

REVIEW ARTICLE

# The Significance of Serum CA15-3 and Haematological Materials in The Diagnosis and Prognosis of Invasive Ductal Carcinoma of The Breast

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## Abstract:

**Background:** The other most prevalent malignancy amongst females is breast tumour. A mammary tumour is a multi-step process involving different cell categories, challenging to avoid internationally. Solitary of the finest methods to prevent mammary tumours is by initial identification. Due to initial recognition, the 5-year comparative persistence ratio for individuals with breast tumours is 80% in numerous developed countries. Together the appreciation of mammary tumours and the construction of avoidance measures have progressed considerably in the previous ten years.

**Objectives:** Study the correlation of serum CA15-3, with ALT, AST, TSB, Blood Urea, Serum Creatinine, neutrophils, lymphocytes, leukocytes, erythrocytes, thrombocytes, haemoglobin, NLR parameters in individuals with invasive ductal carcinoma.

**Methods:** The serum CA15-3 of all subjects was measured by the ELISA technique (Enzyme Linked Fluorescent Assay), ALT, AST, ALP, B.Urea, S.Creatinine, as well as TSB were measured by colourimetric methods and neutrophils, lymphocytes, WBC, RBC, PLT, Haemoglobin, as well as NLR measured by an Electrical Impedance Cell Counting methods (CBC, automated machine).

**Results:** The { mean  $\pm$  SD } of Ages and Genders among Patients with healthy groups were not significant. There was no significant variance in mean WBC count between the patients' subject and control subject, However, the mean RBC count was significantly lower in the patients' subjects compared to the healthy subject, In addition, the mean haemoglobin level was significantly lower in the patients' subject compared to a control subject, There was no significant variance in mean platelet count between the patients' and healthy subjects, Moreover, the mean neutrophil count was considerably higher in the patients' subject than the control subject, However, the mean lymphocyte count was significantly lower in the patients' subject compared to a control subject, Therefore, the mean neutrophil/lymphocyte ratio count was considerably higher in the patients' subjects compared to the control group. Mean serum CA15-3 was considerably higher in individuals with invasive breast carcinoma compared to a control subject.

**Conclusion:** the study results of the correlation among serum CA15-3 and other parameters in invasive ductal carcinoma of the breast show a considerable positive correlation among CA15-3, and neutrophils, lymphocytes, haemoglobin, and NLR. Moreover, there is a weak significance with AST and RBC, while there is no correlation between serum midkine and ALT, WBC, TSB, B.Urea, and S.Creatinine.

**Keywords:** invasive ductal carcinoma, serum CA15-3, haematological materials

## Introduction:

**A** mammary tumour is one of the most prevalent human neoplasms; There are many different tumour subtypes, risk factors, and treatment options for breast cancer (1). When cancerous cells multiply in the breast, BC develops. This illness is classified as cancer when malignant cells form in the lining of the breast's milk-producing glands or ducts (ductal epithelium). The ability of cancer cells to invade nearby healthy tissue or spread throughout the body, a process known as metastasis, and their unregulated division, which

leads to abnormal development, distinguish them from other types of cells (2). Globally, mammary cancer is the most prevalent neoplasm that kills females and affects them(3). Men can also develop breast tumours, while females are more than 100 times more likely to do so than males. In America, there will be 42,260 breast cancer deaths in 2019, according to estimates(4). After cardiovascular diseases, breast neoplasm is the other largest cause of mortality for females in Iraq(5). Whereas the Iraqi Cancer Council reported that the proportion of females with breast cancer is 34.06% higher than that of



other types, i.e. the illness killed 23.02% of Iraqi women and had a 32.31 / 100,000 infection rate or 6,018 / 100,000 in 2018, and the prevalence of it is rising in women between the ages of 35 and 75(6). Both sexes have mammary glands. However, males only have primitive mammary glands. After puberty, they are fully developed in females.

From the pectoral region, each breast projects a softly rounded projection. The areola, a darkly pigmented circular area, can be seen on the skin above the elevation's centre. A node that emerges from the areola's centre is called the nipple(7). Each lobe empties into a lactiferous duct at the summit of the nipple. The lactiferous sinus is a dilatation close to each lactiferous duct's terminus. In the smaller ducts, the columnar epithelium is present. Larger ducts have two or three layers of the cell-based epithelium. In the direction of their nipple openings, the lining becomes stratified and squamous.

