



# A case-control study on risk factors of breast cancer in 2 hospitals in Douala

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## Abstract

**Background:** Breast cancer is the most common malignancy and the leading cause of cancer death in Cameroonian women. There are several risk factors (modifiable and non-modifiable) involved in the genesis of breast cancer. Knowledge of these risk factors is crucial for prevention. The objective of this study was to identify factors associated with the occurrence of breast cancer in two hospitals in Douala, Cameroon.

**Methods:** We conducted a case-control study over a period of 6 months at the Douala General Hospital and Laquintinie Hospital of Douala. The study compared sociodemographic, clinical and lifestyle data of 123 women and men with histologically proven breast cancer (cases) to those of 246 women and men without breast cancer (controls). Cases and controls were matched according to age and sex. After obtaining informed consent, data were collected and analyzed with SPSS version 23.0. We used Chi-square and Fisher's tests to find the associated factors expressed as odds-ratios in their 95% confidence intervals with a significance level  $P < 0.05$ . In order to eliminate confounding factors, a multivariate analysis was performed.

**Results:** The mean age at diagnosis of breast cancer was  $46 \pm 10.58$  years (range 23 to 76 years). The most common histologic type was invasive ductal carcinoma. The tumor was diagnosed at stage III of WHO classification in 41.47% of cases. Per our multivariate analysis, independent factors associated to the occurrence of breast cancer includes a monthly income of  $> 400.000$  Francs CFA (aOR:7.135[1.529-33.301];  $p:0.012$ ); late menopause (aOR:5.351[1.226-23.351];  $p:0.026$ ); family history of breast cancer (aOR:2.776[1.050-7.340];  $p:0.040$ ); obesity (aOR:2.122[1.147-3.828];  $p:0.017$ ); alcohol consumption (aOR:2.735[1.504-4.973];  $p:0.001$ ); chronic stress (aOR:3.014[1.335-6.805];  $p:0.008$ ).

**Conclusion:** Patients with breast cancer are often young and diagnosed at late stages. Some modifiable risk factors associated with breast cancer include alcohol intake, stress, obesity, high monthly income. Clinicians should consider these factors when advising patients, and they should screen for breast cancer in order to decrease the incidence of late-stage at diagnosis.

**Keywords:** Breast cancer; Patient characteristics; Associated factors; Douala; Cameroon

Submitted: 25 July 2021 | Accepted: 20 August 2021 | Published: 23 August 2021

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**Citation:** Charlotte TN, Merciel Jordane YS, Henri E, Roger Guy EM, Albertine E, et al. (2021) A case-control study on risk factors of breast cancer in 2 hospitals in Douala. SM J Gynecol Obstet 7: 10.

## Introduction

Breast cancer is the most common cancer in women worldwide [1–4], with 2.1 million new cases recorded in 2018 [1–4]. According to the World Health Organization (WHO) and GLOBOCAN 2018, it accounts for about 11.6% of all cancers [5]. According to statistics provided by the American Cancer Society in the United States, one in 8 women have a risk of developing invasive breast cancer. In 2019, 271.270 cases of breast cancer were diagnosed with 42.260 deaths [6]. It is the leading cause of cancer mortality among women worldwide (627.000 deaths in 2018) with a majority of deaths recorded in developing countries [7,8]. In West Africa, specifically in Niger, breast cancer is the most common malignant disease (16.51%); it accounts



for 27.36% of female cancers. The mean age is  $44.10 \pm 12.63$  years (14–86 years) for women and  $48.19 \pm 13.08$  years for men and diagnosis is most often made at late stage of disease [9]. In Cameroon in 2014, breast cancer was the second most common malignancy after cervical cancer [10]. In 2015 Sando et al found an increase in its incidence (multiplied by 3.16) and it was the most common malignancy (31.5% of all cancers) [11]. Studies in Cameroon revealed that incidence of breast cancer is increasing rapidly. Patients are diagnosed at a young age according to studies published by Tchente et al, Enbang et al (mean age 46 and  $46.58 \pm 15.72$  years respectively) [13,12]. Diagnosis is usually made at an advanced stage, thus the need of early diagnosis through screening and prevention [11].

