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## CLINICAL RELEVANCE OF HORMONAL RECEPTOR EXPRESSION IN BREAST CANCER: AN IMMUNOHISTOCHEMICAL STUDY FROM TRIPOLI, LIBYA

**Background.** Breast cancer (BC) is the most frequently diagnosed malignancy among women in Libya; however, limited data are available on the immunohistochemical (IHC) profiles of BC in the region. This study aimed to characterize BC cases in Western Libya based on clinical, pathological, and IHC features. **Materials and Methods.** Thirty formalin-fixed paraffin-embedded BC tissue samples were collected from the patients at the National Cancer Institute in Sabratha, Libya, between January and April 2024. IHC staining for estrogen receptor (ER), progesterone receptor (PR), human epidermal growth factor receptor 2 (HER2), and Ki-67 was performed. **Results.** Patients' age ranged from 24 to 63 years (mean  $44.60 \pm 10.23$ ), with the 44–53-year group being the most frequent (33%). Invasive ductal carcinoma was the most common subtype (74%), especially grade 3 (47%). Most tumors were ER-positive (78.6%), PR-positive (67.9%), and HER2-negative (67.9%), with low Ki-67 expression in 53.6% of cases. HER2 score 0 was most prevalent (40%). Mean PR expression was the highest in grade 2 tumors ( $53.0 \pm 32.2$ ), whereas Ki-67 in grade 3 tumors ( $51.1 \pm 29.7$ ). Significant associations were found between ER status and mean corpuscular hemoglobin ( $p = 0.039$ ) and mastectomy status and mean cell hemoglobin concentration ( $p = 0.031$ ). **Conclusion.** The findings highlight the predominance of hormone receptor-positive and HER2-negative tumors in this Libyan cohort.

**Keywords:** breast cancer, immunohistochemistry, hormone receptors, HER2, Ki-67, Libya.

Breast cancer (BC) is the most commonly diagnosed malignancy and the leading cause of cancer-related mortality among women worldwide, accounting for approximately 2.3 million new cases and 685,000 deaths in 2020 [1]. Its heterogeneity in morphology, molecular characteristics, and clinical behavior necessitates precise diagnostic and classification techniques to guide effective treatment planning and prognostication.

Immunohistochemistry (IHC) has emerged as a cornerstone in the pathological assessment of BC, providing crucial insights into tumor biology through the detection of key biomarkers such as estrogen receptor (ER), progesterone receptor (PR), and human epidermal growth factor receptor 2 (HER2). These markers form the basis for classifying BC into molecular subtypes — luminal A, luminal B, HER2-positive, and triple-nega-

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tive — which are pivotal in determining therapeutic strategies [2, 3].

Beyond its diagnostic utility, IHC also serves as a predictive and prognostic tool. For instance, ER and PR positivities indicate potential responsiveness to hormone therapy, while HER2 overexpression may qualify patients for targeted anti-HER2 treatments [4]. Triple-negative BC (TNBC), characterized by the absence of ER, PR, and HER2, poses a clinical challenge due to its aggressive nature and lack of targeted therapy options [5, 6].

In low- and middle-income countries, including those in North Africa and the Middle East, access to standardized IHC testing remains limited, often due to resource constraints, lack of trained personnel, and infrastructural challenges. Consequently, underutilization of IHC contributes to diagnostic delays, suboptimal treatment decisions, and poorer patient outcomes [7–9]. Strengthening IHC capabilities in these regions is therefore essential to improve diagnostic accuracy and align local BC management practices with international standards [10].

This study aims to evaluate the diagnostic relevance of IHC in BC cases within a regional context, emphasizing its role in tumor classification and the identification of molecular subtypes. By addressing local challenges and analyzing biomarker expression profiles, the research contributes to a broader understanding of BC biology and supports the advancement of personalized oncology in under-resourced settings.

