Western European Journal of Medicine and Medical Science
Volume 2, Issue 8, August, 2024
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

MEASURING THE LEVEL OF PARATHYROID HORMONE AND STUDYING ITS RELATIONSHIP WITH THYROID HORMONES IN PATIENTS WITH ARTHRITIS AND THYROID DISEASE

[1] Lubna Alaa Saber , [2]Assit. Prof. Shaimaa Essa Ahmed
[1] Biochemistry, College of Applied Sciences, Samarra University, Iraq
[2]Clinical Biochemistry, Dentistry College, University of Tikrit, Iraq
la230025sc@st.tu.edu.iq
shaemaa.essa@tu.edu.iq

Abstract
Parathyroid hormone (PTH) is a small protein that participates in controlling the balance of calcium and phosphate in the body. It has an effect on the skeleton, as it affects the processes of building and breaking down bones. Samples were taken from arthritis and thyroid patients, and the levels of ESR, TSH, T4, T3, PTH, and Ca were measured to determine the level of each of them and to know the relationship between them. The results were TSH (1.650±4.240 p≤0.005)T4 (6.82±44.10 p≤0.005)
, T3 (0.727±1.823, p≤0.005) ESR(6.61±47.80 p ≤0.005)
ca(0.609±7.311p ≤0.005) The results showed that a high level of ESR indicates the presence of arthritis, a high level of TSH, and a low level of both T 3and T 4indicate hypothyroidism and a low level of PTH, as well as ca. Parathyroid hormone is related to bones, as blood calcium decreases and bone resorption increases. Hypothyroidism also affects the parathyroid gland.

Key Words: arthritis, thyroid, Bones, Calcium, Thyroid gland

Introduction:

The parathyroid glands are a pair of glands that are usually located behind the left and right lobes of the thyroid gland. Each gland is a flat, yellowish-brown oval shaped like a lentil, and is usually about 6 mm long, 3 to 4 mm wide, and 1 to 2 mm anteriorly and posteriorly (1). There are usually four parathyroid glands. The parathyroid glands on each side that are higher up are called the superior parathyroid glands, while the two lower ones are called the inferior parathyroid glands. Healthy parathyroid glands generally weigh about 30 mg in men and 35 mg in women. (2)(3) These glands are not visible or can be felt during a neck examination.

The parathyroid glands vary in number: three or more small glands,(4) and can usually be located on the posterior surface of the thyroid gland.(4) Occasionally, some individuals may have six, eight, or more parathyroid glands.(3) In rare cases, the parathyroid glands may be within the thyroid gland itself, the chest, or even the thymus gland.(4)

Parathyroid hormone (also known as parathyroid hormone) is an 84-amino acid peptide produced and secreted naturally by the parathyroid glands, which regulates the systemic metabolism of calcium, phosphate, and vitamin D. It is a small protein involved in controlling calcium and phosphate homeostasis, as well as bone physiology. Parathyroid hormone has effects opposite to those of calcitonin. (5) The main function of the parathyroid glands is to

Western European Journal of Medicine and Medical Science
Volume 2, Issue 8, August, 2024
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

maintain calcium and phosphate levels in the body within a very narrow range, so that the nervous and muscular systems can function properly. (6) The parathyroid glands do this by secreting parathyroid hormone (parathyroid hormone). Parathyroid disease is traditionally divided into conditions in which the parathyroid gland is overactive (hyperparathyroidism) and conditions in which the parathyroid gland is underactive or underactive (hypoparathyroidism). Both conditions are characterized by symptoms related to excess or deficiency of parathyroid hormone in the blood. (7) Hypoparathyroidism may present with symptoms related to low calcium, It is generally treated with vitamin D analogues.

