3rd International Scientific Conference of Biotechnology
(3rd ISCB-2024)
JOURNAL OF BIOTECHNOLOGY RESEARCH CENTER, VOL. 19, NO. 1 (2025) (SPECIAL ISSUE)

Investigating Hormonal Level Biomarkers in the Diagnosis and Early Detection of Breast Cancer

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Received: 2/1/2025
Accepted: 3/3/2025
Online: 15/4/2025

ABSTRACT

Background: Breast cancer is a major public health problem, with a high incidence among females worldwide, increasing with age and environmental conditions. Hormonal biomarkers have gained attention for their potential utility in the early detection of breast cancer. The study aimed to investigate the effect of biomarkers of different hormone levels, including prolactin, Testosterone, Cortisol, and Human Chorionic Gonadotropin (HCG) in the diagnosis and early detection of breast cancer risk. Methodology: Blood and saliva samples were collected from volunteer females, including 50 healthy females (NB), 111 benign breasts (BB), and 20 malignant breasts (MB) samples to determine hormone level biomarkers using enzyme-linked immunosorbent assay (ELISA). Results: The results showed that hormonal biomarkers, particularly prolactin, testosterone, and HCG, can serve as indicators for the early detection of breast cancer in both serum and saliva. In contrast, cortisol hormonal biomarkers did not have an effective association with early breast cancer detection. Conclusion: The results of this study showed that the present association between hormonal biomarkers, including prolactin, testosterone, and HCG, could serve as biomarkers for the early detection of breast cancer. In contrast, cortisol did not have an effective association with early breast cancer detection.

Keywords: Breast cancer, cortisol, biomarkers, human chorionic gonadotropin, prolactin, testosterone.

https://doi.org/10.24126/jobrc.2025.19.1.915

INTRODUCTION

Breast cancer is the most common malignancy among females worldwide, with over two million new cases diagnosed each year (1). It is a significant public health concern and the second leading cause of cancer-related deaths in the United States. Breast cancer ranks among the most prevalent malignancies worldwide, posing substantial morbidity and mortality challenges. Despite advancements in treatment modalities, early detection remains paramount for reducing mortality rates and enhancing patient outcomes. The sensitivity of mammography decreases further with increasing breast density, potentially masking cancer and leading to non-detection. Current evidence suggests that the sensitivity of mammography decreases from around 85-90% for females with average breast density to around 60-65% for females with dense breasts (2,3). While mammography is the primary method for breast cancer detection, it has limitations, highlighting the need for reliable noninvasive diagnostic and prognostic biomarkers (4). Biomarkers are present in bodily fluids or tissues, and their level varies when multiple cancer types are present, stimulating the immune response with excellent specificity and a strong reaction to the tumor or the tumor itself. The ideal biomarker may be able to identify tiny cancers with high selectivity and specificity, which could aid in the screening process or provide information for an early diagnosis (5,6). Early detection and monitoring are crucial due to the disease's heterogeneity and distinct molecular subtypes, essential for ensuring successful treatment and optimal patient prognosis (7,8). Hormonal markers have emerged as potential

