International Journal of Advances in Medicine
*Vasudevan MS et al. Int J Adv Med. 2022 Mar;9(3):243-248*
http://www.ijmedicine.com
pISSN 2349-3925 | eISSN 2349-3933
DOI: https://dx.doi.org/10.18203/2349-3933.ijam20220425

**Original Research Article**

# A study of gonadal dysfunction in women with thyroid disease

**Manasa Saligrama Vasudevan, Naveenkumar Hosalli***

Department of Medicine, Mysore Medical College and Research Institute, Mysore, Karnataka, India

**Received:** 23 December 2021
**Revised:** 14 February 2022
**Accepted:** 16 February 2022

***Correspondence:**
Dr. Naveenkumar Hosalli,
E-mail: naveenhosalli14@gmail.com

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ABSTRACT

**Background:** Thyroid diseases are among the commonest endocrine disorders. It effects growth, embryonic development, tissue differentiation, maturation, metabolism, increases chronotropic and inotropic action of heart. The aim was to study gonadal dysfunction in women with thyroid disease; to study levels of FSH, LH, prolactin, estrogen and testosterone in hypothyroid and hyperthyroid.
**Methods:** All participants fulfilling the inclusion criteria were interviewed as per proforma and medical details were recorded in proforma sheet and patients were subjected to necessary blood investigations.
**Results:** Among 80 study subjects, majority were in the age group 26-35 years (60.1%) and majority had overt hypothyroid disease (72.5%). Symptoms of hypothyroid subjects mainly were fatigue, weight gain, hair loss, oligomenorrhea. Hyperthyroid subjects had fatigue, palpitations, oligomenorrhea, polymenorrhea. Prolactin had positive correlation with TSH in hypothyroid subjects, their LH, FSH levels were normal and sex steroid levels were low. In contrary, majority of the hyperthyroid subjects had normal prolactin and FSH, high LH and high sex steroid levels.
**Conclusions:** The study demonstrated that thyroid disease in women causes menstrual abnormalities due to altered gonadotropin patterns which in turn alter ovarian hormone pattern. Hypothyroidism is associated with hyperprolactinemia leading to anovulation and abnormal menstrual cycle. Hyperthyroidism is associated with increased levels of LH, estrogen and testosterone with normal levels of PRL and FSH. Screening, identifying and correcting thyroid disease should be undertaken to prevent infertility as early as possible.

**Keywords:** Hypothyroidism, TSH, Oligomenorrhea, Prolactin, Hyperthyroid, PCOD

## INTRODUCTION

The thyroid was named by Thomas Wharton, an anatomist, after the ancient Greek shield as glandula thyreoidea (glandula=gland thyreos=shield, eidos=form) in 1656. The English named it as thyroid gland.[1] It weighs around 12-20 g in size and is the guardian of all major metabolic events in the human body. The function of thyroid hormones includes modulation of carbohydrates, proteins and fat metabolism, gene expression and also sexual and reproductive function, thus when the thyroid hormone gets out of balance, many body functions are affected.[2] The normal thyroid function via its interaction in several pathways is important to maintain normal reproduction. In both genders, changes in SHBG and sex steroids are a consistent feature associated with hypo/hyperthyroidism.[3] They were reported many years ago since the renaissance and even before that in Sushruta Samhita written about 1400 BC.

The effects of thyroid hormones on the impaired function of reproductive and to great extent is thought to be due to changes in TSH level, whose secretion overlaps with FSH, LH and prolactin and thus it may have overlapping function.[4] Increasing exposure to thyroid disruptors

including industrial and agricultural contaminants has been identified as a growing health concern throughout India.[5]

### *Aims and objectives*

The aims and objectives were to study gonadal dysfunction in women with thyroid disease and to study levels of FSH, LH, prolactin, estrogen, testosterone in hypothyroid and hyperthyroid.

## METHODS

### *Study design*

The study design was a cross-sectional observational study.

### *Study place*

The study took place in K. R. hospital, Mysuru.

### *Duration of study*

The study duration was from January 2018 to June 2019.

### *Source of data*

Observation method of primary source of information on the venous blood samples of women with thyroid disease attending outpatient department of medicine at K. R. hospital, Mysuru was the source of data.

