

CLINICOPATHOLOGICAL AND MOLECULAR CHARACTERISTICS OF BREAST CANCER IN SOUK AHRAS, ALGERIA: A REGIONAL COMPARATIVE STUDY

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Abstract: This study describes the institutional distribution and biological characteristics of breast cancer among records from two areas of Souk Ahras Province, Algeria: central Souk Ahras and Sedrata. We examined descriptive regional patterns in tumor profiles; because of the small sample and non-significant biomarker comparisons, these patterns should not be interpreted as established regional biological differences. A retrospective descriptive analysis of medical records was performed, including data on hormone receptor status (ER, PR), HER2 expression, the Ki-67 proliferation index, and other biological parameters, such as hematological parameters, liver enzyme levels, and CA 15-3 levels. Descriptively, tumors in Sedrata more often showed hormone-receptor positivity (5/6; 83.3%), whereas central Souk Ahras had higher observed proportions of high Ki-67 expression (12/17; 70.6%) and triple-negative status (4/17; 23.5%). None of the between-region biomarker comparisons was statistically significant. Cancer-type distribution among institutionally recorded suspected cancer cases differed between regions ($p < 0.001$), whereas the breast cancer biomarker profiles did not differ significantly (all $p > 0.05$). These results support continued biological monitoring but do not establish regional differences in breast cancer biology.

Keywords: breast cancer, hormone receptors, Souk Ahras, Sedrata, tumor profile.

INTRODUCTION

Cancer is a major global public health challenge, encompassing a diverse group of diseases characterized by abnormal and uncontrolled cell proliferation that can affect various organs. As cancer progresses, malignant cells acquire the ability to invade surrounding tissues and spread to distant sites through metastasis, often leading to severe complications and potentially death (WHO, 2022).

Today, cancer ranks among the leading causes of mortality worldwide. According to the World Health Organization (WHO, 2022), nearly 20 million new cancer cases were diagnosed in 2021, resulting in approximately 10 million deaths and highlighting the substantial global burden of the disease.

Breast cancer is the most common cancer among women globally, affecting both developed and developing countries. In developing regions, its incidence continues to rise, largely due to increased life expectancy, rapid urbanization, and the adoption of Western lifestyles (WHO, 2020).

Despite significant advances in our understanding of the disease, the etiology of breast cancer remains only partially understood. Breast cancer is highly heterogeneous at the clinical, histological, and molecular levels, which complicates its diagnosis and treatment (Kamali *et al.*, 2017).

Several risk factors have been identified, including tobacco use, high body mass index, low fruit and vegetable intake, and physical inactivity (Globocan, 2020). These factors underscore the critical importance of prevention and health education in the fight against breast cancer.

Cancer is a major public health issue worldwide, and Algeria is no exception. Among all cancer types, breast cancer is the most common cancer among women, and

its incidence is steadily increasing in the eastern regions of the country, including the province of Souk Ahras (Fermas *et al.*, 2022; Belhadj *et al.*, 2021; Benarba *et al.*, 2014).

- According to an epidemiological study conducted in eastern and southeastern Algeria between 2014 and 2018, breast cancer accounted for 43% of newly diagnosed cancer cases among women in the region. The provinces of Annaba, Sétif, Constantine, and Souk Ahras recorded some of the highest incidence rates (Fermas *et al.*, 2022).

- According to the cancer registry, the crude incidence rate in the region increased from 52 cases per 100,000 women in 2014 to approximately 69.4 cases per 100,000 women in 2018 (Fermas *et al.*, 2022). In Souk Ahras specifically, a local cancer center reported 69 breast cancer cases diagnosed since January 2021, with the number projected to reach approximately 80 cases by the end of the year.

Despite these figures, several indicators point to a lack of available data, particularly at the local level, including the wilaya, district, and hospital levels. Few studies have specifically focused on Souk Ahras, and published data on cancer-related factors, clinical characteristics, and biological profiles in the region remain limited. Furthermore,

Many national and regional studies do not consistently cover all wilayas and do not always provide up-to-date, validated cancer registry data for each location (Fermas *et al.*, 2022; Cherbal *et al.*, 2021).

In addition, risk factors specific to Souk Ahras, including lifestyle, environmental factors, access to healthcare, and health awareness, remain poorly documented in the current literature. These gaps highlight the need for more comprehensive local studies

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to better characterize the epidemiological and biological features of breast cancer in the region.

This study also includes an analysis of biochemical profiles to assess variations in specific parameters among individuals and compares the clinical and biological characteristics of breast cancer among individuals from two regions within Souk Ahras Province: central Souk Ahras and Sedrata. This comparison aims to evaluate the potential influence of environmental, socioeconomic, and healthcare access factors on the observed tumor characteristics, thereby contributing to a better understanding of breast cancer and supporting more targeted management strategies in the region.