Carbohydrate antigen 15-3, also known as cancer antigen 15-3, is a tumor marker that is sometimes used in the management of breast cancer. It is a protein that can be found in the blood, and its levels may be elevated in some individuals with breast cancer (8). CA 15-3 can also be elevated in non-cancerous conditions and in other types of cancer, such as ovarian, lung, and liver cancers (9). CA 15-3 is Breast Cancer Detection and Monitoring often used in conjunction with other diagnostic tests, imaging studies, and physical examinations to monitor the progression of breast cancer and assess the effectiveness of treatment, It can help doctors track changes in CA 15-3 levels over time to evaluate response to therapy or detect potential cancer recurrence. Serial measurements of CA 15-3 are typically more informative than a single measurement (10).

Provocative cells and their intermediaries in the tumour micro-environment are thought to play a significant part in the initiation and progress of cancer in cancer patients. An increased peripheral NLR and PLR at the baseline earlier than the first treatment are indicative of a poor prognosis for breast carcinoma, according to the latest meta-analysis (11).

Patients with advanced cancer have a high blood neutrophil concentration, which is linked to a poor prognosis. Due to this, the ratio of blood neutrophils to other leukocytes, or the NLR, has been proposed as a predictive factor of cancer. In patients with more progressive cancers, NLR is higher and is associated with a lower chance of survival in many cancers. NLR, a straightforward and affordable biomarker, has thus been introduced as a key prognostic factor in a variety of tumour types. Another factor is that, except for stomach cancer, where a high NLR is a marker of a good prognosis, neutrophilia is linked to a poor clinical outcome in all cancers (12).

Inflammatory blood markers, such as the NLR, which is the ratio between the total neutrophil count and the total lymphocyte count, have become predictive and prognostic indicators in recent years. At various stages of cancer growth (beginning, promotion, attack, and spread), the role of inflammation in the neoplasm has been extensively documented. Reactive oxygen species and reactive nitrogen species are created by activated inflammatory cells, and these compounds can destroy DNA and variability of the genome, which can lead to the growth of cancer. They can aid in the development of metastases and encourage the growth of tumours. Their capacity to secrete proteases, especially matrix metalloproteases, aids in the invasion of tumours. Because of their ability to stimulate transcriptional activators and signal transducers, neutrophils also play a role in

the development of tumours (13).

### Aims of the Study:

1. To estimate the renal and liver function in breast cancer patients and clarify how it relates to the disease state.
3. To determine the level of haematological materials and tumour marker CA15-3 in patients with invasive ductal carcinoma and compare them, if any.

### Materials and Methods

#### Subjects

The study was conducted on individuals who were clinically and laboratory diagnosed with colorectal cancer and who attended the Al Sadr Teaching Hospital and Middle Euphrates Hospital for Oncology and Hematology in Al Najaf Al Asharaf– Iraq; samples and all information were taken from the patients, and healthy people were selected for the study. Laboratory tests were carried out in the laboratories of the Clinical Biochemistry Branch / College of the Medicine / University of Al-Qadisiyah. Also, some laboratory tests were conducted in the Clinical Chemistry Unit / Laboratory Division of the Al Sadr Teaching Hospital and Middle Euphrates Hospital for Oncology and Hematology. One hundred and twenty-nine individuals participated in the study between September 2022 and May 2023 (for sample collection), divided into two groups: patients subject: sixty people are patients with colorectal carcinoma selected from the Al Sadr Teaching Hospital and Middle Euphrates Hospital for Oncology and Hematology, after confirming their clinical and laboratory diagnoses. Control subject: Sixty-nine healthy people who do not have any disease. They were established after asking people and conducting all required laboratory analyses

#### Blood Sample Collection

Each participant was taken 6 ml of blood drawn from a vein and placed in two test tubes: 2ml with an EDTA tube for neutrophils and lymphocytes, leukocytes, erythrocytes, thrombocytes, haemoglobin and NLR and 4ml with a gel tube for biochemical analysis. Whole blood is processed and subjected to the necessary studies directly. At the same time, blood samples in gel tubes were centrifuged for ten minutes at a force of 3000 x g to obtain a sample (serum), which was then kept in three separate Eppendorf tubes at -40 C in the deep freeze until the analysis time.