candidates due to their intricate involvement in breast cancer pathophysiology. Endocrine therapy targeting hormone receptors has played a crucial role in these positive outcomes, particularly in hormone receptor-positive breast cancer, which accounts for 83% of invasive cases (9). Breast cancer incidence is increasing among younger females in developing countries, accenting the importance of modified treatment decisions based on tumor characteristics, comorbidity, and life expectancy. Breast cancer, which is seen more in advanced ages, starts to be seen at earlier ages. In the United States, only 5% to 7% of all breast cancers are diagnosed in patients younger than 40 years (10). The global burden of breast cancer is significant, with Iraq experiencing a high incidence and mortality rate among females. Risk factors for breast cancer include age, family history, dietary factors, and genetic factors. Factors that repeatedly regulate cell-specific proliferation and differentiation are significant actors in oncogenesis and possible therapeutic targets in established cancers. The protective effects of pregnancy, such as hormonal changes affecting breast tissue and placental ageing, may influence post-pregnancy breast cancer risks, particularly for hormone receptor-negative tumors that are more common during this period. Human Chorionic Gonadotropin (HCG) is primarily known for its role in pregnancy and garnered interest as a biomarker for breast cancer as its serum levels in breast cancer patients elevated compared to healthy controls. HCG may promote tumor progression via various mechanisms, including angiogenesis and immune modulation. The HCG may exhibit anti-tumoral effects during pregnancy but can promote tumor growth when expressed inappropriately. In addition, prolactin hormones play a role in breast cancer development by creating a lasting genomic in the mammary gland and acting to resist malignant transformation, considered by cellular differentiation, apoptosis, and inhibition of growth (11). Mechanistically, the signals initiated by prolactin that cause alveolar cells to proliferate during pregnancy and coordinate their differentiation upon birth have been identified (12,13). Cholesterol, a steroid hormone, has been linked to breast carcinogenesis, with altered serum cholesterol levels observed in breast cancer patients. Moreover, cholesterol is pivotal in estrogen receptor signaling, highlighting its relevance in hormone-dependent breast cancer (1). Testosterone suggests a potential role in breast cancer development, with androgen receptor signaling implicated in tumor progression (14). The salivary biomarkers are a fraction of their blood counterparts used to display and predict the clinical status of systemic diseases for detection, which has been garnering increasing interest, and technology based on their detection is offering a promising new clinical strategy for breast cancer. Our study aimed to investigate the impact of biomarker hormones in detecting and identifying breast cancer risk in Iraqi females.

METHODOLOGY

A cross-sectional study was conducted on 181 Iraqi females from October 2023 to July 2024. All participants were collected from Al-Elwiya Hospital, the Oncology Teaching Hospital in Baghdad, and Rezgari Hospital in Erbil. All experimental procedures were conducted per the Declaration of the Human Ethics Committee of the Ministry of Health in Iraq. Written consent was taken from each individual participating in the study under the supervision of the consultant, and after obtaining approval for the sampling of patients and control.

Inclusion criteria: The study included 131 female samples; the diagnosis was confirmed according to the fine needle aspiration (FNA) technique carried out by specialists and 50 healthy controls. Hormone receptor status was assessed and required a primary diagnosis of early breast cancer before treatment involved cases with available blood specimens drawn within 12-5 months before breast cancer diagnosis.

Exclusion criteria: included severe kidney or cardiovascular disease, inflammatory disease, prior bowel resection, pregnancy, age under 18, and participation in another clinical trial.

Sample Collection: Samples were collected from volunteer females (NB, BB, and MB). Approximately 5–10 mL of venous blood was collected in EDTA tubes. The serum was separated from whole blood by centrifugation at 13000 rpm for 20 min at 37 °C. Approximately 3–5 mL of saliva was transferred into a sterile cop and centrifuged at 3000 rpm for 10 mins to obtain supernatant.

Determination of Hormonal biomarkers

Hormonal biomarkers, including prolactin, testosterone, cortisol, and Human Chorionic Gonadotropin (HCG), were measured in both serum and saliva samples using a commercial AccuBind employing competitive enzyme-linked immunosorbent assay (ELISA) microwell kit (Monobind Inc, USA) for all study groups (NB, BB, MB and MB).

Statistical Analysis

Data were statistically analysed in this study using SPSS software (IBM SPSS Statistics for Windows, Version 20.0, and Armonk, NY, USA). A one-way ANOVA was used for statistical differences to determine the differentiation of biomarkers in blood and saliva samples in all study groups, with mean ± standard error (M ± SE) at $p \leq 0.05$ being significant. Pearson correlations were used to determine the effects of hormone levels between patients and normal females. Bonferroni multiple comparisons correlations between hormones levels in blood and saliva samples for patient samples.

RESULTS

The results of the age factor for females in the current study provide the means were (44.2, 45 - 54.1) Mean ± SD for the NB, BB, and MB groups, respectively.

