Osol Journal of Medical Sciences (OJMS) ISSN: 3005-9097
DOI: 10.69946/ojms/2025.03.02.09, pp(79-87)

Assessment of Metabolic Changes after Thyroidectomy in Thyroid Cancer Patients

Alaa Saadi Abbood[1], Anwar M. Lazm[2], Sama S. Majeed[3]

[1]Iraqi center for cancer and medical genetics research, Mustansiriyah university, Baghdad, 11001, Iraq

[2]Department of Optics Techniques, College of Health and Medical Techniques, Middle Technical University, Baghdad, 11001, Iraq

[3]Physiotherapy Department, Al-Mansour University College, Baghdad, 11001, Iraq

Corresponding Author email: (Alaasabbood@uomustansiriyah.edu.iq)

Abstract

Objective: Thyroidectomy is an essential component in the treatment of thyroid cancer. But taking out the thyroid gland can have a big effect on metabolic balance because it stops the body from making thyroid hormones. The goal of this study was to look at the metabolic changes that happen following thyroidectomy in people with thyroid cancer. It focused on the function of the liver and kidneys, the regulation of glucose, the lipid profile, the levels of electrolytes, and the activity of lipoprotein lipase (LPL).

Methods: We looked at 50 people who had their thyroids removed and compared them to healthy people of the same age. Six months after surgery, blood samples were taken. We assessed biochemical markers like liver enzymes (ALP, AST, ALT), fasting blood glucose, 1ipid profi1e, electrolytes (Na, Ca), renal parameters (urea, creatinine), and LPL activity. We used SPSS v27 and GraphPad Prism v9 for statistical analysis. We used T-tests or Mann-Whitney U-tests as needed and also did correlation analysis.

Results: Patients had high alkaline phosphatase levels (mean: 125 U/L), borderline impaired fasting glucose levels (mean: 101 mg/dL), and very high levels of dyslipidemia (mean total cholesterol: 300 mg/dL; triglycerides: 356 mg/dL). There was a small drop in LPL activity (mean: 8.4 U/L). Hyponatremia and hypocalcemia were examples of electrolyte abnormalities that were probably caused by temporary hypoparathyroidism. Most of the kidney parameters were normal; however, there were small increases in urea and creatinine levels. Age was more strongly linked to changes in metabolism than sex.

Conclusion: Thyroidectomy causes major metabolic problems, especially with the metabolism of lipids and glucose. To lower long-term hazards, especially in elderly patients, it is best to keep an eye on metabolism all the time and use hormone replacement solutions that are tailored to each person.

Keywords: Thyroidectomy, Thyroid Cancer Patients, LPL activity, Metabolism function

1. Introduction

The prevalence of thyroid cancer, the predominant endocrine malignancy, has significantly escalated during the last few decades [1]. Thyroidectomy, which is the surgical removal of the thyroid gland, is an important part of treating thyroid cancer [2]. The thyroid gland plays a very important function in controlling metabolism by making thyroid hormones, triiodothyronine (T3) and thyroxine (T4). These hormones have a large effect on body work. Thyroidectomy requires lifelong thyroid hormone replacement treatment to maintain metabolic equilibrium, it eliminates the body's ability to produce thyroid hormones. After a thyroidectomy, metabolic alterations are affected by things such as changes in thyroid hormone levels, TSH suppression is needed to treat cancer, and the use of other treatments like radioactive iodine[3]. These changes are seen in several methods, such as changes in energy and variations in basal metabolic rate caused by thyroid hormone 1eve1abnormalities [4].

