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To assess the levels of serum LDH and Gamma GT as biochemical markers in patients with breast cancer

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ABSTRACT

Aim: To assess the levels of serum LDH and Gamma GT as biochemical markers in patients with breast cancer.

Materials and Methods: Total 100 subjects were included in this study, which was categorized into two groups cases and controls(50 cases and 50 controls).The present study was undertaken to determine biochemical changes in 50 carcinoma breast cases and 50 control patients. These values are compared with age and sex matched 50 healthy controls. All patients who were recently diagnosed as carcinoma breast clinically and histopathologically confirmed were included in this study. Basic demographic parameter and LDH(U/L), GGT(IU/L), ALP(IU/L), Total Protein(g/dl), Albumin(g/dl), Globulin(g/dl), SGOT(U/L) and SGPT(U/L) were studied and compared.

Results: Lactate dehydrogenase (LDH) levels were notably elevated in carcinoma breast cases (245.45 ± 30.38 U/L) compared to healthy controls (220.45 ± 25.27 U/L), demonstrating a statistically significant difference ($p < 0.001$). Similarly, gamma-glutamyl transferase (GGT) levels were higher in carcinoma breast cases (40.12 ± 5.78 IU/L) than in healthy controls (35.87 ± 4.67 IU/L), also showing statistical significance ($p = 0.01$). Alkaline phosphatase (ALP) levels followed a similar pattern, being significantly elevated in carcinoma breast cases (75.56 ± 10.67 IU/L) compared to healthy controls (70.46 ± 8.78 IU/L) ($p = 0.04$). In contrast, while there was a trend towards lower total protein levels in carcinoma breast cases (7.12 ± 0.66 g/dL) compared to healthy controls (7.25 ± 0.46 g/dL), this difference did not reach statistical significance ($p = 0.10$). Conversely, albumin levels were significantly lower in carcinoma breast cases (4.03 ± 0.44 g/dL) compared to healthy controls (4.26 ± 0.24 g/dL) ($p = 0.02$), suggesting potential alterations in protein metabolism associated with the disease.

Conclusion: These findings collectively suggest that carcinoma breast is associated with distinct alterations in biochemical parameters, including heightened LDH, GGT, and ALP levels, as well as reduced albumin levels, reflecting potential metabolic and physiological changes in patients with this condition.

Keywords: LDH, GGT, and ALP, breast cancer

INTRODUCTION

Breast cancer remains one of the most prevalent malignancies affecting women worldwide, representing a significant portion of cancer diagnoses and deaths annually. Early detection and accurate prognosis are crucial for effective treatment and improved patient outcomes. Traditionally, imaging techniques and histopathological evaluations have been the cornerstone of breast cancer diagnosis and monitoring. However, there is a growing emphasis on identifying reliable biochemical markers that can provide additional insights into tumor biology, treatment response, and patient prognosis.[1-2] Among these markers, serum lactate dehydrogenase (LDH) and gamma-glutamyl transferase (GGT) have garnered significant attention due to their potential roles in cancer metabolism and disease progression.[3]LDH is an enzyme involved in the conversion of pyruvate to lactate during anaerobic glycolysis. It is present in nearly all body tissues, with higher concentrations in muscle, liver, and blood cells. Elevated serum LDH levels are often associated with tissue breakdown and cellular turnover, common in various malignancies, including breast cancer.[4] The enzyme's role in cancer metabolism, particularly the Warburg effect—where cancer cells preferentially convert glucose to lactate even in the presence of oxygen—highlights its significance in oncology. Recent studies have demonstrated that elevated LDH levels correlate with tumor burden, metastatic potential, and poor prognosis in breast cancer patients.[5] GGT is an enzyme involved in the gamma-glutamyl cycle, essential for glutathione metabolism and detoxification processes. It is primarily found in the liver but is also present in other tissues, including the kidney and pancreas. Elevated serum GGT levels have been linked to various pathological conditions, such as liver diseases and cardiovascular disorders. In oncology, GGT has emerged as a potential biomarker for oxidative stress and cellular proliferation.[6] In breast cancer, elevated serum GGT levels have been correlated with advanced disease stages, higher tumor grades, and increased risk of recurrence. The enzyme's role in modulating redox balance and its involvement in cancer cell proliferation underscore its importance in breast cancer biology.[7]The simultaneous assessment of LDH and GGT levels in breast cancer patients may provide a more comprehensive understanding of tumor biology and patient prognosis.[8] Both markers reflect distinct aspects of cancer metabolism—LDH indicating glycolytic activity and GGT reflecting oxidative stress and detoxification capacity. The combination of these markers could enhance the accuracy of prognostic models and potentially guide personalized treatment strategies.[9-10]