1. Differences in Biomarker Levels in Blood and Saliva Samples

The results of the difference of hormonal biomarkers in serum samples shown in Table 1 were produced for prolactin hormonal level at 5.77 ± 0.35, 14.92 ± 1.11, and 4.45 ± 0.21 (p=0.05) for NB, BB, and MB, respectively. On the other hand, the results of the testosterone hormonal level were 0.43 ± 0.02, 0.40 ± 0.01, and 0.73 ± 0.05 (p= 0.05) for NB, BB, and MB, respectively. The results of the hormonal level biomarkers for prolactin and testosterone produced no significant differences for NB, BB, and MB females in the study groups In contrast, the results of cortisol hormonal levels produced significant differences 8.02 ± 0.20, 8.23 ± 0.10, and 11.66 ± 1.73 (p= 0.03) for NB, BB, and MB females, respectively. Moreover, the results of HCG hormonal levels produced significant differences of 0.43 ± 0.01, 0.42 ± 0.01, and 0.95 ± 0.24 (p=0.01) for NB, BB, and MB, respectively. The blood samples' cortisol and HCG hormonal levels showed significant differences in NB, BB, and MB.

The results of hormonal biomarkers in saliva samples were determined for prolactin hormonal levels provided at 2.14 ± 0.13, 4.62 ± 0.34, and 1.35 ± 0.07 (p=0.05) for NB, BB, and MB, respectively. On the other hand, the results of the testosterone hormonal level were 0.02 ± 0.001, 0.02 ± 0.001, and 0.04 ± 0.002 (p-0.05) for NB, BB, and MB, respectively. The results of the hormonal level biomarkers for prolactin and testosterone produced no significant differences for NB, BB, and MB females in the study groups. In contrast, the results of cortisol hormonal levels in saliva samples were 0.48 ± 0.01, 0.47 ± 0.01, and 0.67 ± 0.10 (p= 0.03), respectively, for NB, BB, and MB. Moreover, the results of HCG hormonal levels were 0.11 ± 0.00, 0.08 ± 0.004, and 0.24 ± 0.06 (p= 0.004) for NB, BB, and MB, respectively. The results of cortisol and HCG hormonal levels in saliva samples produced significant differences for NB, BB, and MB.

The current study examined the levels of hormonal biomarkers (prolactin, testosterone, cortisol, and HCG) in the serum and saliva of all study groups (NB, BB, and MB). According to the differences in biomarker levels in blood and saliva samples for prolactin and testosterone, the results showed no significant differences between healthy and breast cancer patients' groups. Prolactin and testosterone levels may not be reliable biomarkers for distinguishing between healthy females, benign tumor, and malignant tumor patients. Cortisol levels produced no significant difference between cortisol and other hormones (prolactin, testosterone, or HCG) between breast cancer patients and healthy controls in either blood or saliva samples. Cortisol does not appear to be a reliable biomarker for breast cancer risk or progression, as its levels remain consistent across study groups. HCG levels showed significant differences, particularly in saliva samples, with higher levels in breast cancer patients compared to healthy controls. A weak positive correlation between HCG and prolactin was observed in saliva but not blood samples. The elevated HCG levels in serum and saliva may serve as a potential diagnostic marker for breast cancer, especially in younger females (<40 years) and primiparous females.

Table (1): Differences of Biomarker Levels in Blood and Saliva Samples in all Study Groups

Samples	Hormones	NB (Mean ± SE)	BB (Mean ± SE)	MB (Mean ± SE)	P-value
Serum	Prolactin (ng/mL)	5.77 ± 0.35	14.92 ± 1.11	4.45 ± 0.21	0.05
	Testosterone (ng/dL)	0.43 ± 0.02	0.40 ± 0.01	0.73 ± 0.05	0.05
	Cortisol (µg/dL)	8.02 ± 0.20	8.23 ± 0.10	11.66 ± 1.73	0.03*
	HCG (mIU/mL)	0.43 ± 0.01	0.42 ± 0.01	0.95 ± 0.24	0.01*
Saliva	Prolactin (ng/mL)	2.14 ± 0.13	4.62 ± 0.34	1.35 ± 0.07	0.05
	Testosterone (ng/dL)	0.02 ± 0.001	0.02 ± 0.001	0.04 ± 0.002	0.05
	Cortisol (µg/dL)	0.48 ± 0.01	0.47 ± 0.01	0.67 ± 0.10	0.03*
	HCG (mIU/mL)	0.11 ± 0.003	0.08 ± 0.004	0.24 ± 0.06	0.004*

One-way ANOVA statistical analysis. NB: healthy females, BB: Benign breast, and MB: Malignant breast, *Significant at p≤0.05