Defects with glucose metabolism could be due to insulin resistance or changes in glucose homeostasis. Lipid Metabolism Dysregulation: increases levels of triglycerides and cholesterol, which can lead to heart defects [5]. alterations in body structure: more fat mass, 1ess 1ean body mass, and weight changes that were not expected. Concerns about bone health: TSH suppression therapy often makes bone density loss worse [6]. A perfect evaluation of metabolic alterations can enhance thyroid hormone replacement therapy, mitigate the risk of related comorbidities, and formulate customized interventions for afflicted patients. Lipoprotein lipase is one of the key enzymes that breaks down triglycerides in lipoproteins into free fatty acids; this is a major part of lipid metabolism [7]. Changes in thyroid hormones after a thyroidectomy could affect LPL activity, which could modify lipid profiles, energy balance, and metabolic health [8]. This study seeks to assess the metabolic changes seen in thyroid cancer patients post-thyroidectomy. The study aims to improve clinical strategies for treating the metabolic consequences of thyroidectomy and facilitate improved outcomes for thyroid cancer survivors by examining critical factors such as 1ipid profi1es, glucose metabolism, body composition, and bone health.

2. Methods section

An amount of 5 mL from venous blood was withdrawn from each subject under aseptic conditions, about 50 serum samples were collected from people who had their thyroid gland removed and 50 samples from normal people as a control group. The samples included different age groups ranging from 27 to 65 years, between men (27) and 23 women. The collection period was between April to November 2024 from Al-Amal National Oncology Hospital, Al-Andalus Hospital and Al-Dawli Al-Ahli Hospital. Follow-up periods for 6 months. Statistical Package for the Social Sciences 27 (Spss) has been used for descriptive statistics and graph pad prism 9 has been used for normality test, comparison between groups, correlation and drawing figures. The data that exhibited a normal distribution presented as mean ± standard deviation (SD) and the T-test used utilized, while for data that exhibits non-normally distributed data the Mann-Whitney test was utilized and presented as medians and Interquartile range. As some parameters are normally distributed and others aren't the spares man correlation has utilized.

3. Results and Discussion Section

Demographic Characteristics: A total of 50 post-thyroidectomy patients were enrolled, comprising 27 males (54%) and 23 females (46%), aged between 27 and 65 years. Males had a significantly higher

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mean age compared to females (53.7 ± 7.39 years vs. 46.0 ± 10.73 years; $p < 0.004$). Age distribution revealed that the majority of male participants were within the 56–65-year age group (44.4%), whereas most female participants were younger, with 47.8% falling within the 25–45 year range as showed in Fig. 1. Thyroidectomy, especially in thyroid cancer patients, causes major metabolic changes due to the abrupt stop of endogenous thyroid hormone synthesis [9]. This study showed thyroid hormone pull and the body's adaptive mechanisms by measuring liver and renal function, glucose concentrations, electrolyte equilibrium, lipid profiles, and LPL enzyme activity. Considerations of gender and age. Men were older (mean age 53.7 vs. 46.0 in women), which may have confounded metabolic outcomes. Age affects insulin sensitivity, lipid metabolism, and hormone replacement therapy. Age-related bias must be considered in future research because older men may have more metabolic disturbances. The results of a thyroidectomy can differ depending on factors such as the patient's age, gender, metabolic rate, and hormonal balance. Due to inherent differences in recovery between age groups, treatment efficacy may differ accordingly. Instead of gender-specific metabolic effects, the confounding variable age could account for some of the observed disparities between the sexes [10]. Men in their 56s and 70s make up the bulk, accounting for 44.4%. The male population between the ages of 25 and 45 comprises just 18.5%. Many women are younger, with 47.8% aged 25–45. Due to age inequality, this study has older men than women [11]. These findings' future implications. The mean age of males is significantly higher than females (p-value < 0.004). The 56–65 age group has more men than the 25–45. Age may affect metabolic outcomes after thyroidectomy, so future studies should account for age. The findings of this study confirm that thyroidectomy induces multifaceted metabolic changes in thyroid cancer patients.

