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Article

Effect of hypothyroidism on ovarian reserve status in Iraqi women: hormonal study

Eman M Abbas[1,*], Basil O Saleh [2], Omar M Aljuboori[3]
[1]MSc, clinical biochemistry, Department of Biochemistry, College of Medicine, University of Baghdad.
[2]MSc, Ph.D. clinical biochemistry, Department of Biochemistry, College of Medicine, University of Baghdad.
[3]FIBMS (Endocrinology), FIBMS (medicine), Baghdad Teaching Hospital, Medical city.
*Correspondence: alaswadammona@gmail.com
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Abstract: Background: Hypothyroidism is a clinical syndrome prevalent in women, even those of reproductive age. Ovarian reserve can be defined as the number and quality of follicles in the ovary at any given time. Evaluation of ovarian reserve is recommended for patients at risk of decreased ovarian reserve. Objective: This study aims to evaluate the effect of hypothyroidism on ovarian reserve in Iraqi women by hormonal measurements of serum anti-mullerian hormones AMH, FSH, and LH. Subjects and methods: This case–control study was carried out at the Department of Biochemistry, College of Medicine, University of Baghdad, in collaboration with Endocrinology and Diabetes Clinic, Baghdad Teaching Hospital, and National Center for Teaching Laboratories, Medical City, during the period from November 2021 to March 2022. This study involved 88 women, age range (20-40 years). Fifty-one of them [Group I (GI)] had primary hypothyroidism and were diagnosed by an endocrinologist based on clinical analysis and thyroid function tests, including serum TSH, T4 and T3. Patients with symptoms and signs suggestive of hypothyroidism and elevated TSH with T4 less than the reference level were considered overt hypothyroidism.
While patients with elevated TSH with standard T4 and T3 were considered subclinical hypothyroidism [1], serum thyroid peroxidase antibody (TPOAb) was used to differentiate hypothyroidism patients with Hashimoto`s disease [2]. Thirty-seven of the included women were healthy and served as a control group and referred to group II (GII). Results: The mean (±SD) value of serum AMH of hypothyroidism women was significantly lower than that of controls ($p < 0.0001$). However, the mean value of AMH did not differ significantly between women who had overt and subclinical hypothyroidism, regular and irregular menstrual cycle, well and poorly controlled thyroid status, and who had positive and negative anti-TPO. The mean (±SD) value of serum LH of hypothyroidism women was significantly higher than that of the control group ($p < 0.004$), while that of FSH did not differ significantly. Serum TSH levels positively correlated with LH levels (r=0.3, p 0.03). In addition, BMI values were significantly positively correlated with FSH levels (r= 0.3, p 0.04). Conclusions: This study suggested the need for serum measurement of AMH in women suffering from hypothyroidism.

Keywords: hypothyroidism, ovarian reserve, AMH.

Introduction

Hypothyroidism is prevalent in iomen, even in those of reproductive age. Hypothyroidism results from low levels of thyroid hormone with varied etiology and manifestations. Untreated hypothyroidism increases morbidity and mortality. Autoimmune thyroid disease (Hashimoto thyroiditis) is the most common cause of hypothyroidism, but globally, lack of iodine in the diet is the most common cause. The patient presentation can vary from asymptomatic disease to myxedema coma [3]. The diagnosis of hypothyroidism is easily made with simple blood tests and can be treated with exogenous thyroid hormone. Hypothyroidism is termed primary when the thyroid gland cannot produce adequate amounts of thyroid hormone. The less common, secondary or central hypothyroidism is labeled when the thyroid gland is normal, and the pathology is related to the pituitary gland or hypothalamus. The most prevalent etiology of primary hypothyroidism is an iodine deficiency in iodine-deficient geographic areas worldwide [4]. Anti-Müllerian hormone (AMH) is a glycoprotein involved in the regulation of follicle growth, inhibition of the recruitment of primordial follicle, and inhibition of aromatase expression, which leads to a decrease in granulosa cells sensitivity to FSH [5]. AMH test represents ovarian reserve but is not dependent on the menstrual cycle.
Nonetheless, it can be affected by environmental and genetic factors [6]. These factors may lead to errors in interpreting serum AMH levels in clinical practices. Ovarian reserve can be defined as the number and quality of follicles in the ovary at any given time. Evaluation of ovarian reserve is recommended for patients who are at risk of decreased ovarian reserve. Ovarian reserve can be evaluated with some measurements in the early follicular phase of the menstrual cycle: investigation of antral follicle count (AFC) and ovarian volume, serum follicle-stimulating hormone (FSH), estradiol (E2), Anti-Mullarian hormone (AMH) measurement [7]. Ovarian reserve function can reflect women's endocrine function and fertility and is often related to age. This function will gradually factor affecting the ovary's functional reserve of the ovary is thyroid disorders. Thyroid diseases are one of the most common endocrine problems in reproductive age and may cause menstrual and ovulation disorders and infertility; the prevalence of subclinical and clinical hypothyroidism in women of reproductive age is (4–10%) and (0.1–2%), respectively [9].

