.05 | 47.18±9.48 |
| p-value | | 0.03 | 0.38 | 0.09 | 0.02* | 0.001** | 0.001** | 0.001 | 0.4 | 0.003* | 0.001* |
| BMI (kg/cm2) | | | | | | | | | | | |
| Non-obese | 67 (45.60) | 49.69±19.37 | 50.52±20.28 | 52.49±19.13 | 55.65±16.81 | 57.07±21.81 | 51.67±17.20 | 52.18±18.95 | 59.83±20.77 | 52.19±11.68 | 55.18±12.79 |
| Obese | 80 (54.40) | 50.52±20.28 | 46.91±23.31 | 46.89±17.96 | 55.21±19.03 | 52.03±19.74 | 47.89±20.36 | 49.29±17.25 | 54.46±20.72 | 49.89±11.56 | 50.92±12.75 |
| p-value | | 0.81 | 0.31 | 0.07 | 0.89 | 0.14 | 0.23 | 0.36 | 0.12 | 0.23 | 0.07* |
| Number of children | | | | | | | | | | | |
| ≤ 2 children | 47 (32) | 51.56±16.97 | 48.69±23.19 | 53.05±15.67 | 52.92±16.01 | 52.73±18.17 | 50.21±17.80 | 48.36±16.50 | 56.78±22.84 | 51.56±10.41 | 52.03±12.05 |
| >2 children | 100 (68) | 49.47±21.05 | 48.58±22.31 | 47.74±19.74 | 56.58±18.82 | 55.07±21.96 | 49.34±19.64 | 51.67±18.70 | 56.97±19.96 | 50.59±11.84 | 53.26±13.44 |
| p-value | | 0.55 | 0.97 | 0.17 | 0.25 | 0.56 | 0.79 | 0.32 | 0.95 | 0.63 | 0.59 |
| Menstrual status | | | | | | | | | | | |
| Premenopausal | 88 (59.90) | 50.09±18.33 | 52.60±21.06 | 47.82±18.19 | 51.86±19.21 | 51.04±17.07 | 48.74±18.10 | 47.06±15.14 | 54.94±21.69 | 50.96±10.03 | 50.45±11.57 |
| Postmenopausal | 59 (40.10) | 50.21±21.99 | 42.67±23.46 | 51.86±19.21 | 53.36±16.01 | 59.20±24.71 | 50.93±20.39 | 55.90±20.67 | 59.85±19.32 | 50.80±13.23 | 56.47±14.21 |
| p-value | | 0.97 | 0.008** | 0.19 | 0.09 | 0.01** | 0.49 | 0.003 | 0.15 | 0.93 | 0.008* |
| Physical activities | | | | | | | | | | | |
| Active | 63 (42.90) | 54.01±18.43 | 50.89±22.68 | 50.77±19.73 | 60.85±18.00 | 58.61±22.88 | 54.22±18.50 | 54.69±19.30 | 61.30±21.66 | 54.14±11.34 | 57.21±13.48 |
| Inactive | 84 (57.10) | 47.23±20.41 | 46.90±22.37 | 48.44±17.84 | 51.33±16.98 | 51.10±18.57 | 46.16±18.76 | 47.54±16.49 | 53.61±19.70 | 48.49±10.85 | 49.61±11.66 |
| p-value | | 0.04* | 0.29 | 0.47 | 0.001* | 0.03** | 0.01** | 0.01** | 0.02** | 0.003* | 0.001* |

PF, physical functioning; RP, role physical; BP, bodily pain; GH, general health; RE, role emotional; SF, social functioning; MH, mental health; *, statistical significant ($p < 0.05$) using independent t-test; **, statistical significant ($p<0.05$) using Mann–Whitney U test (p=0.004), RP (p = 0.001), GH (p = 0.03), as well as in MCS (p=0.001), RE (p = 0.03), VT (p = 0.004), and MH (p = 0.001) in comparison to those with a lower education (high school and below). Employed participants demonstrated significantly higher scores in PCS (p=0.003), PF (p=0.03), GH (p=0.02), as well as in MCS (p=0.001), RE (p=0.001), VT (p=0.001), and MH (p = 0.001) compared to the unemployed.

