------ Raf. J. Sci., Vol. 28, No.4, pp. 1-7, 2019------

Evaluation of Thyroid Stimulating Hormone and Thyroid Hormone Concentrations in Females with Hypothyroidism and Hyperthyroidism

***Payman A. Hamasaeed**
Department of Biology / College of Education / University of Salahaddin
Saeed Kh. Hussain
Department of Microbiology /College of Medicine/ Hawler Medical University
Sana M. Ashraf
Department of Pathological analysis / College of Science/ University of Knowledge
***E-mail:** paymanakram@yahoo.com

(Received 6 / 3 / 2018 ; Accepted 15 / 4 / 2019)

ABSTRACT

This study was designed to evaluate thyroid stimulating hormone (TSH) and thyroid hormones Concentrations. Setting of the present study was performed in Teaching Hospital in Erbil city - Iraq from 1st of October 2017 to 1st of March 2018. A total of 433 female were participated for blood tests to estimate thyroid function. Only 323 (74.6%) cases showed overall variation in hormonal level and 110 (25.4%) cases were normal. According to educational statue most of cases were with Bachelor level (67%). Generally 291(90%) of cases were married. 52% of the cases were 41 to 45 age group and 14.2 % cases was in both 26 to 30 and 31-35 age groups.

About 59 (18.3%) cases had high TSH level only 13 (4%) case is considered as hypothyroidism when examined by consultation and collaboration with senior physician, while 54 (16.7%) cases had low TSH level but 41(12.7%) cases were considered hyperthyroidism. The result shows that 4 (1.7%) case have high T_3 level and 52 (16.09%) case have low T_3 level**.** While 26(8.04%) case have high T_4 level and 61 (18.9%) case have low T_4 level. In conclusion, we believe that thyroid diseases are more prevalent in women in Erbil and hyperthyroidism patient was more than hypothyroidism.

Keywords: Hyperthyroidism, Hypothyroidism, TSH ,T_4,T_3.

تقييم تركيز هرمون منبه الدرقية وهرمونات الغدة الدرقية في الإناث المصابات بقصور الغدة الدرقية وفرط نشاط الغدة الدرقية

الملخص

صممت هذه الدراسة لتقييم تركيز هرمون منبه الدرقية TSH وهرمونات الغدة الدرقية. أجريت الدراسة في المستشفى التعليمي في مدينة أربيل/ العراق للفترة ما بين الأول من تشرين الأول 2017 إلى الأول من آذار 2018، من مجموعة تكونت من 433 أنثى شاركن في فحوصِات الدَمّ لتقدير وظيفة الغدة الدرقّيةِ، فقد أظهرت 323 (74.6 %) حالة اختلافاً عامّاً في المستوى الهرموني، بينما كانت 110 (25.4 %) حالات طبيعية. أما بالاعتماد على المستوى الدراسي فإنّ معظمهن (67%) حاصلات على الشهادة الجامعية الأولية (البكالوريوس)، وكان معظمهن متزوجات (90%). كما تبيّن أنّ (52%) منهن كن ضمن الفئة العمرية 41–45 و(14.2%) ضمن كل من فئات 26–30 و31–35.

تبيّن أن 59 (18.3 %) من الحالات كَان مستوى TSH لديهن عالياً، واعتبرت 13 (4 %) من هذه الحالات قصوراً في إفرازات الغدة الدّرقية عندما فحصن ذلك بعد التّشاور والتعاونَ مَع الطبيبِ المختصِ، في حين كان مستوى TSH لدى 54 (16.7 %) حالة منخفضاً، وعدّت 41 (12.7 %) منهن حالات مرضية من خلال فرطَ إفراز الغدة الدرقية. كما أظهرت النتائج بأنّ 4

(1.7 %) حالات كَانَت ذات مستوى عال من T_3، و52 (16.09 %) من الحالات كَانَت ذات مستوى منخفض من T_3. بينما اتسمت 26 (8.04 %) حالة بمستوى عالٍ من T_4 م، و 61 (18.9 %) حالة بمستوىً منخفضٍ من T_4.

الكلمات الدالة: فرط الغدة الدرقية، قصور الغدة الدرقية، TSH، T_4، T_3.

INTRODUCTION

The thyroid gland is located in front of the larynx on either side and anterior to the trachea and is shaped like a butterfly. It produces thyroxine, a hormone that regulates the metabolic activity of the body. Over activity of the thyroid gland [Hyperthyroidism (thyrotoxicosis)] is the condition that occurs due to excessive thyroid hormone of any cause and therefore includes hyperthyroidism. Signs and symptoms vary between people and may include speeding up of metabolism, weight loss, temperature elevation, nervousness and irritability, but under activity of the thyroid gland [Hypothyroidism (myxoedema)] which is a common endocrine disorder resulting from deficiency of thyroid hormone or, more rarely, from their impaired activity at tissue level leads to inadequate production of thyroid hormones and a slowing of metabolism, deepens the voice, causes weight gain, water retention, retards growth and mental development in children. Both conditions also alter hair and skin growth, bowel function and menstrual flow (Ilse, 2011; Beers *et al*., 2006).

In the United States hyperthyroidism affects about 1.2% of the population. About half of these cases have obvious symptoms while the other half do not. It occurs between two and ten times more often in women. The disease is more common in those over the age of 60 years. Subclinical hyperthyroidism modestly increases the risk of cognitive impairment and dementia (Rieben *et al*., 2016). While the prevalence of hypothyroidism is 0.3% to 0.4%, increasing with age, and more females are affected (Muller *et al*., 2008).