MATERIAL AND METHODS

Study site

The study population comprised residents of Souk Ahras Province (wilaya), located in northeastern Algeria. The province has a population of 479,002 inhabitants and a developing healthcare infrastructure. It currently has three public hospital establishments (Établissements Publics Hospitaliers, EPH), two of which are located in the provincial capital: EPH Ancien Hôpital, with a capacity of 160 beds (178 organized beds), and EPH Ibn Rochd, with a capacity of 217 beds.

The third establishment, EPH Houari Boumediene, is located in Sedrata and has a capacity of 238 beds (155 organized beds). Overall, the province has a total bed capacity of 615 beds, including 534 organized beds. In addition, two new hospitals are currently being commissioned and are expected to further strengthen healthcare services in the province.

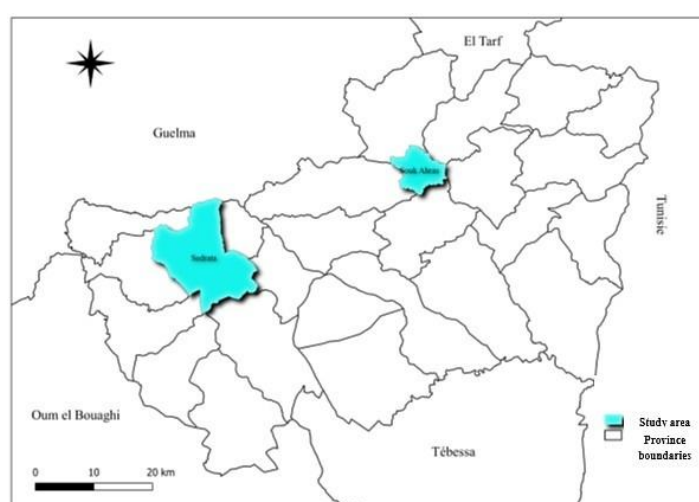


Fig.1. Geographical location of Souk Ahras Province, northeastern Algeria (QGIS Development Team, 2021).

Type and research framework

This was a retrospective, descriptive, and comparative study based on a review of the medical records of individuals treated for breast cancer between January 1, 2025, and March 31, 2025, at the following provincial hospitals:

- Souk Ahras Hospital Center
- Sedrata Hospital

The data used in this study were obtained from pathology records and private laboratory files. The use of these medical records for this retrospective study was authorized by the Ethics Committees of the participating healthcare institutions. As the study was based exclusively on anonymized retrospective data, informed consent was waived in accordance with institutional regulations. All collected information was anonymized before analysis to ensure the confidentiality of individuals.

Studied population

This study included all individuals admitted to the medical oncology department during a three-month period. A total of 28 individuals were included, all of whom were women (28 women and no men).

Inclusion criteria

Women diagnosed with breast cancer between January and March 2025.

Permanent residents of the two study areas with complete medical records containing essential sociodemographic, clinical, histological, and therapeutic data.

Exclusion criteria

Incomplete medical records (e.g., absence of information on cancer type, chronic diseases, or medical history).

Individuals residing outside the study areas.

Records containing insufficient data for reliable statistical analysis.

Data Collected

The collected data were organized into three main categories: sociodemographic, clinical, and therapeutic data, providing a comprehensive overview of the characteristics of individuals with breast cancer.

Sociodemographic Data

These included age at diagnosis, marital status, educational level, and employment status.

Clinical Data

These data included the date and circumstances of diagnosis (self-palpation, mammography, etc.), clinical stage according to the TNM classification (tumor size, lymph node involvement, and presence of metastases), histological tumor type (ductal carcinoma, lobular carcinoma, etc.), and HER2 status.

Therapeutic Data

These relate to the delay between diagnosis and the start of treatment, as well as the types of treatments received: surgery (mastectomy or tumorectomy), chemotherapy, radiotherapy, and hormone therapy.

Statistical Analysis

Statistical analysis was performed using SPSS software. A retrospective comparative study was conducted among patients from Souk Ahras and Sedrata, Algeria. Clinical, histological, and biological data were collected from medical records. Fisher's exact test was used to compare categorical variables between the two regions, with $p < 0.05$ considered statistically significant.

Ethical Considerations

The study was conducted in accordance with ethical principles:

Authorization to use the data was obtained from the ethics committees of the participating healthcare institutions.

The data were anonymized to ensure the confidentiality of individuals.

No direct contact with individuals was required.

Studied Parameters

Institution-based Proportion of Breast Cancer Cases

Data were collected from the medical registers of the oncology departments at Souk Ahras and Sedrata hospitals over the defined study period. All suspected cancer cases recorded by the participating institutions during this period were classified according to tumor location.