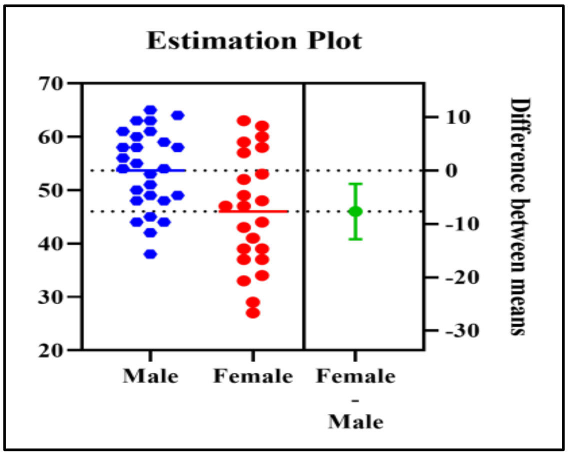

Fig. 1 Age Distribution among Male and Female Participants

The biochemical data from the Liver Function Tests demonstrate that metabolism changes after thyroidectomy. The most important alteration is that ALP levels go up, which is consistent with changes in bone turnover or parathyroid hormone dynamics. The liver enzymes (AST and ALT) stay the same, and the liver function is average, with ALP at 140 U/L, 45 U/L, and 151 U/L. The median level of AST was 16 U/L, with a minimum of 12 U/L and a high of 50 U/L. The median level of ALT was 20 U/L, with a minimum of 10 U/L and a maximum of 80 U/L.., as shown in Table 1. High levels of liver enzymes (ALP, AST, and ALT) can mean minor liver stress or alterations in bone turnover. This could be because of stopping hormones or TSH suppression medication [12]. These patterns align with the research conducted by Zhou et al. [13], , which noted hepatic fat buildup and

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elevated enzyme levels during RAI and levothyroxine treatment. An increase in ALT may be a sign of how the liver cells adjust to changes in metabolism. There was also a problem with how glucose was used, as seen by borderline high fasting blood glucose levels. Jing supports the idea that this could happen because insulin sensitivity goes down after surgery [14], which connects hypothyroid conditions to weight gain and defects with glucose regulation. The age difference in the sample—older males compared to younger females—may have messed up the results, especially for glucose and lipid indices, since age has a big effect on metabolic rate and hormone response.

Table 1: Serum Liver Enzyme (ALP, AST, ALT) in Post-Thyroidectomy Patients

	Alkaline Phosphatase (ALP) U/L	Aspartate Aminotransferase (AST)U/L	Alanine Aminotransferase (ALT) U/L
Mean	125	20.7	26.7
Std. deviation	32.0	9.40	19.2
Std. error of the mean	4.52	1.33	2.71
Median	140	16.0	20.0
25% Percentile	110	15.0	10.0
75% Percentile	147	25.0	40.3
Minimum	45.0	12.0	6.00
Maximum	151	50.0	80.0
Range	106	38.0	74.0

Results of Urea and Creatinine Renal Function Tests Display The average levels of urea were 35±9.48 mg/dL, the lowest was 16 mg/dL, and the highest was 48 mg/dL. The average levels of creatinine were 1.28 mg/dL, the lowest was 0.40 mg/dL, and the highest was 1.90 mg/dL, as shown in Fig. 2 [15]. There were significant electrolyte imbalances, such as hyponatremia and hypocalcemia, which could be signs of temporary hypoparathyroidism or SIADH. These results are in line with what Van Uytfanghe et al [7] found [13], they stress keeping an eye on calcium levels after surgery to avoid defects from parathyroid damage. This study found that most patients have calcium levels that are close to normal six months following surgery, but a considerable number of them have metabolic problems that last, like as hyponatremia and hypocalcemia [14]. The differences in electrolyte profiles show that personalized postoperative care and follow-up with an endocrinologist are important to avoid problems and improve long-term results for those who have survived thyroid cancer. [16]. The significant rise in total cholesterol and triglycerides, alongside reduced LPL activity, highlights disrupted lipid metabolism. Although correlations between LPL and lipid parameters were not statistically significant, a weak negative trend between LPL and triglycerides suggests impaired lipid clearance [17]. Similar mechanisms have been reported in studies from Iraq and internationally, attributing dyslipidaemia to thyroid hormone deficiency and reduced lipolytic activity [18].

