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Dietary and Non-Dietary Factors Associated with Breast Cancer Among Women Attending Oncology Services in Bujumbura, Burundi

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ABSTRACT

Introduction
Breast cancer is a leading cause of cancer mortality and the second most prevalent cancer among women in Burundi. There remains a substantial shortage of population-based epidemiological data on the burden and risk factors of breast cancer in the country, leaving affected populations with limited awareness of risk factors and available care services. Both modifiable factors (such as diet and tobacco use) and non-modifiable factors (such as genetic predisposition) have been examined in relation to breast cancer.

Purpose
To assess dietary and non-dietary factors associated with breast cancer among women attending oncology services in Bujumbura, Burundi.

Methods
A total of 193 participants with complete data—comprising 71 cases and 122 controls—were included in the analysis. Data were analyzed in STATA, and odds ratios (ORs) with 95% confidence intervals (CIs) and *p*-values were estimated to evaluate associations with breast cancer.

Results
Lower odds of breast cancer were observed among women with a university level of education (adjusted odds ratio [AOR] = 0.20, 95% CI [0.04, 0.98], p = .047) and frequent consumption of tubers/plantains (AOR = 0.33, 95% CI [0.14, 0.80], p = .015). Higher odds of breast cancer were observed among women using modern contraceptives (AOR = 3.73, 95% CI [1.57, 8.82], p = .003), those with chronic pathologies (AOR = 2.90, 95% CI [1.34, 6.29], p = .007), and those reporting frequent consumption of meat/fish (AOR = 5.29, 95% CI [1.08, 25.87], p = .040), legumes/seeds (AOR = 5.81, 95% CI [2.00, 16.81], p = .001), and oils/fats (AOR = 5.47, 95% CI [1.95, 15.32], p = .001).

Conclusions
Strategies that promote women's education, support informed contraceptive counseling, encourage healthier dietary practices, and strengthen prevention and management of chronic conditions may help address factors associated with breast cancer in this setting.

INTRODUCTION

According to estimates from the International Agency for Research on Cancer, approximately one in five people will develop cancer during their lifetime, and roughly one in nine men and one in twelve women will die from the disease (Bray et al., 2024). In 2022, lung cancer was the most frequently diagnosed cancer globally (approximately 2.5 million new cases, or 12.4% of all diagnoses), followed by female breast cancer (11.6%), colorectal cancer (9.6%), prostate cancer (7.3%), and stomach cancer (4.9%) (Bray et al., 2024).

In East Africa, an estimated 28% to 37% of breast cancer cases could potentially be prevented through early detection and appropriate treatment (American Cancer Society, 2024; Joko-Fru et al., 2020). In Burundi, breast cancer ranked as the 22nd leading cause of death in 2020 with a mortality rate of 0.51%, and 18% of patients referred abroad for care were diagnosed with cancer, led by breast cancer (Niyonsaba et al., 2021). In 2022, Burundi recorded an estimated 863 new breast cancer cases (10.8% of all cancers), 513 deaths (8.9%), and a 5-year prevalence of 1,597 cases (0.0115%) (Global Cancer Observatory, 2024).

Despite efforts to establish a population-based cancer registry in Bujumbura, epidemiological surveillance data on cancer in Burundi remain scarce (Ministère de la Santé Publique et de la Lutte contre le Sida, 2024). Available evidence largely stems from targeted research studies (Manirakiza et al., 2020), and public understanding of gynecological and breast cancers—including associated risk factors and pathways to appropriate care—remains limited (Ministère de la Santé Publique et de la Lutte contre le Sida, 2024). Concurrently, reducing malnutrition toward World Health Organization benchmarks and controlling chronic non-communicable diseases are major priorities for Burundi's health system (République du Burundi, 2018, 2024).

Several modifiable lifestyle factors have been studied in relation to breast cancer risk in women, including physical activity, adiposity/obesity, alcohol use, tobacco smoking, and dietary intake. Because behavioral exposures frequently co-occur or cluster, examining both individual and joint relationships is important (Mohamed Khalis, 2019). Addressing key modifiable risk factors can help reduce future cancer burden and yield substantial health and economic benefits (Bray et al., 2024; Ganry & Le Guilloux, 2007).

This study aimed to identify dietary and non-dietary factors associated with breast cancer among women attending oncology services in Bujumbura, Burundi, to inform prevention and control efforts. We hypothesized that dietary patterns and food consumption frequencies, as well as sociodemographic, anthropometric, behavioral, reproductive, hormonal, medical, surgical, and family history factors, would be associated with breast cancer status. To our knowledge, this is the first investigation of its kind in Burundi.