Secondary source of information from published articles, journals, books, case sheets, discharge summary, related websites were used in planning, developing, synopsis and during dissertation as supporting document.

### *Methods of collection of data*

*Sampling procedure*

5 ml of venous blood, after taking written consent from the subjects was processed.

### *Sample size*

The sample size was a total of 80 patients.

### *Inclusion criteria*

Subjects who gave valid informed written consent for study and females above 18 years of age with newly diagnosed thyroid disease were included in the study.

### *Exclusion criteria*

Critically ill subjects; patients with pregnancy, lactating females, post menopause; patients with chronic kidney disease, chronic heart disease, chronic liver disease; patients who were immunocompromised; and patients with drugs altering thyroid function were excluded.

### *Method of study*

All participants fulfilling the inclusion criteria were interviewed as per proforma and a detailed clinical examination was done. Participant's demographic, social and medical details were recorded in proforma sheet and patients were subjected to necessary blood investigations were also done.

Subclinical hypothyroidism was diagnosed when free T3, free T4 was normal with TSH being high. Over hypothyroidism was diagnosed when TSH was high with low total/free T3, T4 levels.

Subclinical hyperthyroidism was diagnosed when free T3, free T4 was normal with TSH being low. Over hyperthyroidism was diagnosed when TSH was low with high total/free T3, T4 levels.

The diagnosis of PCOD was made based on Rotterdam criteria.[6]

The following investigations were done: (1) T3, T4, TSH; (2) FSH, LH and prolactin; (3) estrogen and testosterone; (4) complete hemogram; (5) liver function test; (6) renal function test; (7) electrocardiogram; (8) random blood sugar; (9) if necessary-fT3, fT4, TPO antibodies, FNAC of thyroid gland, USG neck, FBS, PPBS, HBA1C were done

### *Ethical approval*

The ethical approval for this study was taken.

Statistical analysis

Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions.

Chi square test was used as test of significance for qualitative data.

*Graphical representation of data*

MS excel and MS word was used to obtain various types of graphs such as bar diagram and pie diagram. P value (probability that the result was true) of $<0.05$ was considered as statistically significant after assuming all the rules of statistical tests.

*Statistical software*

MS excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

## RESULTS

### *Age distribution of subjects*

Mean age in the present study was 28.975±6.07 in years.

Majority of the women were between the age group 26-35 years in our study comprising 60.1% of the sample size.

Majority of subclinical hypothyroid subjects were in the age group 31-35 years, majority of overt hypothyroid subjects were between 26 to 35 years, subclinical hyperthyroid subjects were >36 years and overt hyperthyroid were majority between 31-35 years of age.

### *Menstrual irregularities in women with hypothyroidism*

Out of 60 patients, 42 had oligomenorrhea, 13 had menorrhagia, 3 had amenorrhea, 2 had polymenorrhea.

### *Menstrual irregularities in women with hyperthyroid disease*

Menstrual irregularities were oligomenorrhea in 75%, polymenorrhea in 15%, amenorrhea in 2%.

**Table 1: Distribution of thyroid disease among different age groups in the present study.**

| Age (years) | SCH | OH | S hyper | O hyper |
|---|---|---|---|---|
| **<20** | 0 | 8 | 0 | 3 |
| **21-25** | 0 | 7 | 0 | 2 |
| **26-30** | 0 | 22 | 0 | 4 |
| **31-35** | 2 | 13 | 0 | 7 |
| **>36** | 0 | 8 | 1 | 3 |
| **Total** | 2 | 58 | 1 | 19 |

**Table 2: Levels of LH, FSH, PRL, E2, T in subclinical hypothyroid subjects.**

| Parameters | Mean | Standard deviation | P value |
|---|---|---|---|
| **LH** | 2.95 | 0.25 | 0.255 |
| **FSH** | 2.8 | 0.7 | 0.947 |
| **PRL** | 50.05 | 2.05 | 0.184 |
| **E2** | 19.55 | 1.45 | 0.25 |
| **T** | 11..5 | 0.5 | 0.285 |