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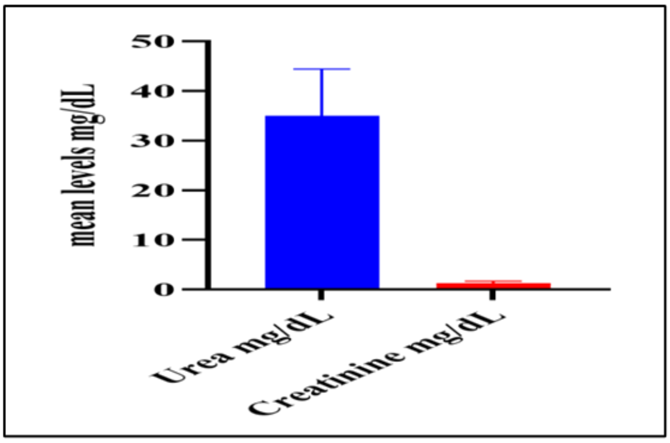

Fig. 2 Mean Serum Urea and Creatinine Levels in Post-Thyroidectomy Patients.

And Fasting Blood Glucose (FBS) showed by the mean FBS among thyroidectomy participants was 101±19 mg/dl, the minimum was 70 mg/dl and the maximum was 140 mg/dl as presented in Table 2.

Table 2: Fasting Blood Glucose Characteristics among Post-Thyroidectomy Patients

FBS mg/dl	
Mean	101
Std. deviation	19.0
Std. error of the mean	2.68
Median	95.0
25% Percentile	80.0
75% Percentile	119
Minimum	70.0
Maximum	140
Range	70.0

Table 3 shows Electrolyte Levels by the mean levels of NA, which were 109±17.7 mmol/L with a minimum of 50 mmol/L and a maximum was 135 mmol/L, while the mean levels of Ca were 8.36±1.44 mg/dl, minimum of 5.5 and a maximum of 10.7.

Table 3: Serum Electrolyte Levels (Sodium and Calcium) in Thyroidectomy Patients

	Na mmol/L	Ca mg/dl
Mean	109	8.36
Std. deviation	17.7	1.44
Std. error of the mean	2.51	0.203
Median	114	8.80
25% Percentile	99.8	7.00
75% Percentile	120	9.48
Maximum	135	10.7
Minimum	50.0	5.50
Range	85.0	5.20

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Also, the mean levels of LPL (Lipoprotein Lipase Activity) among post-thyroidectomy participants were 8.40±1.47 U/L, the minimum was 5.30 U/L and the maximum was 11.3 U/L as presented in Table 4.

Table 4: Lipoprotein Lipase (LPL) Activity in Patients Six Months Post-Thyroidectomy

LPL Activity (U/L) Post-Thyroidectomy (6 months)	
Mean	8.40
Std. deviation	1.47
Std. error of the mean	0.208
Median	8.45
25% Percentile	7.33
75% Percentile	9.15
Minimum	5.30
Maximum	11.3
Range	6.00

Whereas, Fig. 3 shows the mean levels of Lipid Profile, Total Cholesterol 300 mg/dL with a minimum of 268 mg/dL and maximum 323 mg/dL, while Triglycerides mean levels 356 mg/dL and the minimum 328 mg/dL and maximum 392 mg/dL.