## Materials and Methods

**Patient selection and sample collection.** A total of 30 BC tissue samples were collected from female patients at the National Cancer Institute, Sabratha, Libya, after obtaining informed consent. The samples were collected between January and April 2024. The patients' ages ranged from 24 to 63 years. All patients underwent comprehensive clinical evaluations, including magnetic resonance imaging (MRI), computed tomography (CT) scan, ultrasound, sonomammography, and digital mammography. The diagnostic and therapeutic procedures followed the standard protocols for cancer patients as approved by the Libyan Ministry of Health under Order No.564. Sample collection and acquisition of clinical data were conducted in strict accordance with the ethical principles outlined in the Declaration of Helsinki.

**Immunohistochemical analysis.** IHC analysis was conducted on formalin-fixed, paraffin-embedded (FFPE) BC tissue sections using the fully automated Ventana Benchmark XT staining system (Ventana Medical System, Inc., USA). The analysis targeted the expression of ER, PR, HER2, and proliferation marker Ki-67. The following ready-to-use monoclonal antibodies and clones were employed: anti-ER (clone SP1), anti-PR (clone 1E2), anti-HER2 (clone 4B5), and anti-Ki-67 (clone 30-9), all supplied by Ventana/Roche Diagnostics.

The staining protocol followed the manufacturer's guidelines, with built-in quality control procedures. Each run included appropriate positive and negative controls to validate the assay performance. Slides were independently reviewed by two experienced pathologists. ER and PR expression levels were assessed using the Allred scoring system, while HER2 was evaluated according to the ASCO/CAP 2018 guidelines. Ki-67 proliferation index was determined by calculating the percentage of positively stained tumor nuclei in at least 500 invasive carcinoma cells in hotspot areas. All IHC procedures were performed at Attassami Medical Laboratory, a certified private pathology facility located in Tripoli, Libya.

**Statistical analysis.** Statistical analysis was performed using SPSS (Version 26, IBM corp.). Continuous variables with normal distribution were expressed as mean  $\pm$  standard deviation (SD), including hematological parameters and IHC marker expression levels. Categorical variables such as patient demographics (age groups), clinical characteristics (disease duration), and treatment history were presented as frequencies and percentages. One-way analysis of variance (ANOVA) was used to compare the mean expression levels of ER, PR, HER2, and Ki-67 across BC subtypes. Additionally, the Chi-square ( $\chi^2$ ) test was employed to assess statistical associations between categorical variables. This included evaluating the relationship between ER and PR status and the selected clinical parameters, as well as the association between the positive/negative expression status of all IHC markers and tumor subtypes. A  $p$ -value  $< 0.05$  was considered statistically significant.

## Results

**Patient demographic and clinical characteristics.** The demographic and clinical data of the study population were systematically collected and analyzed

to provide a comprehensive overview of the patients' baseline profiles. The variables included age at diagnosis, duration of disease, and year of initial diagnosis. These parameters were extracted from medical records and patient interviews. The age distribution of BC patients ranged from 24 to 63 years, with a mean age of  $44.60 \pm 10.23$  years. The most frequent BC was recorded in 44–52-year-old patients, accounting for 33% of the cases, followed closely by the 34–43-year-old group at 30%. In contrast, younger patients (24–33 years) represented only 13% of the cohort. Overall, approximately 63% of patients were between 34 and 53 years old, indicating that middle-

**Table 1. Clinical, pathological, and diagnostic features of BC patients**

Characteristics	Number of cases	
	N	%
Sample		
Left breast mass	10	33
Right breast mass	15	50
Whole breast	5	17
Tumor Type		
Invasive ductal carcinoma (grade 2)	8	27
Invasive ductal carcinoma (grade 3)	14	47
Fibroadenoma	2	7
Ductal carcinoma in situ	4	13
Invasive lobular carcinoma	2	7
Malignant tumor	28	93
Benign tumor	2	7
Symptoms		
Normal nipple	21	70
Nipple discharge	2	7
Bloody nipple	5	17
Nipple retraction	2	7
Examination Test		
Histopathological exam	30	
CT scan	19	
ECHO-mammographic	8	
MRI	3	
Digital mammography	1	
Ultrasound	1	
Mastectomy		
Yes	8	27
No	22	73

aged women formed the majority of the affected population in this study. These findings are consistent with the commonly reported age range for BC incidence in similar regional and global studies. Additionally, the duration of illness among the patients was also identified. The majority (43%,  $n = 13$ ) had a duration of illness of 2–4 years, with a mean duration of  $3.61 \pm 2.09$  years.