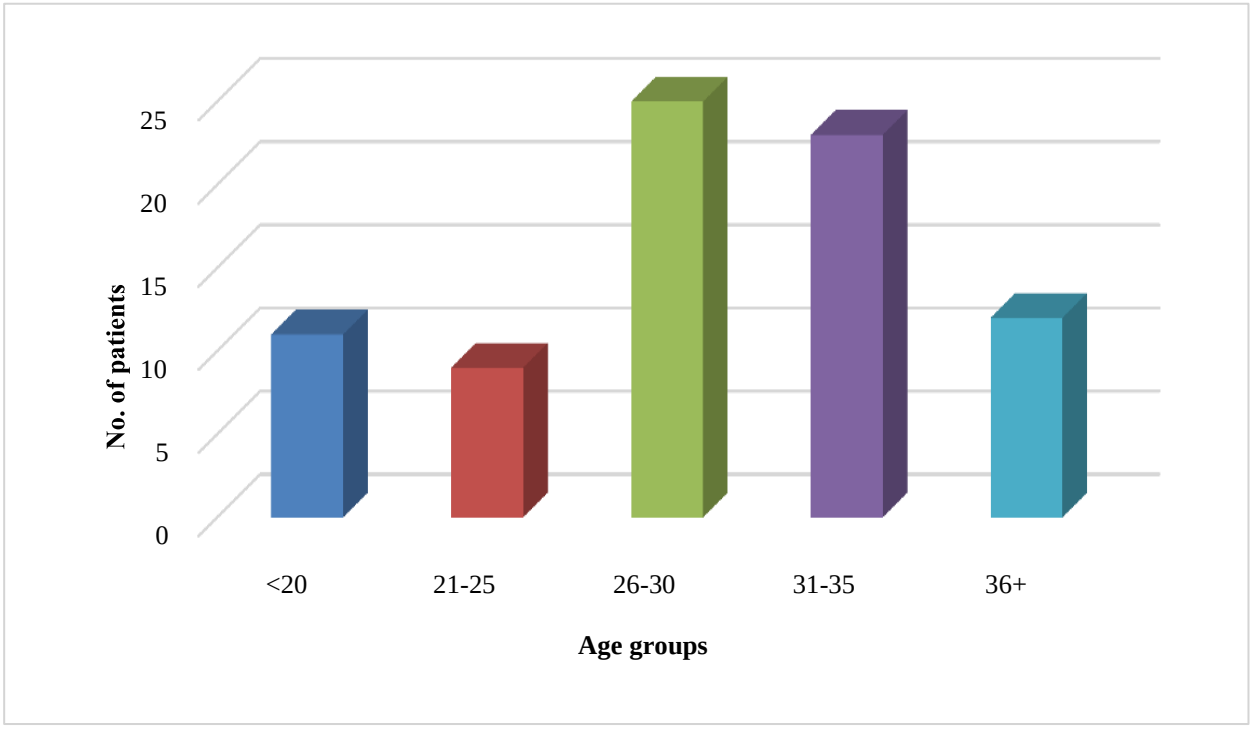


**Figure 1: Bar diagram showing age distribution of subjects.**

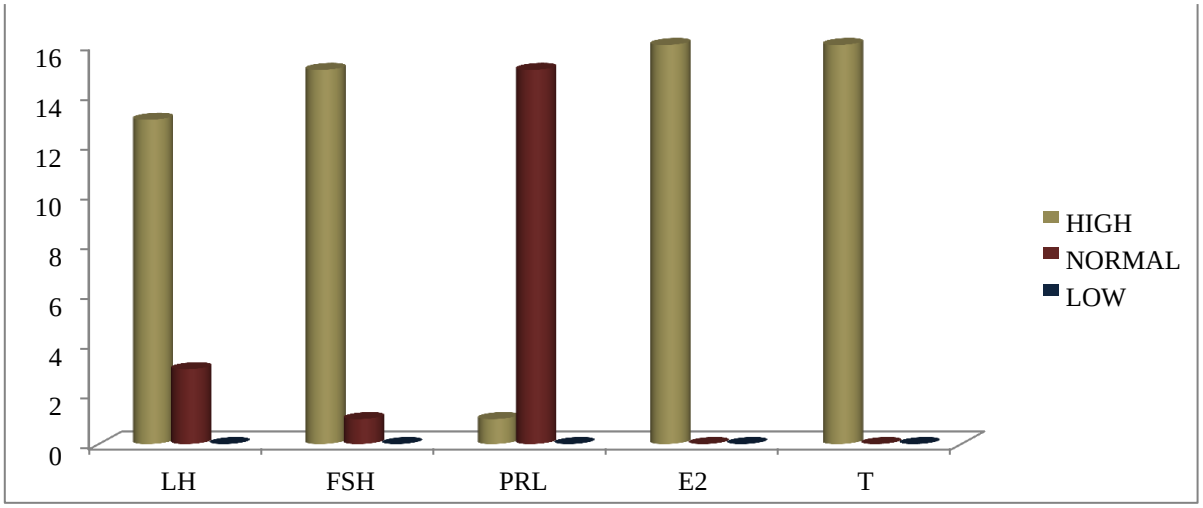


**Figure 2: The levels of LH, FSH, PRL, E2, T in overt hypothyroid patients with PCOD.**

***The levels of LH, FSH, PRL, E2, T in women with hypothyroidism***

Among 42 subjects with overt hypothyroid without PCOD, all the subjects had normal values of LH and FSH and high levels of prolactin. 30 had low levels and 12 subjects had normal levels of estradiol. 32 subjects had low testosterone levels and 10 had normal levels.

Out of 16 subjects with overt hypothyroid with PCOD, 13 women had high and 3 normal levels of LH. 15 subjects had high and 1 had normal levels of FSH 15 had normal and one high levels of PRL

All had high levels of estrogen and progesterone.

The data obtained was statistically insignificant, as $p>0.05$ but the levels were similar to subjects with overt hypothyroidism without PCOD. FSH and LH levels were normal, PRL levels were high and estrogen and testosterone levels were low.

***Levels of LH, FSH, PRL, E2 and T in women with overt hyperthyroidism***

Out of 19 women with overt hyperthyroidism, 16 subjects had high and 3 had normal LH levels. FSH was normal in 16, high in 2 and low in 1 subject. PRL was normal in 18 subjects and high in only one subject. Estrogen and testosterone were in 18 subjects and low in only one subject.

## DISCUSSION

***Menstrual irregularities in women with hypothyroidism***

In Veeresh et al study 16 patients were hypothyroid of which 7 had oligomenorrhea, 3 had amenorrhea, 3 had polymenorrhea, 2 had menorrhagia and one had normal menstrual cycle.[3]

Present study, 60 hypothyroid subjects of which 42 had oligomenorrhea, 13 had menorrhagia, 3 had amenorrhea, 2 had polymenorrhea.

