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Socioeconomic characteristics and risk factors for breast cancer: A case-control study in the Souss-Massa region, Morocco

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Abstract
Aim: Across the world, breast cancer is the most common type of cancer affecting women. In Morocco, convincing evidence between several risk factors and breast cancer has been established. The objective of this study is to investigate the socio-economic characteristics and risk factors for breast cancer among women at the Souss-Massa Regional Oncology Center (SMROC).
Material and Methods: A case-control study was conducted at the SMROC. Between May 1 to the end of September 2021, 300 women were recruited, including 150 cases and 150 age-matched controls. Information on the socioeconomic profile of cases and controls and risk factors was obtained using a questionnaire administered by two investigators. The database was created in Excel and statistical analysis was performed using Epi-Info software (version 7).
Results : Low socioeconomic level (OR: 6.7292; 95% CI: 4.0488 - 11.1841), BMI (OR 11.4545; 95% CI: 6.1416 - 21.3636), low Daily Physical Activity (OR: 91.8333; 95% CI: 34.9146 - 241.5423), benign breast disease (OR: 10.5455, 95% CI: 4.0290 - 27.6014), age at first menstruation (OR: 7. 8533; 95% CI: 4.6940 - 13.1389), nulliparity (OR: 2.4225; 95% CI: 1.3244 - 4.4310), use of hormonal contraception (OR: 2.1667; 95% CI: 1.1940 - 3.9318), absence of breastfeeding (OR: 2.2190; 95% CI: 1.2575 - 3.9156), were associated with an increased risk of breast cancer.
Discussion: Our study confirms the multi-factoriality of breast cancer. It is essential to further promote early detection and preventive measures, especially among high-risk population. These results must be confirmed by a multicenter study at the national level.

Keywords
Socioeconomic Characteristics, Risk Factors, Breast Cancer, Morocco

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Introduction

Breast cancer in women is a public health problem. The worldwide incidence of breast cancer was 55.2 per 100,000 women, with a mortality rate of 13.0% [1]. Breast cancer is the most common type of malignancy affecting women worldwide. In 2018, the global incidence of this type of cancer in women over 50 years of age was 154.8 per 100,000 women [1]. According the International Agency for Research on Cancer, the future incidence of the disease will reach 3.19 million new cases by 2040 [1].

In Morocco, despite the early detection program for breast and cervical cancer, implemented since 2011 [1], breast cancer is constantly increasing. It is the first type of malignant tumors in Moroccan women, in terms of both incidence and mortality, with a particularity of affecting young women [2]. Indeed, 11.7 K new cases of breast cancer are detected and 3.7 K deaths in 20201. The future forecast of this type of cancer is expected to reach 16018 new cases in 2030 [1].

In the absence of a cancer registry for the southern regions of Morocco, statistics from the SMROC, as a public structure that covers the entire population of the four southern regions in terms of cancer care, have shown an increase in the incidence of breast cancer in women for the years 2018, 2019 and 2020, with 310, 323 and 349 new cases, respectively. The occurrence of cancer is due to multitude of factors. The objective of this study was to determine the socio-economic characteristics and risk factors for cancer among women managed at the SMROC level.

Material and Methods

Type, population and location of the study

This is a case-control study conducted at the SMROC. A total of 300 women (150 cases and 150 age-matched controls) were recruited between 01 May and 30 September 2021. The study included women over 18 years of age, under the care of the SMROC, and with histological confirmation of breast cancer.

Data collection

Information on the socio-economic characteristics of cases and controls (age, marital status, menopausal status, place of residence, level of education, occupation, household income) and risk factors was obtained using a questionnaire administered by two investigators. A pre-test of the questionnaire was conducted with 5 women to verify the relevance of the questions.

Statistical analysis

The analysis included a description of the study population according to different characteristics and a comparison between cases and controls according to risk factor exposure. Determination of the study population was performed via Open Epi software. The database was created in Excel and statistical analysis was performed using Epi-Info software (version 7). A p value < 0.05 was used to indicate statistical significance.