**Clinical and diagnostic features of the study population.** A detailed summary of the clinical presentations, diagnostic modalities, and pathological findings of the BC patients is presented in Table 1. Most of the biopsy samples were obtained from the right breast mass (50%). Invasive ductal carcinoma was the most common histopathological subtype, accounting for 74% of all BC cases in this cohort. Fibroadenoma was also identified in 7% of patients. The nipple appeared normal in 70% of cases, while bloody nipple discharge was observed in 16%.

BC diagnosis was established using several diagnostic tools, the most significant of which was the histopathological examination, performed in all patients (47%). In addition, the table outlines the complications encountered during disease progression and therapeutic interventions, including surgical procedures such as mastectomy. This comprehensive overview provides critical insights into clinical variability and management strategies among the studied cohort.

**General laboratory parameters.** Various investigations, including complete blood count, erythrocyte sedimentation rate, blood glucose levels, liver enzymes, and tumor markers, were conducted as a part of disease monitoring and therapy (Table 2).

**IHC receptor status.** The expression status of ER, PR, and HER2 was determined by IHC. Table 3 summarizes the distribution of these markers among the study population, presented as both frequency and percentage. The results were categorized into positive and negative expression for each marker based on the established clinical cut-off values. These biomarkers play a critical role in BC classification and in guiding therapeutic decisions, particularly concerning hormonal and targeted therapies. Among the IHC markers, ER-positive expression was the most frequent, observed in 78.6% of the cases, followed by PR-positive expression and HER2-negative status, accounting for 67.9% of the analyzed cases each. It is important to note that the total number of patients assessed for

each marker varied slightly due to the differences in tissue availability and staining quality.

These findings indicate that the majority of tumors in this cohort belong to the hormone receptor-positive subtype, which is consistent with global BC trends. Hormone receptor-positive tumors, particularly those expressing ER, are typically associated with a better prognosis and a favorable response to endocrine therapy. The predominance of HER2-negative cases further supports the prevalence of luminal-like subtypes, which are less aggressive compared to HER2-positive or TNBC.

**Quantitative expression levels of ER, PR, and Ki-67.** The IHC expression of ER, PR, and the proliferation marker Ki-67 was further classified into three categories: low, moderate, and high, based on the percentage of positively stained tumor cells. As shown in Table 4, the majority of cases exhibited low expression across all three markers. Low Ki-67 expression was observed in 53.6% of the analyzed cases, indicating a predominance of tumors with a relatively lower proliferative index and potentially more favorable prognosis. These stratified results offer a more nuanced understanding of receptor activity beyond binary positive /negative classification.

**HER2 IHC scoring distribution.** The IHC expression of HER2 was assessed and scored according to the ASO/CAP 2018 guidelines, using a standardized scale from 0 to 3+. As summarized in Table 5, the highest proportion of cases fell into the score 0 category, accounting for 42.9% of the study population. This indicates a predominance of HER2-negative BC, which are not eligible for anti-HER2 targeted therapy. Lower frequencies were observed in the intermediate (1+ and 2+) and overexpressed (3+) categories. These findings align with the overall hormone receptor-dominant phenotype observed in this cohort.