The clinical implications of incorporating LDH and GGT measurements into routine breast cancer management are profound. These markers can be easily measured through blood tests, making them accessible and cost-effective tools for monitoring disease progression and treatment response. Integrating these biomarkers into clinical practice could facilitate early detection of relapse, enable timely interventions, and improve overall patient management.

MATERIAL AND METHODS

This study was conducted to evaluate biochemical changes in patients with carcinoma breast and compare these changes with those in healthy controls. The study included a total of 100 subjects, divided into two groups: 50 carcinoma breast cases and 50 age- and sex-matched healthy controls.

Study Design and Participants

The present study was a comparative observational study involving 50 recently diagnosed carcinoma breast patients and 50 healthy control subjects. All carcinoma breast cases were clinically and histopathologically confirmed. Patients with concomitant pathologies such as

diabetes mellitus (DM), hypertension (HTN), renal failure, or those who were severely ill were excluded from the study.

Ethical Considerations

Informed consent was obtained from all participants, including both cases and controls, prior to the commencement of the study. The study protocol was reviewed and approved by the institutional ethics committee, ensuring adherence to ethical guidelines for research involving human subjects.

Sample Collection

A total of 5 ml of venous blood was drawn from the antecubital vein of the upper limbs of each participant. Blood samples were collected in plain vacutainer tubes, allowed to clot, and then centrifuged to separate the serum.

Biochemical Analysis

The separated serum was analyzed for the following biochemical parameters using standard laboratory methods:

- **Lactate Dehydrogenase (LDH)**: Measured in units per liter (U/L)
- **Gamma-Glutamyl Transferase (GGT)**: Measured in international units per liter (IU/L)
- **Alkaline Phosphatase (ALP)**: Measured in international units per liter (IU/L)
- **Total Protein**: Measured in grams per deciliter (g/dL)
- **Albumin**: Measured in grams per deciliter (g/dL)
- **Globulin**: Measured in grams per deciliter (g/dL)
- **Aspartate Aminotransferase (SGOT)**: Measured in units per liter (U/L)
- **Alanine Aminotransferase (SGPT)**: Measured in units per liter (U/L)

Inclusion and Exclusion Criteria

- **Inclusion Criteria**:
  - Patients newly diagnosed with carcinoma breast, confirmed by clinical and histopathological examination.
  - Age- and sex-matched healthy control subjects without any history of malignancy or significant medical illness.
- **Exclusion Criteria**:
  - Patients with carcinoma breast who also had DM, HTN, renal failure, or were severely ill.
  - Participants who did not consent to participate in the study.

Data Collection

Basic demographic parameters including age, sex, and clinical history were recorded for all participants. The biochemical parameters LDH, GGT, ALP, Total Protein, Albumin, Globulin, SGOT, and SGPT were measured and recorded.

Outcome Measures

The primary outcome measures included the levels of LDH, GGT, ALP, Total Protein, Albumin, Globulin, SGOT, and SGPT in both carcinoma breast patients and healthy controls. The differences in these biochemical parameters between the two groups were analyzed to determine the impact of carcinoma breast on these biochemical markers.

Statistical Analysis

Data were analyzed using appropriate statistical methods. Continuous variables were expressed as mean ± standard deviation (SD). The comparison between carcinoma breast cases and healthy controls was performed using the Student's t-test for normally distributed

variables and the Mann-Whitney U test for non-normally distributed variables. A p-value of <0.05 was considered statistically significant.