Ethical considerations

Our study was approved by the Biomedical Research Ethics Committee of the Faculty of Medicine and Pharmacy of Rabat, number 30/21. Authorization for data collection was granted by the Souss-Massa Regional Health Directorate and the ROC. Participation in this study was strictly voluntary, and all patients were informed of the purpose of the study, and were given the right to withdraw at any stage during the study without giving any excuses. Written informed consent from the women to participate in the study was obtained before the survey was started.

Results

Table 1 presents the socioeconomic characteristics of the cases and controls in our study. Multivariate analysis of the results showed no statistically significant association between breast cancer and the variables age, marital status and menopausal status of the women. Nevertheless, exposure to this type of cancer is observed more in women over 40 to under 50 years of age, in single and widowed women, and in postmenopausal women. However, there was a statistically significant association between breast cancer and rural origin of women (OR: 2.0932; 95% CI: 1.2773 - 3.4303, $p < 0.05$). Compared to controls, cases had a lower socioeconomic level (OR: 6.7292; 95% CI: 4.0488 - 11.1841).

Table 2 describes the risk factors for breast cancer. The cases and controls, for the most part, did not consume alcohol or tobacco, so the risk calculation is not applicable. As for body mass index (BMI), the risk was significantly elevated in women who were overweight by more than 25 to less than 30 kg/m² and more than 30 kg/m² respectively (OR: 11.4545; 95% CI: 6.1416 - 21.3636, $p < 0.001$) and (OR 8.6114; 95% CI: 3.9092 - 18.9694, $p < 0.001$). Compared with controls, the risk was significantly elevated in cases with low daily physical activity (< 15min/day) (OR: 91.8333; 95% CI 34.9146 - 241.5423). Compared with controls, patients had a history of benign breast disease (OR: 10.5455, 95% CI: 4.0290 - 27.6014). The risk was high in women with a family history of breast cancer (OR: 5.9847, 95% CI: 3.0317 - 11.8139). For diabetes, risk indicated the existence of an association but was not statistically significant. For hormonal risk factors in cases and controls in our study, women who had their first menstrual period before the age of 12 years had a significantly higher risk of breast cancer compared to controls (OR: 7.8533; 95% CI: 4.6940 - 13.1389). Among 150 patients, 70 were menopausal, 63.75% of whom had undergone menopause after the age of 47 years. Regarding risk factors related to reproduction and the use of certain treatments, nulliparous women had a significantly higher risk of breast cancer than controls (OR: 2.4225; 95% CI: 1.3244 - 4.4310). As for breastfeeding, women who never breastfed had an elevated risk of breast cancer compared with those who did (OR: 2.2190; 95% CI: 1.2575 - 3.9156). For hormonal contraception, the risk was significantly elevated in women who had used it for more than 10 years (OR: 2.1667; 95% CI: 1.1940 - 3.9318). For contraceptive use at menopause, the results showed no difference.

Discussion

The present study analyzed the socio-economic profile and risk factors of breast cancer in women at the SMROC in Agadir. In our study, the average ages in cases and controls were 40 and 49 years, respectively, in agreement with the results of the study by Khalis et al. (2018) [3]. In contrast, Znati et al. (2014), showed that younger women (aged 35 years and younger) were most exposed [4]. This can be explained by the unhealthy lifestyle

adopted by women and the use of hormonal contraception. The results of our study showed no difference in age, marital status, menopausal status and place of residence. These data are consistent with the study by Khalis et al. (2018) [3]. This is explained, perhaps, by the change in women's lifestyles in the two settings. We found a significant association between low socioeconomic status and breast cancer risk (OR: 6.7292; 95% CI: 4.0488 - 11.1841). These results corroborate with the study by Berger et al. (2012) [5]. This association may be due to financial difficulties and inequality in access to early diagnosis and care of breast cancer.

Our study did not reveal an association between smoking status and alcohol consumption. Contrary to the results of a national study, which found an association between breast cancer and smoking [3]. The particularities of the Moroccan community culture, considering alcohol and tobacco use by women as socially repressed behavior, are explanatory reasons for this situation. In fact, smoking is not considered an established risk factor for breast cancer [6].