Participants engaged in regular physical activity had higher scores in PCS (p=0.003) and MCS (p=0.001). Physical activity had a significant role in PF (p = 0.04), GH (p = 0.001), RE (p=0.03), VT (p = 0.01), MH (p = 0.01), and SF (p=0.02). No significant differences in the SF-36 domain scores were found with respect to the number of children (p > 0.05) and body mass index (p > 0.05). While postmenopausal participants had significantly increased MCS (p=0.008), RE scores (P=0.01), and MH (P=0.003), and lower RP scores (P= <0.008) relative to premenopausal participants.

Tables 3 shows the mean ± SD scores of the SF-36 domains, PCS and MCS by clinical characteristics. A significant difference was found between the participants with short duration since the cancer diagnosis (< 5 years) and the participants with long duration (> 5 years) for all SF-36 domains (Range, p = 0.04-0.001), and MCS (p=0.001), except for BP (p =0.11). Meanwhile, BC participants with an advanced cancer stage (III/IV) scored lower in PF (p=0.006), BP (p=0.01), GH (p=0.04), and PCS (p=0.003) and MH (p=0.004), and SF (p=0.05) and MCS (p=0.01) than those in early stages (I/II). Participants after radical mastectomy had lower mean scores in PF (p=0.008), GH (p=<0.04), PCS (0.001), RE (p=0.03) and MCS (p=0.03) compared to those who had breast-conserving surgery. Results showed a significant impact of chemotherapy and hormonal therapy on several SF-36 domains. Participants who underwent chemotherapy had reduced PF (P=0.001), RE (P=0.01), MH (P=0.001), PCS (p=0.05) and MCS (p=0.001) scores. Meanwhile, participants who underwent hormonal therapy reported lower BP scores (P=0.04), and higher MH scores (P=0.003). No significant difference was found regarding radiotherapy (p > 0.05). The family history of cancer was related to Vitality and Mental health. Participants with a positive family history of cancer had lower mean scores in VT (p = 0.01) and MCS (0.01) compared to those who had a negative family history. In addition, participants with multiple comorbidities reported significantly lower scores in RP (p = 0.03) and SF (p = 0.01) than those without comorbidities.

*Predictors of quality of life among breast cancer survivors*

Table 4 represents the results of association between independent variables (sociodemographic and clinical variables) and dependent variables (the scores for each domain of the SF-36). The regression model confirmed that chemotherapy, age, cancer stage, cancer duration, and surgical interventions were significantly associated with physical function (p=0.001) and explained 30% of the variance in PF (R2 = 0.30). Participants with advanced stage cancer III/IV (β = -0.18, p = 0.01), treated with chemotherapy (β = 0.36), and underwent radical mastectomy (β = 0.14, p = 0.04), were associated significantly with lower physical function scores. Meanwhile, young participants (< 50 years) (β = -0.28, P =0.001), and since cancer diagnosis (β = 0.19, P =0.01) were statistically significantly correlated with better physical function scores.

Age, education, and cancer duration were significant predictors of role physical (p < 0.001) and explained 24 % of the variance in role physical score (R2 = 0.24). The most remarkable predictors of poor role physical were old age (β = -0.34, p = 0.001) and short duration (< 5years) since cancer diagnosis (β = − 0.15, p = 0.04). Meanwhile, education level (college and above) was significantly associated with higher physical cores (β = 0.21, p = 0.005).

The results showed that cancer stage, hormonal therapy and obesity were significant predictors for bodily pain (p < 0.001) and it explained 9 % of the variance in bodily pain score (R2 = 0.09). As, participants with advanced stage cancer III/IV (β = -0.18, p = 0.02), and treated with hormonal therapy (β = -0.19, p = 0.02), and obese (β = -0.17, p = 0.02) exhibited significantly lower bodily pain scores. Cancer duration and physical activity explained 12% of the variance of general health (R2=0.12), whereby better general health scores were associated with long duration since cancer diagnosis (> 5years) (β = 0.24, p = 0.002), and engagement in regular physical activity (β = -0.24, p = 0.001).

The multiple linear regression model confirmed that employment status and chemotherapy were significant (p<0.001) determinants of role emotional and explained 11% of the variance in role emotional ($R^2$ = 0.11). Employed participants were associated with better role emotional (β = -0.27, p = 0.001). Chemotherapy is associated with a decrease in role emotional (β =0.19, p = 0.02). Participants who were unmarried (β = -0.17, p = 0.02), employed (β = -0.34, p = 0.001) were associated with increased vitality. These predictors explained 20% of the variance in vitality (R2=0.20). The regression model confirmed that educational level, marital status, cancer stage, chemotherapy, and hormonal therapy were statistically significant associated with mental health (p<0.001) and explained 32% of the variance in the mental health domain (R2 = 0.32). Participants in advanced stage cancer III/IV (β = -0.17, p = 0.01), treated with chemotherapy (β = 0.19, p = 0.01) and hormonal therapy (β = -0.15, p = 0.03) were associated with worse mental health. Meanwhile, college education and above (β = 0.29, p = 0.003), and unmarried (β = -0.24, p = 0.001) BC participants were statistically significantly reported better mental health scores.