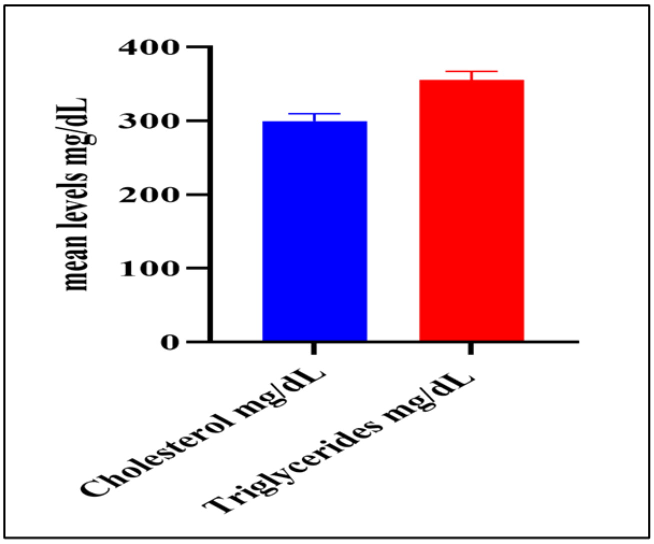

Fig. 3 Mean Levels of Total Cholesterol and Triglycerides after Thyroidectomy

The correlation between LPL Activity (U/L) Post-Thyroidectomy and Triglycerides was weak negative r= -0.252, while the association between LPL Activity (U/L) Post-Thyroidectomy with Total Cholesterol Total Cholesterol was weakly positive, 0.057. And the correlation between Triglycerides with Total Cholesterol is weakly negative r= r=-0.191. All these correlations were non-significant.: ..Renal parameters remained within normal limits for most participants, although slight increases in urea and creatinine were observed. These may relate to altered protein metabolism or hemodynamic changes during the post-operative period, as also noted by Ahmed et al [19]. The descriptive statistics demonstrate that most thyroid cancer patients achieve stable LPL activity levels within the physiological range by six months post-thyroidectomy. Also, the observed variability underscores the need for individualized metabolic monitoring, especially in patients with borderline or low enzyme activity that may be at increased risk of lipid abnormalities [20].

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According to the statistics, it seems that the subjects of thyroid surgery are undergoing great metabolic alterations, particularly lipid and glucose metabolism- most likely, the withdrawal of the hormone and the subsequent endocrine response of the body [21]. These effects, that are typically not evident, may place the patients in danger of heart illness and metabolic issues in case they are not monitored [22]. These findings indicate that lipid metabolism is altered slightly following thyroidectomy and LPL may be associated with the level of triglycerides in a direction that is rather anti-intuitive [23]. Similar to confounding factors, you see.

The results can be completely altered by such things as the common stuff- thyroid hormone replacement therapy, nutrition, or kidney functioning [24], [25]. that the distinctions between the patients in the reaction of their endocrine and metabolic systems to thyroidectomy may complicate the associations. Thus, we should conduct bigger studies and have tighter control of the hormone variables to determine what exactly LPL is doing with lipid homeostasis following a thyroidectomy. [26]. These findings demonstrate the significance of continuing to monitor the level of metabolism and creating an individualized hormone replacement regimen following thyroid surgery. The research needs to expand on age and sex controls and examine long-term trends of both the positive and the negative endpoints beyond the 6 months of follow-up.

Table 5: The correlation coefficients between the activities of LPL and the lipids (triglycerides and total cholesterol) are as follows.

		TGs	TCs
LPL	r	-0.252	0.0579
	P-value	0.076	0.689
TGs	r		-0.191
	P-value		0.182
TCs	r	-0.191	
	P-value	0.182	

4. Conclusion

Thyroidectomy in thyroid cancer patients leads to measurable alterations in liver enzymes, lipid profiles, glucose metabolism, and electrolyte levels. These results also point to the need for a review as time passes with age.

Acknowledgments

The authors would like to thank Mustansiriyah University (www.uomustansiriyah.edu. iq) Baghdad, Iraq, for support in the present work.