Mechanism of action of parathyroid hormone: Parathyroid hormone regulates calcium homeostasis and phosphate metabolism through a complex interaction that affects bone turnover and renal excretion of calcium and phosphate. In addition, PTH increases the synthesis of vitamin 1,25(OH)2D3, which enhances intestinal absorption of calcium. PTH administration results in the release of calcium from the bone surface. Chronic administration of PTH results in an increase in the number and activity of osteoclasts; however, intermittent administration results in increased trabecular bone deposition. PTH increases serum calcium concentration directly, by increasing bone resorption and increasing renal calcium reabsorption, and indirectly, by increasing renal synthesis of 1,25(OH)2D3 through activation of 25OHD3-1-hydroxylase in the proximal tubular cell. PTH administration also results in the release of phosphate from bone and increases phosphaturia by inhibiting phosphate reabsorption in the proximal (and partially distal) tubules. Although serum phosphorus may increase bone resorption caused by parathyroid hormone, parathyroid hormone lowers serum phosphorus concentration through its phosphaturic effect, thereby reducing the potential negative effect of hyperphosphatemia on calcium homeostasis. The direct result of all these actions is an increase in serum calcium concentration and a decrease in serum phosphate concentration (8).

PTH has profound effects on the skeleton at the tissue level. High circulating levels of the hormone can produce both catabolic and anabolic effects on bone, depending on the temporal profile of its excess. Persistent (or chronic) elevations in PTH, as in primary or secondary hyperparathyroidism, increase the rate of bone remodeling and can lead to bone loss.(9)
Low or normal PTH levels in a patient with hypocalcemia indicate hypoparathyroidism when serum magnesium levels are normal (10).

Patients with hypoparathyroidism present with severe hypocalcemia, hyperphosphatemia, tetany, hypomagnesemia, and low vitamin D levels. Basal ganglia calcifications are another very common feature of this syndrome. The most common cause of hypoparathyroidism is damage or removal of the parathyroid glands during neck surgery, especially complex thyroid surgery. However, hypoparathyroidism may occur as a congenital disorder or as an autoimmune condition, in isolation or in association with other organ failure. The reader is referred to several excellent recent clinical reviews of this rare condition (11-13)

PTH is a hormone important for many cellular processes, primarily focusing on mineral metabolism. This tightly regulated hormone is critical for the regulation of calcium and phosphate homeostasis as well as bone metabolism. Dysregulation leads to dramatic clinical pictures characterized by poor bone mineralization and increased soft tissue mineralization. These abnormalities in turn lead to cardiovascular disease and renal failure. Key gaps in our understanding of PTH include the role of intracellular signaling, the interaction of PTH with

Western European Journal of Medicine and Medical Science
Volume 2, Issue 8, August, 2024
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

other hormones involved in mineral metabolism, and the mechanisms by which PTH may affect cardiovascular health. Women with low TSH levels who are treated with T4 lose bone minerals from the spine more rapidly than women without known thyroid disease. (14) Given the decreased serum levels of PTH and 1,25-dihydroxyvitamin D3 and impaired intestinal calcium absorption in patients with thyrotoxicosis, it is thought that increased calcium levels directly reflect accelerated bone resorption. Suppression of PTH secretion in patients with thyrotoxicosis, and the resulting decreased PTH-mediated renal tubular calcium reabsorption, are thought to be the mechanisms responsible for hypercalciuria in these patients. Patients with thyrotoxicosis rarely develop symptoms due to hypercalcemia and hypercalciuria. However, thyrotoxicosis is a known risk factor for osteoporosis (15).

The method of work:

Serum samples were taken from patients with arthritis and hypothyroidism, aged 30-45 years. (T3, TSH, and T4) were measured to determine the level of thyroid hormones, (PTH) was measured to determine the level of parathyroid hormone, (ESR) was measured to determine the level of arthritis, and blood calcium (Ca) was measured. These analyses were measured using special ELISA kits for each analysis. The method of making ELISA kits is done through several steps. The first step is to add blood serum to the reaction wells containing the antibody at a temperature of 37 degrees Celsius for 90 minutes. The second step is to add the binding enzyme. The third step is to wash the wells, where we empty the wells of their contents and wash them in the washing solution and dry them. The fourth step is to add TMB (sabstrat), which in turn shows the blue color. The fifth step is to add stop solution to stop the reaction, where the blue color turns to yellow and its intensity indicates the intensity of the reaction. The sixth step is to read the results in the device at a wavelength of 450 nm, which is the wavelength for reading the yellow color.

