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Abdellah Hussein Elsadek
Internal Medicine, Faculty of Medicine, Al-Azhar University, Cairo, Egypt

Ahmed Ali Hassan Ali
Internal Medicine, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Bassem Ragab Abdel-Aziz
Obstetrics and Gynecology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Mohamed Ahmed Anwar Shaheen
Clinical Pathology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Ismail Atia Khalil Elfauomy
Internal Medicine, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt,
esmaielfauomy@gmail.com

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ORIGINAL ARTICLE

Study of the Association between Thyroid Hormonal Abnormalities and Polycystic Ovary Syndrome among Egyptian Females

Abdellah H. Elsadek [a], Ahmed A. H. Ali [a], Bassem R. Abdel-Aziz [b], Mohamed A. A. Shaheen [c], Ismail A. K. Elfauomy [a,*]

[a] Department of Internal Medicine, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt
[b] Department of Obstetrics and Gynecology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt
[c] Department of Clinical Pathology, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt

Abstract

Background: ***Polycystic Ovary Syndrome (PCOS) is marked by hyperandrogenism, anovulation with menstrual irregularities, and morphologic polycystic ovarian alterations. The implicated hormonal abnormalities may extend to other endocrine glands.***

Aim of the Work: ***To investigate whether thyroid hormone abnormalities and PCOS are related in Egyptian women.***

Patients and Methods: ***There were 500 women in the cohort diagnosed with PCOS based on the 2003 Rotterdam Criteria. Clinical, menstrual, and reproductive factors and ovarian morphology were analyzed in relation to the underlying thyroid gland's clinical and hormonal status.***

Results: ***The prevalence of amenorrhea, oligomenorrhea, and hirsutism/acne was found to be 16.2%, 54.8%, and 70.6%, respectively, with a mean Ferriman-Gallwey hirsutism score of 8.04 ± 4.101. Elevated Body Mass Index (30.40 ± 11.98 kg/m2) and waist circumference (91.77 ± 9.93 cm) suggested underlying insulin resistance. Gravidity, parity, and miscarriage analysis revealed 69.2% nulligravida, 78.2% nullipara, and 7.8% miscarriage among the studied patients. The thyroid gland examination indicated that 70.4% had a normal appearance, 10.4% had a diffuse goiter, 16.4% had a multi-nodular goiter, and 2.8% had a solitary thyroid nodule. Functional assessment revealed 69.6% euthyroid, 14.8% with subclinical hypothyroidism, 9.6% hypothyroid, 4.8% hyperthyroid, and 1.2% subclinical hyperthyroidism. Thyroid-stimulating hormone (TSH) levels correlated significantly with body weight, BMI, and miscarriage in PCOS patients (P-value <0.001, <0.001, and 0.012, respectively).***

Conclusion: ***This study underscores the connection between thyroid abnormalities and reproductive parameters in PCOS.***

Keywords: Thyroid Hormonal Abnormalities; Polycystic Ovary Syndrome; Egyptian Females

1. Introduction

Polycystic ovarian syndrome (PCOS) is a prevalent hormonal condition affecting females. Approximately 6-10% of women get Polycystic Ovary Syndrome (PCOS) during their reproductive years. One in ten women suffers signs of the condition during her reproductive years.[1]

Several studies have attempted to determine the prevalence of PCOS in Egypt. It is estimated that around 13% of females have given birth, and 37.5 percent of patients have primary or secondary infertility.[2]

Furthermore, there is mounting evidence indicating a correlation between PCOS and the heightened occurrence of thyroid disorders, including nodular goiter and autoimmune thyroiditis.[3]

Thyroid problems and polycystic ovary syndrome (PCOS) are prevalent endocrine illnesses in the general population. Despite having distinct etiopathogenesis, hypothyroidism, and PCOS share numerous similar traits.[4] Primary hypothyroidism has been associated with an elevation in ovarian volume and the occurrence of cystic abnormalities in the ovaries. Conversely, there is a growing recognition that thyroid issues are more prevalent among women with PCOS than in the general population.[5,6]

The objective of the present study is to assess the correlation between thyroid hormonal irregularities and PCOS in Egyptian individuals with PCOS and to investigate its influence on the clinical results.