References

[1] Ratziu, V., Scanlan, T. S., & Bruinstroop, E. (2025). Thyroid hormone receptor-β analogues for the treatment of metabolic dysfunction-associated steatohepatitis (MASH). Journal of Hepatology, 82(2), 375–387. https://doi.org/10.1016/j.jhep.2024.10.018

[2] Sosnowska, A., Mudlaff, M., Mombelli, E., Behnisch, P., Zdybel, S., & Besselink, H. (2025). Identification of new PFAS for severe interference with thyroid hormone transport: A combined in

vitro/in silico approach. Journal of Hazardous Materials, 491, 137949. https://doi.org/10.1016/j.jhazmat.2025.137949

[3] Pawlak, W. A., Dudkiewicz, M. A., Pawłocik, W. E., Wojtala, L. E., Kapłon, K. E., & Maciejewska, D. E. (2023). Is there a diet for Hashimoto thyroiditis? A review of literature. Independent Public Healthcare Center of the Ministry of Interior and Administration in Poznań. https://doi.org/10.5604/01.3001.0053.7464

[4] Gopalakrishnan, M., Ramidha, P., & Vinitha, V. (2022). Comparative study of lipid profile anomalies in thyroid dysfunction. National Journal of Physiology, Pharmacy and Pharmacology, 12(9), 1366–1370. https://doi.org/10.5455/njppp.2022.12.01014202213012022

[5] Akber, N. T., & Yenzeel, J. H. (2023). Evaluation of some biochemical parameters in Iraqi patients with hyperthyroidism. Iraqi Journal of Biotechnology, 22(1), 7–19.

[6] Marino, L., Kim, A., Ni, B., & Celi, F. S. (2025). Thyroid hormone action and liver disease: A complex interplay. Hepatology, 81(2), 651–669.https://doi.org/10.1097/HEP.0000000000000551

[7] Van Uytfanghe, K., Ehrenkranz, J., Halsall, D., Hoff, K., Loh, T. P., & Spencer, C. A. (2023). Thyroid stimulating hormone and thyroid hormones: An ATA-commissioned review of current clinical and laboratory status. Thyroid, 33(9), 1013–1028.

[8] Wasson C, Kelly A, Ninan D, Tran Q. Absolute Obstetric Anesthesia Review: The Complete Study Guide for Certification and Recertification. Absolute Obstetric Anesthesia Review: The Complete Study Guide for Certification and Recertification. 2018. 1–188 p.

[9] Ghazi, S. M., Salman, A. A., & Jawad, A. A. (2023). Assessing cardiovascular changes in Iraqi women with hypothyroidism. Journal of Medicine and Life, 16(4), 579–582. https://doi.org/10.25122/jml-2022-0220

[10] Jiang HJ, Underwood TC, Bell JG, Ranjan S, Sasselov D, Whitesides GM. Mimicking Lighting-Induced Electrochemistry on the Early Earth. Proc Natl Acad Sci [Internet]. 2017;120:2017. Availablfrom:http://www.pnas.org/lookup/suppl/doi:10.1073/pnas.2216830120/-/DCSupplemental.https://doi.org/10.1073/pnas.2216830120

[11] Abdulateef, M. L., Hilal, N. N., & Abdul-Aziz, M. M. (2023). The relation among vitamin B12 and B9 in hypothyroidism in Iraqi patients. South Asian Research Journal of Pharmaceutical Sciences, 5(6), 235–239. https://doi.org/10.36346/sarjps.2023.v05i06.005

[12] Jin, Y. J., Hah, J. H., Kwon, M. J., Kim, J. H., Kim, S. K., & Kim, J. H. (2022). Association between thyroid cancer and weight change: A longitudinal follow-up study. International Journal of Environmental Research and Public Health, 19(11), 1–10.