Results:

The results of this study showed that the level of erythrocyte sedimentation rate (ESR) mm/h was (47.80±6.61) for the group of patients, while its level was (15.29±3.09) for the healthy group, as in Table (1-1) below:

ESR Mean ±SD	**the group**
47.80 **±6.61**	**The patients**
15.29 **±3.09**	**Healthy people**
0. 05	**P-Value**

Western European Journal of Medicine and Medical Science
Volume 2, Issue 8, August, 2024
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

The mu/LTSH level was (4.240±1.650) for the patients group while it was (1.272±0.414) for the healthy group, and the T3 ng/ml level was (1.823±0.727) for the patients group while it was (8.871±2.710) for the healthy group (control group) and T4 nmol/l (6.82±44.10) for the patients group while it was (242.0±32.9) for the healthy group as in Table (1-2) below:

T_4 Mean ±SD	**T_3** Mean ±SD	**TSH** Mean ±SD	**the group**
44.10 ±6.82	**1.823 ±0.727**	**4.240 ±1.650**	**The patients**
242.1 ±32.9	**8.871 ±2.710**	**1.272 ±0.414**	**Healthy people**
0. 05	**0.05**	**0. 05**	**P-Value**

The PTH level was low (23.86±6.10) pg/ml, and the calcium level in the patient group was (7.311±0.609) mg/dl, while its level in healthy people was (10.231±0.326) as in Table (1-3) below:

Ca Mean ±SD	**PTH** Mean ±SD	**the group**
7.311 ±0.609	**23.86 ±6.10**	**The patients**
10.231 ±0.326	**62.60 ±11.4**	**Healthy people**
0. 05	**0. 05**	**P-Value**

Discussion:

The ESR levels of the patients group were high compared to the healthy group ($p \leq 0.05$), indicating the presence of arthritis, and the TSH level of the patients group was high compared

Western European Journal of Medicine and Medical Science
Volume 2, Issue 8, August, 2024
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

to the healthy group as well ($p \leq 0.05$), while the results of the T3 and T4 tests were low in the patients group ($p \leq 0.05$), indicating hypothyroidism, and the PTH level was low in the patients group ($p \leq 0.05$), indicating hypoparathyroidism, and as for the low calcium level, it is an indication of the action of parathyroid hormone, which works to maintain the calcium level in the blood, and the presence of a high ESR level indicates the presence of arthritis associated with low calcium. It is believed that the suppression of PTH secretion in patients with hypothyroidism, and the resulting decrease in renal tubular calcium reabsorption mediated by (15) PTH, PTH has profound effects on the skeleton at the tissue level. High circulating levels of the hormone can produce both catabolic and anabolic effects on bones (9). Parathyroid hormone is affected by thyroid disorders and thus affects the regulation of calcium levels, which in turn affects the structural structure of bones. Parathyroid hormone is decreased by hypothyroidism or thyrotoxicosis or may be a result of thyroid surgery. The parathyroid gland regulates the systemic metabolism of calcium, phosphate and vitamin D. PTH is a small protein involved in the control of calcium and phosphate balance, as well as bone physiology. The main function of the parathyroid glands is to maintain calcium and phosphate levels in the body within a very narrow range, so that the nervous and muscular systems can function properly.