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* Corresponding author at: Internal Medicine, Faculty of Medicine for Boys, Al-Azhar University, Cairo, Egypt.
E-mail address: esmailelfauomy@gmail.com (I. A. K. Elfauomy).

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2. Patients and methods

This study was conducted on 500 females diagnosed with PCOS who attended obstetrics, gynecology, and Endocrine outpatient clinics of Al-Azhar University Hospital from July 2022 to July 2023.

2.1.Inclusion Criteria: All females who were married ≥ 2 years with the diagnosis of PCOS based on Rotterdam Criteria 2003[7], which defined the presence of two of the following three characteristics at least: oligo-ovulation, increased androgen levels (clinical and or laboratory), morphological features of polycystic ovary detected by ultrasound were valid for inclusion.

2.2.Exclusion criteria: Females with past known thyroidal illness before enrollment, females with past thyroid surgery, females on L-thyroxin replacement, Cushing's syndrome, and active malignancy

2.3.Methods: All enrolled patients were subjected to the following:

2.4.Full history taking: Full menstrual history, fertility history including gravidity, parity, and miscarriage, history suggestive for hyperandrogenism including hirsutism and acne, and history suggestive for thyroidal abnormalities including Symptoms of hypo/hyperthyroidism and goiter.

2.5.Complete clinical examination with special emphasis on Thyroid gland examination, clinical evaluation of thyroid status, clinical stigmata of insulin resistance, and clinical features of hyperandrogenism, particularly hirsutism and acne. The degree of hirsutism was evaluated according to the Ferriman and Gallwey score.

2.6.Thyroid hormone measurements: TSH, free T3, and free T4

A venipuncture-drawn 2 ml of venous blood was centrifuged for 20 minutes at 3000 rpm, yielding serum samples frozen at -20 degrees Celsius until needed. Following the manufacturer's instructions, TSH, FT3, and FT4 were quantitatively measured on a Cobas e411 using electrochemiluminescence immunoassay (ECLIA). According to the National Academy of Clinical Biochemistry's recommendations for laboratory diagnosis and thyroid disease monitoring, thyroid abnormalities were diagnosed and classified.[8]

2.7.Radiological evaluation of the ovaries by transvaginal ultrasonography. A single transvaginal sonographer used an UltraSonix RP ultrasound scanner with a 9-MHz transvaginal transducer to do an ultrasound scan at random times during the menstrual periods.

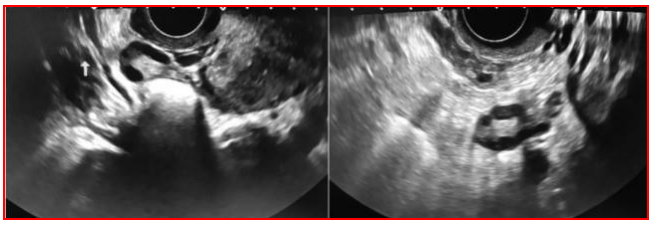

Figure 1. Trans vaginal Ultrasound showing PCO.

The sonographic criteria of PCOS were included according to Rotterdam Criteria.[7] The evaluation involved considering all the follicles in each ovary, independent of their arrangement, from the inner edge to the outside edge. Additionally, sections on different planes were examined to ensure comprehensive research. The follicular diameter refers to the average diameter measured across three sections or the follicle's diameter in the scan when it appears round. We employed the ellipsoid formula 0.52 × (D1×D2×D3) to compute the volume. A criterion of ovarian volume above 10mm3 was established.

2.8.Statistical analysis: The analysis was conducted using the software package STATA (version 12; STATA Inc., College Station, TX, USA). The significance threshold was $p < 0.05$, and the confidence interval was 95%.

3. Results

Table 1. Demographic and anthropometric characteristics of the patients.