***Menstrual irregularities in women with hyperthyroid disease***

In the present study, 20 were hyperthyroid of which 15 had oligomenorrhea, 3 had polymenorrhea and 2 had amenorrhea. In Veeresh et al study out of 10 patients with hyperthyroid profile, 2 had oligomenorrhea, 1 had amenorrhea, 2 had polymenorrhea, 3 had hypomenorrhea, 2 had normal cycle.[3]

In Krassas study among the hypothyroid subjects, the levels of LH, FSH were in normal range, prolactin at higher levels, whereas estrogen and testosterone were at lower level. In Saran et al the levels of LH, FSH were in lower levels contrary to Krassas study.[7] Prolactin and TSH were high, estrogen and testosterone were at lower levels similar to Krassas study. In Veeresh et al and Lal et al study the levels of LH, FSH, PRL and TSH were similar as Krassas study.[7,8]

In the present study, the levels of LH and FSH were normal. PRL and TSH levels were high. But the estrogen and testosterone levels were low among majority of the hypothyroid subjects similar to Krassas et al study.[9]

***Levels of hormones in hypothyroid patients with PCOD***

In the Kanwar et al study LH levels were significantly raised in cases, FSH were normal in both cases and controls but cases had higher levels than controls.[12] PRL was normal in cases and TSH was high among the cases compared to the controls.

In the present study, LH levels were raised in 13 subjects where as it was normal in 3 subjects. FSH was normal in 15 subjects where as it was high in 1 subject. PRL levels

were normal in 15 and high in 1. TSH was high in all the subjects.

***Hormonal levels in hyperthyroid patients***

In Krassas study the levels of LH and FSH were either high or normal, prolactin level was normal, TSH was low whereas estrogen and testosterone levels were high. In Veeresh et al and Lal et al study the levels of LH, FSH and PRL were normal, with TSH being low.