Breast cancer records were identified among all suspected cancer records to calculate the institution-based proportion of breast cancer cases in each region. This proportion is not a population-based incidence rate because the study did not use a defined population denominator or person-time at risk. Only records with sufficiently complete biological assessments were included in the subsequent analyses.

Age

Age was available for 26 of the 28 included individuals (20/20 in Souk Ahras and 6/8 in Sedrata). Verification of the individual ages listed in Table 2 yielded a minimum age of 38 years, a maximum age of 72 years, and a mean age of 55.6 years (1,445/26). Two Sedrata records lacked individual age and laterality details and were treated as missing in age analyses.

Table 1.

Verified age summary for the 26 evaluable records

Minimum age among 26 evaluable records	38
Maximum age among 26 evaluable records	72
Mean age among 26 evaluable records	55.6

Table 2.

Verified individual age and breast-cancer location data; two Sedrata records had missing age and laterality

Case No.	Age (years)	Souk Ahras		
		Location		
		Right Side	Left Side	Bilateral
(01/25)	48	*		
(02/25)	71	*		
(03/25)	38		*	
(04/25)	69	*		
(06/25)	65		*	
(10/25)	45		*	
(11/25)	52	*		
(12/25)	41		*	
(14/25)	56	*		
(23/25)	65		*	
(26/25)	39	*		
(27/25)	52	*		
(28/25)	44	*		
(29/25)	63	*		
(30/25)	52	*		
(31/25)	39	*		
(32/25)	59		*	
(35/25)	72		*	
(40/25)	54			*
(41/25)	68	*		

		Souk Ahras		
		Location		
Case No.	Age (years)	Right Side	Left Side	Bilateral
Sedrata (6/8 individual records available; 2 missing)				
(01/25)	52		*	
(10/25)	59			*
(11/25)	50	*		
(12/25)	64	*		
(14/25)	64	*		
Missing record (age/laterality unavailable)				
(22/25)	64	*		
Missing record (age/laterality unavailable)				

Medical and Surgical History

Individual histories, extracted from the medical records, were classified into two categories:

- **Medical history:** chronic diseases (such as diabetes or hypertension) and a family history of breast cancer.

- **Surgical history:** previous surgeries (appendectomy, mastectomy, etc.).

The data were entered into Excel and compared between the two regions using Fisher's exact test. The results were visualized using histograms showing the distribution of medical and surgical histories by region.

Type of Breast Cancer

Histological types were identified from pathological reports. Tumors were classified according to histological type (adenocarcinoma, lobular carcinoma, non-specific types, etc.).

Hormone Receptors

Using the evaluable-case denominators specified in the Results, no statistically significant differences were found between Souk Ahras and Sedrata for ER/PR positivity ($p = 0.621$), HER2 positivity ($p = 0.552$), high Ki-67 expression ($p = 0.356$), or triple-negative status ($p = 1.000$). Two-sided Fisher's exact tests were calculated separately for each biomarker after excluding records missing that biomarker.

RESULTS AND DISCUSSION

During the study period, 143 suspected cancer cases were recorded by the two participating institutions: 93 in Souk Ahras and 50 in Sedrata. Figure 2 shows the institutional distribution of suspected cancer types in Souk Ahras.

Among these institutionally recorded suspected cancer cases, 48 were breast cancer cases, corresponding to a sample proportion of 33.6% (48/143). This measure is not a population-based incidence rate.

Table 3.

Institution-based proportion of breast cancer among suspected cancer cases recorded in Souk Ahras and Sedrata

Region of origin	Total number of suspected cancers	Breast cancer cases, n	Institution-based proportion (%)
Souk Ahras	93	34	36.6%
Sedrata	50	14	28.0%
Total	143	48	33.6%

Distribution by region

Souk Ahras

During the study period, 143 suspected cancer cases were recorded by the two participating institutions (93

in Souk Ahras and 50 in Sedrata). Of these, 48 were breast cancer cases, corresponding to an institution-based sample proportion of 33.6% (48/143), not a population incidence rate.

Epidemiological profile of suspected cancers in Souk Ahras

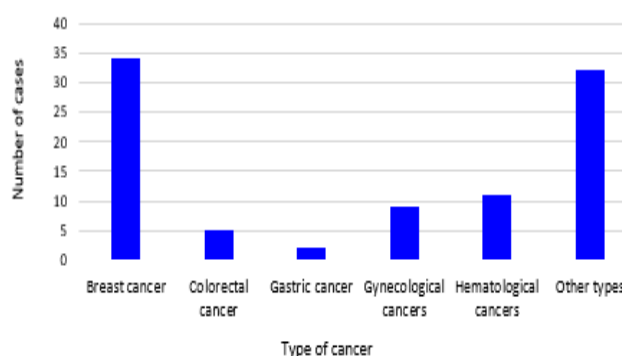


Fig. 2. Epidemiological profile of suspected cancers in Souk Ahras.