**Expression profiles of ER, PR, HER2, and Ki-67.** The mean ± SD expression levels of ER, PR, HER2, and Ki-67 across different BC subtypes are presented in Table 6. The highest mean ER expression was observed in invasive ductal carcinoma grade 3, and PR expression was in invasive ductal carcinoma grade 2. HER2 expression analysis revealed the highest mean value in ductal carcinoma in situ, followed by invasive ductal carcinoma grade 3 and invasive ductal carcinoma grade 2. Notably, invasive lobular carcinoma showed no detectable HER2 expression. For the Ki-67 proliferation index, the

**Table 2. Laboratory and tumor marker results among BC patients**

Laboratory analysis	N	%
<b>ESR</b>		
High	30	100
<b>WBC</b>		
Low	5	16.7
Normal	25	83.3
<b>Lymphocytes</b>		
Low	3	10.0
Normal	23	76.7
High	4	13.3
<b>Neutrophils</b>		
Low	1	3.3
Normal	29	96.7
<b>RBC (normal)</b>	30	100
<b>HB</b>		
Low	9	30.0
Normal	21	70.0
<b>HCT</b>		
Low	17	56.7
Normal	12	43.3
High	1	3.3
<b>MCV</b>		
Low	5	16.7
Normal	25	83.3
<b>MCH</b>		
Low	18	60.0
Normal	11	36.7
High	1	3.3
<b>MCHC</b>		
Low	9	30.0
Normal	21	70.0
<b>Platelets</b>		
Low	3	10.0
Normal	23	76.7
High	4	13.3
<b>Blood Glucose</b>		
Normal	27	90.0
High	3	10.0
<b>Urea (normal)</b>	30	10
<b>AST</b>		
Normal	29	96.7
High	1	3.3
<b>ALT</b>		
Normal	29	96.7
High	1	3.3
<b>CEA (normal)</b>	30	100
<b>CA15.3 (normal)</b>	30	100

*Notes:* ESR — erythrocyte sedimentation rate; WBC — white blood cells; RBC — red blood cells; HB — hemoglobin; HCT — hematocrit; MCV — mean cell volume; MCH — mean cell hemoglobin; MCHC — mean cell hemoglobin concentration; AST — alanine aminotransferase; ALT — alanine aminotransferase; CEA — carcinoembryonic antigen; CA 15.3 — cancer antigen 15.3.

highest mean expression was observed in invasive ductal carcinoma grade 3, followed by invasive lobular carcinoma, invasive ductal carcinoma grade 2, and ductal carcinoma in situ. Meanwhile, no significant differences between the expression of tu-

**Table 3. IHC expression status of ER, PR, and HER2 receptors (positive vs. negative)**

Variables		Number of cases (%)
ER	Negative	6 (21.4)
	Positive	22 (78.6)
PR	Negative	9 (32.1)
	Positive	19 (67.9)
HER2	Negative	19 (67.9)
	Positive	9 (32.1)

**Table 4. Stratified expression levels of ER, PR, and Ki-67**

Marker	Expression level	Frequency	Distribution of cases (%)
ER	Low	15	53.6
	Moderate	7	25.0
	High	6	21.4
PR	Low	19	67.9
	Moderate	5	17.8
	High	4	14.3
Ki-67	Low	15	53.6
	Moderate	6	21.4
	High	7	25.0

**Table 5. HER2 scoring profile based on frequency and percentage**

HER2 score	Number of cases (%)
0	12 (42.9)
1	7 (25.0)
2	1 (3.5)
3	8 (28.6)

**Table 6. Distribution of ER, PR, HER2, and Ki-67 expression levels among tumor subtypes**

Tumor subtype	ER (M ± SD)	PR (M ± SD)	HER2 (M ± SD)	Ki-67(M ± SD)
Invasive ductal carcinoma (grade 2)	43.75 ± 31.48	53.00 ± 32.24	1.12 ± 0.99	28.75 ± 24.89
Invasive ductal carcinoma (grade 3)	49.37 ± 38.21	29.28 ± 24.39	1.21 ± 1.4	51.07 ± 29.68
Ductal carcinoma in situ	45.00 ± 31.09	33.33 ± 32.14	1.75 ± 1.5	22.50 ± 11.90
Invasive lobular carcinoma	45.00 ± 7.01	30.00 ± 0.01	0	45.00 ± 21.21

mor subtypes for any of the markers were observed using one-way ANOVA ( $p > 0.05$ ). Additionally, the association between categorical marker expression status (positive vs. negative) and tumor subtypes was assessed using the Chi-square test. The analysis revealed no significant relationship for ER, PR, HER2, and Ki-67 (all  $p > 0.05$ ), supporting the findings observed in the continuous variable analysis through ANOVA.