METHODS

Study Design and Setting

This hospital-based case–control study was conducted across three facilities in Bujumbura offering oncology services: Kamenge University Teaching Hospital (*Centre Hospitalo-Universitaire de Kamenge*, CHUK), *Centre Médico-Chirurgical de Kinindo* (CMCK), and Tanganyika Hospital (TH).

Study Period and Population

Cases were women aged ≥18 years with a histologically confirmed diagnosis of breast cancer seen between January 1, 2022, and September 30, 2024, at CHUK, CMCK, or TH. Controls were women aged ≥18 years who attended the internal medicine department of the same hospitals during the study period and had a negative breast cancer diagnosis.

Sample Size and Sampling Technique

Sample size was estimated using Epi Info (version 7.2.6.0) for an unmatched case–control design assuming an odds ratio of 2.5, 80% statistical power, a 95% confidence level, and a 1:2 case-to-control ratio, based on a reported contraceptive prevalence of 29.7% in Burundi in 2023. This yielded a minimum required sample of 176 participants (59 cases and 117 controls) (Sullivan & Soe, 2007). Simple random sampling was used to select eligible cases and controls.

Eligibility Criteria

- **Inclusion criteria:** Women aged ≥18 years; histologically confirmed breast cancer diagnosis

during the study window (for cases) or negative breast cancer status in internal medicine during the study window (for controls); ability to participate in the interview; and provision of informed consent.

- **Exclusion criteria:** Male sex; consultation outside the study period; age <18 years; inability to cooperate with the interview; or refusal/lack of informed consent.

Study Variables

Age at diagnosis was categorized as <40, 40–49, 50–59, and ≥60 years based on breast cancer epidemiology literature and comparable studies (Gevao et al., 2024). Height, body mass index (BMI), marital status, education level, age at menarche, and age at menopause were defined with reference to established literature (Hassen et al., 2022; Kretzler et al., 2022; Sayed et al., 2021). Occupation, religion, residence, income, and food groups were categorized in alignment with Burundi's household living conditions survey (Institut de Statistiques et d'Études Économiques du Burundi, 2021) and Food and Agriculture Organization of the United Nations (FAO) dietary assessment guidance adapted to locally available foods (Food and Agriculture Organization of the United Nations, 2010, 2018; Institut de Statistiques et d'Études Économiques du Burundi, 2021).

Food frequency variables were initially collected across multiple frequency tiers and collapsed into binary categories for regression analysis. Most food groups were categorized as "Sometimes/week or less" versus "Once/day or more." Fruit consumption was categorized as "Once/week or less" versus "Sometimes/week or more" to account for lower fruit intake frequency in sub-Saharan African populations (Okekunle et al., 2024) as well as affordability, availability, and seasonality (Stadlmayr et al., 2023).

Data Collection and Statistical Analysis

Data were collected in October and November 2024. Anthropometric and clinical baseline information (such as admission weight and height) was extracted from medical records where available to reflect status at presentation rather than subsequent disease progression. A structured questionnaire adapted from breast cancer literature was translated from French into Kirundi and pre-tested with 19 female inpatients in the Internal Medicine Department of Prince Regent Charles Hospital (*Hôpital Prince Régent Charles*, HPRC), who were excluded from the final analytic sample. Pre-testing verified item clarity and structure prior to fieldwork.

Trained nurses or resident physicians in each participating department administered the digitized questionnaire using KoboCollect (v2024.1.3) on smartphones and uploaded records to a KoboToolbox server managed exclusively by the first author. Access to the electronic dataset was restricted to authorized research team members. No direct personal identifiers were recorded, and confidentiality was maintained throughout data cleaning, analysis, and reporting.

Data were imported into Microsoft Excel 2021 and analyzed using STATA (version 15). Bivariate logistic regression was used to estimate crude odds ratios (CORs) and 95% CIs between candidate explanatory variables and breast cancer status. Multivariable logistic regression was then conducted to adjust for confounding, incorporating variables with $p \leq .20$ in bivariate analysis alongside *a priori* confounders (age, menopausal status, marital status, occupation, and BMI).

Ethical Considerations

Ethical approval was obtained from the Institutional Bioethics Committee of the Faculty of Medicine, University of Burundi (reference no. 03/10/2024). Written informed consent was obtained from all participants prior to enrollment, and participant anonymity and data confidentiality were strictly upheld.

RESULTS

Of 194 individuals initially enrolled, one participant was excluded due to an incomplete questionnaire, leaving 193 participants (71 cases and 122 controls) in the final analysis—exceeding the minimum target sample of 176. All eligible participants with complete records were retained to preserve statistical power.