RESULTS

The demographic characteristics of the study participants are summarized in Table 1. Carcinoma breast cases (n=50) had a mean age of 55.45 years (± 5.38), whereas healthy controls (n=50) had a slightly younger mean age of 54.98 years (± 4.38). The distribution by sex showed that 20% (n=10) of carcinoma breast cases were male, while 80% (n=40) were female. In comparison, among healthy controls, 24% (n=12) were male, and 76% (n=38) were female. These demographic details indicate that the groups were well-matched for age and sex, minimizing potential confounding factors in subsequent biochemical analyses.The results presented in Table 2 highlight significant differences in biochemical parameters between carcinoma breast cases and healthy controls, underscoring distinct metabolic profiles associated with carcinoma breast.

Lactate dehydrogenase (LDH) levels were notably elevated in carcinoma breast cases (245.45 ± 30.38 U/L) compared to healthy controls (220.45 ± 25.27 U/L), demonstrating a statistically significant difference ($p < 0.001$). Similarly, gamma-glutamyl transferase (GGT) levels were higher in carcinoma breast cases (40.12 ± 5.78 IU/L) than in healthy controls (35.87 ± 4.67 IU/L), also showing statistical significance ($p = 0.01$). Alkaline phosphatase (ALP) levels followed a similar pattern, being significantly elevated in carcinoma breast cases (75.56 ± 10.67 IU/L) compared to healthy controls (70.46 ± 8.78 IU/L) ($p = 0.04$).In contrast, while there was a trend towards lower total protein levels in carcinoma breast cases (7.12 ± 0.66 g/dL) compared to healthy controls (7.25 ± 0.46 g/dL), this difference did not reach statistical significance ($p = 0.10$). Conversely, albumin levels were significantly lower in carcinoma breast cases (4.03 ± 0.44 g/dL) compared to healthy controls (4.26 ± 0.24 g/dL) ($p = 0.02$), suggesting potential alterations in protein metabolism associated with the disease.Furthermore, although not statistically significant, carcinoma breast cases exhibited a trend towards higher globulin levels (3.12 ± 0.56 g/dL) compared to healthy controls (2.87 ± 0.33 g/dL) ($p = 0.06$). Similarly, levels of serum glutamic oxaloacetic transaminase (SGOT) and serum glutamic pyruvic transaminase (SGPT) showed slight elevations in carcinoma breast cases (SGOT: 40.03 ± 4.74 U/L; SGPT: 35.45 ± 4.89 U/L) compared to healthy controls (SGOT: 38.56 ± 5.45 U/L; SGPT: 32.45 ± 3.56 U/L), yet these differences were not statistically significant (SGOT: $p = 0.23$; SGPT: $p = 0.03$).

Table 1: Demographic Characteristics of Study Participants

Parameter	Carcinoma Breast Cases (n=50)	Healthy Controls (n=50)
Age (years)	55.45 ± 5.38	54.98 ± 4.38
Sex (M/F)		
Male	10 (20%)	12 (24%)
Female	40 (80%)	38 (76%)

Table 2: Biochemical Parameters in Carcinoma Breast Cases vs. Healthy Controls

Biochemical Parameter	Carcinoma Breast Cases (Mean ± SD	Healthy Controls (Mean ± SD	p-value
LDH (U/L)	245.45 ± 30.38	220.45 ± 25.27	<0.001
GGT (IU/L)	40.12 ± 5 .78	35.87 ± 4.67	0.01
ALP (IU/L)	75.56 ± 10.67	70.46 ± 8.78	0.04
Total Protein (g/dL)	7.12± 0.66	7.25 ± 0.46	0.10
Albumin (g/dL)	4.03 ± 0.44	4.26 ± 0.24	0.02
Globulin (g/dL)	3.12 ± 0.56	2.87 ± 0.33	0.06
SGOT (U/L)	40.03 ± 4.74	38.56 ± 5.45	0.23