#### Inclusion Criteria

patients with and without metastatic invasive ductal carcinoma of the breast without mastectomy.

#### Exclusion Criteria

Patients were excluded if they had cancer (colorectal, ovarian, pancreatic, lung, kidney, and prostatic cancers), Inflammatory bowel disease, Cardiovascular diseases and Renal diseases

#### Statistical analysis

The statistical analysis was performed using version 25 of the Statistical Package for the Social Sciences (SPSS) from IBM on a Windows® platform. Continuous variables were represented by mean and standard deviation. The comparison between patients group and the Healthy group was conducted using analysis of variance student t-test, and a P-value of  $\leq 0.05$  indicated statistical significance. The strength and direction of the correlation were measured by the Pearson correlation coefficient (r) value, with significant association indicating the direction of the correlation. The Pearson correlation coefficient (r) measures the strength and direction of the association between

two variables. A weak correlation is indicated by an r-value less than 0.5, a moderate correlation is indicated by an r-value between 0.4 and 0.7, and a strong correlation is indicated by an r-value greater than 0.7.

## Results

**Correlation of mean age between individuals with invasive ductal carcinoma and control subject**

As indicated in Table 1, There was no considerable variance in mean age among patients and healthy subjects, 54.33 ±12.12 years versus 53.81 ±12.61 years, respectively ( $p = 0.451$ ). The frequency distribution of women with invasive breast carcinoma according to grade and stage of disease

The present study included 19 cases with moderately differentiated tumours (grade II), accounting for 31.7 % and 41 cases of poorly differentiated tumours (Grade III), accounting for 68.3 %, as shown in Figure 1.

In addition, this study included 26 status stage II diseases (43.3 %), 24 status stage III conditions (40.0 %) and ten status stage IV diseases (16.7 %), Figure 2.

### Results of haematological parameters

As indicated in Table 2, There was no significant variance in mean WBC count between the patients' subject and control subject, 5.78 ±2.28 X10<sup>9</sup>/L versus 6.18 ±1.11 X10<sup>9</sup>/L, respectively ( $p = 0.202$ ). However, the mean RBC count was significantly lower in the patients' subjects compared to the healthy subject, 4.05 ±0.59 X10<sup>12</sup>/L versus 4.26 ±0.58 X10<sup>12</sup>/L, respectively ( $p = 0.047$ ). In addition, the mean haemoglobin level was significantly lower in the patients' subject compared to a control subject, 10.66 ±1.25 g/dl against 11.16 ±0.77 g/dl, respectively ( $p < 0.001$ ). There was no significant variance in mean platelet count between the patients' and healthy subjects, 288.12 ±159.75 X10<sup>9</sup>/L versus 291.00 ±67.99 X10<sup>9</sup>/L, respectively ( $p = 0.892$ ).

Moreover, the mean neutrophil count was considerably higher in the patients' subject than the control subject, 8.02 ±4.17 X10<sup>9</sup>/L versus 3.92 ±2.07 X10<sup>9</sup>/L, respectively ( $p < 0.001$ ). However, the mean lymphocyte count was significantly lower in the patients' subject compared to a control subject, 1.85 ±1.03 X10<sup>9</sup>/L vs. 2.81 ±1.24 X10<sup>9</sup>/L, respectively ( $p < 0.001$ ). Therefore, the mean neutrophil/lymphocyte ratio count was considerably higher in the patients' subjects compared to the control group, 12.08 ±7.15 versus 2.03 ±0.91L, respectively ( $p < 0.001$ ).

### Results of renal parameters

As indicated in Table 3, There was no significant variance in mean blood urea between individuals with breast carcinoma and the healthy subject, 25.23 ±8.27 mg/dl versus 27.00 ±6.80 mg/dl, respectively ( $p = 0.186$ ). Moreover, there was no significant variance in mean serum creatinine between individuals with breast carcinoma and the healthy subject, 0.55 ±0.37 mg/dl versus 0.59 ±0.09 mg/dl, respectively ( $p = 0.329$ ).

### Liver parameters results

As indicated in Table 4, the Mean AST level was considerably higher in individuals with invasive ductal carcinoma compared to a control subject, 24.03 ±17.31 IU/L versus 22.02 ±12.21 IU/L, respectively ( $p = 0.025$ ). However, there was no significant variance in mean ALT between individuals with breast carcinoma and the control subject, 25.23 ±8.27 IU/L versus 27.00 ±6.80 IU/L, respectively ( $p = 0.442$ ).