For BMI, our study found a statistically significant association between high BMI and breast cancer risk (OR: 11.4545; 95% CI: 6.1416 - 21.3636). Several epidemiological studies have considered overweight and obesity a risk factor for breast cancer in women [3,7,8]. This is mainly due to the interaction between fat cells (a component of breast tissue) and breast cancer cells. Excess fat tissue in obese women is a risk factor [3].

Our study showed a highly significant association between lack of regular physical activity and breast cancer risk (OR: 91.8333; 95% CI: 34.9146 - 241.5423). In addition, regular physical activity reduces the risk of breast cancer by approximately 35% [9]. It is suggested that regular moderate physical activity confers protection against breast cancer [10].

Regarding the personal medical history, 40% of the cases had a benign breast disease. At this level, we found a significant difference between cases and controls (OR: 10.5455; 95% CI: 4.0290 - 27.6014). One idea supports this finding: Certain non-cancerous breast conditions may cause a slight increase in the risk of breast cancer in women when associated with increased cell counts (atypical hyperplasia; complex fibroadenoma; sclerosing adenosis; papillomatosis; radial scarring; fibrocystic breast changes). One study confirmed that proliferative lesions without atypia increase the risk of breast cancer by a factor of two, while hyperplastic lesions with atypia increase this risk by at least four times [11].

For diabetes, our study did not show a statistically significant association between diabetes and breast cancer. Our study found that only 24.67% of the cases had diabetes, contrary to the study by Bernard et al. (2016) [12]. The association between diabetes and breast cancer is explained by other factors such as lack of physical activity, overweight, dietary habits.

As for the family history of breast cancer, we found a difference between cases and controls (OR: 5.9847; 95% CI: 3.0317 - 11.8139). Several studies have associated family history with the risk of breast cancer [3,8]. This may be due to genetic mutations, especially in the BRCA1 and BRCA2 genes, which are involved in about 65% of hereditary forms of breast cancer [6]. Furthermore, our study revealed a highly significant association between early age at first menstruation and increased risk of breast cancer (OR: 7.8533; 95% CI/ :4.6940 - 13.1389). In a meta-analysis, early age at first menstruation was associated with breast cancer risk (OR: 1.05; 95% CI: 1.04-1.05) [13]. This relationship is explained by early and prolonged exposure of the breast to estrogen during ovarian activity [14].

According to several studies, late age at menopause is a risk factor for breast cancer [3,15,16]. Our study did not reveal an

Table 1. Socio-economic characteristics of control and breast cancer patients

Variable	Cases n = 150	Controls n = 150	OR (CI95%)	Corrected X^2	p-value
Age at recruitment (years)					
< 40	10 (6.67)	0 (0.00)	-	83.793	0.0038
40 – 50	72 (48.00)	63 (42.00)	1.2747 (0.8081 – 2.0108)	0.8620	0.3532
50 – 60	42 (28.00)	56 (37.33)	0.6528 (0.4014 – 1.0616)	25.611	0.1095
≥ 60	26 (17.33)	60 (42.00)	0.8049 (0.4512 – 1.4358)	0.3465	0.5561
Marital status					
Single	22 (14.67)	12 (8%)	1.9766 (0.9399 – 4.1567)	26.869	0.1012
Married	97 (64.67)	101 (67.33)	0.8879 (0.5505 – 1.4321)	0.1337	0.7146
Divorced	24 (16.00)	20 (13.33)	1.2381 (0.6515 – 2.3528)	0.2397	0.6244
Widowed	7 (4.67%)	17 (11.33)	0.3830 (0.1539 – 0.9527)	36.685	0.0555
Menopausal status					
Postmenopausal	80 (53.33)	72 (48.00)	1.2381 (0.7868 – 1.9482)	0.6534	0.4189
Premenopausal	70 (46.67)	78 (52.00)	0.8077 (0.5133 – 1.2709)	0.6534	0.4189
Area of residence					
Urban	89 (59.33)	113 (75.33)	0.4777 (0.2915 – 0.7829)	80.168	0.0046
Rural	61 (40.67)	37 (24.67)	2.0932 (1.2773 – 3.4303)	80.168	0.0046
Socioeconomic level (monthly income in MAD)					
< 2000	114 (76.00)	48 (32.00)	6.7292 (4.0488 – 11.1841)	566.962	< 0.001
2000 – 4000	32 (21.33)	74 (49.33)	0.2785 (0.1681 – 0.4615)	245.234	< 0.001
≥ 4000	4 (2.67)	28 (18.67)	0.1194 (0.0407 – 0.3497)	185.051	< 0.001