Bivariate Analysis of Sociodemographic and Anthropometric Factors

Mean age (± SD) was 45 ± 9.7 years among cases and 40 ± 15.9 years among controls. In bivariate analysis **(Table 1)**,

working as a private employee (COR = 0.13, 95% CI [0.04, 0.40], $p < .001$), attaining a university education (COR = 0.17, 95% CI [0.05, 0.61], $p = .006$), and reporting income/ability to meet basic needs (COR = 0.54, 95% CI [0.30, 0.99], $p = .047$) were associated with lower odds of breast cancer, whereas ages between 40 and 49 years (COR = 3.38, 95% CI [1.58, 5.19], $p = 0.002$) and 50 and 59 years (COR = 4.80, 95% CI [2.08, 11.17], $p < 0.001$), a weight over 75 kg (COR = 2.56, 95% CI [1.18, 5.55], $p = 0.017$), obesity (i.e., BMI over 30 kg/m²; COR = 2.40, 95% CI [1.01, 5.74], $p = 0.048$), and being widowed (COR = 10.22, 95% CI [2.05, 50.75], $p = 0.004$) were associated with higher odds of breast cancer.

Table 1:
Bivariate Analysis of Sociodemographic and Anthropometric Factors ($N = 193$)

Variable / Category	Cases: n (%)	Controls: n (%)	COR (95% CI)	p value
Age (years)				
≤39	21 (29.6)	71 (58.2)	1.00 (Ref.)	—
40–49	23 (32.4)	23 (18.9)	3.38 (1.58–7.19)	.002
50–59	20 (28.2)	14 (11.5)	4.80 (2.08–11.17)	<.001
≥60	7 (9.9)	14 (11.5)	1.69 (0.60–4.73)	.318
Height (meters)				
≥1.60	42 (59.2)	69 (56.6)	1.00 (Ref.)	—
≤1.52	14 (19.7)	13 (10.7)	1.76 (0.75–4.12)	.187
1.53–1.59	15 (21.1)	40 (32.8)	0.61 (0.30–1.24)	.179
Weight (kg)				
≤59	26 (36.6)	50 (41.0)	1.00 (Ref.)	—
>59 to <65	8 (11.3)	26 (21.3)	0.59 (0.23–1.48)	.265
65 to <75	13 (18.3)	28 (23.0)	0.89 (0.39–2.00)	.784
≥75	24 (33.8)	18 (14.8)	2.56 (1.18–5.55)	.017
BMI (kg/m²)				
Normal (<25.0)	30 (42.3)	67 (54.9)	1.00 (Ref.)	—
Overweight (25.0–29.9)	27 (38.0)	42 (34.4)	1.43 (0.75–2.74)	.274
Obese (≥30.0)	14 (19.7)	13 (10.7)	2.40 (1.01–5.74)	.048
Marital status				
Single	6 (8.5)	23 (18.9)	1.00 (Ref.)	—
Married	57 (80.3)	93 (76.2)	2.34 (0.90–6.11)	.080
Widowed	8 (11.3)	3 (2.5)	10.22 (2.05–50.75)	.004
Separated	0 (0.0)	3 (2.5)	1.00a	—
Place of residence				
Rural	34 (47.9)	52 (42.6)	1.00 (Ref.)	—
Urban	37 (52.1)	70 (57.4)	0.80 (0.44–1.45)	.478
Profession				
Agriculture	21 (29.6)	24 (19.7)	1.00 (Ref.)	—
Civil servant	28 (39.4)	24 (19.7)	1.33 (0.59–2.56)	<.001
Private employee	5 (7.0)	42 (34.4)	0.13 (0.04–0.40)	<.001
Others	17 (23.9)	32 (26.2)	0.60 (0.26–1.39)	.239
Education level				
No formal/basic education	9 (12.7)	9 (7.4)	1.00 (Ref.)	—
Primary	19 (26.8)	13 (10.7)	1.46 (0.45–4.67)	.522
Secondary	36 (50.7)	61 (50.0)	0.59 (0.21–1.62)	.307
University	7 (9.9)	39 (32.0)	0.17 (0.05–0.61)	.006
Income				
No	42 (59.2)	54 (44.3)	1.00 (Ref.)	—
Yes	29 (40.8)	68 (55.7)	0.54 (0.30–0.99)	.047
Religion				
Adventist	2 (2.8)	1 (0.8)	1.00 (Ref.)	—
Catholic	40 (56.3)	74 (60.7)	0.27 (0.02–3.07)	.292
Protestant	23 (32.4)	37 (30.3)	0.35 (0.02–5.10)	.448
Muslim	5 (7.0)	7 (5.7)	0.31 (0.02–3.62)	.351
Jehovah's Witness	1 (1.4)	0 (0.0)	1.00a	—
No religion	0 (0.0)	3 (2.5)	1.00a	—

Note. COR = crude odds ratio; CI = confidence interval; Ref. = reference category. [a]Zero-cell/sparse category in original output; estimate/confidence interval not estimable.