The etiology of breast cancer is still unknown. Numerous epidemiological studies in developed countries have identified a number of well-established and probable risk factors. A distinction is made between modifiable and non-modifiable risk factors [14,15]. Modifiable risk factors include nulliparity, advanced maternal age at first delivery, absence of breastfeeding, birth control pills, hormone replacement therapy, stress, environmental pollution, obesity, alcohol and tobacco consumption, and sedentary lifestyle. Non-modifiable risk factors include family history of breast cancer, personal history of breast diseases, chest irradiation, early menarche, late menopause and genetic predisposition.

Given the geographic and ethnic variation of the risk of breast cancer [16,17], the increase in its incidence and mortality rate in developing countries such as Cameroon, prevention of modifiable risk factors and appropriate screening remain the only effective methods of combating this disease. A recent retrospective study done in Douala collected data mainly from patient files (which are not often well filled and conserved) [18]; some factors like physical activity were not explored in this study. As such, we wanted to interview and examine women directly (prospective) to get more information, hence the interest of this work entitled factors associated with breast cancer in two hospitals in the city of Douala.

## Methods

This was a case-control study with prospective collection of data which took place in the gynecology, oncology and radiotherapy unit of Douala General Hospital and Laquintinie Hospital. Participants in the cases category were consented patients with histologically diagnosed breast cancer. Participants in the control category were consented patients who consulted in the service (after participants in the cases category were diagnosed), with normal clinical and radiological breast examination. Cases and controls were matched for sex and age with a matching ratio of 1:2 cases and controls respectively. Patients were recruited consecutively.

Data collection was carried out during individual interviews using a pretested questionnaire by the main investigator in different health facilities. Firstly, we explained the aim of the study to participants and we obtained informed consent before filling the first part of the questionnaire. We then examined the patients and filled the rest of the questionnaire. In order

to complete missing information and ensure the quality of information delivered by patients, we used patients' files and patients' physicians as further sources of data collection.

Ethical clearance was obtained from the ethic committee of the university of Douala (N°2159CEI-Udo/01/2020/T) and authorization from the directors of Douala General hospital and Laquintinie hospital was granted. The study was carried out in accordance with the fundamental principles of medical research.

Studied variables were sociodemographic (age at diagnosis of breast cancer, profession, marital status, level of education, religion, monthly income) ; past obstetrics and gynecological history (age at menarche and menopause, types of contraception, , age at first delivery, parity, breast feeding and duration) ; past medical history (history of breast disease, irradiation and chronic disease) ; family history of carcinoma (breast, endometrial, colon, ovarian cancers) including the degree of relationship with the patient; life style (alcohol and tobacco use, physical activity, chronic stress : divorce, loss of relative, professional stress or joblessness) ; anthropometric parameters (weight, height, body mass index) ; staging of the disease and histological type.

Data were recorded and processed using statistical software SPSS version 23.0 and MS EXCEL 2013. Statistics were descriptive and analytic. The sociodemographic, clinical and histological characteristics were described using mean and median for quantitative variables and percentage for qualitative variables. Chi-square and Fisher's tests were used to identify factors associated to breast cancer with statistical significance set at  $p < 5\%$ . Odds ratio with confidence interval at 95% were calculated. In order to eliminate confounding factors, a multivariate logistic regression was performed.

## Results

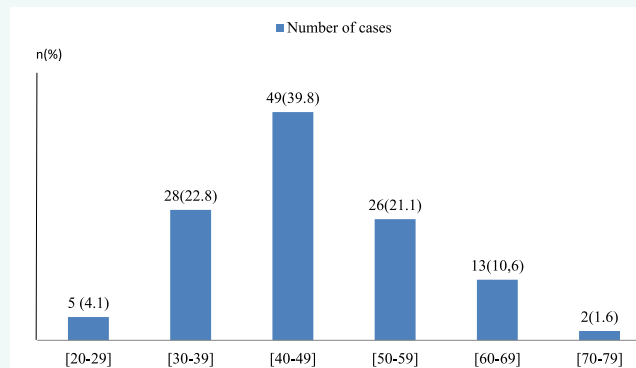
A total of 128 cases were enrolled (126 women and 2 men). Five women refused to participate (participation rate: 96.1%). The study population was then composed of 123 cases and 246 controls.