VARIABLES	MEAN	± SD
AGE (YEARS)	27.50	1.86
WAIST CIRCUMFERENCE (CM)	91.77	9.93
HEIGHT (CM)	164.2	7.00
WEIGHT (KG)	81.04	11.91
BMI (KG/M^2)	30.40	11.98

The age distribution of the selected patients spanned from 22 to 35 years, with a mean ± SD of 27.5±1.86. Their waist circumference ranged from 76 to 118 cm, with a mean ± SD of 91.77 ± 9.93. Heights ranged from 150 to 179 cm, with a mean ± SD of 164.2 ± 7.00. Their weight varied from 55.1 to 118.9 kg, with a mean ± SD of 81.04 ±11.91. Consequently, their body mass index (BMI) covered a range from 22.8 to 39.5 kg/m2, with a mean ± SD of 30.40 ±11.98, Table 1.

Table 2. Gravidity, Parity, and Miscarriage frequencies among the studied patients.

		NUMBER	PERCENTAGE
GRAVIDITY	Nulligravida	346	69.2%
	Gravida-1	117	23.4%
	Multigravida	37	7.4%
PARITY	Nullipara	391	78.2%
	Para-1	98	19.6%
	Multipara	11	2.2%
MISCARRIAGE	Absent	461	92.2
	present	39	7.8

Among the studied patients, 346 (69.2%) were nulligravida, while 117 (23.4%) were gravida-1, and the remaining 37 (7.4%) were multigravida. 391 (78.2%) of them were nullipara, 98 (19.6%) were para-1, and the remaining 11 (2.2%) were multipara. A 7.8% experienced miscarriage, Table 2

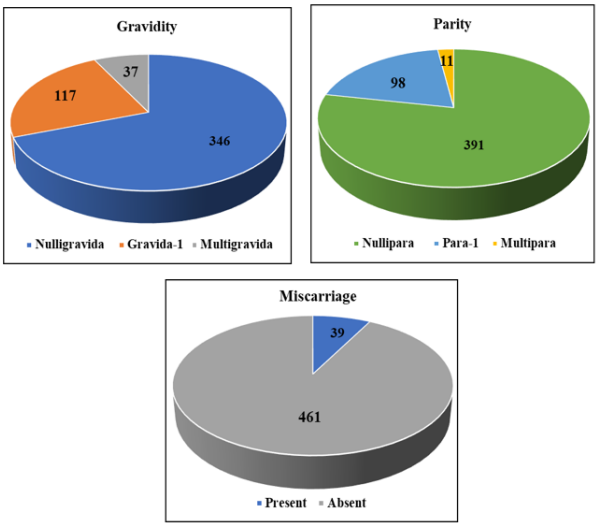

Figure 2. The frequencies of the Gravidity, Parity, and miscarriage among the studied patients.

Table 3. Clinical characteristics of the patients in the study group.

	NUMBER		PERCENTAGE	
MENSTRUAL ABNORMALITIES				
NORMAL	145		29.0%	
AMENORRHEA	81		16.2%	
OLIGOMENORRHEA	274		54.8%	
HYPERANDROGENIC SYMPTOM				
ASYMPTOMATIC	147		29.4%	
HIRSUTISM & ACNE	353		70.6%	
FERRIMAN AND GALLWEY SCORE	Minimum	Maximum	Mean	SD
	1	14	8.04	4.101

In terms of Menstrual cycle abnormalities, 145 (29%) had normal menstrual cycles, 81 (16.2%) experienced amenorrhea, and 274 (54.8%) had oligomenorrhea. Regarding Hyperandrogenic symptoms, 147 (29.4%) were asymptomatic, while353 (70.6%) exhibited hirsutism and acne. The results of Ferriman and Gallwey scores ranged from 1 to 14, with a mean ± SD of 8.04 ± 4.101, Table 3.

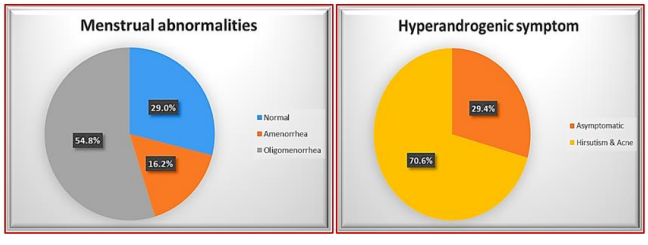

Figure 3. distribution of menstrual status and HA symptoms.

Table 4. Evaluation of number of follicles in both ovaries and ovarian volumes.