In addition, there was no significant variance in mean ALP between individuals with breast carcinoma and the control sub-

ject, 102.62 ±53.47 IU/L versus 95.08 ±27.26 IU/L, respectively ( $p = 0.306$ ). Moreover, there was no significant variance in mean TSB between individuals with breast carcinoma and the healthy subject, 0.50 ±0.31 mg/dl versus 0.43 ±0.38 mg/dl, respectively ( $p = 0.496$ ).

**4.6. Correlation of serum CA15-3 between individuals with invasive ductal carcinoma and control subject**

As indicated in Table 5, Mean serum CA15-3 was considerably higher in individuals with invasive breast carcinoma compared to a control subject, 87.17 ±63.56 U/ml versus 1.77 ±1.07 U/ml, respectively ( $p < 0.001$ ).

**4.7. Correlation study**

As indicated in Table 6, the grade of disease was positively correlated to WBC count, neutrophil count and neutrophil to lymphocyte ratio. The stage of disease was positively related to CA-15-3, NLR, AST, ALT, ALP and TSB.

## 5. Discussion

Breast cancer(BC) is one of the most common human neoplasms; There are many different tumour subtypes, risk factors, and treatment options for breast cancer (1). When cancerous cells multiply in the breast, BC develops. This illness is classified as cancer when malignant cells form in the lining of the breast's milk-producing glands or ducts (ductal epithelium). The ability of cancer cells to invade nearby healthy tissue or spread throughout the body, a process known as metastasis, and their unregulated division, which leads to abnormal development, distinguishing them from other types of cells (2).

The mean age of individuals with invasive mammary carcinoma in the present study is comparable to that obtained by (14), who collected registered data for breast cancer cases from the Iraqi Cancer Registry/Ministry of Health, enrolling 23,792 patients. They found that the mean old was 52 years. In addition, the mean age in this study was approximately similar to that obtained by (15), who carried out a retrospective descriptive study in which medical notes and histopathological reports of individuals with confirmed diagnoses of breast tumours between January 2011 and December 2015 were reviewed in Basra and they found a mean age of 50 years.

Worldwide, about 80% of women with BC are individuals aged more than 50 years. Overall, tumour in elder age is not just restricted to mammary tumours; the accumulating large quantity of cellular alterations and exposure to possible carcinogens cause carcinogenesis to elevate over time(16).

It appears that Iraqi women often present when a tumour is beyond stage I, which makes disease control a difficult mission and the survival shorter than that obtained in developed countries. The proportions of disease grades and locations in the current study are comparable to those in other Iraqi studies (17) (18).

In line with the present study results,(19) described that leukocyte counts were higher in individuals with mammary tumours than in healthy subject. However, according to (20), they conducted a large case-control study and associated leukocyte counts between individuals with mammary tumours ( $n = 4,402$ ) and propensity score-matched controls ( $n = 4,402$ ) selected from the Korean National Health and Nutrition Examination Survey; they found that WBC count mean in patient's group was considerably lower than that of a control subject in clear controversy to current study finding.

Evidence is mounting that prolonged low-grade inflammation may contribute to the aetiology of several malignancies (21)

(22) (23). Leukocyte count, an inflammatory parameter, has emerged as a helpful indicator of infection and a predictor of other diseases (20). Even within the normal range, a high leukocyte count has been linked to atherosclerotic cardiovascular disorders, tumour incidence, and mortality (24) (25). In the context of well-known impact modifiers for mammary tumour growth, the function of leukocyte counts as a representation of inflammation has not been investigated (20).

In line with the present study, it has been shown that mean RBC count and mean haemoglobin are lower in individuals with invasive ductal carcinoma compared to the control subject in several previous reports (19) (26).

Anaemia is frequently seen in cancer patients, with proportions ranging from 22.7% (27) to 63% (28) and up to 89% after chemotherapy (29). Elevated incidence of anaemia has been associated with reduced quality of life and drug response in individuals with breast tumours (30) (31) and increases the burden of the tumour (32).