The mean age at diagnosis of breast cancer was  $46 \pm 10.58$  (extremes 23 and 76years). The age group [40-49] was the most represented (40%), figure 1. Patients were married (61.8%), jobless (39.8%), mostly of catholic religion (58.5%) and had secondary level of education (40.7%).

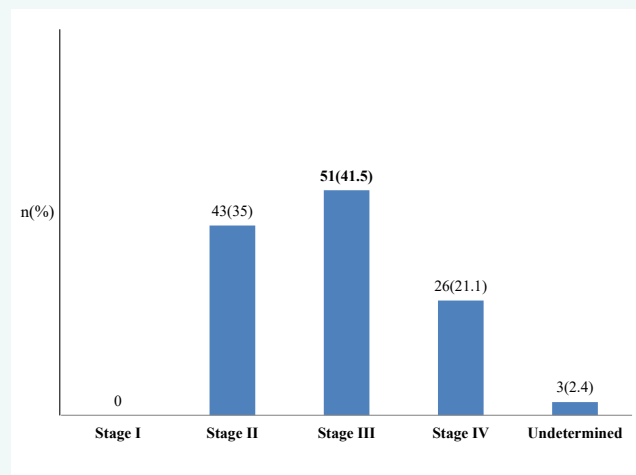
The common histological type found was invasive ductal carcinoma (79.7%) followed by invasive lobular carcinoma (8.1%).

The left breast was the most affected with breast cancer in 59.3% of cases, and bilateral disease was observed in two patients (1.6%). Breast cancer developed on the upper external quadrant and inner superior quadrant in 48% and 18.7% respectively. The main stage at diagnosis was stage III (41.5%) and 21.1% of patients had metastatic breast disease at diagnosis (figure 2).

Sociodemographic, clinical and lifestyle factors associated to breast cancer are found on tables 1 to 6. After multivariate analysis, independent factors associated to breast cancer include : monthly income of more than 400.000F CFA (aOR:7.135[1.529-



**Figure 1** Distribution of patient with breast cancer according to age.



**Figure 2** Distribution according of patients with breast cancer according to WHO staging.

**Table 1:** sociodemographic factors associated to breast cancer.

Variables	Characteristics	Case N (%)	Control N (%)	OR	IC 95%	p
Marital status	Married	76(61.8)	161(65.4)	0.854	0.545-1.337	0.489
	Divorce	4(3.3)	7(2.8)	1.148	0.329-3.998	1.000
	Widow	13(10.6)	24(9.8)	1.093	0.536-2.229	0.806
	Single	30(24.4)	54(22)	1.147	0.688(1.911)	0.598
Education level	Primary	25(20.3)	39(15.9)	1.354	0.776-2.363	0.285
	Secondary	50(40.7)	118(48.0)	0.743	0.479-1.152	0.183
	University	45(36.6)	85(34.6)	1.093	0.696-1.716	0.700
	Functionally illiterate	3(2.4)	4(1.6)	1.513	0.333-6.866	0.690
Profession	housewife	49(39.8)	96(39.0)	1.035	0.665-1.611	0.880
	Trader	16(13)	41(16.7)	0.748	0.401-1.394	0.359
	Farmer	6(4.9)	3(1.2)	4.154	1.021-16.901	0.065
	Civil servant	18(14.6)	47(19.1)	0.726	0.401-1.313	0.288