VARIABLES	MINIMUM	MAXIMUM	MEDIAN	IQR
LEFT OVARY FOLLICLE NUMBERS	12	21	16.64	15 - 18
LEFT OVARIAN VOLUME (ML^3)	9.7	16.2	13.5	12.2 - 14.8
RIGHT OVARY FOLLICLE NUMBERS	14	25	20.56	19 - 22
RIGHT OVARIAN VOLUME (ML^3)	10.3	16.7	14.1	12.9 - 15.5
BOTH OVARIES FOLLICLE NUMBERS	13	23	18.58	17 - 20
BOTH OVARIAN VOLUME (ML^3)	10.1	17.4	13.8	12.5 - 15.1

The average number of follicles of the left ovaries was 16.64 with IQR of 15-18. Similarly, the right ovaries harbored an average of 20.56 follicles with IQR of 19-22 moreover, the average number of follicles in both ovaries was 18.58 with IQR of 17-20. Regarding the ovarian volume, the average left ovarian volume was 13.5 ml3 with IQR of 12.2-14.8 Similarly, the average right ovarian volume 14.1 ml3 follicles with IQR of 12.9-15.5 moreover, the average volume of both ovaries was 13.8 ml3 with IQR of 12.5-15.1, Table 4.

Table 5. Prevalence of Thyroid Disorders: Clinical Examination and Functional Status.

THYROID GLAND CLINICAL EXAMINATION	Number	Percentage
NORMAL THYROID GLAND	352	70.4%
DIFFUSE GOITER	52	10.4%
MULTI NODULAR GOITER	82	16.4%
SOLITARY THYROID NODULE	14	2.8%
THYROID GLAND FUNCTIONAL STATUS		
EUTHYROID	348	69.6%
HYPERTHYROIDISM	24	4.8%
HYPOTHYROIDISM	48	9.6%
SUBCLINICAL HYPERTHYROIDISM	6	1.2%
SUBCLINICAL HYPOTHYROIDISM	74	14.8%

Regarding thyroid gland clinical examination, 70.4% (n=352) had a normal thyroid gland examination, 10.4% (n=52) had a diffuse goiter, 16.4% (n=82) had a multi-nodular goiter, and 2.8% (n=14) had a solitary thyroid nodule. Regarding Thyroid gland functional status, 69.6% (n = 348) were euthyroid, 4.8% (n=24) were hyperthyroid, 9.6% (n=48) were hypothyroid, 1.2% (n=6) had subclinical hyperthyroidism, and 14.8% (n=74)

had subclinical hypothyroidism, Table 5.

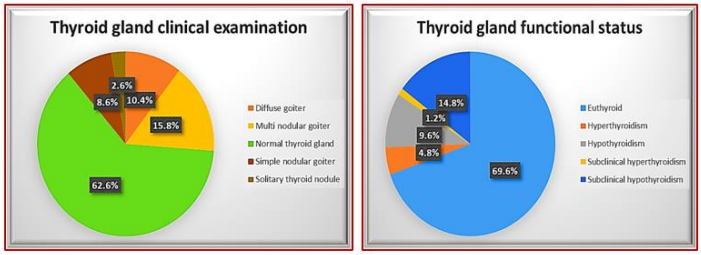

Figure 4. Prevalence of Thyroid Disorders: Clinical Examination and Functional Status.

Table 6. Thyroid hormonal profile levels of the studied patients.

HORMONES	MINIMUM	MAXIMUM	MEDIAN	IQR
TSH (UIU/ML)	0.01	16.40	3.40	2.52 - 4.90
FREE T3 (PG/ML)	1.2	6.7	2.80	2.50 - 3.0
FREE T4 (NG/DL)	0.2	2.9	1.30	1.0 - 1.47

The TSH levels ranged from 0.01 to 16.4 (µIU/ml) with Median value 3.4 and IQR (2.52-4.9). The Free T4 levels ranged from 0.2 to 2.9 (ng/dl) with a Median value of 1.30 and IQR (1.0-1.47). The Free T3 levels ranged from 1.2 to 6.7 (pg/dl) with Median value 2.8 and IQR (2.5-3), Table 6.