Sedrata

Among 50 suspected cancer cases recorded at the Sedrata institution, 14 were breast cancer cases (28.0%). Eight breast cancer records were included in the study;

individual age and laterality were available for six of these eight records, and the two records with missing age/laterality are explicitly identified in Table 2. Figure 3 shows the corresponding Sedrata profile.

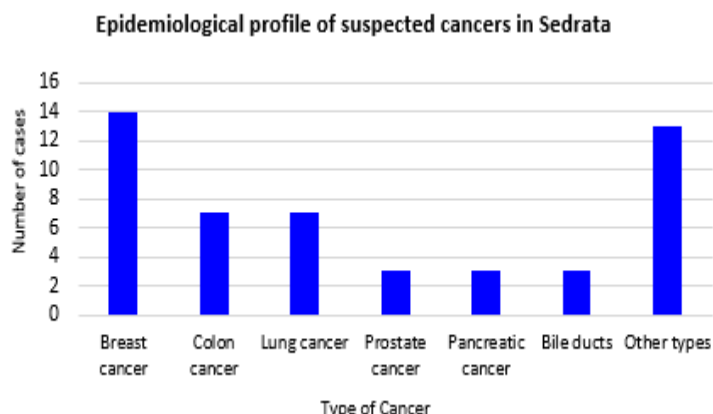


Fig. 3. Epidemiological profile of suspected cancers in Sedrata.

Statistical comparison of cancer profiles between Souk Ahras and Sedrata

A statistically significant difference was observed in the distribution of cancer types among suspected cancer records from Souk Ahras and Sedrata (Fisher's exact test, $p < 0.001$). Breast cancer was the most frequently recorded malignancy in both institutional samples. Because these data are hospital-based and lack population denominators, they cannot be used to infer regional population incidence or its determinants.

Age

The analysis of breast cancer cases recorded in Souk Ahras and Sedrata revealed variability across age groups. The corrected age-group distributions are presented in Figures 4 and 5.

In Souk Ahras (20 cases studied):

Among the 20 Souk Ahras records, the largest age group was 50–59 years, with 6 cases (30%).

Three cases occurred among women younger than 40 years (15%); the remaining age groups comprised 4 cases aged 40–49 years (20%), 5 aged 60–69 years (25%), and 2 aged 70 years or older (10%).

The frequency of breast cancer cases increased markedly from the age of 50 years, consistent with national and international epidemiological data.

These findings highlight the importance of early detection and screening, particularly among women aged 40–59 years, who together represented 10 of 20 cases (50%) in Souk Ahras.

Distribution of cases by age groups (Souk Ahras)

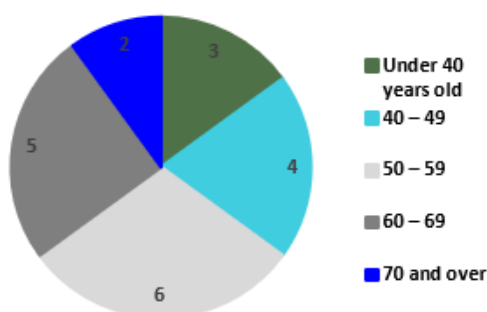


Fig. 4. Verified distribution of cases by age group (Souk Ahras; $n = 20$).

In Sedrata, individual age was available for 6 of the 8 included breast cancer records:

Among the six evaluable Sedrata records, three individuals were aged 50–59 years (50.0%) and three were aged 60–69 years (50.0%).

No evaluable Sedrata record was younger than 50 years; age was missing for two of the eight included Sedrata records.

Because two Sedrata ages were missing and the regional sample was small, the age pattern is reported descriptively.

These findings should be interpreted cautiously and should not be used to infer population-level age distributions.

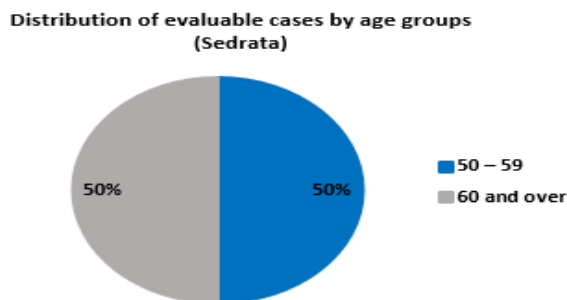


Fig. 5. Verified distribution of evaluable cases by age group (Sedrata; n = 6; two ages missing).

Based on the 26 evaluable ages, the grouped counts were <50 years: 7 versus 0; 50–59 years: 6 versus 3; and ≥60 years: 7 versus 3 (Souk Ahras versus Sedrata). No statistically significant regional difference was detected (Fisher–Freeman–Halton exact test, $p = 0.257$). Two Sedrata records with missing age were excluded from this comparison.