	Private sector	24(19.5)	42(17.1)	1.177	0.675-2.053	0.564
	Retired	4(3.3)	5(2.0)	1.620	0.427-6.144	0.488
	Student	2(1.6)	5(2.0)	0.797	0.152-4.166	1.000
Monthly income						
	[0-50000[	32(26.0%)	84(34.1)	0.678	0.419-1.097	0.113
	[50000-100000[	31(25.2%)	59(24.0)	1.068	0.647-1.763	0.797
	[100000-150000[	14(11.4%)	40(16.3)	0.661	0.345-1.269	0.211
	[150000-200000[	14(11.4%)	21(8.5)	1.376	0.674-2.810	0.379
	[250000-300000[	17(13.8%)	29(11.8)	1.200	0.631-2.281	0.577
	[350000-400000[	2(1.6%)	8(3.3)	0.492	0.103-2.351	0.506
	>400000	13(10.6)	5(2)	<b>5.696</b>	<b>1.982-16.372</b>	<b>&lt;0.001</b>
Religion						
	Catholic	72(58.5%)	107(43.5)	<b>1.834</b>	<b>1.183-2.843</b>	<b>0.006</b>
	Muslim	5(4.1%)	13(5.3)	0.759	0.264-2.181	0.608
	Pentecostal	5(4.1%)	14(5.7)	0.702	0.247-1.996	0.505
	Protestant*	34(27.6%)	83(33.7)	0.750	0.466-1.207	0.235
	Jehovah's Witness	4(3.3%)	21(8.5)	0.360	0.121-1.073	0.057
	Others*	3(2.4%)	8(3.3)	0.744	0.194-2.854	0.758

Protestant\*: Evangelic, Presbyterian and Baptist church; Others\*: Revival Church

**Table 2:** hormonal factors associated to breast cancer.

Variables	Characteristics	Case N (%)	Controls N (%)	OR	IC 95%	p
Age at menarche						
	< 12 years	7(5.8)	13(5.4)	1.082	0.420-2.784	0.871
	12-14 years	72(59.5)	172(71.7)	<b>0.573</b>	<b>0.362-0.907</b>	<b>0.017</b>
	≥ 15 years	42(34.7)	55(22.9)	<b>1.811</b>	<b>1.20-2.930</b>	<b>0.015</b>
Age at menopause						
	< 45 years	2(1.7)	1(0.4)	4.050	0.364-45.119	0.259
	45-55 years	35(28.9)	71(28.3)	0.980	0.606-1.585	0.935
	> 55 years	10(8.3)	3(1.2)	<b>7.171</b>	<b>1.937-26.592</b>	<b>0.001</b>
Hormonal status						
	Genital activity	69(57)	142(58.7)	0.934	0.601-1.453	0.763
	Perimenopause	5(4.1)	25(10.3)	<b>0.374</b>	<b>0.140-1.003</b>	<b>0.043</b>
	Menopause	47(38.8)	75(31)	1.414	0.896-2.231	0.135
HRT*						
	Yes	2(4.3)	1(1.3)	3.289	0.290-37.316	0.558
	No	45(95.7)	74(98.7)	Réf	Réf	Réf
Hormonal contraception						
	Yes	35(28.9)	33(13.6)	<b>2.578</b>	<b>1.505-4.413</b>	<b>&lt;0.001</b>
	No	86(71.1)	209(86.4)	Réf	Réf	Réf
Type of contraception						
	Implant	7(5.8)	5(2.1)	2.911	0.904-9.370	0.114
	Injection	5(4.1)	5(2.1)	2.043	0.580-7.198	0.311
	IUD*	1(0.8)	6(2.5)	0.328	0.039-2.754	0.432
	Oral contraceptive	22(18.2)	17(7)	<b>2.941</b>	<b>1.492-5.780</b>	<b>0.001</b>
Duration of use						



	< 5 years	28(23.1)	28(11.6)	<b>2.301</b>	<b>1.291-4.100</b>	<b>0.004</b>
	5-9 years	4(3.3)	4(1.7)	2.034	0.500-8.278	0.449
	≥ 10 years	3(2.5)	1(0.4)	6.127	0.631-59.536	0.110
Age at first use of contraception						
	<20 years	3(2.5)	1(0.4)	6.127	0.631-59.536	0.110
	20-24 years	4(3.3)	3(1.2)	2.724	0.600-12.369	0.228
	25-29 years	11(9.1)	16(6.6)	1.413	0.634(3.146)	0.396
	≥30 years	17(14)	13(5.4)	<b>2.879</b>	<b>1.349-6.147</b>	<b>0.005</b>