Cancer duration and comorbidities explained 11% of the variance in social function (R2 = 0.11), whereby longer duration since cancer diagnosis (> 5 years) was associated with better social function scores (β = 0.26, p = 0.001). In contrast presence of comorbidities was associated with worst social function (β = -0.21, p = 0.008). The results confirmed that engagement in regular physical activity (β = -0.23, p = 0.002, and β = -0.19, p = 0.01) were the most significant factors positively affecting PCS and MCS, respectively. Moreover, younger BC participants (< 50years) (β = -0.33, p = 0.007) and employed (β = -0.30,

Table 3. SF-36 Scores by Clinical Characteristics (n = 147)

|  | N (%) | PF<br>Mean ± SD | RP<br>Mean ± SD | BP<br>Mean ± SD | GH<br>Mean ± SD | RE<br>Mean ± SD | VT<br>Mean ± SD | MH<br>Mean ± SD | SF<br>Mean ± SD | PCS<br>Mean ± SD | MCS<br>Mean ± SD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| History of cancer |  |  |  |  |  |  |  |  |  |  |  |
| Yes | 33 (22.40) | 45.41±19.47 | 54.16±19.40 | 49.60±20.64 | 53.18±14.24 | 49.84±16.46 | 42.83±19.20 | 48.28±13.59 | 51.39±21.14 | 50.59±10.65 | 48.08±9.49 |
| No | 114 (77.60) | 51.51±19.79 | 47.01±23.17 | 49.39±18.13 | 56.06±18.95 | 55.62±21.78 | 51.58±18.59 | 51.29±19.13 | 58.51±20.58 | 50.99±11.62 | 54.25±13.56 |
| p-value |  | 0.12 | 0.11 | 0.95 | 0.42 | 0.16 | 0.01** | 0.39 | 0.09 | 0.85 | 0.01* |
| Cancer duration |  |  |  |  |  |  |  |  |  |  |  |
| ≤5yrs | 87 (59.20) | 46.17±17.00 | 42.19±23.93 | 47.39±19.38 | 51.36±15.25 | 51.44±17.43 | 46.24±18.22 | 47.41±15.60 | 52.36±20.72 | 49.55±8.88 | 49.37±11.74 |
| >5yrs | 60 (40.80) | 55.58±22.11 | 53.30±20.31 | 52.29±16.75 | 60.96±20.01 | 58.27±24.27 | 54.24±19.25 | 54.99±20.24 | 63.15±19.52 | 52.75±14.03 | 57.67±13.17 |
| p-value |  | 0.004* | 0.003** | 0.11 | 0.001* | 0.04** | 0.01** | 0.01** | 0.002** | 0.09 | 0.001* |
| Cancer Stage |  |  |  |  |  |  |  |  |  |  |  |
| I/II | 92 (62.60) | 53.60±20.70 | 48.92±22.88 | 52.25±19.82 | 57.60±19.44 | 55.13±22.28 | 50.98±19.88 | 53.95±18.92 | 59.44±21.83 | 53.09±12.04 | 54.87±13.90 |
| III/IV | 55 (37.40) | 44.51±16.98 | 48.12±22.11 | 44.87±15.69 | 51.85±14.85 | 53.59±18.24 | 47.40±17.47 | 45.17±15.14 | 52.79±20.11 | 47.34±9.25 | 49.59±10.67 |
| p-value |  | 0.006* | 0.87 | 0.01** | 0.04* | 0.59 | 0.27 | 0.004** | 0.05** | 0.003* | 0.01* |
| Surgery types |  |  |  |  |  |  |  |  |  |  |  |
| Mastectomy | 65 (44.20) | 45.31±20.35 | 48.11±24.11 | 47.91±18.73 | 52.05±17346 | 50.31±18.61 | 46.99±16.51 | 48.71±17.45 | 55.27±20.64 | 48.35±10.64 | 50.33±12.34 |