[13] Zhou, L., Li, S., Wu, Y., Chen, Q., Hu, X., & Jiang, J. (2023). Significant dysregulation of lipid metabolism in patients with papillary thyroid carcinoma after thyroidectomy. Frontiers in Endocrinology, 14, Article 1179201. https://doi.org/10.3389/fendo.2023.1179201

[14] Ali, N., & Majeed, A. (2022). Thyroid hormone concentration and receptor. Egyptian Academic Journal of Biological Sciences, B. Zoology, 14(1), 221–230. https://doi.org/10.21608/eajbsz.2022.233650

[15] Wang, K., & Gulec, S. A. (2024). Metabolic consequences of thyroidectomy and patient-centered management. Journal of Clinical Medicine, 13(23), 7465. https://doi.org/10.3390/jcm13237465

[16] Jing, L., & Zhang, Q. (2022). Intrathyroidal feedforward and feedback network regulating thyroid hormone synthesis and secretion. Frontiers in Endocrinology, 13, Article 992883. https://doi.org/10.3389/fendo.2022.992883

[17] Akash, M. S. H., Rehman, K., & Hashmi, M. Z. (2021). Endocrine disrupting chemicals-induced metabolic disorders and treatment strategies. In Environmental Endocrine Disruptors (pp. 1–10). Springer. https://doi.org/10.1007/978-3-030-45923-9_29

[18] Frank-Raue, K., & Raue, F. (2023). Thyroid dysfunction in peri- and postmenopausal women: Cumulative risks. Deutsches Ärzteblatt International, 120(18), 311–316. https://doi.org/10.3238/arztebl.m2023.0069

[19] Abd, K. A., Al-Qaisi, A. H. J., & Hairunisa, N. (2023). The influence of thyroid hormones on lipid profile and adipokine levels in Iraqi women with thyroid disorders. Al-Nahrain Journal of Science, 26(3), 6–11. https://doi.org/10.22401/ANJS.26.3.02

[20] Mohammed Hussain, M., & Ahmed Saleh, N. (2023). Estimation of vitamin D concentration in children's thyroid disorders. Journal of Advanced Educational Science, 3(4), 5–8. Retrieved from www.dzarc.com/education

DOI: 10.69946/ojms/2025.03.02.09, pp(79-87)

[21] Sohn, S. Y., Joung, J. Y., Cho, Y. Y., Park, S. M., Jin, S. M., & Chung, J. H. (2015). Weight changes in patients with differentiated thyroid carcinoma during postoperative long-term follow-up under TSH suppression. Endocrinology and Metabolism, 30(3), 343–351. https://doi.org/10.3803/EnM.2015.30.3.343

[22] Beserra, J. B.; Morais, J. B. S.; Severo, J. S.; Cruz, K. J. C.; de Oliveira, A. R. S.; Henriques, G. S., et al. (2021). Relation between zinc and thyroid hormones in humans: a systematic review. BiologicalTrace Element Research, 199(11): 4092-4100. doi: 10.1007/s12011-020-02562-5

[23] Laukova M, Glatman Zaretsky A. Regulatory T cells as a therapeutic approach for inflammatory bowel disease. Eur J Immunol. 2023;53(2):1–14.

[24] Iqbal, M. A.; Ahmad, S.; Mumtaz, T.; Naseem, Z.; Malik, J.; Ahmad, H., et al. (2021). Prospective Analysis of Lipid Variations in Hyperthyroid Subjects from Lahore, Pakistan. BioMed Research International, 2021. doi: 10.1155/2021/9936782

[25] Lee, Y. K., Lee, H., Han, S., Jung, H., Shin, D. Y., Nam, K. H., Chung, W. Y., & Lee, E. J. (2019). Association between TSH level after total thyroidectomy and hypercholesterolemia in female patients with differentiated thyroid cancer: A retrospective study. Journal of Clinical Medicine, 8(8), 1106. https://doi.org/10.3390/jcm8081106

[26] Al-Mosawi, H. M., & Abbas, E. A. (2021). The correlation of thyroid diseases with anemia among Iraqi patients. Iraqi Medical Journal, 5(1), 22–25. https://doi.org/10.22317/imj.v5i1.1024