Medical and surgical history of individuals

Medical history

Most individuals had no known medical history, with an identical proportion of 75% in both regions.

Diabetes was reported in 10% of individuals in Souk Ahras and 12.5% in Sedrata, indicating comparable proportions between the two regions.

Hypertension (HTA) was reported only in Souk Ahras (10%), with no cases reported in Sedrata.

Cataracts were reported only in Sedrata (12.5%).

A family history of breast cancer in a first-degree relative (mother or sister) was reported in one individual from Souk Ahras (5%), while no such history was reported in Sedrata. Overall, no statistically significant difference was observed in medical history between patients from the two regions (Fisher's exact test, $p = 0.643$). The regional distribution is shown in Figure 6.

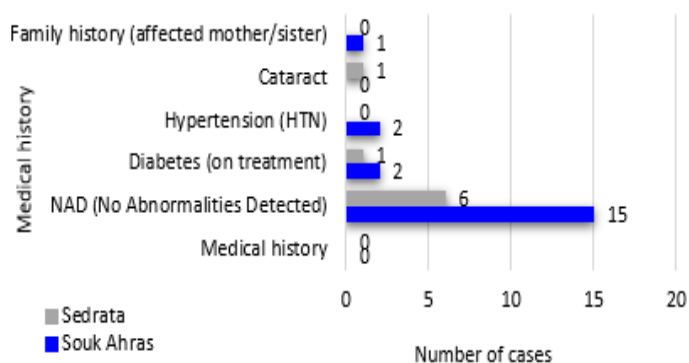


Fig. 6. Distribution of individuals by medical history.

Surgical history

The absence of surgical history (no relevant antecedents) was more frequent in Souk Ahras (90%) than in Sedrata (75%).

Appendectomy was reported only in Souk Ahras (10%), with no cases reported in Sedrata.

In Sedrata, two individuals (12.5% each) had specific surgical histories: one had undergone a right total mastectomy, and the other had undergone cataract surgery. Neither of these surgical histories was reported in Souk Ahras.

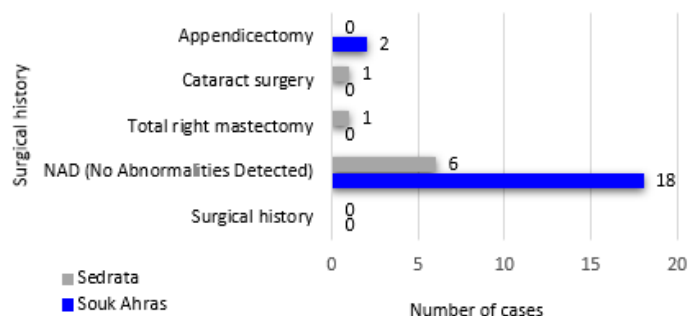


Fig. 7. Distribution of individuals by surgical history.

Statistical comparison of medical and surgical histories between Souk Ahras and Sedrata:

No statistically significant difference was observed in the distribution of surgical history between Souk

Ahras and Sedrata (Fisher's exact test, $p = 0.142$). The regional distribution is shown in Figure 7.

Type of breast cancer

The analysis of breast cancer histological types revealed variability between the two regions in terms of diversity and frequency; the categories are summarized in Figure 8.

Sedrata

The majority of cases (87.5%) were infiltrating nonspecific mammary adenocarcinomas, indicating a predominantly homogeneous histological profile.

Infiltrating lobular carcinoma accounted for the remaining 12.5% of cases.

No other histological types were observed, suggesting a relatively homogeneous histological profile in this region.

Souk Ahras

A large proportion of cases (65%) were also classified as infiltrating nonspecific adenocarcinoma, similar to Sedrata, although this histological type was less predominant in Souk Ahras.

In addition, 15% of individuals had invasive or unspecified mammary carcinomas, which were not observed in Sedrata.

The Souk Ahras region showed greater histological diversity, including:

- Bilateral infiltrating lobular carcinoma: 5%
- Histopathological diagnosis requiring verification against the original pathology report (recorded as “mammary adenoma, Grade II, T3, Stage IIB”): 5%
- Histopathological diagnosis requiring verification against the original pathology report (recorded as “non-invasive carcinoma, Grade III, T3 N1 M0”): 5%
- Unreported cases: 5%

The two internally inconsistent histopathological entries were not interpreted as valid staged tumor categories and should be corrected from the original pathology reports before final publication. Their uncertainty may reflect transcription or coding errors in the retrospective records.