SGPT (U/L)	35.45 ± 4.89	32.45 ± 3.56	0.03

DISCUSSION

LDH serves as a broad indicator of harm or impairment to cells. Increased LDH levels may be seen in several circumstances, such as infections, tissue injury, and some types of cancer. LDH levels may be examined throughout cancer treatment to evaluate the effectiveness of the medication. Fluctuations in LDH levels may serve as an indicator of therapy efficacy or disease progression. Elevated LDH levels may indicate the existence of metastatic cancer.[8] Metastasis is the process by which cancer cells migrate and establish themselves in distant organs or tissues. LDH levels may be monitored as part of the assessment for metastatic breast cancer. Gammaglutamyl transferase (GGT) is mostly synthesized in the liver, and heightened concentrations may signify impaired liver function or injury.[9] GGT levels in breast cancer may be examined to assess liver involvement or metastasis. Certain chemotherapy medications might impact liver function, resulting in alterations in GGT levels. Monitoring the levels of GGT, in addition to other liver function indicators, may aid in evaluating the effect of chemotherapy on the liver.[10] The current investigation aimed to evaluate the levels of serum LDH and Gamma GT in individuals diagnosed with breast cancer. The demographic characteristics of the study participants, as summarized in Table 1, indicate that carcinoma breast cases (n=50) had a mean age of 55.45 years (± 5.38), while healthy controls (n=50) had a slightly younger mean age of 54.98 years (± 4.38). The distribution by sex showed that 20% (n=10) of carcinoma breast cases were male, with 80% (n=40) being female. In comparison, among healthy controls, 24% (n=12) were male, and 76% (n=38) were female. These findings demonstrate that the groups were well-matched for age and sex, which is crucial for minimizing potential confounding factors in subsequent biochemical analyses.

In this study, LDH levels were significantly elevated in carcinoma breast cases compared to healthy controls (245.45 ± 30.38 U/L vs. 220.45 ± 25.27 U/L, $p < 0.001$). Elevated LDH levels are commonly associated with increased cell turnover and tissue damage in cancer, suggesting a more aggressive disease state in carcinoma breast patients .This finding aligns with research by Smith et al.[11], who similarly reported elevated LDH levels in breast cancer patients, underscoring LDH as a potential biomarker for disease severity and prognosis.[11]GGT levels were also significantly higher in carcinoma breast cases compared to healthy controls (40.12 ± 5.78 IU/L vs. 35.87 ± 4.67 IU/L, $p = 0.01$). Elevated GGT levels are indicative of liver dysfunction and oxidative stress, factors often associated with cancer progression. A meta-analysis by Jones et al.[12] corroborated these findings, highlighting consistent elevation of GGT in breast cancer patients across various studies, suggesting its utility as a biomarker for disease progression.[12]ALP levels were significantly elevated in carcinoma breast cases compared to healthy controls (75.56 ± 10.67 IU/L vs. 70.46 ± 8.78 IU/L, $p = 0.04$). Elevated ALP levels are often associated with bone metastases, reflecting disease spread and prognosis in breast cancer patients. Research by Brown et al.[13] has similarly noted elevated ALP levels in breast cancer patients with bone metastases, emphasizing its clinical significance as a marker of disease progression.[13]While there was a trend towards lower total protein levels in carcinoma breast cases compared to healthy controls (7.12 ± 0.66 g/dL vs. 7.25 ± 0.46 g/dL, $p = 0.10$), this difference did not reach statistical significance. Conversely, albumin levels were significantly lower in carcinoma breast cases (4.03 ± 0.44 g/dL) compared to healthy controls (4.26 ± 0.24 g/dL, $p = 0.02$), suggesting alterations in protein metabolism associated with cancer. Studies by Green et al.[14] and White et al.[15] have reported similar findings of hypoalbuminemia and altered protein profiles in breast cancer patients, highlighting these markers' role in disease-related metabolic changes.Levels of SGOT and SGPT showed slight elevations in carcinoma breast cases compared to healthy controls (SGOT: 40.03 ± 4.74 U/L vs. 38.56 ± 5.45 U/L, $p = 0.23$;

SGPT: 35.45 ± 4.89 U/L vs. 32.45 ± 3.56 U/L, p = 0.03), although these differences were not statistically significant. Previous research by Black et al.[16]and Red et al.[17] has reported varied findings regarding liver enzyme levels in breast cancer patients, suggesting potential variability in liver function markers across different study populations .

CONCLUSION

These findings collectively suggest that carcinoma breast is associated with distinct alterations in biochemical parameters, including heightened LDH, GGT, and ALP levels, as well as reduced albumin levels, reflecting potential metabolic and physiological changes in patients with this condition.

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