The propagation of anaemia in cancer patients is related to many factors. The most frequent causes are biological causes (33), chemotherapy (34), demographic reasons (35), and forms of cancer (35). The occurrence of anaemia in cancer patients was significantly predisposed by socio-demographic characteristics, such as increasing age (35) (36); race, like Hispanics (35); and sex, like women. Additionally, the number of chemotherapy regimens (37) (38), the type of chemotherapy (35) (37), and the delay or reduction of chemotherapy dose (39) all contributed to an increase in the incidence of cancer-related anaemia. Moreover, anaemia in cancer patients is strongly correlated with both the disease itself (37) (40) and the kind of cancer (41). Furthermore, cancer treatment (surgery, hormone therapy, radiation, and targeted therapy), the impact of cancer (through direct invasion of the bone marrow), and the impact of cytokines secreted by cancer cells all contributed to an increase in the occurrence of anaemia in cancer patients (42).

Regarding platelet count, and in agreement with the current study finding, (43) found no significant variance in mean platelet count between individuals with breast cancer and healthy subjects; however, (44) reported significantly less mean platelet count in women with breast carcinoma compared to a control group and this is inconsistent with current study observation. Indeed, most previous authors linked the platelet count to disease behaviour, such as grade of disease, stage of disease and survival rates (45) (46) (47) (48) (49).

Regarding neutrophil count, lymphocyte count and NLR in this study are consistent with previous reports. To our information, only three small studies conducted on Asian females evaluated the relationship between NLR and the threat of mammary tumours (50) (51) (52). Two of the three investigations compared mammary tumour status with benign mammary disease (BBD) controls (50) (51), and the third one utilised healthy subjects as reference subjects. In one of the investigations (52), the NLR was considerably higher in mammary tumour individuals compared with the BBD subjects, and individuals with NLR > 1.67 were associated with an elevated threat of mammary tumours. This finding was dependable with the other two investigations (50) (52), proposing that NLR could be an independent risk factor for mammary tumours.

There is much evidence to suggest that cancer patients frequently have renal impairment. Reports show this renal insufficiency is linked to worse overall survival and higher cancer-re-

lated mortality. Consequently, it is crucial to check for renal insufficiency in cancer patients using a suitable and accurate method of estimating renal function (53).

In the study of (54), blood urea and serum creatinine levels were measured in a group of women with breast carcinoma and compared to a control group; the results revealed no statistically significant variance in mean blood urea or serum creatinine between the two groups. Thus, the present study agrees with that of (54). In addition, the current study results are consistent with that of (55), who found no significant variance in blood urea and serum creatinine between women with breast carcinoma and the control subject.

Indeed, current results agree with (124), who found no significant difference in mean TSB but a considerably higher level of AST in breast tumour patients compared to a control group. Still, they disagree with the finding of significantly higher ALT levels in the cancer subject compared to a control subject. Previous reports evaluated the liver function test in breast cancer patients in association with liver metastasis (56) or chemotherapy effect (57), and these two patterns were not among the goals of the present study.

The effectiveness of assessing CA15-3 levels for breast cancer individuals remains debated. European Group on Tumor Markers has suggested the CEA and CA15-3 levels be utilised for evaluating prognosis, the initial detection of disease progression, and cure monitoring in mammary tumours. The American Society of Clinical Oncology and the National Comprehensive Cancer Network index do not currently recommend the usage of serum CA15-3 and CEA for mammary tumour screening and directing therapy (58). These disagreements may be partly due to the conflicting decisions of research (59) (60). The low positive degree of serum tumour parameters is also a possible cause. But several investigations found that continuous CA15-3 rise usually occurred in patients with disease advance (61).

In the present study, the grade of disease was positively correlated to WBC count, neutrophil count and neutrophil to lymphocyte ratio. In contrast, the stage of illness was positively related to CA-15-3, NLR, AST, ALT, ALP and TSB. The positive correlation of grade of disease with leukocyte count may be due to its positive correlation with neutrophils, as neutrophils are the largest fraction of leukocyte count. The positive correlation of the stage of disease with liver enzymes can be attributed to liver metastasis, destroying liver cells and liberating their enzymes into circulation.