OR: Odds ratio; CI: Confidence interval; CNOPS: Caisse nationale des organismes de prévoyance sociale; CNSS: Caisse nationale de la sécurité sociale; MAD: Moroccan dirham

Table 2. Distribution of cases and controls by risk factor exposure

Factors	Cases n = 150	Controls n = 150	OR (CI95%)	corrected X^2	p-value
Tobacco status					
Former	0 (0.00)	5 (3.33)	-	32.542	0.0712
Smoker	0 (0.00)	1 (0.67)	-	0.0000	10.000
Never	150 (100.00)	144 (96.00)	-	42.517	0.0392
Alcohol consumption					
Yes	0 (0.00)	2 (1.33)	-	0.5034	0.4780
No	150 (100.00)	148 (98.67)	-	0.5034	0.4780
BMI Kg/m2 (Before the disease)					
< 18.5	3 (2.00)	12 (8.00)	0.2347 (0.0648 – 0.8495)	44.912	0.0341
18.5 – 24.9	14 (9.33)	115 (76.67)	0.0313 (0.0161 – 0.0611)	1.359.989	< 0.001
25 – 29.9	84 (56.00)	15 (10.00)	11.4545 (6.1416 – 21.3636)	697.120	< 0.001
> 30	49 (32.67)	8 (5.33)	8.6114 (3.9092 – 18.9694)	346.545	< 0.001
Physical activity Min/Day					
< 15	114 (76.00)	5 (3.33)	91.8333 (34.9146 – 241.5423)	1.624.588	< 0.001
15 – 30	30 (20.00)	22 (14.67)	1.4545 (0.7952 – 2.6607)	11.399	0.2857
30 – 60	3 (2.00)	87 (58.00)	0.0148 (0.0045 – 0.0485)	1.093.492	< 0.001
> 60	3 (2.00)	36 (24.00)	0.0646 (0.0194 - 0.2152)	301.798	< 0.001
Benign breast disease					
Yes	40 (26.67)	5 (3.33)	10.5455 (4.0290 – 27.6014)	302.222	< 0.001
No	110 (73.33)	145 (96.67)	0.0948 (0.0362 – 0.2482)	302.222	< 0.001
Diabetes					
Yes	37 (24.67)	28 (18.67)	1.4267 (0.8201 – 2.4818)	12.570	0.2622
No	113 (75.33)	122 (81.33)	0.7009 (0.4029 – 1.2193)	12.570	0.2622
Family history					
Yes	51 (34.23)	12 (8.00)	5.9847 (3.0317 – 11.8139)	293.625	< 0.001
No	99 (65.77)	138 (92.00)	0.1671 (0.0846 – 0.3298)	293.625	< 0.001
If yes same location					
Yes (n = 51)	29 (56.86)	4 (33.33)	2.6364 (0.7029 – 9.8888)	13.160	0.2513
No (n= 12)	22 (43.14)	8 (66.67)	0.3793 (0.1011 – 1.4228)	13.160	0.2513
Degree of relationship with the patient					
1st degree	25 (49.02)	9 (75.00)	0.3205 (0.0777 – 1.3225)	16.972	0.1927
2nd degree	26 (50.98)	3 (25.00)	3.2100 (0.7562 – 12.8733)	16.972	0.1927
Age at first menstruation (years)					
≤ 12	113 (75.33)	42 (28.00)	7.8533 (4.6940 – 13.1389)	654.060	< 0.001
> 12	37 (24.67)	108 (72.00)	0.1273 (0.0761 – 0.2130)	654.060	< 0.001
Age at menopause (years)					
≤ 47	29 (36.25)	21 (29.17)	1.3810 (0.6977 – 2.7331)	0.5703	0.4501
> 47	51 (63.75)	51 (70.83)	0.7241 (0.3659 – 1.4332)	0.5703	0.4501
Number of children					
0	39 (26.00)	19 (12.67)	2.4225 (1.3244 – 4.4310)	77.159	0.0055
1 – 3	71 (47.33)	70 (46.67)	1.0271 (0.6527 – 1.6165)	0.0000	10.000
> 3	40 (26.67)	61 (40.67)	0.5306 (0.3260 – 0.8634)	59.704	0.0145
Breastfeeding (months)					
Never breastfed	43 (28.67)	23 (15.33)	2.2190 (1.2575 – 3.9156)	70.124	0.0081
< 24	92 (61.33)	81 (54.00)	1.3512 (0.8535 – 2.1392)	13.654	0.2426
≥ 24	15 (10.00)	46 (30.67)	0.2512 (0.1329 – 0.4747)	185.198	< 0.001
Use of hormonal contraception					
Yes	95 (63.76)	111 (74.00)	0.6181 (0.3769 – 1.0137)	31.965	0.0738
No	54 (36.24)	39 (26.00)	1.6178 (0.9865 – 2.6531)	31.965	0.0738
Duration (years)					
< 5	35 (36.84)	50 (45.05)	0.7117 (0.4065 – 1.2459)	11.029	0.2936
5 – 10	21 (22.11)	34 (30.63)	0.6427 (0.3421 – 1.2075)	14.904	0.2222
> 10	39 (41.05)	27 (24.32)	2.1667 (1.1940 – 3.9318)	58.329	0.0157
Contraception at menopause					
Yes	3 (3.80)	5 (7.04)	0.5211 (0.1199 – 2.2636)	0.2695	0.6037
No	76 (96.20)	66 (92.96)	1.9192 (0.4418 – 8.3377)	0.2695	0.6037