Subjects and methods:

This case–control study was carried out at the Department of Biochemistry, College of Medicine, University of Baghdad, in collaboration with the Endocrinology and Diabetes Clinic, Baghdad Teaching Hospital, and National Center for Teaching Laboratories, Medical City, during the period from November 2021 to March 2022. This study involved 88 women, age range (20-40 years). Fifty-one of them [Group I (GI)] had primary hypothyroidism and were diagnosed by an endocrinologist based on clinical analysis and thyroid function tests, including serum TSH, T4 and T3. Patients with symptoms and signs suggestive of hypothyroidism and elevated TSH with T4 less than the reference level were considered overt hypothyroidism. While patients who have elevated TSH with standard T4 and T3 were considered subclinical hypothyroidism [1]. Serum thyroid peroxidase antibody (TPOAb) was used to differentiate hypothyroidism patients with Hashimoto`s disease [2]. Thirty-seven of the included women were healthy and served as a control group and referred to group II (GII). Inclusion criteria included women diagnosed with overt and subclinical hypothyroidism, age range (20-40 years). Exclusion criteria involved those women who had a history of endometriosis,

hyperprolactinemia, polycystic ovarian syndrome, pregnancy, hysterectomy, oophorectomy or any other ovarian surgery, on oral contraceptive drugs, DM, kidney diseases, liver diseases and smoker women. Five milliliters of peripheral venous blood were aspirated from each included hypothyroidism woman and control one, allowed to clot for 15 minutes, and then were centrifuged at 2500 rpm for 10 minutes to obtain serum that was used for measurement of T3, T4, and TSH by Vidas, AMH, FSH, and LH by using ELISA technique and anti-TPO by codebase e411. Body mass index (BMI) was measured and calculated by using the equation:

$$\text{BMI (Kg/m}^2\text{)} = \text{weight (Kg)/ height (m}^2\text{)} \quad (1)$$

SPSS version 25.0 software, frequency, percentage, mean, and standard deviation were used to describe data used for all statistical analysis. ANOVA is used to evaluate the difference in the mean level of numeric data between more than 2 variables. Pearson correlation regression r was used to evaluate the correlation between Numeric data. Receiver operating characteristic (ROC) was used to evaluate test reliability. The significance levels were chosen at $p < 0.05$.

Results:

Table 1 reveals the demographic results, including age, BMI of patients and controls. The age range of included patients and controls was 20-40 years, with a non-significant difference in the mean (±SD) value of the age of the patients group (31.75 ± 6.28 years) and controls (29.41 ± 6.198 years). However, Patients had statistically significant differences in mean values of BMI (26.27 ± 5.01 kg/m2) in comparison to controls (23.05 ± 5.55 kg/m2, P<0.006).

Parameter	Hypothyroidism Patients (n=51)	Controls (n=37)	p-value
Age (year)	31.75 ± 6.28	29.41 ± 6.20	0.08
BMI (kg/m2)	26.27 ± 5.01	23.05 ± 5.55	0.006

Table 1. Mean (±SD) values of age, BMI of patients and controls.