Bivariate Analysis of Hormonal and Reproductive Factors

Mean age at menarche was 14.4 years among cases and 14.1 years among controls, while mean age at first pregnancy was 23.9 years among cases and 21.9 years among controls. As shown in **Table 2**, parity <3 versus ≥3 (COR = 0.25, 95% CI [0.11, 0.56], $p = .001$) was associated with lower odds of breast cancer, whereas menopausal status (COR = 1.88, 95% CI [1.02, 3.45], $p = .040$), use of modern contraceptives (COR = 2.44, 95% CI [1.31, 4.52], $p = .005$), and intrauterine device (IUD) use relative to implant (COR = 12.80, 95% CI [1.20, 135.57], $p = .034$) were associated with higher odds in bivariate testing.

Table 2:
Bivariate Analysis of Hormonal and Reproductive Factors

Variable / Category	Cases: n (%)	Controls: n (%)	COR (95% CI)	p value
Age at menarche (years)				
>15	1 (1.4)	1 (0.8)	1.00 (Ref.)	—
<12	56 (78.9)	104 (85.2)	1.21 (0.06–21.21)	.894
12–15	14 (19.7)	17 (13.9)	0.65 (0.30–1.42)	.285
Age at first pregnancy (years)				
<20	13 (20.3)	23 (35.9)	1.00 (Ref.)	—
20–30	45 (70.3)	39 (60.9)	2.04 (0.91–4.56)	.082
>30	6 (9.4)	2 (3.1)	5.30 (0.93–30.20)	.060
Parity				
≥3	53 (82.8)	35 (54.7)	1.00 (Ref.)	—
<3	11 (17.2)	29 (45.3)	0.25 (0.11–0.56)	.001
Duration of breastfeeding (months)				
>24	13 (20.3)	10 (15.6)	1.00 (Ref.)	—
<12	4 (6.3)	3 (4.7)	1.02 (0.18–5.66)	.977
12–24	47 (73.4)	51 (79.7)	0.70 (0.28–1.76)	.461
Age at menopause (years)				
≤45	11 (34.4)	12 (32.4)	1.00 (Ref.)	—
>45	21 (65.6)	25 (67.6)	0.91 (0.33–2.49)	.864
Multiple pregnancies				
No	56 (87.5)	55 (85.9)	1.00 (Ref.)	—
Yes	8 (12.5)	9 (14.1)	0.87 (0.31–2.42)	.795
History of abortion				
No	41 (64.1)	50 (78.1)	1.00 (Ref.)	—
Yes	23 (35.9)	14 (21.9)	2.00 (0.91–4.38)	.082
Menopausal status				
Premenopausal	39 (54.9)	85 (69.7)	1.00 (Ref.)	—
Menopausal	32 (45.1)	37 (30.3)	1.88 (1.02–3.45)	.040
Circumstance of menstrual cessation				
Natural	22 (68.8)	37 (100.0)	1.00 (Ref.)	—
Chemotherapy-induced	8 (25.0)	0 (0.0)	1.00a	—
Surgical	2 (6.3)	0 (0.0)	1.00a	—

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Use of modern contraceptives				
No	38 (53.5)	90 (73.8)	1.00 (Ref.)	—
Yes	33 (46.5)	32 (26.2)	2.44 (1.31–4.52)	.005
Type of modern contraceptive				
Implant	5 (15.2)	8 (25.0)	1.00 (Ref.)	—
Injectable	11 (33.3)	8 (25.0)	2.20 (0.52–9.29)	.284
Tubal ligation	1 (3.0)	0 (0.0)	1.00a	—
Oral contraceptive pills	8 (24.2)	15 (46.9)	0.85 (0.20–3.49)	.825
Intrauterine device (IUD)	8 (24.2)	1 (3.1)	12.80 (1.20–135.57)	.034

Note. COR = crude odds ratio; CI = confidence interval; Ref. = reference category. Denominators reflect applicable subgroups (e.g., parous women, postmenopausal women, contraceptive users). [a]Zero-cell/sparse category in original output; estimate not estimable.