In the present study, majority of the subjects had high levels of LH, normal levels of FSH and prolactin. And majority had high levels of estrogen and testosterone with TSH at low levels among subjects with hyperthyroidism. The results were similar to Krassas and Veeresh et al studies.

***Hormonal levels in hypothyroid and hyperthyroid patients in the present study***

In the present study, the levels of LH in hypothyroid subjects were normal but among majority of the hyperthyroid subjects the levels of LH were high. The levels of FSH were normal in both hypothyroid and hyperthyroid subjects. PRL levels were high in hypothyroid subjects and had positive correlation with TSH levels. In hyperthyroid subjects' majority had normal levels. The levels of estrogen and testosterone were low in hypothyroid subjects whereas their levels were high in majority of hyperthyroid subjects.

**Table 3: Comparison of menstrual irregularities in women with hypothyroidism among various studies.**

| Study | Oligomenorrhea | Amenorrhea | Polymenorrhea | Menorrhagia | Normal |
|---|---|---|---|---|---|
| **Veeresh et al** | 7 | 3 | 3 | 2 | 1 |
| **Present study** | 42 | 3 | 2 | | |

**Table 4: Comparison of menstrual irregularities in women with hyperthyroid disease among various studies.**

| Study | Oligomenorrhea | Amenorrhea | Polymenorrhea | hypomenorrhea | Normal |
|---|---|---|---|---|---|
| **Veeresh et al** | 2 | 1 | 2 | 3 | 2 |
| **Present study** | 15 | 2 | 3 | | 0 |

**Table 5: Comparison of hormonal levels in the present study with other studies.**

| Study | Krassas study | | Veeresh et al | Saran et al | Lal et al | Present study |
|---|---|---|---|---|---|---|
| **LH** | N | Mean±SD | 40.0±8.11 | 5.89±2.12 | 3.21±1 | 3.24±2.33 |
| | | P value | <0.001 | - | - | <0.001 |
| **FSH** | N | Mean±SD | 6.2±2.7 | 12.14±3.12 | 2.55±2.08 | 2.53±0.98 |
| | | P value | NS | - | - | 0.041 |
| **PRL** | H | Mean±SD | 23.5±2.93 | 39.65±31.78 | 67±11 | 52.8±4.68 |
| | | P value | <0.001 | | <0.001 | <0.001 |
| **TSH** | H | Mean±SD | 25.3±3.25 | 77.85±90.09 | 9.23±0.7 | 40.24±68 |
| | | P value | <0.001 | - | - | 0.04 |
| **E2** | L | Mean±SD | - | 50±17.33 | - | 20.92±3.6 |
| | | P value | - | | - | <0.001 |
| **T** | L | Mean±SD | - | 35.4±17.8 | - | 12.85±1.6 |
| | | P value | - | | - | <0.001 |

*the numbers within the parentheses indicates the total number of subjects who were enrolled in the study.

**Table 6: Comparison of levels of levels of hormones in women with hyperthyroidism among different studies.**

| Study | Krassas et al | Veeresh | Lal et al | Present study |
|---|---|---|---|---|
| | | Mean±SD | Mean±SD | Mean±SD |
| **LH** | H/N | 55.95±8.64 | 5.5±1.29 | 13.23±5.04 |
| **FSH** | H/N | 2.15±0.92 | 3.78±0.75 | 3.93±1.77 |
| **PRL** | N | 11.79±2.52 NS | 18.01±1.06 | 19.73±4.46 |
| **TSH** | L | 0.14±0.08 | 0.14±0.05 | 0.15±0.023 |
| **E2** | H | - | - | 395.74±155.97 |
| **T** | H | - | - | 82.13±3.86 |