Table 7. Correlation between TSH level and variables among studied patients.

VARIABLES	CORRELATION COEFFICIENTS	P-VALUE
AGE	0.055	0.216
WEIGHT (KG)	0.254	<0.001
BMI (KG/M2)	0.222	<0.001
FERRIMAN AND GALLWEY SCORES	0.087	0.052
AVERAGE NUMBER OF FOLLICLES IN BOTH OVARIES	-0.034	0.442
AVERAGE OVARIAN VOLUME (ML^3)	-0.007	0.875
NULLIGRAVIDITY	0.066	0.142
NULLIPARITY	0.073	0.102
MISCARRIAGE	0.112	0.012
MENSTRUAL ABNORMALITIES	0.073	0.105
HYPERANDROGENISM SYMPTOM	0.070	0.119

There is a strong positive relationship between TSH levels and Body The weight, BMI, and the likelihood of Miscarriage, with statistically significant P-values of <0.001, <0.001, and 0.012, respectively. However, there was no statistically significant link found between TSH levels and the other covariates, Table 7.

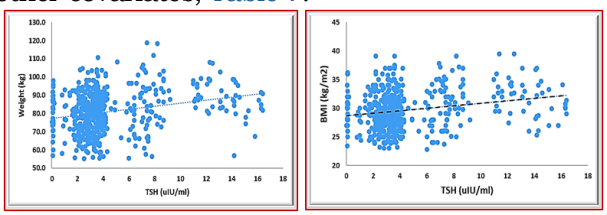

Figure 5. Correlation between TSH levels and the patient's weight & BMI.

4. Discussion

The relationship between PCOS and other endocrine disorders, particularly thyroid abnormalities, has been a longstanding area of interest. Our study represents the first Egyptian trial to illuminate this intricate relationship by including a substantial cohort of 500 PCOS patients.

Among the 500 studied patients, oligomenorrhea was prevalent in more than half of the cases (54.8%). This finding was aligned with previous studies suggesting that a high percentage of females with PCOS experience oligomenorrhea. For example, Salih et al.[9] found that 72% of PCOS patients had oligomenorrhea.

Similarly, Jesmin et al.[10] Additionally, these results were corroborated by a study that revealed that oligomenorrhea was present in 64.4% to 71.8% of patients diagnosed with PCOS. Furthermore, it was discovered that oligomenorrhea manifested in 75-85% of women diagnosed with Polycystic Ovary Syndrome (PCOS).

Concerning fertility negative results among the patients under investigation, 69.2% had never been pregnant, and 78.2% had never given birth. In addition, a total of 7.8% of the patients suffered from miscarriage.

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The previous research lacked definitive data on the proportion of females diagnosed with PCOS who experienced pregnancy or childbirth. However, studies have demonstrated a correlation between PCOS and an increase in subfertility, ectopic pregnancy, and early pregnancy loss.[11]

Furthermore, an additional study revealed that there was no notable disparity in the number of live births (parity) between women diagnosed with PCOS (1.9 ± 1.3 children) and the control group (1.7 ± 1.0 children). [12] A recent study found that PCOS is linked to 75% of cases of ovulatory infertility, and the infertility rate in PCOS ranges from 2% to 5%.[13]

Additionally, Acharya et al.[14] highlighted that PCOS is a common cause of anovulatory fertility.

Furthermore, the present findings indicate a significant incidence of Hirsutism and acne, with a prevalence rate of 70.6%. The incidence of hirsutism in PCOS varies between 65% and 75%, whereas the occurrence of acne in adult females with PCOS is approximately 76% according to the NIH definition and 36% according to the Rotterdam criteria.[15]

The Ferriman and Gallwey mean score in our series was 8.04. Previously, Gürbüz & Alanya Tosun,[16] reported a mean Score of 7.4 in patients with PCOS, which is aligned with the current study. Alternatively, Espinós et al.[17] found that the mean score using the modified Ferriman-Gallwey method was 15.1 in women with PCOS.

Furthermore, the current study examined the morphological characteristics of ovaries, including the average number of follicles (ranged from 13 to 23 (Median= 18.58, IQR= (17-20)) and volume of both ovaries (ranged from 10.1 to 17.4 ml^3 (Median= 13.8, IQR= (12.5-15.1)).