The mean (±SD) values of T3, T4, TSH and anti-TPO of hypothyroidism and controls are shown in table 2. The mean (±SD) value of serum T3 of hypothyroidism women (1.51± 0.33 nmol/ml) did not differ significantly from that of controls (1.48 ± 0.41 nmol/ml). The mean value of serum T4 was significantly lower in hypothyroidism women (85.99 ± 25.63 nmol/ml) compared to controls (95.35 ± 15.02 nmol/ml, $p < 0.050$). In addition, the mean (±SD) value of TSH in hypothyroidism was significantly elevated compared to the control group (12.31 ± 14.28, 2.05 ± 0.97 uIU/ml, respectively, $p < 0.0001$). Moreover, the mean value of anti-TPO was significantly elevated in the hypothyroidism group (100.01 ± 129.74 lU/ml) in comparison with the control group (2.74 ± 0.55 lU/ml, $p < 0.0001$).

Parameter	Hypothyroidism patients (n=51)	Controls (n=37)	P- value
T3 nmol/ml	1.51 ± 0.33	1.48 ± 0.41	0.75
T4 nmol/ml	85.99 ± 25.63	95.35± 15.02	0.050
TSH μIU/ml	12.31 ± 14.28	2.05 ± 0.97	< 0.0001
Anti-TPO lU/ml	100.01 ± 129.74	2.74 ± 0.55	< 0.0001

Table 2. Mean (±SD) T3, T4, TSH, and anti-TPO values of hypothyroidism patients and controls.

Table 3 shows the mean (±SD) values of serum AMH, FSH and LH of hypothyroidism patients and controls. The mean values of serum AMH of hypothyroidism patients (0.59 ± 0.11 ng/ml) were significantly lower than that of controls (1.10 ±

0.21 ng/ml, p < 0.0001). In addition, the mean (±SD) value of serum FSH of hypothyroidism patients (8.79 ± 5.15 mlU/ml) did not differ significantly from that of control group (8.21 ± 3.37 mlU/ml), while the mean (±SD) value of serum LH of hypothyroidism patients (11.55 ± 12.79 mlU/ml) was significantly higher than that of control group (5.19 ± 2.44 mlU/ml, p < 0.004).

Parameter	Hypothyroidism patient (n=51)	Controls (n=37)	P –value
AMH (ng/ml)	0.59 ± 0.11	1.10 ± 0.21	< 0.0001
FSH mlU/ml	8.79 ± 5.15	8.21 ± 3.37	0.54
LH mlU/ml	11.56 ± 12.79	5.19 ± 2.44	0.004

Table 3. Mean (±SD) values of AMH, FSH, and LH of hypothyroidism patients and controls.

Table 4 indicates no significant differences in measured parameters (AMH, FSH, and LH) between patients and women according to their thyroid status overt and sub-clinical hypothyroidism.

Parameter	Overt Hypothyroidism (n=42)	Subclinical hypothyroidism (n=9)	P -value
AMH (ng/ml)	0.597 ± 0.105	0.55 ± 0.101	0.21
FSH (mlU/ml)	9.162 ± 5.43	7.09 ± 3.343	0.27
LH (mlU/ml)	12.993 ± 13.68	4.86 ± 1.85	0.08

Table 4. Mean (±SD) serum AMH, FSH, and LH values of clinical and subclinical hypothyroidism patients group.

Table 5 shows no significant differences in mean values of AMH, FSH and LH in hypothyroidism women with irregular menstrual cycles.

Parameter	Regular cycle (n=27)	Irregular cycle (n=24)	P -value
AMH (ng/ml)	0.58 ± 0.11	0.59 ± 0.10	0.77
FSH (mlU/ml)	8.50 ± 5.12	9.13 ± 5.41	0.67
LH (mlU/ml)	11.4 ± 14.3	11.74 ± 11.19	0.92

Table 5. Mean (±SD) values of serum AMH, FSH, and LH of hypothyroidism patients group with regular and irregular menstrual cycle.