| BC | 82 (55.80) | 53.96±18.61 | 49.02±21.30 | 50.65±18.61 | 58.07±18.14 | 57.50±21.98 | 51.70±20.65 | 52.11±18.46 | 58.21±21.04 | 52.92±11.56 | 54.87±13.28 |
| p-value |  | 0.0088 | 0.81 | 0.37 | 0.04* | 0.03** | 0.13 | 0.25 | 0.39 | 0.01* | 0.03* |
| RT |  |  |  |  |  |  |  |  |  |  |  |
| Yes | 107 (72.80) | 50.08±19.79 | 48.62±22.54 | 48.02±18.32 | 54.40±18.49 | 54.24±20.99 | 49.65±19.69 | 51.34±17.38 | 57.29±20.67 | 50.28±11.74 | 53.13±13.07 |
| No | 40 (27.80) | 50.31±20.28 | 48.59±22.74 | 53.23±19.22 | 58.12±16.51 | 54.53±20.51 | 49.53±17.34 | 48.64±19.79 | 55.90±21.55 | 52.57±10.91 | 52.15±12.91 |
| p-value |  | 0.95 | 0.99 | 0.13 | 0.27 | 0.94 | 0.97 | 0.42 | 0.72 | 0.28 | 0.69 |
| CT |  |  |  |  |  |  |  |  |  |  |  |
| Yes | 91 (61.90) | 44.29±18.18 | 50.17±22.34 | 49.59±18.79 | 53.85±15.90 | 50.88±15.86 | 48.28±17.40 | 45.94±14.97 | 54.59±20.16 | 49.47±9.51 | 49.93±10.62 |
| No | 56 (38.10) | 59.65±18.76 | 46.08±22.76 | 49.20±18.57 | 57.94±20.86 | 59.99±26.18 | 51.78±21.37 | 58.18±20.06 | 60.67±21.57 | 53.22±13.67 | 57.64±15.07 |
| p-value |  | 0.001* | 0.28 | 0.9 | 0.18 | 0.01** | 0.28 | 0.001** | 0.08 | 0.05* | 0.001* |
| HT! |  |  |  |  |  |  |  |  |  |  |  |
| Yes | 77 (52.40) | 51.03±20.50 | 48.64±22.91 | 46.49±17.85 | 56.55±18.69 | 56.02±23.25 | 48.04±18.69 | 54.82±18.14 | 57.86±20.65 | 50.68±12.01 | 54.19±13.76 |
| No | 70 (47.60) | 49.16±19.11 | 48.59±23.23 | 52.69±19.09 | 54.15±17.24 | 52.45±17.67 | 51.35±19.35 | 45.96±16.86 | 55.86±21.57 | 51.15±10.73 | 51.41±12.01 |
| p-value |  | 0.57 | 0.99 | 0.04** | 0.42 | 0.3 | 0.29 | 0.003** | 0.56 | 0.8 | 0.19 |
| Co-morbidity |  |  |  |  |  |  |  |  |  |  |  |
| No | 89 (60.50) | 49.83±19.86 | 51.74±22.16 | 48.68±18.65 | 55.06±17.88 | 55.99±19.96 | 49.40±18.53 | 51.89±18.49 | 61.27±20.93 | 51.33±11.28 | 54.17±12.87 |
| Yes | 58 (39.50) | 50.67±19.89 | 43.82±22.40 | 50.61±18.75 | 55.94±18.31 | 51.75±21.94 | 49.94±19.90 | 50.00±17.47 | 51.75±19.80 | 50.25±11.58 | 50.86±13.02 |
| p-value |  | 0.81 | 0.003** | 0.54 | 0.77 | 0.28 | 0.86 | 0.74 | 0.01** | 0.57 | 0.13 |

PF, physical functioning; RP, role physical; BP, bodily pain; GH, general health; RE, role emotional; SF, social functioning; MH, mental health; *, statistical significant ($p < 0.05$) using independent t-test; **, statistical significant ($p<0.05$) using Mann–Whitney U test

Table 4. Multiple Linear Regression for QoL Predicators in Breast Cancer Participants* (n=147).