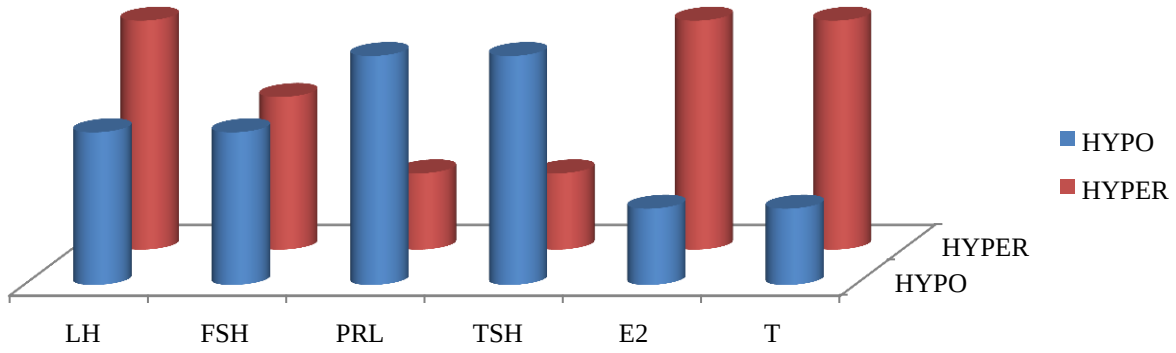


**Figure 3: Comparison between hormonal levels in hypothyroid and hyperthyroid patients.**

***Limitations***

The present study was an observational study. No controls were enrolled in the study. No intervention or follow up was done to the subjects involved so the effect of hormone replenishment or reduction could not be studied.

## CONCLUSION

The study demonstrated that thyroid disease in women causes menstrual abnormalities, mostly oligomenorrhea both in hypo and hyper thyroid women due to altered gonadotropin patterns which in turn alter ovarian hormone pattern. Fatigue was also the most common symptom among both hypothyroid and hyperthyroid subjects. Majority of the hypothyroid subjects were overweight. Hypothyroidism is associated with hyperprolactinemia with normal levels of LH, FSH and decreased levels of estrogen and testosterone, leading to anovulation and abnormal menstrual cycle. Hyperthyroidism is associated with increased levels of LH, estrogen and testosterone with normal levels of PRL and FSH which lead to abnormal menstrual cycles in women of reproductive age group.

*Funding: No funding sources*
*Conflict of interest: None declared*
*Ethical approval: The study was approved by the Institutional Ethics Committee*

## REFERENCES

1. Ellis H. The early days of thyroidectomy. J Perioper Pract. 2011;21(6):215-6.
2. Veeresh T, Moulalli D, Sarma VHS. A study on serum FSH, LH, and prolactin levels in women with thyroid disorders. Int J Scientif Res. 2015;5(3).
3. Krassas GE, Poppe K, Glinoer D. Thyroid function and human reproductive health. Endocr Rev. 2010;31(5):702-55.
4. Koutras DA. Disturbances of menstruation in thyroid disease. Ann N Y Acad Sci. 1997;816:280-4.
5. Kalra S, Unnikrishnan AG, Sahay R. Thyroidology and public health: the challenges ahead. Indian J Endocrinol Metab. 2011;15(2):73-5.
6. Azziz R. Diagnosis of polycystic ovarian syndrome: the rotterdam criteria are premature. J Clin Endocrinol Metabol. 2006;91(3):781-5.
7. Saran S, Gupta BS, Philip R, Singh KS, Bende A, Agroiya P, et al. Effect of hypothyroidism on female reproductive hormones. Indian J Endocrinol Metabol. 2016;20(1).
8. Lal RZ, Biyani S, Lodha R. Correlation of thyroid hormones with fsh, lh and prolactin in infertility in the reproductive age group women. IAIM. 2016;3(5):146-50.
9. Krassas GE. Thyroid disease, menstrual function and fertility. Fertil Steril. 2000;74(6):1063-70.
10. Jameson JL, Mandel SJ, Weetman AP. Thyroid gland and physiology and testing: Harrison principles of internal medicine. 20th ed. USA: McGraw Hill; 2018: 2701.
11. Salvatore D, Daves TF, Schlumberger MJ, Hay ID, Larsen PR. Thyroid physiology and diagnostic evaluation of patients with thyroid disorders. Williams endocrinology. 13th ed. Philadelphia: Elsevier; 2016: 336.
12. Kanwar G, Jain N, Shekawat M, Sharma N. Estimation of LH, FSH, prolactin and TSH levels in Polycystic Ovarian Syndrome and Correlation of LH and FSH. J Family Med Prim Care. 20198(1):256-60.

**Cite this article as:** Vasudevan MS, Hosalli N. A study of gonadal dysfunction in women with thyroid disease. Int J Adv Med 2022;9:243-8.