HRT\*: hormone replacement therapy for menopause; IUD\*: Intra Uterine Device

**Table 3:** Obstetrical factors associated to breast cancer.

Parity	Characteristics	Case N (%)	Controls N (%)	OR	IC 95%	p
	<b>0</b>	7(5.8)	32(18.2)	<b>0.403</b>	<b>0.172-0.942</b>	<b>0.031</b>
	<b>1-2</b>	39(32.2)	73(30.2)	1.101	0.688-1.761	0.688
	<b>3-4</b>	45(37.2)	63(26)	<b>1.682</b>	<b>1.054-2.184</b>	<b>0.028</b>
	<b>≥5</b>	30(24.8)	74(30.6)	0.748	0.456-1.228	0.250
Age at 1 <sup>st</sup> pregnancy						
	<b>&lt;30 years</b>	108(91.5)	222(96.9)	0.340	0.126-0.919	
	<b>≥30 years</b>	10(8.5)	7(3.1)	<b>2.937</b>	<b>1.088-7.926</b>	<b>0.027</b>
Age at 1 <sup>st</sup> delivery						
	<b>&lt;30 years</b>	100(87.7)	201(95.3)	0.355	0.152-0.829	
	<b>≥30 years</b>	14(12.3)	10(4.7)	<b>2.814</b>	<b>1.207-6.559</b>	<b>0.013</b>
Breastfeeding						
	<b>Yes</b>	111(91.7)	198(81.8)	<b>2.467</b>	<b>1.195-5.092</b>	<b>0.012</b>
	<b>No</b>	10(8.3)	44(18.2)	Ref	Ref	Ref
Duration of Breastfeeding*						
	<b>&lt;6 months</b>	10(8.3)	8(3.3)	<b>2.635</b>	<b>1.012-6.860</b>	<b>0.040</b>
	<b>6-12 months</b>	55(45.5)	116(47.9)	0.905	0.584-1.402	0.656
	<b>13-23 months</b>	40(33.1)	72(29.8)	1.166	0.730-1.863	0.520
	<b>≥24 months</b>	6(5)	2(0.8)	<b>6.261</b>	<b>1.244-31.500</b>	<b>0.019</b>

\*N:111

**Table 4:** Breast pathologies and familial history of breast cancer.

Variables	Characteristics	Case N (%)	Controls N (%)	OR	IC 95%	p
Breast pathologies	Fibroma	6(4.9)	9(3.7)	1.350	0.470-3.884	0,576
	Cyst	1(0.8)	2(0.8)	1.000	0.090-11.137	1.000
	Fibrocystic changes	6(4.9)	2(0.8)	<b>6.256</b>	<b>1.244-31.469</b>	<b>0.019</b>
	Mastitis	1(0.8)	6(2.4)	0.328	0.039-2.754	0.432
Family history of cancer						
Breast cancer	Yes	21(17.1)	12(4.9)	<b>4.015</b>	<b>1.903-8.469</b>	<b>&lt;0.001</b>
	No	102(82.9)	234(95.1)	Ref	Ref	Ref
Colon cancer	Yes	2(1.6)	2(0.4)	2.017	0.281-14.489	0.603
	No	121(98.4)	244(99.2)	Ref	Ref	Ref
Ovarian cancer	Yes	2(1.6)	1(0.4)	4.050	0.364-45.102	0.259
	No	121(98.4)	245(99.6)	Ref	Ref	Ref