Previous investigations have corroborated the findings of our research regarding the ovarian volume in patients with polycystic ovary syndrome (PCOS). These investigations have found that the average volume in persons with PCOS is between 10.6 and 16.7 ml, while healthy women usually have volumes ranging from 5.2 to 8.7 ml.[18] Top of Form

Regarding thyroidal hormonal disturbances and clinical examination of the thyroid gland among the selected patients, although most of our cases demonstrated euthyroid status and normal thyroid gland clinical examination, a subset of participants exhibited variations. Specifically, 14.8% had subclinical hypothyroidism, emerging as the most common thyroid dysfunction.

This finding emphasizes the importance of comprehensive evaluation for potential endocrine disparities, especially thyroidal abnormalities, and highlights the diversity in thyroidal health within the studied cohort.

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Recent research has revealed the complex connection between PCOS and thyroid function, specifically focusing on the involvement of TSH. For example, Lee et al.[19] revealed elevated TSH levels, confirming SCH diagnosis in the PCOS group compared to the control group.

A Chinese metanalysis by Ding et al.[20] A study comparing 692 people diagnosed with Polycystic Ovary Syndrome (PCOS) to 540 patients without PCOS revealed that women with PCOS have a greater risk of developing Subclinical Hypothyroidism (SCH). Likewise, research conducted in Pakistan compared cases and controls by Raj et al.21 was Conducted on a sample of two hundred patients diagnosed with PCOS compared to another sample of two hundred patients without PCOS. Their data indicates a robust correlation between subclinical hypothyroidism (SCH) in women with polycystic ovary syndrome (PCOS) compared to women without any health issues.

On the contrary, Abdollahi et al.[22] Discovered that all PCOS patients had normal levels of TSH, T3, and T4.

In our study, TSH demonstrated a significant positive correlation with case weights, BMI, and occurrence of miscarriage. In contrast, no statistically significant differences were found between TSH and other variables, including age, the Ferriman and Gallwey scores, follicle numbers, ovarian volume, nulla-gravidity, and nulliparity.

Rojhani et al.[23] A recent study proposed a potential link between TSH levels and weight gain as well as excessive body mass in people with PCOS. However, Fatima et al.[24] o correlation was observed between obesity and subclinical hypothyroidism in patients with polycystic ovary syndrome (PCOS).

The diverse findings underscore the complexity of the relationship between thyroid dysfunctions and various phenotypes in PCOS.

4. Conclusion

Monitoring women with PCOS for thyroid problems is pertinent and indispensable, considering the substantial evidence indicating an elevated susceptibility to thyroid dysfunction in this demographic.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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There are no conflicts of interest.

References

1. Anwaar, M.; Jabeen, Q. Thyroid Dysfunction: In Connection with PCOS. In Polycystic Ovary Syndrome - Functional Investigation and Clinical Application. IntechOpen.2022. DOI:10.5772/intechopen.102492
2. Sanad, AS. Prevalence of polycystic ovary syndrome among fertile and infertile women in Minia Governorate, Egypt. The Egyptian Journal of Fertility and Sterility.2014; 125, 81-2.
3. Duran C, Basaran M, Kutlu O, et al. Frequency of nodular goiter and autoimmune thyroid disease in patients with polycystic ovary syndrome. Endocrine. 2015;49(2):464-469.
4. Singla R, Gupta Y, Khemani M, Aggarwal S. Thyroid disorders and polycystic ovary syndrome: An emerging relationship. Indian J Endocrinol Metab. 2015;19(1):25-29.
5. Sinha U, Sinharay K, Saha S, Longkumer TA, Baul SN, Pal SK. Thyroid disorders in polycystic ovarian syndrome subjects: A tertiary hospital based cross-sectional study from Eastern India. Indian J Endocrinol Metab. 2013;17(2):304-309.
6. Benetti-Pinto CL, Berini Piccolo VR, Garmes HM, Teatin Juliato CR. Subclinical hypothyroidism in young women with polycystic ovary syndrome: an analysis of clinical, hormonal, and metabolic parameters. Fertil Steril. 2013;99(2):588-592.
7. Rotterdam ESHRE/ASRM-Sponsored PCOS consensus workshop group. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome (PCOS). Hum Reprod. 2004;19(1):41-47.