2. Effects of Hormone Levels on Breast Cancer Patients

The results of multiple Bonferroni comparisons assessing the effects of hormone levels on breast cancer in serum samples are shown in Table 2. Prolactin showed a negative difference for BB patients 9.15 (p= 0.05) compared with NB and MB 10.50 (p=0.05) compared with BB patients. On the other hand, the results for prolactin gave no significance for MB compared with the NB group 1.30 (p=1). On the other hand, testosterone results provided significance for MB 0.30 (p-0.05) compared with NB and MB 0.30 (p=0.5) compared with BB -0.30 (p=0.5), but no significance for BB 0.03 (p=1) compared with NB.

Moreover, cortisol produced a negative significance for MB3.60 (p=0.05) compared with NB and MB 3.40 (p-0.07) compared with BB. In contrast, BB was not significantly different -0.20 (P-1) compared with NB. Moreover, HCG produced no significant difference between BB and NB 0.01 (p=1) but a negative difference between MB and BB 0.50 (p= 0.03), and MB compared with BB 0.50 (p= 0.03).

The results of multiple Bonferroni comparisons for the effects of hormone levels on breast cancer in saliva samples for prolactin showed negative significance for BB 2.53 (p=0.05) compared with NB; however, a positive significance 3.30 (p= 0.05) for MB compared with BB patients. On the other hand, the results for prolactin show no significance of 1.30 (p=1) for MB compared with the NB group. On the other hand, testosterone provided no specificity for BB 0.030 (p=1) compared with NB but produced a negative significance MB 0.02 (p=0.05) compared with NB and MB 0.02 (p= 0.5) compared with BB. In contrast, cortisol produced no significance, 0.003 (p=1) for BB and -0.20 (p=0.07) compared with the NB group, as well as MB 0.03 (p=0.07) compared with BB patients. Moreover, HCG produced no significant difference between BB and NB 0.03 (p-1), but a negative significant difference between MB -0.12 (p=0.03) and NB, as well as for MB -0.50 (p= 0.005) compared with BB patients.

Prolactin produced a negative difference for BB compared to NB and MB compared to BB, but no significant difference for MB compared to NB. Prolactin levels are lower in benign and malignant tumor patients compared to healthy females, but the lack of significance between malignant tumor patients and healthy females limits its diagnostic utility. Testosterone provides a negative significance for MB compared to NB and MB compared to BB, but no significant difference for BB compared to NB. Testosterone levels are significantly lower in malignant tumor patients compared to both healthy females and benign tumor patients, suggesting its potential as a biomarker for malignancy. Cortisol levels provide a negative significance for MB compared to NB and MB compared to BB, but there is no significant difference for BB compared to NB. Cortisol levels are significantly lower in patients with malignant tumors than in healthy females and patients with benign tumors, indicating its potential utility in distinguishing malignant from benign tumors. The HCG level shows no significant difference between BB and NB but exhibits a negative difference between MB and BB and between MB and NB. HCG levels are significantly

lower in patients with malignant tumors compared to healthy females and those with benign tumors, suggesting its potential as a marker for malignancy.

Table (2): Effects of Hormone Levels Between Patients and Healthy Females

Samples	Dependent Variable	(I) Labels	(J) Labels	Mean (I-J) Difference	P-value
Serum	Prolactin (ng/mL)	NB	BB	-9.15*	0.05
			MB	1.30	1
		BB	MB	10.50*	0.05
	Testosterone (ng/dL)	NB	BB	0.03	1
			MB	-0.30*	0.05
		BB	MB	-0.30*	0.05
	Cortisol (µg/dL)	NB	BB	-0.20	1
			MB	-3.60*	0.05
		BB	MB	-3.40	0.07
	HCG (mIU/mL)	NB	BB	0.01	1
			MB	-0.50*	0.03
		BB	MB	-0.50*	0.03
Saliva	Prolactin (ng/mL)	NB	BB	-2.53*	0.002
			MB	0.80	0.75
		BB	MB	3.30*	0.05
	Testosterone (ng/dL)	NB	BB	0.002	1
			MB	-0.02*	0.05
		BB	MB	-0.02*	0.05
	Cortisol (µg/dL)	NB	BB	0.003	1
			MB	-0.20	0.07
		BB	MB	-0.20	0.07
	HCG (mIU/mL)	NB	BB	0.03	1
			MB	-0.12*	0.03
		BB	MB	-0.15*	0.005