Also, Table 6 reveals that the mean values of AMH, FSH, and LH did not significantly differ between hypothyroidism women with positive and negative anti-TPO results.

Parameter	Anti-TPO (positive) (n=22)	Anti-TPO (negative) (n=28)	P -value
AMH (ng/ml)	0.58 ±0.09	0.58 ± 0.11	0.97
FSH (mlU/ml)	9.50 ± 6.31	8.09 ± 4.07	0.34
LH (mlU/ml)	11.10 ± 14.90	11.92 ± 11.41	0.82

Table 6. Mean (±SD) values of serum AMH, FSH, and LH of hypothyroidism patients group with positive and negative anti-TPO.

The mean value of serum LH of uncontrolled hypothyroidism women (13.44 ± 13.88 mlU/ml) was significantly increased when compared with controlled ones (4.70 ± 1.22 mlU/ml, p < 0.04).

Parameter	TSH level < 4.5 (n=11)	TSH level ≥ 4.5 (n=40)	P -value
AMH (ng/ml)	0.59 ± 0.10	0.59 ± 0.11	0.95
FSH (mlU/ml)	9.127 ± 5.63	8.71 ± 5.09	0.81
LH (mlU/ml)	4.70 ± 1.22	13.44 ± 13.88	0.04

Table 7: Mean (±SD) values of serum AMH, FSH, LH of controlled and uncontrolled hypothyroidism patients group.

In the patient's group, TSH levels were significantly positively correlated with LH levels ($r = 0.31$, $p < 0.03$), considered moderate. In addition, BMI was significantly positively correlated with FSH levels ($r = 0.28$, $p < 0.04$), which is also considered moderate.

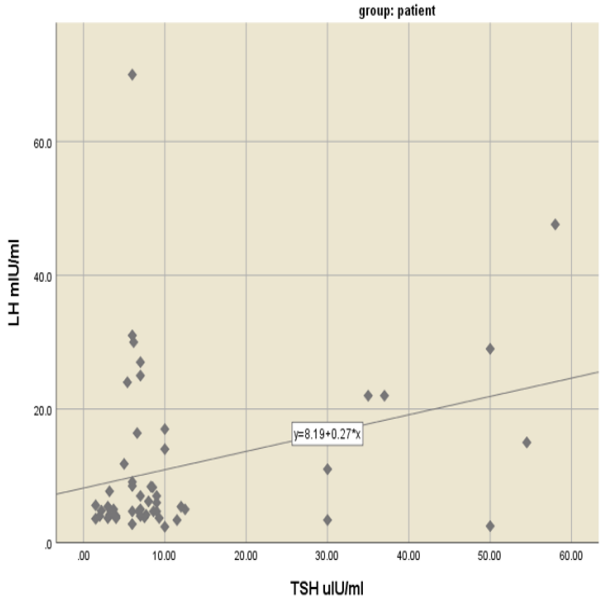

Figure 1. Scattered dot diagram of a correlation between LH and TSH.

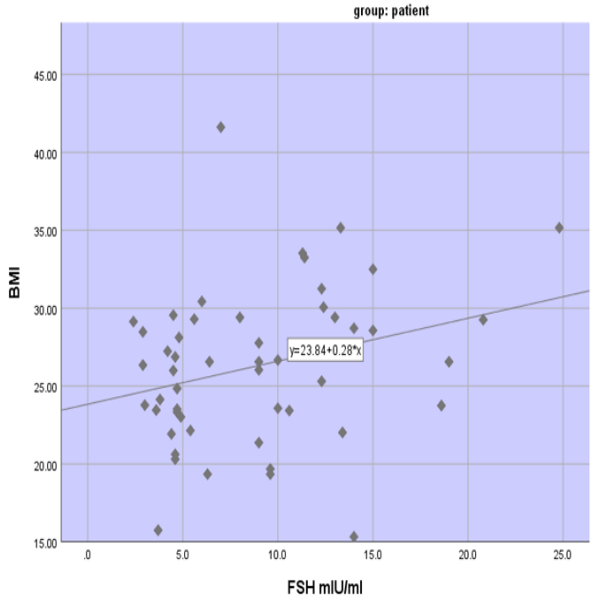

Figure 2. Scattered dot diagram of the correlation between FSH and BMI.