While statistical significance was not achieved in the comparison of mean biomarker expression levels, particularly for PR and Ki-67, between grade 2 and grade 3 invasive ductal carcinoma subtypes, the observed trends suggest biologically relevant differences. PR expression appeared higher in grade 2 tumors, whereas Ki-67 levels tended to increase with tumor grade, consistent with more aggressive behavior. These findings, although not statistically conclusive, align with the previous literature and underscore a pattern, which warrants further investigation. The absence of statistical significance may reflect limitations related to sample size and heterogeneity rather than a lack of real biological variation.

**Statistically significant associations between hormonal receptors and laboratory findings.** Statistical analysis revealed several significant associations between clinical and laboratory parameters in BC patients. ER status showed a significant association with mean corpuscular hemoglobin (MCH) levels ( $p = 0.039$ ). Moreover, undergoing mastectomy was significantly associated with mean corpuscular hemoglobin concentration (MCHC) levels ( $p = 0.031$ ), suggesting a potential link between surgical intervention and erythrocyte hemoglobin concentration.

**Discussion**

This study presents a comprehensive clinicopathological and IHC analysis of 30 BC patients treated in Libya, offering one of the few detailed investiga-

tions of this kind in the region. The findings shed light on demographic trends, tumor characteristics, and associations between clinical features and biomarker expression, contributing valuable insight to the local and regional understanding of BC presentation and behavior.

The analysis of the mean age of BC patients is consistent with regional data indicating a younger median age of BC onset compared to western populations, where breast incidence often peaks in women aged 55 and older [11, 12]. The relatively high proportion of younger women may reflect genetic, environmental, or healthcare access-related differences in the Libyan population.

The most common histological type was invasive ductal carcinoma grade 3 (46%), while invasive lobular carcinoma and fibroadenoma represented only 7% each. The data are consistent with the global predominance of invasive ductal carcinoma [9, 13]. A majority of tumors were located in the right breast (50%), with bilateral involvement in 17% of cases. This pattern aligns with published data suggesting a slight predominance of right-sided breast cancers [14], although laterality remains largely incidental.

ER-positivity was observed in 78.6% of tested cases, and PR in 67.9%. These proportions closely resemble the global averages reported concerning large cohorts (e.g., the SEER database), supporting the notion that hormone receptor-positive tumors are common among Libyan women [15]. Notably, half of the ER and PR cases showed low expression percentages, which may impact therapeutic response, especially to hormone therapy. HER2 scoring showed that 42.9% of cases had a score of 0, while 28.6% were scored as +3, suggesting that a minority of patients may benefit from HER2-targeted therapy. This finding highlights the importance of accurate HER2 testing to guide treatment decisions [16]. Ki-67 showed low expression in 53.6% of cases, with higher expression in invasive ductal carcinoma grade 3, supporting its role as a proliferation marker in aggressive tumors [17].

Mean PR expression was the highest in invasive ductal carcinoma grade 2, while ER expression peaked in ductal carcinoma in situ. Ki-67 showed the highest average in grade 3 invasive ductal carcinoma, indicating a more aggressive biological behavior. HER2 expression remained low across all subtypes. Despite observable trends in biomarker

distribution across histological subtypes, no significant associations were found. The absence of statistically significant differences in the expression of ER, PR, HER2, and Ki-67 across BC subtypes may be attributed to the small sample size, which limits statistical power and should not rule out potential clinical relevance.