Bonferroni-Multiple Comparisons: *Significant at 0.05, NB: healthy females, B: Benign breast, and MB: Malignant breast

3. Correlations Between Hormone Levels for Patients in Blood and Saliva Samples

The Pearson correlation coefficient between hormone biomarkers for BB and MB patients in this study is described in Table 3. The correlation coefficients between prolactin and testosterone provided a negative correlation for serum samples 0.30 (p=0.02) and a negative correlation of 0.35 (p= 0.01) between prolactin and testosterone for saliva samples. In contrast, prolactin and cortisol showed no correlation coefficients: 0.01 (p= 0.43) for serum samples and -0.11 (p= 0.41) for saliva samples. On the other hand, HCG and testosterone provided no correlation coefficient for serum samples 0.19 (p= 0.16) and no correlation between HCG and testosterone 0.22 (p=0.09) saliva samples. In addition, HCG and cortisol provided no correlation coefficients for serum samples 0.19 (p= 0.51) and no correlation between HCG and cortisol 0.06 (p=0.67) for saliva samples.

Prolactin and Testosterone, as well as prolactin and cortisol, were negatively correlated in serum samples and saliva samples. HCG and Testosterone, as well as HCG and cortisol, were found not to correlate with serum or saliva samples. Prolactin and testosterone levels, prolactin and cortisol, and HCG and testosterone levels do not show any significant relationship, suggesting independent mechanisms of action. HCG and cortisol levels do not show any significant relationship, further supporting the limited utility of cortisol as a biomarker.

Table 3: Correlations Between Hormone Levels for Patients in Blood and Saliva Samples

			Testosterone (ng/dL)	Cortisol (мg/dL)
Serum	Prolactin (ng/mL)	r	-0.30*	-0.01
		p	0.02	0.43
	HCG (mIU/mL)	r	0.19	0.09
		p	0.16	0.51
Saliva	Prolactin (ng/mL)	r	-0.35**	-0.11
		p	0.01	0.41
	HCG (mIU/mL)	r	0.22	0.06
		p	0.09	0.67

Pearson Correlations: *Correlation is significant at the p≤0.05 level (2-tailed),
****** **Correlation is significant at p≤0.01 level (2-tailed)**

DISCUSSION

These results suggest that breast cancer is more commonly associated with older age than with younger age. However, with the prolongation of life expectancy, we should not exclude the younger population from addition since success is achieved with early and complete treatment of breast cancer (15). However, suspense has increased, and excluding advanced-age patients from follow-up in the early period causes them to present with more advanced cancer stages later (16). Age is one of the important prognostic features in breast cancer, and tumor characteristics and treatment options are other factors that play an essential role in the diagnosis. When young age and advanced age are compared regarding high mortality reasons, young people are diagnosed at a later stage and have more aggressive tumor characteristics (17). While advanced age is effective in prognosis due to numerous comorbidities and, therefore, limitations in treatment options, tumor subtypes with more aggressive features determine the prognosis in young people. While advanced-age breast cancers sometimes remain under treatment due to comorbidities, younger patients may sometimes receive more treatment due to their expectations (marriage, childbirth, starting a business, long life expectancy) (18).