Bivariate Analysis of Behavioral, Family, Medical, and Surgical Factors

A family history of breast cancer was reported by 5.6% of cases and 2.5% of controls, and 36.6% of both cases and controls reported unknown/unaware family history status **(Table 3)**. Overall, 57.7% of cases and 31.1% of controls reported at least one chronic pathology. Awareness of *BRCA* genetic testing status was rare: one case (1.4%) reported a *BRCA*-positive result and seven controls (5.7%) reported a *BRCA*-negative result, all having been tested abroad. Presence of chronic pathologies (COR = 3.02, 95% CI [1.64, 5.54], $p < .001$) and history of chest X-ray (COR = 2.70, 95% CI [1.16, 6.27], $p = .021$) were significantly associated with higher odds of breast cancer in bivariate analysis **(Table 3)**.

Table 3:
Bivariate Analysis of Behavioral, Family History, Medical, and Surgical Factors

Variable / Category	Cases: n (%)	Controls: n (%)	COR (95% CI)	p value
Alcohol consumption				
No	36 (50.7)	69 (56.6)	1.00 (Ref.)	—
Yes	35 (49.3)	53 (43.4)	1.26 (0.70–2.27)	.431
Smoking				
No	70 (98.6)	114 (94.2)a	1.00 (Ref.)	—
Yes	1 (1.4)	7 (5.8)a	0.23 (0.02–1.93)	.177
Physical activity				
Low	24 (33.8)	42 (34.4)	1.27 (0.55–2.90)	.564
Moderate	34 (47.9)	51 (41.8)	1.48 (0.67–3.26)	.322
Vigorous (Intensive)	13 (18.3)	29 (23.8)	1.00 (Ref.)	—
Use of skincare products				
No	48 (67.6)	81 (66.4)	1.00 (Ref.)	—
Yes	23 (32.4)	41 (33.6)	0.94 (0.50–1.76)	.863
Family history of breast cancer				
No	41 (57.7)	71 (58.2)	1.00 (Ref.)	—
Yes	4 (5.6)	3 (2.5)	2.30 (0.49–10.82)	.289
Unknown	26 (36.6)	48 (36.6)a	0.93 (0.50–1.73)	.838
Affected relative relationship				
Aunt	2 (50.0)	1 (33.3)	1.00 (Ref.)	—
Mother	0 (0.0)	1 (33.3)	1.00b	—
Sister	1 (25.0)	0 (0.0)	1.00b	—
Grandmother	1 (25.0)	1 (33.3)	0.50 (0.01–19.56)	.711
***BRCA* predisposition status**				
Negative (No)	0 (0.0)	7 (5.7)	1.00b	—
Positive (Yes)	1 (1.4)	0 (0.0)	1.00b	—
Unknown	70 (98.6)	115 (94.3)	0.53 (0.12–2.38)	.415
Chronic pathologies				
No	30 (42.3)	84 (68.9)	1.00 (Ref.)	—
Yes	41 (57.7)	38 (31.1)	3.02 (1.64–5.54)	<.001
High blood pressure				
Negative (−)	65 (91.5)	108 (88.5)	1.00 (Ref.)	—
Positive (+)	6 (8.5)	14 (11.5)	0.71 (0.26–1.94)	.508
Heart disease				
Negative (−)	69 (97.2)	119 (97.5)	1.00 (Ref.)	—
Positive (+)	2 (2.8)	3 (2.5)	1.14 (0.18–7.05)	.880
Gastritis				
Negative (−)	64 (90.1)	116 (95.1)	1.00 (Ref.)	—

Positive (+)	7 (9.9)	6 (4.9)	2.11 (0.68–6.56)	.195
Asthma				
Negative (−)	64 (90.1)	118 (96.7)	1.00 (Ref.)	—
Positive (+)	7 (9.9)	4 (3.3)	3.22 (0.91–11.43)	.070
Diabetes				
Negative (−)	64 (90.1)	102 (83.4)a	1.00 (Ref.)	—
Positive (+)	7 (9.9)	20 (16.4)	0.55 (0.22–1.39)	.212
History of benign breast disease				
No	55 (77.5)	79 (64.8)	1.00 (Ref.)	—
Yes	16 (22.5)	43 (35.2)	0.53 (0.27–1.04)	.067
Chest X-ray				
No	56 (78.9)	111 (91.0)	1.00 (Ref.)	—
Yes	15 (21.1)	11 (9.0)	2.70 (1.16–6.27)	.021

Note. COR = crude odds ratio; CI = confidence interval; Ref. = reference category. aPreserved from original table output as reported (note: 114 + 7 = 121 for smoking controls; 48/122 = 39.3% for unknown family history controls; 102/122 = 83.6% for diabetes-negative controls). [b]Zero-cell/sparse category in original output; estimate not estimable.

