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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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A STUDY OF THE EFFECT OF CA15-3 LEVELS AND APELIN PEPTIDE ON SOME BIOCHEMICAL VARIABLES IN PATIENTS WITH BREAST CANCER IN BAQUBAH CITY

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Abstract.

This cross-sectional study enrolled 70 women aged 18–40 years in Baqubah City (Iraq), from September to November 2024. Participants were divided into two age-matched groups: a control group (n=35, healthy nulliparous women) and a patient group (n=35, physician-diagnosed breast cancer cases). Blood samples were collected from both groups, processed via centrifugation, and analyzed for key biochemical markers, including the tumor antigen CA15-3, apelin, sex hormones (estrogen, progesterone, etc.), and essential minerals (e.g., calcium, zinc). Statistical analysis revealed highly significant differences ($p \leq 0.001$) in serum biomarker levels between breast cancer patients and controls. Elevated CA15-3 and altered apelin concentrations were observed in cancer patients, alongside dysregulated sex hormones and mineral imbalances. These findings underscore the potential diagnostic utility of these biomarkers in breast cancer and highlight metabolic disruptions associated with the disease. Further research is warranted to validate their clinical applicability.

Key words. Apelin peptide, galectin-3, sex hormones, breast cancer, minerals.

Introduction.

Breast cancer is caused by a variety of causes, but the most significant ones are: environment, genetics, poor food, lack of exercise, early age at first menstruation, late childbearing, or not having children at all [1]. Additionally, by activating breast cells, elevated blood levels of the hormones progesterone and estrogen raise the risk of breast cancer [2]. Additionally, a rise in the hormone prolactin raises the risk of breast cancer [3]. According to epidemiological research, the condition may be linked to menopause, the use of contraceptives, and a family history of breast cancer or other cancers [4].

More than 79–92% of individuals with advanced breast cancer have increased CA15-3, one of the diagnostic markers. Its application is highly helpful in identifying the patients' infection stage, and its decline is marginally correlated with effective therapy. As a result, it takes time to confirm that the antigen has significantly decreased [5]. Because it encourages and has both direct and indirect proliferative effects on breast cancer cells, estrogen is a key factor in the development of breast cancer. Through the activation of oncogenes and the stimulation of enzymes and proteins involved in DNA synthesis, it may directly cause tumors. Prolactin secretion and the synthesis of growth factors like transforming growth factor, epidermal growth factor, and non-growth factor peptides like plasminogen activators can both have indirect effects [6].

One of the female hormones that plays a significant part in controlling the menstrual and ovulation processes is progesterone. The proliferative endometrium is changed into a secretory endometrium by it. Follicle maturation and ovulation are prevented by this hormone's inhibition of the pituitary glands gonadotrophin release. It is produced in the brain, uterus, and ovaries and encourages the development of mammary glands. It also relaxes the smooth muscles in the endometrium and sustains pregnancy [7].

Because the peptide apelin is found in both fetal and adult tissues, it has a very high level of effectiveness from the very beginning of cardiovascular development until adulthood. As a result, this system makes a significant and obvious contribution to the expansion of physiological processes. Both the inner layer of the arteries and veins, known as the tunica intima of the retinal vessels, and the endothelial cells of the fetal vasculature exhibit elevated and elevated expression of the APJ receptor [8]. The notion that apelin is essential for endothelial cell proliferation during embryonic development and physiological conditions like breast and other tumors and malignant neoplasms, as well as diabetic retinopathy, is strongly supported by these facts. In the future, apelin may be used as an antiangiogenic to control tumor growth and diabetic retinopathy and as a therapy against angiogenic stimulation like ischemia [9].

Numerous kinds of minerals are useful and significant for preserving the human body's health. They aid in the development of bones and teeth, the regulation of bodily fluids both inside and outside of cells, the transformation of digested food into energy that the body requires for its many essential functions, and the defense against malignant tumors [10]. It contains calcium, potassium, and vitamin D. Vitamin D can be regarded as a non-essential nutrient found in foods since it is gained by prolonged exposure to sunshine [11]. The primary function of vitamin D is to keep the blood's calcium levels balanced by improving intestinal absorption and preserving the amount of calcium and phosphate in the bones [12].

Since zinc's metabolic pathways offer several methods for zinc to contribute to cancer, its immunological function is connected to cellular signaling. Cancer cells are directly impacted by zinc (Zn). It also has a significant impact on immune response and tumor management, as well as the stability and functionality of intracellular machinery linked to cell division [13]. Zinc may be a biomarker that helps identify breast cancer early, which is crucial for better outcomes for people with the condition. For almost ten years, high zinc concentrations have been seen in breast cancer tissue. The molecular alterations that cause zinc metabolism are still unknown [14]. The current study sought to determine how apelin and CA15-3 levels affected certain biochemical variables in breast cancer patients in Baqubah city (Iraq), who had high sex hormone levels and low mineral levels.

Materials and Methods.