References:

1. Abdulqader, A. T., Al-Sammarie, A. M. Y., & Mustafa, M. A. (2022, May). A comparative environmental study of aqueous extracts of ginger and grapes to protect hepatocytes in Albino rabbits and a comparison of extracts in preserving Awassi lamb meat from oxidation. In IOP Conference Series: Earth and Environmental Science (Vol. 1029, No. 1, p. 012001). IOP Publishing.
2. Ali, S. H., Armeet, H. S., Mustafa, M. A., & Ahmed, M. T. (2022, November). Complete blood count for COVID-19 patients based on age and gender. In AIP Conference Proceedings (Vol. 2394, No. 1). AIP Publishing.
3. Betterle C, Garelli S, Presotto F. Diagnosis and classification of autoimmune parathyroid disease. Autoimmun Rev 13: 417–422, 2014. [PubMed] [Google Scholar]
4. Bilezikian JP, Khan A, Potts JT Jr, Brandi ML, Clarke BL, Shoback D, Juppner H, D'Amour P, Fox J, Rejnmark L, Mosekilde L, Rubin MR, Dempster D, Gafni R, Collins MT, Sliney J, Sanders J. Hypoparathyroidism in the adult: Epidemiology, diagnosis, pathophysiology, target-organ involvement, treatment, and challenges for future research. J Bone Miner Res 26: 2317–2337, 2011. [PMC free article] [PubMed] [Google Scholar]
5. Fehrenbach and Herring, 2012, [a] [b] Illustrated Anatomy of the Head and Neck, Elsevier, p. 159
6. Gray, Henry (1980). Williams, Peter L; Warwick, Roger (eds.). Gray's Anatomy (36th ed.). Churchill Livingstone. p. 1453. ISBN 0-443-01505-8.
7. Hsu, C. Y., Mustafa, M. A., Yadav, A., Batoo, K. M., Kaur, M., Hussain, S., ... & Nai, L. (2024). N2 reduction to NH3 on surfaces of Co-Al18P18, Ni-Al21N21, Fe-B24N24, Mn-B27P27, Ti-C60 and Cu-Si72 catalysts. Journal of Molecular Modeling, 30(3), 1-11.
8. Jorge A. Prada, Calcium-Regulating Hormones in Fetal and Neonatal Physiology (Third Edition), 2004

Western European Journal of Medicine and Medical Science
Volume 2, Issue 8, August, 2024
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

9. Kadham, S. M., Mustafa, M. A., Abbass, N. K., & Karupusamy, S. (2024). IoT and artificial intelligence–based fuzzy-integral N-transform for sustainable groundwater management. Applied Geomatics, 16(1), 1-8.
10. Kadham, S. M., Mustafa, M. A., Abbass, N. K., & Karupusamy, S. (2023). Comparison between of fuzzy partial H-transform and fuzzy partial Laplace transform in x-ray images processing of acute interstitial pneumonia. International Journal of System Assurance Engineering and Management, 1-9.
11. Larsen, William J. (2001). Human embryology (3rd ed.). Philadelphia, Pa.: Churchill Livingstone. pp. 377–8. ISBN 0-443-06583-7.
12. Lu Song, Calcium and Bone Metabolism Indices in Advances in Clinical Chemistry, 2017.
13. Lu, Z. F., Hsu, C. Y., Younis, N. K., Mustafa, M. A., Matveeva, E. A., Al-Juboory, Y. H. O., ... & Abdulraheem, M. N. (2024). Exploring the significance of microbiota metabolites in rheumatoid arthritis: uncovering their contribution from disease development to biomarker potential. APMIS.
14. Mahmoud, Z. H., Ajaj, Y., Hussein, A. M., Al-Salman, H. N. K., Mustafa, M. A., Kadhum, E. H., ... & Kianfar, E. (2024). CdIn2Se4@ chitosan heterojunction nanocomposite with ultrahigh photocatalytic activity under sunlight driven photodegradation of organic pollutants. International Journal of Biological Macromolecules, 267, 131465.
15. Meri, M. A., Ibrahim, M. D., Al-Hakeem, A. H., & Mustafa, M. A. (2023). Procalcitonin and NLR Measurements in COVID-19 Patients. Latin American Journal of Pharmacy, 220-223.
16. Mustafa, M. A., Kadham, S. M., Abbass, N. K., Karupusamy, S., Jasim, H. Y., Alreda, B. A., ... & Ahmed, M. T. (2024). A novel fuzzy M-transform technique for sustainable ground water level prediction. Applied Geomatics, 16(1), 9-15.
17. Mustafa, M. A., Raja, S., Asadi, L. A. A., Jamadon, N. H., Rajeswari, N., & Kumar, A. P. (2023). A Decision-Making Carbon Reinforced Material Selection Model for Composite Polymers in Pipeline Applications. Advances in Polymer Technology, 2023(1), 6344193.
18. Riggs BL, Melton III LJ. Involutional osteoporosis. N Engl J Med. 1986;314:1676-86.
19. Ritter, Cynthia S.; Haughey, Bruce H.; Miller, Brent; Brown, Alex J. (August 2012). "Differential Gene Expression by Oxyphil and Chief Cells of Human Parathyroid Glands". The Journal of Clinical Endocrinology & Metabolism. 97 (8): E1499–E1505. doi:10.1210/jc.2011-3366. PMC 3591682. PMID 22585091.
20. Saadh, M. J., Avecilla, F. R. B., Mustafa, M. A., Kumar, A., Kaur, I., Alawayde, Y. M., ... & Elmasry, Y. (2024). The promising role of doped h-BANDs for solar cells application: A DFT study. Journal of Photochemistry and Photobiology A: Chemistry, 451, 115499.
21. Saadh, M. J., Mustafa, M. A., Hussein, N. M., Bansal, P., Kaur, H., Alubiady, M. H. S., ... & Margarian, S. (2024). Investigating the ability of BC2N nanotube to removal Eriochrome blue black from wastewater: A computational approach. Inorganic Chemistry Communications, 163, 112311.
Johnson, S J (1 April 2005). "Best Practice No 183: Examination of parathyroid gland