Bivariate Analysis of Food Consumption Frequency

In bivariate analysis **(Table 4)**, consuming fruits "Sometimes/week or more" versus "Once/week or less" (COR = 0.47, 95% CI [0.25, 0.88], p = .019) and consuming tubers/plantains "Once/day or more" versus "Sometimes/week or less" (COR = 0.47, 95% CI [0.24, 0.90], p = .023) were associated with lower odds of breast cancer. Conversely, consuming meat/fish "Once/day or more" (COR = 3.70, 95% CI [1.08, 12.92], p = .037), consuming cereals/cereal products "Sometimes/week or less" (COR = 1.87, 95% CI [1.03, 3.39], p = .039), and consuming oils/fats "Once/day or more" (COR = 2.70, 95% CI [1.42, 5.12], p = .002) were associated with higher odds of breast cancer.

Table 4:
Bivariate Analysis of Food Consumption Frequency and Breast Cancer

Food Group / Frequency Category	Cases: n (%)	Controls: n (%)	COR (95% CI)	p value
Milk/Dairy products/Eggs				
Once/day or more	8 (11.3)	6 (4.9)	1.00 (Ref.)	—
Sometimes/week or less	63 (88.7)	116 (95.1)	0.40 (0.13–1.22)	.110
Meat/Fish				
Sometimes/week or less	63 (88.7)	118 (96.7)	1.00 (Ref.)	—
Once/day or more	8 (11.3)	4 (3.3)	3.70 (1.08–12.92)	.037
Cereals/cereal products				
Once/day or more	28 (39.4)	67 (54.9)	1.00 (Ref.)	—
Sometimes/week or less	43 (60.6)	55 (45.1)	1.87 (1.03–3.39)	.039
Tubers/plantains				
Sometimes/week or less	53 (74.6)	71 (58.2)	1.00 (Ref.)	—
Once/day or more	18 (25.4)	51 (41.8)	0.47 (0.24–0.90)	.023
Legumes/seeds				
Sometimes/week or less	21 (29.6)	51 (41.8)	1.00 (Ref.)	—
Once/day or more	50 (70.4)	71 (58.2)	1.71 (0.91–3.19)	.092
Vegetables				
Once/day or more	34 (47.9)	54 (44.3)	1.00 (Ref.)	—
Sometimes/week or less	37 (52.1)	68 (55.7)	0.86 (0.48–1.55)	.626
Fruits				
Once/week or less	42 (59.2)	92 (75.4)	1.00 (Ref.)	—
Sometimes/week or more	29 (40.8)	30 (24.6)	0.47 (0.25–0.88)	.019
Oils/fats				
Sometimes/week or less	41 (57.7)	96 (78.7)	1.00 (Ref.)	—
Once/day or more	30 (42.3)	26 (21.3)	2.70 (1.42–5.12)	.002
Sugary products				
Once/day or more	11 (15.5)	9 (7.4)	1.00 (Ref.)	—
Sometimes/week or less	60 (84.5)	113 (92.6)	0.43 (0.17–1.10)	.080
Spices/condiments				
Once/day or more	5 (7.0)	11 (9.0)	1.00 (Ref.)	—
Sometimes/week or less	66 (93.0)	111 (91.0)	1.30 (0.43–3.93)	.632

Note. COR = crude odds ratio; CI = confidence interval; Ref. = reference category.

Multivariable Logistic Regression of Factors Associated With Breast Cancer

In multivariable logistic regression adjusting for age, menopausal status, marital status, occupation, and BMI **(Table 5)**, university education (AOR = 0.20, 95% CI [0.04, 0.98], p = .047) and frequent consumption of 25.87], p = .040), legumes/seeds (AOR = 5.81, 95% CI [2.00, 16.81], p = .001), and oils/fats (AOR = 5.47, 95% CI [1.95, tubers/plantains (AOR = 0.33, 95% CI [0.14, 0.80], p = .015) were associated with lower odds of breast cancer. Conversely, modern contraceptive use (AOR = 3.73, 95% CI [1.57, 8.82], p = .003), presence of chronic pathologies (AOR = 2.90, 95% CI [1.34, 6.29], p = .007), and frequent consumption of meat/fish (AOR = 5.29, 95% CI [1.08, 15.32], p = .001) were associated with higher odds of breast cancer.