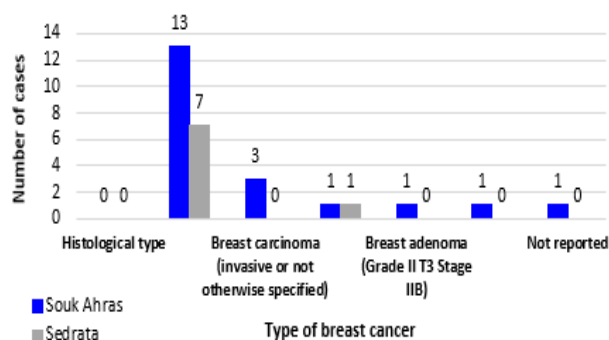


Fig. 8. Distribution of individuals by histological cancer type.

Statistical Comparison of Histological Breast Cancer Types Between Souk Ahras and Sedrata

No statistically significant difference was observed in the distribution of the verified histological categories between Souk Ahras and Sedrata (Fisher’s exact test, $p = 0.850$). The two internally inconsistent Souk Ahras entries were retained as “diagnosis requiring source verification” and were not assigned to carcinoma in situ or adenoma categories for clinical interpretation.

Descriptively, Sedrata had a higher observed proportion of ER/PR-positive and HER2-positive tumors, whereas Souk Ahras had higher observed

proportions of high Ki-67 and triple-negative tumors. Figure 9 displays the positive counts together with the number of evaluable cases and the corresponding percentages. These numerical patterns were not statistically significant and should not be interpreted as established regional biological differences.

The observed biomarker proportions in Souk Ahras and Sedrata are descriptive only. Given the small evaluable samples and non-significant Fisher’s exact tests, no conclusion can be drawn regarding a more favorable or more aggressive regional tumor phenotype.

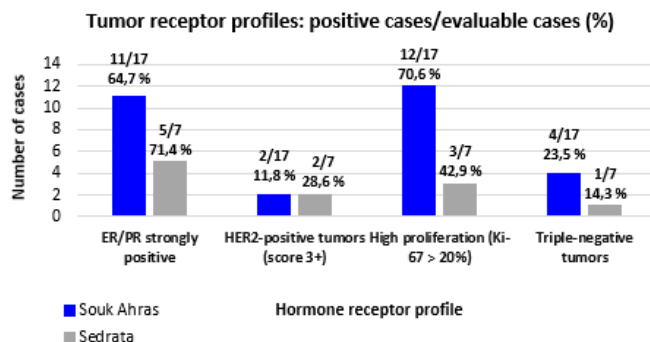


Fig. 9. Tumor receptor profiles. Bars show positive cases/evaluable cases and percentages; biomarker-specific missing data are excluded from the denominators.

For Figure 9, the biomarker-specific denominators and missing data were: ER/PR-Souk Ahras 11/17 positive (64.7%; 3 missing) and Sedrata 5/6 positive (83.3%; 2 missing); HER2-Souk Ahras 2/17 positive (11.8%; 3 missing) and Sedrata 2/7 positive (28.6%; 1 missing); high Ki-67-Souk Ahras 12/17 high (70.6%; 3 missing) and Sedrata 3/7 high (42.9%; 1 missing); triple-negative-Souk Ahras 4/17 (23.5%; 3 missing) and Sedrata 1/7 (14.3%; 1 missing). Percentages use only biomarker-evaluable cases as denominators.

Statistical Analysis of Tumor Biological Profiles

For ER/PR, 17 Souk Ahras cases were evaluable (11 positive; 64.7%; 3 missing) and 6 Sedrata cases were evaluable (5 positive; 83.3%; 2 missing), $p = 0.621$. For HER2, 17 Souk Ahras cases were evaluable (2 positive; 11.8%; 3 missing) and 7 Sedrata cases were evaluable (2 positive; 28.6%; 1 missing), $p = 0.552$. For Ki-67, 17 Souk Ahras cases were evaluable (12 high, >20%; 70.6%; 3 missing) and 7 Sedrata cases were evaluable (3 high; 42.9%; 1 missing), $p = 0.356$. For triple-negative status, 17 Souk Ahras cases were evaluable (4 triple-negative; 23.5%; 3 missing) and 7 Sedrata cases were evaluable (1 triple-negative; 14.3%; 1 missing), $p = 1.000$. All p values are from two-sided Fisher's exact tests. None of the biomarker comparisons was statistically significant.

The present study provides descriptive information on breast cancer records from the participating institutions in Souk Ahras Province. The findings concern this hospital-based sample and do not estimate population incidence or establish regional biological differences.

During the study period, 28 breast cancer cases were recorded in the two regions, including 20 cases in Souk Ahras (71.4%) and 8 in Sedrata (28.6%). This uneven distribution could be explained by the larger population of Souk Ahras, as well as differences in access to healthcare facilities and screening services. Previous studies, notably that of Hachemi (2020), have emphasized the potential role of geographic location and the availability of medical services in cancer detection rates. The relative isolation of Sedrata may contribute to delays in diagnosis.