Discussion

The results of the present study revealed non-significant differences in mean values of age between hypothyroidism patients and controls (Table 1) designed in this study to eliminate the age factor influence in obtaining results. In addition, the study defined the age range of patient women between (20-40 years) in order to avoid the physiological decline of serum AMH with significant elevation of FSH and LH with the advanced age of women. [10] reported that there was no significant association between the age of women and thyroid dysfunction. This study found a significant difference in the mean value of BMI between patient women and controls (Table 1). This finding agreed with that reported by [11], who found that the patients with hypothyroidism had significantly higher BMIs than the healthy individuals. Those authors concluded that there was a trend towards higher BMI in hypothyroidism patients treated with L-thyroxine < 2 years. The mean value of BMI of hypothyroidism women in the present study was 26.27 Kg/m2, indicating that most of these women were overweight, which may be attributed to newly diagnosed and poorly controlled hypothyroidism with consequent low basal metabolic rate. [12] observed that infertile Iraqi female patients tend to be overweight more commonly than the control fertile group. It has also been reported that infertile Iraqi females in Baghdad had a significant association between their infertility and a high score BMI of [13]. This study also agrees with another Iraqi study by [14], who found a highly significant association between infertility, higher BMI, and higher waist-to-hip ratio [14]. A Turkish study presented by [15] explained some reasons why a higher BMI is associated with fertility outcomes. They provide several mechanisms; one of the mechanisms based on the fact that obese women had affected gonadotropin secretion is affected because of hyper-insulinemia in obese women [15]. A study that tried to explain the effect of obesity focused on leptin, an adipokine produced by the adipose tissue and seems responsible for weight regulation. A highly positive linear correlation was found between BMI and serum leptin in infertile obese females than in the fertile control group [16]. This is mainly related to the disturbing metabolism resulting from hypothyroidism, as it is associated with reduced metabolic rate leading to an increase in patients' weight [17]. The mean value of Anti-TPO was significantly higher in the hypothyroidism group than in the control group. This may indicate that autoimmune thyroiditis is an important cause of hypothyroidism in Iraqi patient women. The present study found that both subclinical and overt hypothyroidism women have had significantly lower AMH concentrations than the control group (Table 3). [18] reported a significant decrease in serum AMH in subclinical hypothyroidism women compared to healthy ones. These authors concluded that subclinical hypothyroidism was associated with a lower AMH. [19] observed a higher prevalence of thyroid dysfunction, especially subclinical hypothyroidism, in all enrolled studied women, and AMH levels were decreased in postmenopausal women and premature ovary insufficiency and recommended estimation of AMH as routine screening of premature ovarian insufficiency in patients with autoimmune thyroiditis. It has also been shown that women with autoimmune thyroiditis (AITD) have fewer pregnancies and live births and lower AMH levels compared with age-matched controls. These authors suggested a diminished ovarian reserve in women with AITD (Saglam F. 2014).The lower AMH may be due to a decrease in antral follicle counts by autoimmune attack or a decline in their physiological functions by elevated TSH. The insignificant difference in serum FSH levels between hypothyroidism women of the present study and the control (Table 3) agreed with that reported by [20]. Another study conducted by [21] has shown that hypothyroidism does not influence the classical preovulatory patterns of LH and FSH secretion. (Saglam F. et al., 2014) also found that the mean value of serum FSH was insignificantly different between hypothyroidism women and healthy control women. However, the present study found a significant