**Table 5:** Association of Past Medical History and lifestyle to breast cancer.

	Characteristics	Case N (%)	Controls N (%)	OR	IC 95%	p
Diabetes	Yes	3(2.40)	7(2.8)	0.854	0.217-3.360	1.000
	No	120(97.6)	239(97.2)	Ref	Ref	Ref
Hypertension	Yes	14(11.4)	29(11.8)	0.961	0.488-1.893	0.909
	No	109(88.6)	217(88.2)	Ref	Ref	Ref
HIV	Yes	6(4.9)	10(4.1)	1.210	0.429-3.411	0.718
	No	117(95.1)	236(95.9)	Ref	Ref	Ref
Hyperthyroidism	Yes	1(0.8)	1(0.4)	2.008	0.125-32.380	1.000
	No	122(99.2)	245(99.6)	Ref	Ref	Ref
More than 1 pathology	Yes	3(2.4)	3(1.2)	2.025	0.403-10.183	0.405
	No	120(97.6)	243(98.8)	Ref	Ref	Ref
Irradiation	Yes	31(25.2)	55(22.4)	1.170	1.940	0.542
	No	92(74.8)	191(77.6)	Ref	Ref	Ref
Tobacco	Yes	2(1.6)	1(0.4)	4.050	0.364-45.102	0.259
	No	121(98.4)	245(99.6)	Ref	Ref	Ref
Alcohol	Yes	79(64.2)	102(41.5)	<b>2.535</b>	<b>1.620-3.965</b>	<b>&lt;0.001</b>
	No	44(35.8)	144(58.5)	Ref	Ref	Ref
Physical activity	Yes	37(30.1)	60(24.4)	1.334	0.823-2.162	0.242
	No	86(69.9)	186(75.6)	Ref	Ref	Ref
BMI*	Underweight	2(1.6)	0	----	----	0.111
	Normal	19(15.4)	84(34.1)	<b>0.352</b>	<b>0.202-0.614</b>	<b>&lt;0.001</b>
	Overweight	51(41.5)	104(42.3)	0.967	0.624-1.500	0.881
	Obesity	51(41.5)	58(23.6)	<b>2.296</b>	<b>1.444-3.652</b>	<b>&lt;0.001</b>

BMI\*: body mass index

**Table 6:** Breast cancer associate to stress.

	Characteristics	Case N (%)	Controls N (%)	OR	IC 95%	p
Chronic Stress	Yes	30(24.4)	26 (10.6)	<b>2.730</b>	<b>1.531-4.867</b>	<b>&lt;0.001</b>
	No	93(75.6)	220(89.4)	Ref	Ref	Ref
Stressors	Yes	11(8.9)	5(2.0)	<b>4.734</b>	<b>1.607-13.949</b>	<b>0.002</b>
	No	112(91.1)	241(98)	Ref	Ref	Ref
Infertility	Yes	3(2.4)	8(3.3)	0.744	0.194-2.854	0.758
	No	120(97.6)	238(96.7)	Ref	Ref	Ref
Professional stress	Yes	4(3.3)	2(0.8)	4.101	0.741-22.707	0.098
	No	119(96.7)	244(99.2)	Ref	Ref	Ref
Loss of a loved one	Yes	10(8.1)	5(2)	<b>4.265</b>	<b>1.425-12.770</b>	<b>0.005</b>
	No	113(91.9)	241(98)	Ref	Ref	Ref
Others	Yes	2(1.6)	6(2.4)	0.661	0.131-3.325	0.724
	No	121(98.4)	240(97.6)	Ref	Ref	Ref



33.301]; p:0.01), onset of menopause at over 55 years of age (aOR:5.351[1.226-23.351]; p:0.026) family history of breast cancer (aOR:2.776 [1.050-7.340]; p:0.040), alcohol intake (aOR:2.735[1.504-4.973]; p:0.001), obesity(aOR:2.122[1.147-3.928];p:0.017) and presence of chronic stress (aOR:3.014[1.335-6.805]; p:0.008) (table 7).

## Discussion

### Sociodemographic Profile

**Age:** Advanced age is usually a known risk factor of developing cancer. Studies in developing countries reveal that median age

at occurrence of breast cancer is between 52.7 and 61 years [19,20]. These observations are different in developing countries where patients are younger at diagnosis. In our study, the mean age was  $46 \pm 10.582$ , with the age group 40 to 49 years much represented. Other African studies had similar observations: Togo et al in Mali; Mayi-Tsonga et al in Gabon; Nguefack et al in Cameroon; Zaki et al in Niger; Sando et al and Engbang et al. in Cameroon had respectively mean age at diagnosis of 47.4, 48, 46, 44.10,  $46.08 \pm 4$  and  $46.80 \pm 15.87$  years [21,22,12,9,10,13]. For Gueye et al in 2016 (Senegal), patients were even younger (43.3 years) [23]. These differences between developing and developed countries may be either due to life expectancy (which is higher