Because the study used institutionally recorded suspected cancer cases rather than a population denominator, the observed breast cancer proportions cannot be validly compared with population-based incidence rates reported for Tlemcen, Constantine, or Sétif. Such comparisons were therefore removed from the interpretation.

The distribution of cases by age group revealed distinct patterns between the two regions. In Souk Ahras, the largest group was 50–59 years (6/20; 30%), followed by 60–69 years (5/20; 25%), 40–49 years (4/20; 20%), under 40 years (3/20; 15%), and 70 years or older (2/20; 10%). These verified counts are shown in Figure 4. The 40–49-year group accounted for 20% of cases, indicating a substantial proportion of cases among perimenopausal women. These findings should be interpreted descriptively and are consistent with the need to consider age in local screening strategies.

In Sedrata, among the six records with available age, three individuals were aged 50–59 years (50%) and three were aged 60–69 years (50%); no evaluable record was younger than 50 years. Two of the eight Sedrata records had missing age, as shown in Figure 5. The small sample and missing data limit interpretation of the apparent age pattern.

Medical histories showed a similar profile in both regions, with 75% of individuals reporting no particular medical history. However, some differences were observed: diabetes was reported in 10% of cases in Souk Ahras and 12.5% in Sedrata, while hypertension (HTA) was reported only in Souk Ahras (10%). Although these comorbidities were relatively uncommon in the study population, their presence may be relevant to the overall clinical management of individuals with breast cancer.

Regarding surgical history, a higher proportion of individuals from Souk Ahras (90%) had no history of previous surgery compared with those from Sedrata (75%). Notably, major surgical procedures, such as mastectomy and cataract surgery, were reported only among individuals from Sedrata. These findings may reflect differences in access to surgical care or variations in the characteristics of the individuals between the two regions.

Infiltrating invasive ductal adenocarcinoma was the most common histological type in both regions, accounting for 65% of cases in Souk Ahras and 87.5% in Sedrata. This tumor type, also referred to as invasive ductal carcinoma, is the most common histological subtype of breast cancer worldwide. It originates in the mammary ducts and invades the surrounding breast tissue.

The cases recorded in Souk Ahras showed greater histological diversity, consistent with the national literature, in which invasive ductal carcinoma remains predominant, accounting for approximately 75–85% of cases depending on the series (Aouad *et al.*, 2022).

In Souk Ahras, greater histological diversity was observed, with several other breast tumor types identified in addition to adenocarcinomas. These included bilateral infiltrating lobular carcinoma (5%). Invasive lobular carcinoma originates in the lobules and may present with less clearly defined palpable masses, which can make clinical detection more challenging.

One Souk Ahras record was transcribed as “non-invasive carcinoma, Grade III, T3 N1 M0.” This combination is internally inconsistent because T3 denotes an invasive tumor category and cannot be reconciled with a non-invasive (in situ) diagnosis. In the absence of the original pathology report in the analytical file, this case was reclassified as “histopathological diagnosis requiring source verification” and was not clinically interpreted as carcinoma *in situ*.

A second Souk Ahras record was transcribed as “mammary adenoma, Grade II, T3, Stage IIB.” A benign adenoma is not assigned malignant tumor grade or TNM stage; therefore, this entry is also internally inconsistent. Pending confirmation from the original pathology report, it was classified as “histopathological diagnosis requiring source verification” and excluded from subtype-specific clinical interpretation.

In contrast, the relative histological uniformity observed in Sedrata may reflect differences in diagnostic practices, the completeness of pathological records, or access to histological investigations. However, the small sample size limits the extent to which these possible explanations can be established.

No inference about early detection or diagnostic access was drawn from the uncertain histopathological records. Verification of the two original pathology reports is required before the corresponding diagnoses and stages can be finalized.

Descriptive differences were observed in the biomarker proportions between the two institutional samples, particularly for hormone receptor expression, HER2 status, and Ki-67; however, none reached statistical significance.

ER/PR positivity was observed in 5/6 evaluable Sedrata tumors (83.3%) and 11/17 evaluable Souk Ahras tumors (64.7%; $p = 0.621$). This numerical difference is a descriptive trend only and does not demonstrate greater endocrine sensitivity in one region.

HER2 positivity was observed in 2/7 evaluable Sedrata tumors (28.6%) and 2/17 evaluable Souk Ahras tumors (11.8%; $p = 0.552$). The difference was not statistically significant and is reported only as a descriptive trend.

High Ki-67 expression ($>20\%$) was observed in 12/17 evaluable Souk Ahras tumors (70.6%) and 3/7 evaluable Sedrata tumors (42.9%; $p = 0.356$). This non-significant numerical difference should be interpreted cautiously and does not establish a regional difference in proliferative activity.

Triple-negative status was observed in 4/17 evaluable Souk Ahras tumors (23.5%) and 1/7 evaluable Sedrata tumors (14.3%; $p = 1.000$). This non-significant numerical difference does not establish a regional difference in tumor aggressiveness.