Western European Journal of Medicine and Medical Science
Volume 2, Issue 8, August, 2024
https://westerneuropeanstudies.com/index.php/3
ISSN (E): 2942-1918 Open Access| Peer Reviewed

specimens". Journal of Clinical Pathology. 58 (4): 338–342. doi:10.1136/jcp.2002.002550. PMC 1770637. PMID 15790694.
22. Shakir, O. M., Abdulla, K. K., Mustafa, A. A., & Mustafa, M. A. (2019). Investigation of the presence of parasites that contaminate some fruits and vegetables in the Samarra City in Iraq. Plant Arch, 19, 1184-1190.
23. Shoback D. Clinical practice. Hypoparathyroidism. N Engl J Med 359: 391–403, 2008. [PubMed] [Google Scholar]
24. Stoll GM, Harris S, Sokoll LJ, Dawson-Hughes B. Accelerated bone loss in hypothyroid patients overtreated with L-thyroxine. Ann Intern Med. 1990;113:265-9.
25. Teresita Bellido, Kathleen M. Hill Gallant, Hormonal Effects on Bone Cells in Basic and Applied Bone Biology (Second Edition), 2019
26. Valluru, D., Mustafa, M. A., Jasim, H. Y., Srikanth, K., RajaRao, M. V. L. N., & Sreedhar, P. S. S. (2023, March). An Efficient Class Room Teaching Learning Method Using Augmented Reality. In 2023 9th International Conference on Advanced Computing and Communication Systems (ICACCS) (Vol. 1, pp. 300-303). IEEE.
27. Williams, S. Jacob; dissections by David J. Hinchcliffe; photography by Mick A. Turton; illustrated by Amanda (2007). Human anatomy: a clinically-orientated approach (New ed.). Edinburgh: Churchill Livingstone. ISBN 978-0-443-10373-5.[page needed].
28. Yaseen, A. H., Khalaf, A. T., & Mustafa, M. A. (2023). Lung cancer data analysis for finding gene expression. Afr. J. Biol. Sci, 5(3), 119-130.
29. Young, Barbara; Heath, John W.; Stevens, Alan; Burkitt, H. George (2006). Wheater's functional histology: a text and colour atlas (5th ed.). Edinburgh: Churchill Livingstone/Elsevier. p. 337. ISBN 978-0-443-06850-8