1. Differences in Biomarker Levels in Blood and Saliva Samples:

The analysis of hormonal biomarkers The results of the hormonal level biomarkers for breast cancer patients in blood and saliva samples for prolactin and testosterone did not significantly differ for NB, BB, and MB females in the study groups. Testosterone levels show no significant differences between serum and saliva samples in breast cancer patients and healthy controls. However, a moderate negative correlation between prolactin and testosterone was observed in both blood and saliva samples, suggesting an inverse relationship between these hormones. The long-term changes in testosterone concentrations, particularly in females aged 40+ or diagnosed 10+ years after pregnancy, may have protective effects related to pregnancy-associated hormonal changes (19,20). Most epidemiologic studies of prolactin and breast cancer have been restricted to single, often small, study samples with limited exploration of effect modification. Prolactin may be a risk factor for postmenopausal breast cancer, particularly in the context of postmenopausal hormone use. Investigations of prolactin interactions with other hormonal factors may further inform breast cancer etiology. However, some studies suggest that prolactin may not be a reliable biomarker for breast cancer risk (21, 22). In contrast, elevated prolactin levels were linked to increased breast cancer risk, particularly in postmenopausal females and hormone-receptor-positive tumors. Prolactin may stimulate breast cell growth, potentially contributing to cancer development (23, 24). In comparison, El-Saghir (25) suggests that prolactin is associated with estradiol and testosterone hormones' prediction of breast cancer risk (26). In contrast, the study found that prolactin concentrations were positively associated with postmenopausal breast cancer risk, despite the fairly consistent findings of earlier studies demonstrating a positive association between prolactin and breast cancer risk in postmenopausal females (27, 28). In a recent survey of invasive postmenopausal breast cancer cases and matched controls from the European Prospective Investigation into Cancer and Nutrition

cohort, prolactin levels were significantly associated with a 29% higher risk of postmenopausal breast cancer (29). This factor correlates with sex hormone levels in postmenopausal females, further suggesting that prolactin may interact with other hormones to influence breast cancer risk (30).

In contrast, the results of cortisol and HCG hormonal levels differed significantly between benign and malignant females. Prolactin, a hormone produced by the pituitary gland, regulates breast development and may contribute to breast cancer etiology. Cortisol levels did not significantly differ between breast cancer patients and healthy controls in either blood or saliva samples. No significant correlations were found between cortisol and other hormones (prolactin, testosterone, or HCG) in either sample type.Cortisol does not appear to be a reliable biomarker for breast cancer risk or progression, as its levels remain consistent across study groups. HCG Levels in blood and saliva produced significant differences that were higher in breast cancer patients than healthy controls, particularly in saliva samples. A weak positive correlation between HCG and prolactin was observed in saliva but not blood. Elevated HCG levels in serum and saliva may serve as a potential diagnostic marker for breast cancer, particularly in younger females (<40 years) and primiparous females (31).

2. Effects of Hormone Levels on Breast Cancer Patients in Blood and Saliva Samples:

The results of multiple Bonferroni comparisons regarding the effects of hormone levels on breast cancer in saliva samples showed a negative significance for BB compared to NB for prolactin. In contrast, a positive significance was observed for MB compared to BB patients. In contrast, the results for prolactin indicated no significance for MB compared to the NB group. Furthermore, testosterone exhibited no specificity for BB compared to NB but revealed a negative significance for MB against both NB and BB. In contrast, cortisol demonstrated no significance for BB compared to the NB group, but not for MB compared to BB patients. Lastly, HCG showed no significant difference between BB and NB, yet revealed a significant negative difference for MB compared with NB and MB compared with BB patients. The hormonal correlations between Prolactin and Testosterone for blood samples gave a moderate negative correlation. A similar moderate negative correlation was found for saliva samples. This indicates a possible inverse relationship between these two hormones in both biological fluids. Prolactin levels fluctuate throughout the menstrual cycle and are typically higher during pregnancy and lactation in normal, healthy females. Some benign cases may exhibit modestly elevated prolactin levels. However, within a physiological range, malignant premenopausal females may demonstrate elevated prolactin levels compared to healthy females, suggesting a potential association with postmenopausal breast cancer and hormone receptor-positive tumors (32, 33). The association between HCG concentration, age factors, HCG levels, and breast cancer risk in primiparous females under 40 years old, including those related to maternal pregnancy testosterone levels and breast cancer risk was discussed by Cornish et al. (19). While serum HCG levels were generally low in healthy, non-pregnant women, elevated HCG levels in particular breast cancer patients may serve as a potential diagnostic marker.