ER status was significantly associated with MCH levels ( $p = 0.039$ ), potentially reflecting systemic hematological changes influenced by tumor biology [18, 19]. Undergoing mastectomy showed a significant relationship with MCHC ( $p = 0.031$ ), which may suggest the presence of anemia or altered red cell indices in patients undergoing invasive interventions. These findings underscore the complex interplay between systemic health markers and tumor characteristics, a field warranting further investigation [20].

Most routine blood and biochemical tests were within normal limits for the majority of patients, though 57% had low hematocrit and 63% had low MCH. These results might reflect the chronic disease impact or nutritional deficiencies.

The high ESR values in a considerable proportion of the study population could indicate an active inflammatory milieu in BC patients in Libya, meriting further investigation into its prognostic value in future local or regional studies [21–23].

Interestingly, tumor markers such as CEA and CA15-3 were normal in 100% of tested patients, echoing previous reports on their limited sensitivity for BC diagnosis at early or non-metastatic stages [24].

Although this cross-sectional study did not directly assess overall survival (OS), several findings have established prognostic implications that may correlate with OS according to existing literature. The high prevalence of ER-positive and PR-positive BC cases suggests a favorable prognosis, as such tumors typically respond well to endocrine therapy [25–27]. Conversely, the predominance of HER2-negative tumors indicates a subset less likely to benefit from HER2-targeted therapies, which may influence survival in specific patient groups [28]. The observation that more than half of cases exhibited low Ki-67 expression implies a lower proliferative index, often associated with less aggressive tumor behavior and potentially longer than OS [29]. Additionally, the correlations between ER positivity and MCH values and between

mastectomy status and MCHC may reflect systemic hematological responses that are increasingly recognized for their prognostic significance [30]. While these interpretations are exploratory, they align with existing data suggesting that molecular and clinical markers play a critical role in determining BC prognosis and long-term survival [25, 27, 31]. Future prospective studies incorporating follow-up data will be essential to validate these observations in the Libyan population.

The study represents one of the first comprehensive attempts to analyze BC biomarker profiles and clinical correlations in a Libyan cohort, providing baseline data that could inform local oncological practice. The integration of clinical, histological, and hematological data enhances the value and applicability of the findings. These findings fill a critical knowledge gap in the Libyan oncology landscape and underscore the importance of integrating immunohistochemical analysis into routine diagnostic protocols. Ultimately, the work serves as a foundation for future research into region-specific tumor biology and supports efforts to align Libyan diagnostic and treatment strategies with international standards of personalized oncology.

The findings also align with regional trends observed in neighboring countries. For instance, a comparative study from Tunisia and Algeria reported high rates of ER positivity (80.8% and 85.1%, respectively), and notably higher HER2 expression in Tunisian cases (30.4%) compared to Algerian ones (15.6%) [32]. In Jordan, luminal A was the most common molecular subtype identified via IHC, accounting for 60% of cases [33]. A study from western Saudi Arabia highlighted varying expression patterns of ER, PR, and HER2, possibly due to genetic, demographic, or procedural differences [34]. Lebanese data reported a lower HER2 expression rate and a mean tumor size of 2.2 cm at diagnosis, reflecting the impact of early detection strategies [35]. Meanwhile, Egypt's National Cancer

Institute serves as a regional model for standardized IHC use in BC diagnostics [36]. In Morocco, a large-scale study conducted in Casablanca analyzed 2,260 BC cases and demonstrated the predominance of the luminal B subtype, using standard IHC profiling for ER, PR, and HER2 markers [37]. Similarly, a study in Eastern Morocco reported that 64.2% of tumors were ER-positive, underscoring the need to expand hormonal therapy access even in cases lacking complete IHC characterization due to limited resources [38]. From Iraq, a regional study in Kurdistan analyzed 824 cases and noted significant variation in the receptor status compared to both Arab and Western populations, partly due to limited access to comprehensive IHC testing [39]. Collectively, these regional studies highlight the crucial role of IHC in stratifying BC subtypes and guiding treatment, especially in low-to-middle-income countries. However, most literature underscores ongoing challenges in standardizing IHC use and ensuring widespread implementation. The present study builds on this gap by providing novel data from Libya, where such investigations remain scarce, and aims to support improvements in diagnostic accuracy and therapeutic planning strategies.