Collection of specimens: Seventy women, ages 18 to 40, participated in this study. Following a specialist doctor's diagnosis, samples were taken from gynecological clinics

and separated in private labs in Baqubah City (Iraq), between September and November 2024. The samples were divided into two groups:

Control group: This group included (35) blood samples from healthy women (as a control group) after confirming that they were nulliparous and within the same age group.

Patient group: This group included (35) blood samples from women with breast cancer who had been diagnosed by specialist doctors. Blood was then collected from the patient and healthy group and separated by centrifugation. Biochemical parameters were then measured, Including CA15-3, apelin, Sex hormones, and Mineral levels. The patients signed a consent form, and the study were approved by the Scientific Committee of the department of Biology, College of Science, University of Diyala (Iraq) with reference letter number (125) on 20.04.2025.

Estimating CA15-3, Galectin-3, and apelin levels in serum: A pre-made test kit (supplied by MyBiosource, USA) was used to measure the levels of apelin and CA15-3 in serum. The sandwich method is used in the enzyme-linked immunosorbent test (ELISA).

Estimating sex hormone levels in serum: Using a hormone device (Minividas) and the procedures outlined in the pre-made test kit (supplied by DRG International, USA) the levels of progesterone and estrogen were determined. These differ based on the manufacturer and from device to device.

Estimating Vitamin D levels in serum: A pre-made kits (supplied by MyBiosource, USA) were used to determine the vitamin level.

Estimating Zinc and Potassium levels in serum: Serum zinc and potassium levels were determined using a diagnostic kit supplied by Randox Laboratories (India).

Statistical analysis: At the probability level ($p < 0.001$), the sick groups and a control group of healthy people were compared using the Duncan's multiple range test in the statistical software SPSS, Statistical Package for the Social Sciences.

Results.

The mean ± standard deviation of the levels of biochemical and diagnostic markers for breast cancer patients relative to healthy people is displayed in the table below.

The current study's findings demonstrated that, at a probability level of $P \leq 0.001$, the blood serum levels of CA15-3, apelin, Galectin-3, Progesterone, K, and Estrogen were significantly higher in breast cancer patients than in the control group, while the levels of Vitamin D were significantly lower in both groups (Table 1).

Table 1. *Displays the blood serum's mean ± standard deviation for the studied samples.*

Parameters	Control	Patients	p value
CA15-3 (U/ml)	8.64±0.44	45.65±14.43	$P \leq 0.001$
Apelin (ng/ml)	1.01±0.92	2. 12±1.15	$P \leq 0.001$
Galectin-3 (ng/ml)	5.07±1.23	15.09±7.86	$P \leq 0.001$
Estrogen (pg/ml)	160.97±30.22	261.69±50.33	$P \leq 0.001$
Progesterone (pg/ml)	0.61±0.18	1.22±0.41	$P \leq 0.001$
Vitamin D (ng/ml)	45.18 ± 6.11	15.72 ± 1.96	$P \leq 0.001$
Zinc (mg/dl)	80.14 ± 6.96	54.20 ± 5.57	$P \leq 0.001$
Potassium (µmol/L)	4.24 ± 0.76	8.04 ± 0.92	$P \leq 0.001$

Discussion.

The most prevalent cancer in women and one of the leading causes of mortality globally is breast cancer. As a result, scientists and physicians find it to be among the most concerning forms of cancer. As a result, a number of diagnostic and predictive indicators that aid in the early detection of breast cancer have been discovered. The cancer antigen (CA15-3) is one of these crucial indicators [16,17]. CA15-3 levels are higher in patients with breast cancer. Both the findings of Li et al. [18], and Hamdi et al. [17] were in agreement with our study's findings. They noted that women with breast cancer have abnormally high levels of the tumor marker CA15-3, which suggests a risk of disease progression or recurrence. One of the most crucial diagnostic markers for breast cancer is the CA15-3 test, and variations in this test are mirrored in the disease state. Utilizing tumor markers in clinical settings will result in more efficient treatment. Accordingly, CA15-3 is a marker with intermediate sensitivity and high specificity for distant disease metastases, and the majority of research has shown that it is a significant prognostic indicator for patients with breast cancer [19,20].

One of the peptides that is frequently present on the surface of some cell types is apelin [21], particularly in organs such the brain, adrenal gland, endothelium, liver, kidney, lung, adipose tissue, digestive system, and human plasma [22]. Apelin has a variety of purposes in organs, including the blood vessels, where its receptors help regulate blood pressure and promote the development of new blood vessels [23]. Since receptors are typically found on the surfaces of osteoblast cells, apelin is also present in bone [24]. Its high level in breast cancer patients [25]. The increase can be attributed to apelin's effect on insulin sensitivity, which can be enhanced directly through internal cell signals and glucose consumption, or indirectly through increased mitochondrial construction and the tension between the tricarboxylic acid cycle (Krebs cycle) and fatty acid oxidation [26]. Numerous inflammatory markers, including TNF, IL-6, and insulin sensitizers, can cause changes in apelin levels. Apesin is secreted through adenosine 5'-monophosphate, which activates the active protein kinase (AMPK), causing insulin resistance in the body and ultimately leading to certain cancers, including breast cancer [27].