Table 5:
Multivariable Logistic Regression of Factors Associated With Breast Cancer

Variable / Category	Cases: n (%)	Controls: n (%)	Bivariate: COR (95% CI)	Bivariate p	Multivariable: AOR (95% CI)	Multivariable p
Education level						
No formal/basic education	9 (12.7)	9 (7.4)	1.00 (Ref.)	—	1.00 (Ref.)	—
Primary	19 (26.8)	13 (10.7)	1.46 (0.45–4.67)	.522	1.87 (0.48–7.30)	.365
Secondary	36 (50.7)	61 (50.0)	0.59 (0.21–1.62)	.307	0.82 (0.23–2.88)	.763
University	7 (9.9)	39 (32.0)	0.17 (0.05–0.61)	.006	0.20 (0.04–0.98)	.047*
Use of modern contraceptives						
No	38 (53.5)	90 (73.8)	1.00 (Ref.)	—	1.00 (Ref.)	—
Yes	33 (46.5)	32 (26.2)	2.44 (1.31–4.52)	.005	3.73 (1.57–8.82)	.003*
Chronic pathologies						
No	30 (42.3)	84 (68.9)	1.00 (Ref.)	—	1.00 (Ref.)	—
Yes	41 (57.7)	38 (31.1)	3.02 (1.64–5.54)	<.001	2.90 (1.34–6.29)	.007*
Meat/Fish						
Sometimes/week or less	63 (88.7)	118 (96.7)	1.00 (Ref.)	—	1.00 (Ref.)	—
Once/day or more	8 (11.3)	4 (3.3)	3.70 (1.08–12.92)	.037	5.29 (1.08–25.87)	.040*
Tubers/plantains						
Sometimes/week or less	53 (74.6)	71 (58.2)	1.00 (Ref.)	—	1.00 (Ref.)	—
Once/day or more	18 (25.4)	51 (41.8)	0.47 (0.24–0.90)	.023	0.33 (0.14–0.80)	.015*
Legumes/seeds						
Sometimes/week or less	21 (29.6)	51 (41.8)	1.00 (Ref.)	—	1.00 (Ref.)	—
Once/day or more	50 (70.4)	71 (58.2)	1.71 (0.91–3.19)	.092	5.81 (2.00–16.81)	.001*
Oils/fats						
Sometimes/week or less	41 (57.7)	96 (78.7)	1.00 (Ref.)	—	1.00 (Ref.)	—
Once/day or more	30 (42.3)	26 (21.3)	2.70 (1.42–5.12)	.002	5.47 (1.95–15.32)	.001*

Note. Adjusted for age, menopausal status, marital status, occupation, and body mass index. COR = crude odds ratio; AOR = adjusted odds ratio; CI = confidence interval; Ref. = reference category. *Statistically significant at p < .05.

DISCUSSION

This study evaluated dietary and non-dietary factors associated with breast cancer among women attending oncology services in Bujumbura.

Neither place of residence nor religion showed a statistically significant association with breast cancer, aligning with findings on residence in Ethiopia (Hassen et al., 2022) and religion in Germany (Kretzler et al., 2022). Similarly, alcohol consumption, smoking, and physical activity were not significantly associated with breast cancer in our sample. These null results differ from studies reporting positive associations with smoking and alcohol use (Heberg et al., 2019; Zeinomar et al., 2023) or protective associations with physical activity (García-Chico et al., 2023; Mititelu et al., 2024). Use of skincare/beauty products also showed no significant association, consistent with a cohort study in Norway (Rylander et al., 2019) but differing from prospective findings in the United States and Puerto Rico (Goldberg et al., 2024). Such differences may reflect variations in exposure intensity, duration, and frequency across populations—including relatively low or infrequent exposure to tobacco and alcohol in our cohort—as well as differences in activity patterns and specific cosmetic products used.

No statistically significant association was observed with family history of breast cancer or history of benign breast disease, contrasting with studies from China and the United States (Liu et al., 2021; Sherman et al., 2024). Chest

X-ray history was associated with breast cancer in bivariate analysis but not after multivariable adjustment, differing from findings at the *Institut Curie* in France (Ribeiro Guerra et al., 2021). Most reproductive and hormonal factors were also non-significant after adjustment, consistent with studies in Sierra Leone and Iran but differing from reports in Ethiopia and Bangui (Balekouzou et al., 2017; Gevao et al., 2024; Hassen et al., 2022), which likely reflects differences in reproductive histories and population structure. Likewise, the bivariate association with parity attenuated after adjustment, suggesting confounding. Only one case (1.4%) reported a *BRCA*-positive result and seven controls (5.7%) reported a *BRCA*-negative result, all tested abroad **(Table 3)**. While this suggests limited local access to molecular genetic testing among participants, the study was not designed to evaluate national diagnostic availability or cost-effectiveness and should not be overextended as a comprehensive national assessment.