This study reveals important patterns in BC presentation and biomarker distribution among Libyan women, with predominance of hormone receptor-positive tumors. It underscores the need for early diagnosis, standardized IHC testing, and integration of hematological data in patient evaluation. It is recommended that future studies expand this work using larger, multicenter cohorts to enhance statistical power and generalizability. Establishing a national BC registry in Libya would significantly aid in tracking epidemiological trends and improving clinical outcomes. Furthermore, increasing access to standardized IHC services and training for laboratory personnel will improve diagnostic accuracy.

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#### КЛІНІЧНА ЗНАЧУЩІСТЬ ЕКСПРЕСІЇ ГОРМОНАЛЬНИХ РЕЦЕПТОРІВ ПРИ РАКУ МОЛОЧНОЇ ЗАЛОЗИ: ІМУНОГІСТОХІМІЧНЕ ДОСЛІДЖЕННЯ В ТРИПОЛІ, ЛІВІЯ

**Вступ.** Рак молочної залози є найчастіше діагностованим злоякісним новоутворенням серед жінок у Лівії; однак дані про імуногістохімічні (ІГХ) профілі пацієнтів у цьому регіоні залишаються обмеженими. Це дослідження мало на меті охарактеризувати випадки раку молочної залози в Західній Лівії на основі клінічних, патологічних та ІГХ характеристик. **Матеріали та методи.** Зібрані 30 зразків тканини раку молочної залози від пацієнток Національного інституту раку в Сабраті (Лівія) із січня по квітень 2024 року фіксували у формаліні та заливали у парафін. ІГХ-фарбування на естрогеновий рецептор (ER), прогестероновий рецептор (PR), рецептор епідермального фактора росту людини 2 (HER2) та Ki-67 виконано за допомогою автоматизованої системи Ventana Benchmark XT. Клінічні та лабораторні дані проаналізовано статистично. **Результати.** Вік пацієнток коливався від 24 до 63 років (середній —  $44,60 \pm 10,23$ ), при цьому найбільшою була група 44—53 роки (33%). Інвазивна протокова карцинома виявилась найпоширенішим підтипом (74%), особливо III ступеня (47%). Більшість пухлин були ER+ (78,6%), PR+ (67,9%) та HER2– (67,9%), із низькою експресією Ki-67 у 53,6% випадків. Середній рівень експресії PR був найвищим у пухлинах поміжного ступеня диференціювання ( $53,0 \pm 32,2$ ), а Ki-67 — у низько диференційованих новоутвореннях ( $51,1 \pm 29,7$ ). Виявлено статистично значущі асоціації між PR-статусом і датою діагнозу ( $p = 0,038$ ), показником експресії PR і датою діагнозу ( $p = 0,039$ ), ER-статусом і МСН ( $p = 0,039$ ), а також між статусом мастектомії та МСНС ( $p = 0,031$ ). Більшість показників клінічного аналізу крові та біохімічних маркерів перебували у межах норми. Експресія імуногістохімічних маркерів не відрізнялась суттєво серед різних підтипів пухлин ( $p > 0,05$ ). **Висновок.** Отримані результати підкреслюють переважання гормон-рецептор-позитивних і HER2-негативних пухлин в дослідженій лівійській когорті, що може вказувати на потенційно сприятливий прогноз. Це дослідження є важливим кроком у розумінні молекулярного профілю раку молочної залози в Лівії та підкреслює цінність включення ІГХ профілювання до рутинної діагностики та прийняття терапевтичних рішень.

**Ключові слова:** рак молочної залози, імуногістохімія, гормональні рецептори, HER2, Ki-67, Лівія.