**Table 7:** multivariate analysis.

Variables	Case N (%)	Control N (%)	Adjusted OR	CI (95%)	Adjusted p value
Region					
Littoral	16(13.4)	60(24.6)	<b>0.277</b>	<b>0.122-0.630</b>	<b>0.002</b>
Religion					
Catholic	72(58.5%)	107(43.5%)	1.316	0.720-2.403	0.372
Monthly income					
>400000	13(10.6%)	5(2.0%)	<b>7.135</b>	<b>1.529-33.301</b>	<b>0.012</b>
Menarche					
≥15years	42(35%)	55(22.9%)	1.806	0.980-3.329	0.058
Peri-menopause	5(4.1)	25(10.3)	1.815	0.986-3.342	0.056
Age at menopause					
>55years	10(8.3)	3(1.2)	<b>5.351</b>	<b>1.226-23.351</b>	<b>0.026</b>
Contraception	35(28.9)	33(13.6)	0.307	0.046-2.046	0.222
Oral contraception	22(18.2)	17(7)	2.427	0.650-9.063	0.187
Age at first use of contraception					
≥30years	17(14)	13(5.4)	2.924	0.794-10.759	0.107
Duration of use					
<5years	28(23.1%)	28(11.6%)	1.725	0.304-9.802	0.539
Parity					
3-4	45(37.2)	63(26)	1.220	0.638-2.334	0.547
Age at 1 <sup>st</sup> pregnancy					
≥30years	10(8.5)	7(3.1)	1.383	0.188-10.189	0.750
Age at 1 <sup>st</sup> delivery					
≥30years	14(12.3)	10(4.7)	1.761	0.389-7.979	0.463
Breastfeeding	111(91.7)	198(81.8)	1.180	0.275-5.067	0.824
Duration of breastfeeding					
<6 months	10(8.3)	8(3.3)	1.380	0.354-5.380	0.643
Fibrocystic changes	6(4.9)	2(0.8)	3.910	0.573-26.671	0.164
Surgical past history/biopsy	7(5.7)	2(0.8)	1.598	0.191-13.376	0.665
Family history of BC*	21(17.1)	12(4.9)	<b>2.776</b>	<b>1.050-7.340</b>	<b>0.040</b>
Alcohol	79(64.2)	102(41.5)	<b>2.735</b>	<b>1.504-4.973</b>	<b>0.001</b>
Obesity	51(41.5)	58(23.6)	<b>2.122</b>	<b>1.147-3.928</b>	<b>0.017</b>
Chronic stress	30(24.4)	26(10.6)	<b>3.014</b>	<b>1.335-6.805</b>	<b>0.008</b>

BC\*: Breast Cancer



in developed countries), genetic factors, or the difficulties in reporting all cases in developing countries.

### Clinical profile

**Topography:** Breast cancer mostly affected the left breast (59.34%). This has been observed in previous studies in Cameroon: Tchente Nguefack et al. in 2012, Essiben et al. in 2013, Engbang et al. in 2015 with respectively 54.76%, 56.9%, 52% of left breast involvement [12,24,13]. But in Mali, Togo et al had different results with the predominance of right breast cancer [21]. Could this be due to the asymmetry usually observed in breast volume? Concerning the location of the tumor on the breast, it is worldwide known that the external superior quadrant of the breast is the most involved. These findings were the same observed in our study.

**WHO staging:** In developing countries, patients often consult at late stage of disease because of ignorance, lack of means, cultural considerations and use of traditional treatment not effective in cancers. In addition, there is no screening program available for early detection of breast cancer. Consequently, patients were mostly diagnosed at stage III of WHO staging in our study. Similar findings were observed in other studies: Nguefack et al. in 2012 and Sando et al. in 2014 in Cameroon; Traore et al in 2015 in Konacy Guinea and Essiben et al. in 2017 in Cameroon with respectively 54.86%, 76.4%, 77.4% and 66.1% diagnosis made at stage III of WHO stratification [12,10,25,26].