| Variable | PF | | | RP | | | BP | | | GH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | ß | 95% CI | B | ß | 95% CI | B | ß | 95% CI | B | ß | 95% CI |
| Age | -11.63 | -0.28 | -17.53 to -5.73 | -15.97 | -0.34 | -22.94 to -9.05 | | | | | | |
| Education | | | | 4.78 | 0.21 | 1.50 to 8.06 | | | | | | |
| BMI (kg/m$^2$) | | | | | | | -6.91 | -0.16 | -12.2 to -0.29 | | | |
| Physical activity | | | | | | | | | | -8.69 | -0.24 | -14.29 to -3.08 |
| Cancer stage | -7.26 | 0.18 | -13.04 to -1.48 | | | | -6.98 | -0.18 | -13.00 to -0.94 | | | |
| Time since diagnosis | 7.39 | 0.19 | 1.42 to 13.37 | -7.11 | -0.15 | -13.93 to -0.31 | | | | 8.77 | 0.24 | 3.15 to 14.38 |
| Surgical intervention | 5.86 | 0.14 | 0.22 to 11.50 | | | | | | | | | |
| Chemotherapy | 14.76 | 0.36 | 8.89 to 20.64 | | | | | | | | | |
| Hormonal therapy | | | | | | | 6.91 | 0.18 | 0.99 to 12.83 | | | |
| number of predictors | 5 | | | 3 | | | 3 | | | 2 | | |
| R$^2$ | 0.3 | | | 0.24 | | | 0.9 | | | 0.12 | | |
| Adjusted R$^2$ | 30% | | | 24% | | | 9% | | | 12% | | |
| F $_{(df)}$ sig | 12.06$_{(5,141)}$ $p<0.001$ | | | 15.32$_{(3,142)}$ $p<0.001$ | | | 4.78 $_{(3,142)}$ $p<0.001$ | | | 10.46$_{(2,144)}$ $p<0.001$ | | |

| Variable | RE | | | Energy /vitality | | | MH | | | SF | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | ß | 95% CI | B | ß | 95% CI | B | ß | 95% CI | B | ß | 95% CI |
| Marital status | -6.9 | -0.17 | -12.85 to -0.94 | | | | -9.01 | -0.23 | -14.39 to -3.63 | | | |
| Education | | | | | | | 5.36 | 0.29 | 2.86 to 7.86 | | | |
| Employment status | -13.06 | -0.34 | -18.78 to -7.34 | -10.72 | -0.25 | -16.54 to -4.90 | | | | | | |
| Family history | 7.53 | 0.16 | 0.83- to 14.25 | | | | | | | | | |
| Cancer stage | | | | | | | -6.35 | -0.17 | -11.48 to -1.21 | | | |
| Time since diagnosis | | | | 9.89 | 0.25 | 4.04 to 15.61 | | | | 11.17 | 0.26 | 4.63 to 17.71 |
| Chemotherapy | | | | | | | 6.94 | 0.18 | 1.52 to 12.23 | | | |
| Hormonal therapy | | | | 9.74 | 0.24 | 3.99 to 15.56 | -5.54 | -0.15 | -10.65 to -0.43 | | | |
| Comorbidity | | | | | | | | | | -9.01 | -0.21 | -15.62 to -2.40 |
| number of predictors | 3 | | | 3 | | | 4 | | | 2 | | |
| R$^2$ | 0.2 | | | 0.19, | | | 0.23 | | | 0.11 | | |
| Adjusted R$^2$ | 20% | | | 19% | | | 23% | | | 11% | | |
| F $_{(df)}$ sig | 11.99 $_{(3,143)}$ $p<0.001$ | | | 10.96 $_{(3,143)}$ $p<0.001$ | | | 13.50 $_{(5,141)}$ $p<0.001$ | | | 8.95 $_{(2,144)}$ $p<0.001$ | | |

*Listed are only the predictors for each domain in stepwise selection method, Ref; Reference, PF, physical functioning; RP, role physical; BP, bodily pain; GH, general health; B, represents the partial regression coefficient; β, standardized beta; F-value, test value of overall significance of the linear regression model; R$^2$, proportion of variance explained.

p = 0.001) were the most significant factors positively affecting PCS, and MCS, respectively. In contrast, advanced cancer stage (β = -0.24, p = 0.001), along with chemotherapy (β = 0.19, p = 0.01 and β = 0.20, p = 0.006) significantly reduced PCS, and MCs, respectively.