Our findings are consistent with the recent Algerian multicenter real-world study by Bounedjar *et al.* (2026), which reported that hormone receptor-positive breast cancers were the predominant molecular subtype among Algerian women. Similarly, our study identified a predominance of hormone receptor-positive tumors, particularly in Sedrata.

The higher observed frequencies of high Ki-67 and triple-negative status in central Souk Ahras were non-significant descriptive trends. They should not be interpreted as evidence of a distinct or more aggressive regional tumor biology.

Breast cancer is heterogeneous in biological characteristics, prognosis, and treatment response. In this small hospital-based sample, Sedrata showed a numerically higher ER/PR-positive proportion, while Souk Ahras showed numerically higher high-Ki-67 and triple-negative proportions; all regional comparisons were non-significant and remain descriptive.

Although previous studies support the prognostic relevance of Ki-67, the present data do not demonstrate a regional difference in proliferation. The observed proportions require confirmation in larger, adequately powered samples with complete biomarker data.

The biomarker patterns observed here can be compared descriptively with published molecular

subtype studies, but the non-significant regional comparisons preclude conclusions about a more favorable or more aggressive phenotype in either region.

The numerical regional patterns underscore the value of complete molecular characterization for every individual, but they do not demonstrate biological differences between Souk Ahras and Sedrata.

These findings are consistent with the recommendations of Saunders *et al.* (2024), who emphasized that strengthening healthcare systems, expanding the oncology workforce, and improving access to comprehensive cancer care are essential to addressing the growing global burden of cancer and improving outcomes for individuals with cancer.

LIMITATIONS

This study has several limitations. The small sample size reduced statistical power and limits generalizability. The short inclusion period does not capture temporal variation in institution-based case proportions. The hospital-based denominator prevents estimation of population incidence. In addition, age was missing for two Sedrata records, and biomarker denominators varied because of missing test results.

The retrospective design depends on the completeness and accuracy of medical records and may introduce information bias. Two records contained internally inconsistent histopathological information and were therefore classified as requiring source verification and excluded from subtype-specific interpretation. Larger prospective multicenter studies using population-based denominators, complete pathology documentation, and complete biomarker assessment are warranted.

CONCLUSION

Breast cancer is currently one of the leading causes of cancer among women, both globally and nationally. Through this epidemiological study conducted in the breast cancer units of Souk Ahras and Sedrata from January to March 2025, we aimed to better characterize the clinical, biological, and prognostic features of individuals treated for breast cancer in the region.

Analysis of the verified medical records showed an age range of 38–72 years and a mean age of 55.6 years among 26 evaluable individuals. Nineteen of 26 evaluable individuals (73.1%) were aged 50 years or older; the largest regional age group was 50–59 years in Souk Ahras (6/20; 30%), while Sedrata had equal numbers in the 50–59 and 60–69 groups (3/6 each). The most frequent histological types were invasive adenocarcinomas of the nonspecific type, often classified as Grade II or III according to the Nottingham classification. The predominance of these invasive forms highlights the clinical importance of breast cancer in the study population, particularly in the context of potential delays in diagnosis and differences in access to screening services.

At the immunohistochemical level, most individuals had tumors showing strong expression of hormone receptors (estrogen and progesterone receptors), a characteristic generally associated with potential responsiveness to endocrine therapy. However, triple-negative and HER2-positive tumors were also

identified, representing biological profiles with different therapeutic and prognostic implications. The Ki-67 proliferation index was high in several cases, indicating increased proliferative activity in a proportion of the tumors studied.

A significant difference was observed in the overall distribution of cancer types among institutionally recorded suspected cancer cases ($p < 0.001$). In contrast, no significant regional differences were detected in age distribution, medical or surgical history, verified histological categories, ER/PR, HER2, Ki-67, or triple-negative status (all $p > 0.05$). Numerical biomarker differences are therefore interpreted only as descriptive trends.

In conclusion, this study highlights the importance of strengthening early detection strategies, improving access to diagnostic examinations, and increasing awareness among women, particularly in underserved areas, about the importance of breast health and appropriate screening. Continued investment in diagnostic facilities and the development of specialized breast cancer services could contribute to improving the overall management of the disease.

Despite its limited sample size and missing data, this study provides a basis for larger investigations. Future studies should use population-based denominators, verify diagnoses directly from original pathology reports, and ensure complete biomarker reporting before making regional comparisons.

AUTHORS CONTRIBUTIONS

Conceptualization, K.M.; methodology, S.M.; data collection, K.M., R.B., and S.M.; data validation, K.M., S.M., and R.B.; data processing, K.M. and S.B.; writing—original draft preparation, K.M. and R.B.; writing—review and editing, K.M., A.O., and H.K.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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