University education was associated with lower odds of breast cancer (AOR = 0.20, 95% CI [0.04, 0.98], p = .047), though the confidence interval is wide and borders statistical significance; unmeasured socioeconomic factors, health literacy, and care-seeking pathways may contribute. Presence of chronic pathologies was associated with higher odds of breast cancer (AOR = 2.90, 95% CI [1.34, 6.29], p = .007), paralleling evidence from a Taiwanese cohort linking cumulative chronic disease burden to cancer risk (Tu et al., 2018), even though individual conditions (hypertension, diabetes, asthma, gastritis, and heart disease) were not individually significant here. Modern contraceptive use was also associated with higher odds (AOR = 3.73, 95% CI [1.57, 8.82], p = .003), similar to findings in Bangui (Balekouzou et al., 2017) but differing from Sierra Leone (Gevao et al., 2024), potentially due to differences in contraceptive methods, duration of use, sample characteristics, and exposure measurement.

Among dietary variables, frequent consumption of meat/fish was associated with elevated but imprecise odds (AOR = 5.29, 95% CI [1.08, 25.87], p = .040), differing from the Sister Study in the United States and Puerto Rico where total meat intake attenuated after adjustment while red meat remained associated (Lo et al., 2020); pooling meat and fish into a single group and local dietary patterns may account for this divergence. Frequent consumption of legumes/seeds showed a strong positive association (AOR = 5.81, 95% CI [2.00, 16.81], p = .001), contrasting with an inverse association in Iran (Sharif et al., 2020) and a null dose–response meta-analysis of prospective studies (Kazemi et al., 2021). In practice, legumes and seeds in this setting may be cooked with oils or fats or accompanied by other meal components not captured by frequency alone, alongside broader lifestyle or socioeconomic factors.

Frequent consumption of oils/fats was also associated with higher odds of breast cancer (AOR = 5.47, 95% CI [1.95, 15.32], p = .001), consistent with a meta-analysis linking high-fat diets to breast cancer (Uhomoibhi et al., 2022), although prospective cohort evidence has been mixed when adjusting for traditional risk factors and often reflects more modest effect sizes (Cao et al., 2016). Because our frequency measure did not capture exact quantities, cooking methods, or fat types—and cooking oils often accompany other dishes—the observed effect size may reflect broader dietary habits or culinary preparation practices. Conversely, frequent consumption of tubers/plantains was associated with lower odds of breast cancer (AOR = 0.33, 95% CI [0.14, 0.80], p = .015). Direct evidence on combined tubers and plantains is limited, though a case–control study in Kerala, India, observed lower odds with more frequent cassava/tapioca intake alongside higher odds for certain other roots and tubers, suggesting effects may vary by specific food item (Jayalekshmi et al., 2009). Finally, the bivariate association with fruit consumption did not persist after multivariable adjustment, potentially reflecting seasonal availability, supply constraints, and retrospective dietary reporting.

Study Limitations

This study has several limitations. Retrospective assessment of diet, lifestyle, and medical history introduces potential recall bias if cases and controls remembered or reported past exposures differently. Dietary assessment relied on consumption frequency without quantifying portion sizes, specific oil/fat types, or multi-dish combinations, limiting mechanistic interpretation. The modest sample size produced wide confidence intervals for several estimates and may have limited power to detect smaller associations. In addition, hospital-based recruitment may introduce selection bias if women who did not attend the participating hospitals differed

systematically from participants, although recruiting cases and controls from the same hospitals over the same period supported internal comparability. Finally, residual confounding from unmeasured or imprecisely measured variables cannot be ruled out.

CONCLUSIONS

This study provides preliminary hospital-based evidence on dietary and non-dietary factors associated with breast cancer among women attending oncology services in Bujumbura. Modern contraceptive use, chronic pathologies, and frequent consumption of meat/fish, legumes/seeds, and oils/fats were associated with higher odds of breast cancer, whereas university education and frequent consumption of tubers/plantains were associated with lower odds. Within the limits of a retrospective case–control design, findings support strengthening chronic disease screening and management, offering tailored contraceptive counseling, and promoting balanced dietary practices—including moderation of frequent oil/fat intake—alongside larger prospective studies with detailed dietary assessment to guide breast cancer control in Burundi.

Use of Artificial Intelligence (AI) Declaration: The authors declare that no generative artificial intelligence (AI) tools were used to generate, modify, or manipulate any primary research data. The authors take full responsibility for the accuracy, integrity, and scientific content of this manuscript.

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