## Discussion

Health-related quality of life is considered a key assessment for cancer patients, and it should be complementary to medical and rehabilitation procedures. In the current study, we analyzed the association between sociodemographic and clinical variables with HRQO using Sf-36 in BC participants. Our results confirmed that Saudi women with breast cancer demonstrated poor HRQOL status with minimum average values of 48.61 and 50.14 for role physical and physical function, respectively, and maximum average values of 56.61 and 55.41 for social function and general health, respectively. As compared to our findings, studies from Saudi Arabia reported lower to moderate HRQOL scores among Saudi women with breast cancer [16-20]. Similarly, our findings are in line with previous studies from Bahrain (26), the Eastern Mediterranean region [13], and Asia [4]. However, the scores from our study were lower than results from the United States [27], United Kingdom [28], and Brazil [29]. The observed variability in HRQOL scores across these studies could be attributed to different study populations, the dynamic nature and multidimensional aspect of HROLQ, time elapsed since diagnosis, health beliefs of the women in the respective studies, and different tools used to measure HRQOL [4, 13; 16-20, 27]. Our results confirmed that younger age, education (college and above), unmarried, employed and participation in physical activity, as well as longer duration were all associated with better HRQOL. In contrast, older age, advanced cancer stage, radical mastectomy, obesity, comorbidity, and adjuvant therapy were associated with poor HRQOL. These findings highlight the importance of managing morbidity and obesity and promoting healthy behavior, such as participation in regular physical exercise for cancer survivors.

In general, younger women (< 50 years) experience better QOL in all SF-36 domains PCS, and MCs, but limitations were observed in social functioning, which is consistent with prior findings [17, 26, 29-31]. On the other hand, some studies suggest that older BC survivors have a better quality of life than younger ones [32- 34].

According to our results, QOL in breast cancer patients was negatively affected by patient age. This might be due to normal physiological changes associated with aging that adversely affect physical function [35, 36]. Furthermore, elderly women discourage physical activity [16-18]. Age-related differences in social functioning may result from younger patients experiencing increased psychological shock, cancer-related depression, anxiety, and stress and possessing fewer coping strategies [37].

In the current study, unmarried women reported higher HRQOL scores compared with married women. In addition, postmenopausal BC women had higher HRQOL scores on RE, MH, and lower RP scores. These findings were like studies from Malaysia [33], and Bahrain (26). Former studies from Saudi Arabia reported conflicting results where Ahmed et al., reported no differences in QOL domains based on marital status [17]. Other studies found that married women performed better on physical function than unmarried women [18]. The discrepancy in HRQOL scores might be due to variations in the distribution of women according to menopausal status between the studies, and coping with the stress of infertility, especially for women in reproductive age, feelings of insecurity about their partner's acceptance along with fears that their spouse will leave them for another woman [18, 20, 26]. This implies the necessity of health education for husbands or family members of patients with breast cancer to improve QOL for these women.

The education level and employment status of BC participants have been found to have a positive influence on QOL as it relates to physical and mental health as well as emotional well-being and vitality, respectively. Similarly, previous studies found significantly higher HRQOL scores among BC participants who had higher school education [33; 38], and were employed [26,33, 38-40]. Unlike our results, Ahmed et al., found unemployment BC survivors reported positive QOL perceptions related to role emotional, emotional well-being, and social function, but lower perceptions regarding physical function. In addition, Al Zahrani et al. [18] BC women with a higher educational status have poor physical well-being scores [18]. The higher QOL reported in our study may be attributable to the explanation that a higher level of education leads to reduced emotional and physical distress thereby enhancing QOL. Higher education also proves to be a doorway to better social engagements and employment options, more knowledge and access to additional medical care, which again lead to better QOL [41,42].

In the present study, regular physical activity was associated with higher scores in physical function, general health, role emotional, vitality, mental health, and social function. It was an independent predictor of general health. Similar results have been demonstrated in other studies, where physical activity has positive effects on HRQOL [37, 43-45]. In this nationally representative sample (57%) of BC survivors did not meet physical activity guidelines. This suggests the need for interventions to improve healthy behaviors such as increasing physical activity. It appears that physical activity can alleviate side effects and lasting effects of cancer treatments such as fatigue, insomnia, sexual dysfunction, metabolic syndrome, bone loss, and cognitive dysfunction and improves functional capacity which leads to better QOL [27, 44].

This study confirmed that comorbidities and obesity negatively affected social functioning and bodily pain in BC participants, respectively, and were considered predictors of poor HRQOL. Similarly, previous studies demonstrated that BC participants with comorbidities and higher BMI have a significantly lower HRQOL in terms of physical functioning, bodily pain, and vitality [37, 46, 47]. Because of Comorbidities and higher BMI often lead to several complications and restrictions with respect to treatment and efficacy, which prove to be negatively affected HRQOL [47, 48].