The positive correlation of grade and disease stage with increasing NLR follows the findings of several previous authors (50) (12). High condensation of blood neutrophils is seen in individuals with progressive tumour and are related to worse persistence (62) (63). Similarly, there is an abundant index for a negative predictive significance of NLR on mammary tumours. Multiple investigations have presented that higher NLR was related to worse persistence (64) (65) (66) (67) (68) (50), and the latest meta-analysis establish that higher NLR was related to both bad disease-free persistence and overall persistence (66). Numerous previous investigations have found that higher NLR was also related to more progressive or advanced mammary tumours (63) (50) (69) (70).

## Conclusion

There are significant changes in the mean haemoglobin, and red blood cells count in patients with invasive ductal breast car-



cinoma compared to the healthy control persons. There are no considerable variations in serum level of urea in addition to creatinine in patients subject in contrast to the healthy subject. In comparison, liver function tests showed a significant elevation in the mean AST level in patients with invasive ductal carcinoma. At the same time, there are no significant differences in serum levels of ALT between the patients and the control groups. Moreover, there are no significant TSB changes between patients and the control group. Compared to the control group, there is a high serum CA15-3 and haematological parameters concentration in patients with invasive ductal carcinoma, which might be a good predictor of invasive ductal breast carcinoma.

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**Figures**

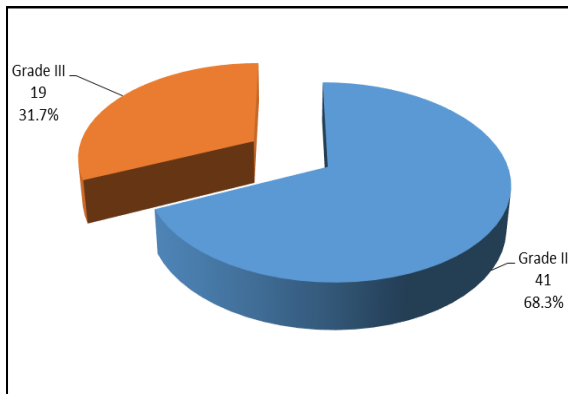


Figure 1: The frequency distribution of women with invasive ductal carcinoma according to a grade of disease

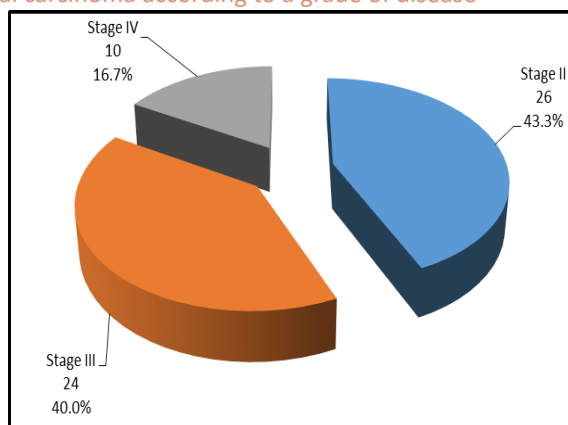


Figure 2: The frequency distribution of women with invasive ductal carcinoma according to a stage of disease

**Tables**

Table 1: Correlation of mean age between individuals with invasive ductal carcinoma and control subject

Characteristic	Invasive breast carcinoma n = 60	Control group n = 69	p
Age (years)			

Mean ±SD	54.33 ±12.12	53.81 ±12.61	0.451   NS
Range	32 -73	21 -65	

n: number of cases; SD: standard deviation; I: independent samples t-test; NS: not significant

Table 2: Correlation of some haematological parameters between individuals with invasive ductal carcinoma and control subject

Characteristic	Invasive breast carcinoma n = 60	Control group n = 69	p
<b>WBC X10<sup>3</sup>/L</b>			
Mean ±SD	5.78 ±2.28	6.18 ±1.11	0.202   NS
Range	1.9 -12.8	4.6 -9	
<b>RBC X10<sup>12</sup>/L</b>			
Mean ±SD	4.05 ±0.59	4.26 ±0.58	0.047   *
Range	2.7 -5.6	3.2 -5.4	
<b>Haemoglobin (g/dl)</b>			
Mean ±SD	10.66 ±1.25	11.16 ±0.77	< 0.001   ***
Range	9 -14.2	9 -12.5	
<b>Platelet count X10<sup>9</sup>/L</b>			
Mean ±SD	288.12 ±159.75	291.00 ±67.99	0.892   NS
Range	64 -920	178 -399	
<b>Neutrophils X10<sup>9</sup>/L</b>			
Mean ±SD	8.02 ±4.17	3.92 ±2.07	<0.001   ***
Range	2.9 -14.3	2.6 -6.5	
<b>Lymphocyte X10<sup>9</sup>/L</b>			
Mean ±SD	1.85 ±1.03	2.81 ±1.24	<0.001   ***
Range	0.2 -4.3	0.9 -4.7	
<b>NLR</b>			
Mean ±SD	12.08 ±7.15	2.03 ±0.91	<0.001   ***
Range	0.58 -37	0.54 -5.7	