3. Correlations Between Hormone Levels in Blood and Saliva Samples:

The Pearson correlation coefficient between hormone biomarkers for prolactin and testosterone provided a negative correlation for serum samples and a negative correlation between prolactin and testosterone for saliva samples. In contrast, the results of prolactin and cortisol showed no correlation coefficients for serum samples and saliva samples. On the other hand, the result of HCG and testosterone provided no correlation coefficient for serum samples and no correlation between HCG and testosterone for saliva samples. In addition, the result of HCG and cortisol provided no correlation coefficients for serum samples and no correlation between HCG and cortisol for saliva samples. Cortisol in blood samples provided no significant correlation. In contrast, saliva samples presented a weak positive correlation between HCG and Prolactin, while there was no significant correlation with the Cortisol hormone. These results suggest that HCG behaves differently in saliva than in blood, with potential implications for using saliva as a diagnostic medium (31,32). Cortisol observed no significant associations found between Cortisol levels and the other hormones (Prolactin, Testosterone, or HCG) in either blood or saliva samples. Similar findings by the various studies regarding the associations between hormone levels and breast cancer risk present a positive correlation between prolactin and postmenopausal cancer, as well as hormone receptor-positive tumors (33,34).

The current study highlights the importance of considering hormone correlations in blood and saliva samples when assessing their utility as biomarkers for breast cancer detection, and both sample types offer insights into hormonal dynamics. Saliva samples may provide a more accessible and potentially informative medium for non-invasive breast cancer screening and management biomarker analysis. However, it had limitations such as a small sample size and constraints in statistical power.

CONCLUSIONS

The current study showed testosterone and HCG are the most impactful biomarkers and showed significant differences in both serum and saliva samples for distinguishing malignant breast cancer from benign tumor patients and healthy females making them strong candidates for diagnostic use particularly in younger females and primiparous females, suggest its potential as a diagnostic marker for breast cancer. Cortisol and prolactin showed limited utility as biomarkers, with cortisol levels remaining consistent across groups and prolactin showing inconsistent patterns. Analyzing hormonal biomarkers in blood and saliva samples reveals similarities and differences in their associations with breast cancer risk. While blood samples remain the gold standard for hormonal analysis, saliva samples offer a promising, non-invasive alternative for biomarker detection.

ACKNOWLEDGMENT

For all members who cooperate and agree to participate in this study.

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دراسة مستويات الهرمونات في تشخيص واكتشاف سرطان الثدي مبكرا

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الخلاصة

الخلفية: سرطان الثدي مشكلة صحية عامة رئيسية، مع ارتفاع معدل الإصابة بين الإناث في جميع أنحاء العالم، ويزداد مع تقدم العمر والظروف البيئية. اكتسبت المؤشرات الحيوية الهرمونية الاهتمام لفائدتها المحتملة في الكشف المبكر عن سرطان الثدي. **الهدف:** هدفت الدراسة إلى التحقيق في تأثير المؤشرات الحيوية لمستويات الهرمونات المختلفة بما في ذلك البرولاكتين والتستوستيرون والكورتيزول وهرمون الحمل في تشخيص واكتشاف خطر الإصابة بسرطان الثدي في وقت مبكر. **المواد وطرق العمل:** تم جمع عينات الدم واللعاب من الإناث المتطوعات بما في ذلك 50 أنثى سليمة و 111 انثى ذات ورم حميد و 20 انثى ذا ت ورم خبيث لتحديد المؤشرات الحيوية لمستوى الهرمون باستخدام اختبار الممتز المناعي المرتبط بالإنزيم. **النتائج:** أظهرت النتائج أن المؤشرات الحيوية الهرمونية، وخاصة البرولاكتين والتستوستيرون وهرمون الحمل، يمكن أن تكون بمثابة مؤشرات حيوية للكشف المبكر عن سرطان الثدي في كل من المصل واللعاب. في المقابل، لم يكن للعلامات الحيوية الهرمونية للكورتيزول ارتباط فعال بالكشف المبكر عن سرطان الثدي. **الاستنتاج**: أظهرت نتائج هذه الدراسة أن الارتباط الحالي بين العلامات الحيوية الهرمونية، بما في ذلك البرولاكتين والتستوستيرون وهرمون الحمل البشري، يمكن أن يعمل كعلامات حيوية للكشف المبكر عن سرطان الثدي. في المقابل، لم يكن للكورتيزول ارتباط فعال بالكشف المبكر عن سرطان الثدي.

الكلمات الدالة: سرطان الثدي، الكوليسترول، المؤشرات الحيوية، هرمون الحمل البشري، البرولاكتين، التستوستيرون.