According to our multiple regression results of the SF-36 domains and MCS, breast cancer patients are more likely to be influenced by long duration (>5 years) post diagnosis of BC. Similarly, several studies from Saudi Arabia and around the world found that patients with a disease duration of three years on average since diagnosis reported better overall quality of life and better psychological and social well-being [17; 26, 49]. In turn, studies conducted across the USA [50], Pakistan [51], reported the lowest QoL domain scores particularly in the physical, psychological, and general quality of life among BC survivors who had over 5 years of diagnosis.

Our results suggest the longer the duration, the more time BC survivors had to become familiar with the disease. They no longer felt shocked, fear, or despair as before. Furthermore, they are more interested in lifestyle modification, and more adaptable to their surroundings, leading to fewer impacts upon their social, emotional, and mental well-being compared to recently diagnosed individuals. Therefore, it is recommended that more attention should be paid to improving the QoL of newly diagnosed patients concerning their emotional and social well-being, so that they will have the motivation to overcome the disease, have more beliefs, and have a better quality of life.

We observed significant reductions in physical function, bodily pain, general health, mental health, and social function as well as PCS, and MCS among breast cancer survivors with advanced stage III/IV. However, the stage at diagnosis is negatively associated with physical function, bodily pain, mental health, and PCS. Similar findings have been reported elsewhere from Turkey [52], Bahrain (26), Saudi Arabia [17; 18], and Malaysia [33]. Furthermore, Ogce et al. [53] suggested that BC survivors with advanced stages of cancer have more difficulty coping strategies and experience greater distress than those with early-stage cancer.

Like other studies [33, 54, 55], the type of surgery significantly impacted QOL as measured by the SF-36, PF; this was the only QOL measure significantly impacted by the type of surgery. Moreover, the results of the current study confirmed a mixed relationship between adjuvant therapy and QOL. Women who received chemotherapy or hormonal therapy had lower QOL scores in physical function, role emotional, mental health, and bodily pain than women who did not receive either type of therapy, which is consistent with results from Saudi Arabia [17], Bahrain [26], Malaysia [33], USA [56], Netherlands [55] and Germany [54]. Most of the QOL scores of conservative surgery participants were associated with both better global quality of life and better physical, role physical and social functioning [33, 47, 55, 56]. Furthermore, our results, and the findings from previous studies [17; 52; 57] found poor QoL among survivors who received adjuvant therapy, suggest that the effects of adjuvant therapy persist for many years after the completion of chemotherapy [56]. Contrary to our finding, recent studies from Saudi Arabia [17], Poland [37] found that chemotherapy and radiotherapy were not a significant predictor of QoL in breast cancer participants. Furthermore, early work of Park et al., [32] found that complementary therapy was not a significant predictor of QoL in breast cancer patients.

The study was limited by its cross-sectional descriptive and purposive sampling, so we could only describe at a selected point of time, which restricted the generalizability of our findings to similar groups of breast cancer survivors. Furthermore, the sample size influenced the use of multiple regression. Therefore, more research with a larger sample size to better understand the QoL of patients with breast cancer at the national level is required.

The strengths of the present study include the use of standardized QOL measures (SF-36). However, combining it with a cancer-specific questionnaire and its breast module provides valuable information. In the current study, there was a high response rate with a well-defined group of cases arising from the underlying population, with a focus on BC women who had lived five years or more after diagnosis. In addition, because all women received care in the same health system, this study lacks the variability in treatment patterns that exists in the general population, thus differences in quality of life are less likely to be attributed to treatment-specific differences.

In conclusion, the results demonstrate that a wide range of factors affect the quality of life of breast cancer survivors. Identifying and addressing these factors may be critical for health care providers and women with breast cancer when attempting to understand and optimize long-term QOL.

## Author Contribution Statement

All authors made a significant contribution to the work reported, whether in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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### *Ethical Declaration*

The present study was performed according to the principles of the Declaration of Helsinki, and ethical approval was obtained from the institutional board committee of King Faisal Specialist Hospital & Research Center (RAC#2211194), Riyadh, Saudi Arabia.

### *Data availability*

The data is available and can be requested from the corresponding author.

### *Conflict of Interest*

The authors declare that there was no conflict of interest.

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