Given that Galectin-3 is a protein that is internally linked to carbohydrates and plays a role in numerous cellular processes [28], its findings were in line with those of Niang et al. [28] and Shafiq et al. [29], who demonstrated in their study that patients with breast cancer had high levels of Galectin-3 [30]. Depending on the kind of cell and the stimuli, galectin-3 may be elevated or lowered during apoptosis. Breast cancer cells that overexpress callectin-3 become resistant to chemotherapeutic medications [31]. Different malignancies exhibit dysregulation of galectin-3, and the expression of this protein changes depending on the location of the tumor. Breast cancer cells release Galectin-3 in response to stressors such hypoxia and food restriction, and cell survival is aided by the buildup of callectin-3 in the cytoplasm [32].

Regarding sex hormones, the group of patients' serum levels of estrogen significantly increased, which was in line with the findings of Abdel Fattah et al. [33], who also reported an

increase in the hormone in the group of patients. It is thought that the increase is due to estrogen's ability to effectively stimulate the growth of breast cancer cells, because estrogen attaches to its receptor, which functions as a transcription factor and helps control cell division, normal cells that develop into cancer cells frequently have ER in the nucleus, which promotes the growth of cancer cells [34]. A key factor in the formation of healthy mammary glands, ER activation triggers the activation of particular pathways that are in charge of the proliferation and differentiation of mammary cells. Conversely, aberrant cell proliferation and the development and spread of breast cancer are linked to altered ER signalling [35]. According to new data, ER is expressed in 70% of breast malignancies [36].

The rise in the progesterone hormone was in line with the findings of Yousif et al [38] and Ahmed et al. [37]. Progesterone is thought to be the cause of the increase because it tends to increase cell proliferation in breast tissue and has biphasic effects on the spread of its cells. Depending on the cell content, it acts as a primary initiator in activating growth promotion; for instance, it increases growth factors that initiate signalling pathways and factors like EGFR (epidermal growth factor receptor) and associated factors, affects the proliferation of breast cancer cells through these and proto-oncogenes, and increases the response of breast cancer cells to growth factors[39], due to the fact that progesterone prepares the reproductive system for the start and maintenance of pregnancy [40].

Regarding mineral levels, the patient group's serum levels of vitamin D significantly decreased, with findings in line with those of González-Fisher et al. [41]. According to Shekarriz-Foumani et al. [42], the active metabolite of vitamin D is thought to be the cause of the decline since it enhances the anticancer effects of numerous cytotoxic and antiproliferative anticancer drugs [43]. According to a prior study, vitamin D insufficiency was linked to tumor size, stage, grade, nodal status, and Her2/neu receptor expression, all of which had an adverse effect on overall survival and disease-free survival in instances of breast cancer [44]. Concern over dietary risk factors has grown significantly. Eating a lot of fruits and vegetables that are low in saturated fat may lower the incidence of breast cancer, according to studies [45].

The conclusion of zinc insufficiency was consistent with the results of both Rizk et al. [46] and Arinola et al [47]. The precise involvement of zinc in cancer [49] and its correlation with malignant tumors [58] are the causes of zinc deficiency. Nonetheless, over 100 distinct metabolic processes are known to require zinc [50]. By changing how histones F and F3 bind to DNA, it affects RNA production, which is necessary for DNA synthesis [51]. The significance of zinc in human cancer is further supported by the fact that both zinc deficiency and zinc supplementation have demonstrated stimulatory and inhibitory responses to tumor growth. The zinc concentration in the serum of breast cancer patients was found to be significantly lower than that of the control group. The higher demand on malignant tissues as a result of increased cell absorption and tumor enzymatic activity may account for this decline in zinc levels [52].

According to our study's findings, a lower risk of breast cancer was linked to both an increase in potassium intake overall and potassium intake from plant sources. Additionally, a relationship between dietary potassium intake and the risk of breast cancer was discovered, indicating that the risk of breast cancer decreased with each 500 mg increase in potassium intake. Increased potassium consumption produced results that were in line with those of a case control study [53]. Given that potassium can help lower the risk of chronic diseases, the rise is thought to be caused by dietary potassium intake or the consumption of foods high in potassium [54]. The primary foods that contribute to potassium consumption are fruits, vegetables, and dairy products [55]. The incidence of breast cancer has been found to be inversely correlated with the diet of non-starchy vegetables [56]. Foods high in potassium, like yogurt, bananas, and tomatoes, have been shown to successfully lower the incidence of lung cancer [57].

The limitations of the present study include the sample size is small and restricted to single centre hindering the generalizability of the data to broader populations. Being cross-sectional study, the relationships between CA15-3, apelin, and biochemical changes over time are irrational perhaps limiting their value for prognostic follow-up. Non-controllable confounding parameters (variations in treatment protocols, disease stages, and lifestyle differences) potentially affecting the findings.

Conclusion.

The study concluded that breast cancer associated with elevated serum CA15-3, apelin, estrogen, progesterone, and potassium. However, vitamin D and zinc were reduced leading to challenged outcome in patients with breast cancer.

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