BMI: Body Mass Index

association between late age at menopause and increased cancer risk. The increased risk of breast cancer in women with late age at menopause is explained, perhaps, by prolonged and high breast exposure to estrogen and progesterone [17].

Nulliparity is considered, according to several epidemiological studies, an established risk factor for female breast cancer [18,19]. Our study did not show an association between nulliparity and breast cancer risk. The explanations given for the protective effect of pregnancy against breast cancer are: decreased estrogen and progesterone levels, increased sex hormone-binding globulin levels and pregnancy-induced differentiation of breast tissue [20,21].

Breastfeeding reduces the risk of breast cancer, especially if prolonged and even in patients with the BRCA131 mutation [22]. Our results did not show a protective effect of breastfeeding against breast cancer. Another study found a protective effect of breastfeeding against breast cancer [23]. Our results did not show an association between the absence of breastfeeding and breast cancer risk. Several pathophysiological mechanisms explain the protective effect of breastfeeding against breast cancer: decrease in the number of ovulatory cycles, cellular differentiation of the mammary epithelium during lactation, excretion of carcinogens through milk [22].

Regarding the use of hormonal contraception, high frequencies were recorded in cases (63.76%) and controls (74.00%), with no difference noted between the two categories. These results differ from those revealed by a cohort study, which confirmed that the risk of breast cancer was higher in women who were using or had recently used contemporary hormonal contraceptives than in women who had never used hormonal contraceptives, and this risk increased with duration of use (RR= 1.38; 95% CI: 1.26 -1.51) [24]. This may be due to the high concentration of hormonal contraceptives in the bloodstream. This may be due to the high concentration of combined estrogen-progestin in hormonal contraceptives [25].

We excluded the use of contraception during menopause from the analysis because of the low frequency revealed in cases (3.80%) and controls (7.04%).

Conclusion

Our study confirms the association between the risk factors studied and the emergence of breast cancer in the exposed population in the Souss-Massa region. It is essential to carry out a multicenter study in order to generalize the results to all women in Morocco.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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