n: number of cases; WBC: white blood cells; RBC: red blood corpuscles; SD: standard deviation; I: independent samples t-test; NS: not significant; \*: significant at p ≤ 0.05; \*\*\*: significant at p ≤ 0.001

Table 3: Correlation of blood urea and serum creatinine between individuals with invasive ductal carcinoma and control subject

Characteristic	Invasive breast carcinoma n = 60	Control group n = 69	p
<b>Blood urea (mg/dl)</b>			
Mean ±SD	25.23 ±8.27	27.00 ±6.80	0.186   NS
Range	11 -62	16 -42	
<b>Serum creatinine (mg/dl)</b>			

Mean ±SD	0.55 ±0.37	0.59 ±0.09	0.329 I NS
Range	0.2 -2.7	0.5 -0.8	

n: number of cases; SD: standard deviation; I: independent samples t-test; NS: not significant

Table 4: Correlation of liver parameters between individuals with invasive ductal carcinoma and control subject

Characteristic	Invasive breast carcinoma n = 60	Control group n = 69	p
AST (IU/L)			
Mean ±SD	26.38 ±15.13	21.73 ±7.40	0.025 I *
Range	9.6 -81	10.3 -43	
ALT (IU/L)			
Mean ±SD	17,21 ± 24, -2	12,21 ± 22, -2	I -, 442
NS			
Range	7A -A	71, 4- 4, 7	
ALP (IU/L)			
Mean ±SD	07, 47 ± 10, 72	27, 27 ± 90, -A	I -, 2- 7
NS			
Range	212- 40	179, 2- 42, 2	
TSB (mg/dl)			
Mean ±SD	0, 21 ± 0, 0	0, 2A ± 0, 42	I -, 497
NS			
Range	2, 9- 0, 1	2, 7- 0, 1	

n: number of cases; SD: standard deviation; AST: aspartate aminotransferase; ALT: alanine aminotransferase; ALP: alkaline phosphatase; TSB: total serum bilirubin; I: independent samples t-test; NS: not significant; \*: significant at p ≤ 0.05

Table 5: Correlation of serum CA15-3 between individuals with invasive ductal carcinoma and control subject

Characteristic	Invasive breast carcinoma n = 60	Control group n = 69	p
CA15-3 (U/ml)			
Mean ±SD	87.17 ±63.56	1.77 ±1.07	<0.001 I ***
Range	35.8 -297.1	0.18 -4.2	

n: number of cases; SD: standard deviation; I: independent samples t-test; \*\*\*: significant at p ≤ 0.001

Table 6: Correlations of grade and stage of the disease to other characteristics

Characteristic	Grade (II, III)		Stage (II, III, IV)	
	r	p	r	p
Age	-0.165	0.208	0.200	0.126
CA15-3	-0.064	0.626	0.922	<0.001***
WBC	0.281	0.029*	-0.013	0.923
RBC	-0.240	0.064	0.124	0.344
HB	-0.110	0.404	0.086	0.514
PLT	-0.030	0.820	-0.014	0.913
Neutrophil	0.355	0.037*	0.261	0.118
Lymphocyte	0.223	0.251	0.246	0.165
NLR	0.685	0.025*	0.272	0.026*
Blood Urea	0.055	0.677	0.161	0.218
Serum Creatinine	0.123	0.351	0.146	0.265
AST	0.025	0.850	0.281	0.029*
ALT	-0.022	0.869	0.358	0.005**
ALP	0.199	0.128	0.438	<0.001***
TSB	-0.041	0.754	0.275	0.033*

\*: significant at p ≤ 0.05; \*\*: significant at p ≤ 0.01; \*\*\*: significant at p ≤ 0.001

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