increase in the mean value of serum LH level. Saglam F. et al. (2014) also found higher levels of LH in hypothyroidism women compared to controls but did not reach a significant level. The present study observed a significant effect of thyroid gland disorder on serum AMH and LH. However, the status of the gland (overt and subclinical hypothyroidism) has no significant difference (Table 4), which agrees with the study of [3] who conducted a meta-analysis to examine the effects of different thyroid dysfunctions on the AMH levels; subclinical and clinical hypothyroidism. They found serum AMH levels tended to be lower in patients with clinical and subclinical hypothyroidism than in healthy subjects, but their differences were insignificant. The present study did not find a significant effect of anti-TPO results, whether positive or negative, on serum mean values of AMH, FSH and LH, which agree with other study conducted by Osuka S. et al. (2018), which revealed no association between anti-TPO positivity and ovarian reserve. These authors reported that the ovarian reserves of patients with hypothyroidism and anti-TPO positivity were not worse than those with isolated subclinical hypothyroidism. They also found non-significant differences in the basal FSH and AMH concentrations between women with anti-TPO negativity and positivity. However, [22] reported that women with autoimmune thyroid diseases tended to respond poorly to controlled ovarian hyperstimulation. The present study found only a significant elevation of serum LH in uncontrolled hypothyroidism compared to control ones without significant differences in serum AMH and FSH (Table 7). The present study also found a significant positive correlation between LH and TSH (Table 8, Figure 1) [23] demonstrated that there was no significant difference in serum AMH levels between the low-normal TSH Group and normal-high TSH group. [7] also found that serum AMH, FSH and LH did not differ significantly among the subgroups of hypothyroidism according to their control as assessed by TSH level.

Conclusion

This study suggested the need for serum measurement of AMH in women who suffered from established hypothyroidism irrespective of thyroid function status and etiology.

References

1. Chakera J. A.; Pearce S. H.; Vaidya B. Treatment for primary hypothyroidism: current approaches and possibilities. *Drug Design, Development and Therapy* **2012**, 6 1–11.
2. Jantikar M. A.. A study on the relationship between thyroid peroxidase antibodies (Anti-TPO antibodies) and thyroid dysfunction patients. *International Journal of Clinical Biochemistry and Research* **2020**, *7(2),* 238–242.
3. Hasegawa Y.; Kitahara Y.; Osuka S.; Tsukui Y.; Kobayashi M.; Iwase A. Effect of hypothyroidism and thyroid autoimmunity on the ovarian reserve: A systematic review and meta-analysis. *Reproductive Medicine and Biology* **2021**, *10*.1002/2.12427.
4. Taylor P. N.; Albrecht D.; Scholz A.; Gutierrez-Buey G.; Lazarus J. H.; Dayan C. M.; Okosieme O. E. Global epidemiology of hyperthyroidism and hypothyroidism. *Nature Reviews Endocrinology* **2018**, *14(5):*301-316.
5. Pellatt L.; Rice S.; Dilaver N.; Heshri A.; Galea R.; Brincat M. Anti-Müllerian Hormone Reduces Follicle Sensitivity to Follicle-Stimulating Hormone in Human Granulosa Cells. *Fertility and Sterility* **2011**, *96(5):*1246–51.e1.
6. Schuh-Huerta, M.S.; Johnson, A.N.; Rosen, P.M.; Sternfeld, B.; Cedars, I.M.; Reijo Pera, A.R. Genetic markers of ovarian follicle number and menopause in women of multiple ethnicities. *Human Genetics* **2012**, *131*:1709–1724.
7. Demirci T.; Apaydin M. The Effect Of Tsh Level On Ovarian Reserve In Women In The Reproductive Period. *Kü Tıp Fak Derg* **2020**, *22(3):*370-376.