**Histologic profile:** The most common histological type of breast cancer found in the literature and in our study was invasive ductal carcinoma [27,28].

### Factors associated to breast cancer after multivariate analysis

#### Family history of breast cancer

Family history of breast cancer was significantly associated with the occurrence of breast cancer. These results are similar to those of other authors in the literature [16,29-31]. This familial association is due to genetic predisposition. It is well known that mutations of BRCA1 and BRCA2 genes play a role in initializing breast cancer, and these mutations are genetically transmitted to offspring.

#### Late menopause

Among risk factors of breast cancer is longer exposure to endogenous hormones (early menarche and late menopause). Our result reveals that late menopause was significantly associated to the occurrence of breast cancer with 5.351 Odds. Similar results were published by other authors [31-33]. Studies done by Msolly et al. in 2013 in Tunisia, Khalis et al in 2018 in Morocco, Matalqah et al in 2011 in Asia and Leon Guerrero et al. in 2017 in the United States of America (USA) didn't show this association [30,34-36]. Differences in studies might be due to definition of age at menopause: 46 to 51 years instead of 55 years in our study; Moreover, some differences exist in the matching of cases and controls according to the age criterion.

### Alcohol consumption

Alcohol intake was found as an associated factor to the development of breast cancer. Qian et al in 2014 in a study done in 3 sub-Saharan Africa: Cameroon, Nigeria and Uganda found that alcohol intake increases the risk of developing breast cancer by 1.67% compared to those who do not use alcohol [37]. Seit et al in 2012 in a metaanalysis of Caucasian population had similar findings [38]. Wu et al in 2012 in the USA found a proportionally increased risk of breast cancer with an increase in the amount of alcohol consumption [39]. One explanation of these findings may be the increased production of growth factors which enhance the development of cancerous cells; moreover, acetaldehyde which is the first metabolite of ethanol has mutant and cancerous properties [40].

### Obesity

The link between obesity and breast cancer may result from the action of adipokines produced by fat cells. Among these adipokines, leptin seems to play an important role. Receptors of Leptin are found on breast cancer cells, and leptin can bind to these receptors inducing cell proliferation. In addition, leptin is believed to be able to oppose antiestrogenic treatments. Obesity was significantly associated to the risk of developing breast cancer in our study and studies published by Senhadji et al in Algeria in 2010, Yu et al in 2012 in China and Wada et al in Japan in 2014 [41,42,43]. Chaveepojnkamjon et al in 2017 in Thailand found an association with both overweight and obese patients [44]. This relationship between obesity and breast cancer is markedly increased after menopause [45].

### Chronic stress

We found that chronic stress due to life events tripled the risk of developing breast cancer. Our results are similar to those of several authors who found an increased risk of breast cancer related to different types of stress, including lifestyle stress, daily activities stress, and stressful experiences of life [46,47]. This could be due to disturbances of metabolic, cellular (oxidative stress, cell degeneration) and neuro-immunoendocrine functions (immune disturbances, alterations of the hypothalamic-pituitary-adrenal axis) induced by stress which is involved in carcinogenesis. Some authors like Santos et al in 2009 did not find an association between stressful life events (divorce, widowhood) and breast cancer risk [48], but they found a nearly significant association between high intensity stress and breast cancer risk.

### Socio-economic level

High socioeconomic level (fixed monthly income > 400000FCFA) was an associated factor to breast cancer in this study. Some authors had same findings in the literature [49,50]. This could be explained by lifestyle, low parity, advanced age at first full term pregnancy. On the contrary, in South-Asian countries, Matalqua et al in 2011 did not reveal significant association between monthly income and breast cancer risk [30]. In the absence of a uniform and valid definition of "socio-economic level", there is surely some bias in various studies.





## Study limit

This was a case-control study with certain biases including memory bias: some participants did not remember exposure to certain risk factors when interviewed during the study.

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