8. Brodell LA, Mercurio MG. Hirsutism: Diagnosis and management. Gend Med. 2010;7(2):79-87.
9. Salih, SM.; Abedalrahman, SK.; Hamdi, UN. Uterine artery pulsatility index among polycystic ovary disease; case control study. Al-Kitab Journal for Pure Sciences.2022;6 (2), 14-24.
10. Jesmin, ZF.; Saha, E.; Yasmin, F., Ara, A., et al. Diagonostic parameters of polycystic ovarian syndrome in outpatient setting. Bangladesh Medical Journal Khulna.2021;53 (1-2), 17-22.
11. Baloch Z, Carayon P, Conte-Devolx B, et al. Laboratory medicine practice guidelines. Laboratory support for the diagnosis and monitoring of thyroid disease. Thyroid. 2003;13(1):3-126.
12. Harris HR, Babic A, Webb PM, et al. Polycystic Ovary Syndrome, Oligomenorrhea, and Risk of Ovarian Cancer Histotypes: Evidence from the Ovarian Cancer Association Consortium. Cancer Epidemiol Biomarkers Prev. 2018;27(2):174-182.
13. McDonnell R, Hart RJ. Pregnancy-related outcomes for women with polycystic ovary syndrome. Womens Health (Lond). 2017;13(3):89-97.
14. Acharya, N.; Acharya, S.; Shukla, S., et al. Polycystic Ovarian Syndrome (PCOS) in Obese Metabolic Phenotypes. International Journal of Current Research and Review.2020; 12 (22), 16-18.
15. Forslund M, Landin-Wilhelmsen K, Schmidt J, Brännström M, Trimpou P, Dahlgren E. Higher menopausal age but no differences in parity in women with polycystic ovary syndrome compared with controls. Acta Obstet Gynecol Scand. 2019;98(3):320-326.
16. Gürbüz, T.; Alanya Tosun, Ş. Analyzing the biochemical, clinical, and hormonal characteristics of patients with polycystic ovary syndrome. Journal of Experimental and Clinical Medicine.2021; 38 (4), 478-484.
17. Espinós JJ, Calaf J, Estadella J, Checa MA. Hirsutism scoring in polycystic ovary syndrome: concordance between clinicians' and patients' self-scoring. Fertil Steril. 2010;94(7):2815-2816.
18. Yousaf, SW. sonographic assessment of primary infertility in women having pcos. Pakistan BioMedical Journal.2022;03-06.
19. Lee HJ, Jo HN, Noh HK, Kim SH, Joo JK. Is there association between thyroid stimulating hormone levels and the four phenotypes in polycystic ovary syndrome? Ginekologia Polska.2023;94 (3), 203-210.
20. Ding X, Yang L, Wang J, et al. Subclinical Hypothyroidism in Polycystic Ovary Syndrome: A Systematic Review and Meta-Analysis. Front Endocrinol (Lausanne). 2018;9:700.
21. Raj D, Pooja F, Chhabria P, et al. Frequency of Subclinical Hypothyroidism in Women With Polycystic Ovary Syndrome. Cureus. 2021;13(9):e17722.
22. Abdollahi, A.; Nakhjavani, M.; Sohrabvand, F. Thyroid Function Status and Thyroid Hormones Disturbances in Polycystic Ovarian Syndrome. Acta Medica Iranica.2018;267-271.
23. Rojhani E, Rahmati M, Firouzi F, Saei Ghare Naz M, Azizi F, Ramezani Tehrani F. Polycystic Ovary Syndrome, Subclinical Hypothyroidism, the Cut-Off Value of Thyroid Stimulating Hormone; Is There a Link? Findings of a Population-Based Study. Diagnostics (Basel). 2023;13(2):316.
24. Fatima M, Amjad S, Sharaf Ali H Sr, et al. Correlation of Subclinical Hypothyroidism With Polycystic Ovary Syndrome (PCOS). Cureus. 2020;12(5):e8142.