8. Adamska A.; Popławska-Kita A.; Siewko K.; Łebkowska A.; Krentowska A.; ska B. A.; Popławski L.; Szumowski P.; Szelachowska M.; towski K.J.A.; and Kowalska I. Body Composition and Serum Anti-Müllerian Hormone Levels in Euthyroid Caucasian Women with Hashimoto Thyroiditis. *Frontiers in endocrinology* **2021**, *12*:657752.
9. Kabodmehri R.; Sharami H. S.,Sorouri Z. Z.,Gashti G. N.,Milani F., Ghaypaz Z., Ghalandari M. The relationship between thyroid function and ovarian reserve: a prospective cross-sectional study. *Thyroid Research* **2021**, *14*:22.
10. Vedantham H., Tanuku P., Jahagirdar J. N, Kamineni V. A study of association between thyroid dysfunction and serum anti-mullerian hormone levels in women presenting with infertility. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology* **2020**, *9.10*: 4097-4102.
11. Popławska-Kita A., Szelachowska M., Siewko K., Telejko B., Kościuszko-Zdrodowska M., Hryniewicka J., Milewski R., Górska M. Body mass analysis in patients with Hashimoto thyroiditis. *Progress in Health Sciences* **2014**, *4.1*: 18-23.
12. Al-Ezairjawi R., Risan A. F., Al-Shareef D. Determination of inhibin B levels in hypothyroidism infertile Iraqi women. *journal of the college of basic education* 2020, 26.109: 459-468.
13. Zeidan M. Determination of inhibin B levels in hypothyroidism infertile Iraqi women. *journal of the college of basic education* **2020**, *26.109*: 459-468.
14. Al-Rubae'I S. Studies on hormonal changes, homocysteine and lipids profile in Iraqi women with infertility. *Journal of Techniques* **2012**, *25.2*.
15. Dağl Z. and Berna D. Impact of obesity on infertility in women. *Journal of the Turkish German Gynecological Association* **2015**, *16.2*: 111.
16. Kumari P., Jaiswar S., Shankhwar P., Deo S., Ahmad K., Iqbal B. and Mahdi A. Leptin as a predictive marker in unexplained infertility in north Indian population. *Journal of clinical and diagnostic research: JCDR* **2017**, *11.3*: QC28.
17. Brent G.A. *Hypothyroidism and thyroiditis*. In: Melmed S, Polonsky K., Larsen PR, Kronenberg H Williams Textbook of Endocrinology **2012**, 12: 430- 440.
18. Rao M., Wang H., Liu J.-Z. S., Wen Y., Wu Z., Yang Z., Su C., Su Z., Wang K., Tang L. Subclinical hypothyroidism is associated with lower ovarian reserve in women aged 35 years or older. *Thyroid* **2020**, *30.1*: 95-105.
19. Rashad M. N., Moafy H., Saleh S. H., Abdelaziz I. Amin I. A., Gomaa F. A. Anti-Müllerian hormone: a predictor of premature ovarian insufficiency in Egyptian women with autoimmune thyroiditis. *Middle East Fertility Society Journal* **2018**, *23.4*: 286-291.
20. Saran S., Gupta S. B., Philip R., Singh S. K., Bende A. S., Agroiya P., Agrawal P. Effect of hypothyroidism on female reproductive hormones. *Indian journal of endocrinology and metabolism* **2016**, *20.1*: 108; 10.4103/2230-8210.172245.
21. Hapon M.B., Gamarra-Luques C., Jahn G.A. Short-term hypothyroidism affects ovarian function in the cycling rat. *Reproductive biology and endocrinology* **2010**, *8.1*: 1-11.
22. Magri F., Schena L., Capelli V., Gaiti M., Zerbini F., Brambilla E., Rotondi M.,De Amici M., Spinelli A., Nappi R., Chiovato L. Anti-Mullerian hormone as a predictor of ovarian reserve in ART protocols: the hidden role of thyroid autoimmunity. *Reproductive Biology and Endocrinology* **2015**, *13.1*: 1-8.
23. Weghofer A., Himaya E., Kushnir A., Barad H., Gleicher N. The impact of thyroid function and thyroid autoimmunity on embryo quality in women with low functional ovarian reserve: a case-control study. *Reproductive Biology and Endocrinology* **2015**, *13.1*: 1-6.

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