The list of differential diagnoses for hypothyroidism is long, because the most frequent presenting symptoms are nonspecific, which is as follows: Addison disease, sleep apnea, anovulation, autoimmune thyroid disease and iron deficiency, pregnancy, chronic fatigue syndrome, constipation, De Quervain thyroiditis, depression, eosinophilia-myalgia syndrome, erectile dysfunction, fibromyalgia, nontoxic, goiter, hypercholesterolemia, hypochondriasis,panhypopituit arism, ileus, hypothermia, menopause, myxedema coma or crisis, ovarian insuffi-ciency, polyglandular autoimmune syndrome, sleep dis-orders, subacute thyroiditis, lymphomas, thyroxin-binding globulin deficiency, and euthyroid sick syndrome (Eskes *et al*., 2010; Levy *et al*., 2012). Objective of this study were the following:

1- To determine the educational status, marital status and age groups of our population which consist of 433 female in Erbil city -Iraq.

2- To evaluate variations in thyroid stimulating hormone and thyroid hormones levels.

3- To Estimate the levels of TSH,T_3 and T_4 among female with hypothyroidism and hyperthyroidism.

4- Stimulation and enhance abnormal thyroid function in female to initial treatment medications to slow down or increase thyroid hormone production.

MATERIALS AND METHODS

Experimental design: This study was designed to analyze the ordering pattern of thyroid tests related for 433 females (outpatient and in-patient) with different age groups that referred by clinicians to hormones lab in Erbil Teaching Hospital from 1st of October 2017 to 1st of March 2018 for thyroid function tests for the first time in order to diagnose whether they have a thyroid disorder. A structured questionnaire was used for the collection of information from the females. With the help of questionnaire, information relevant to the study about their personal history (educational status marital status, age, duration of any symptoms they feel, use of medication was taken and question regarding their regularity of menstrual cycle). Exclusion criteria included

pregnant women and menopausal women (women were considered to be menopausal if more than one year had elapsed since their last menstrual period).

Sample collection: Blood samples were collected with the help of professional technicians from the inner side of the elbow by using 5cc syringes. Then samples tubes were brought to hormones lab and incubated at 37 C^o for 40 minutes. Then serum was centrifuged at 3000 rpm for 20 minutes and stored at -40 C^o in eppendorfs till the time of assay.

Technique used: Samples were analyzed by the Electrochemiluminesence immunoassay intended for use on Eleccsys and Cobas immunoassay analyzers. Machine was calibrated and the serum was prepared and processed according to manufacturer's instructions. Analysis of results was done to find out the percentage of abnormal reports. The criterions for abnormal reports were results higher or lower than the reference interval.

Data entry and analysis: Each returned questionnaire was given an identity number (ID). Prior to data entry and analysis, the questions of study were coded. The data was entered into a Microsoft Excel Spreadsheet, after data cleaning; descriptive statistics (numbers and percentage) were calculated for all variables. T-test and chi square were used for analysis the data by Graph Pad Prism 6.

RESULTS AND DISCUSSION

Blood tests for thyroid function are an important part of the process for diagnosing thyroid disease and treating thyroid conditions. From 433 female that referred by clinicians to hospital for these test 110 (25.4%) female were normal to these tests and 323(74.6%) were shows abnormality in these tests as shows in (Table 1).

Table 1: Blood tests for thyroid function for 433 female

Cases	Number	%
Normal thyroid function female	**110**	**25.40%**
Abnormal thyroid function female	**323**	**74.60%**
Total	**433**	**100.00%**

Table 2: Distribution of abnormal thyroid function females according to educational statue

Educational statue	Number of cases	%
Bachelor level	**217**	**67%**
Below the Bachelor level	**84**	**26%**
Cannot write and read	**22**	**7%**
Total	**323**	**100%**

(Table 3) indicated that according to marital status 291(90%) of cases were married and the remain 32(10%) not married .

Table 3: Distribution of abnormal thyroid function females according to marital status

Marital status	Number of cases	%
Married	**291**	**90%**
Not married	**32**	**10%**
Total	**323**	**100%**

As per age wise distribution it is seen in (Table 4) that, the most prevalent abnormal thyroid function females is 52% of the 41 to 45 age group and it was 14.2 % in both 26 to 30 and 31-35 age groups. Only one 0.3% case in the age group of 45-50.

The results of this study were found to be coincided with findings of many other studies which reported that the incidence of hypothyroidism in females is more Moreover, it was most common thyroid disorder and it is six times more common in women. A study was conducted on distribution of 25237 thyroid patients in different age and sex revealed that thyroid problems prevailed more in females 73%, the percentage of adult group (<40) was 64.0% then old age (>40) was 27%. (Khattak *et al*., 2001). Another study demonstrated that the prevalence of thyroid diseases occur nearly 10 times more common in females (Devdhar *et al*., 2007). Faisal; 2010 showed that spectrum of thyroid disorders among Iraqi females was 14.45% hypothyroidism. Mahadevan (2010) concluded that thyroid disorders were found to be higher in females. Also recent study on 300 patients thyroid dysfunction was present in 68% females and elderly population had more incidences (Senthil *et al*., 2015). Other researchers aimed to explore the impact of gender and age on Thyroid Function in a large Chinese cohort. Females had higher incidence of thyroid dysfunction with 35 years < age ≤ 45 years (Venkateshwarlu *et al*., 2013) and (Meng *et al*., 2015).

Table 4: Distribution of abnormal thyroid function females according to Age groups

Age groups of abnormal thyroid function females	Number of cases	%
20-25	**37**	**12%**
26-30	**46**	**13%**
31-35	**46**	**15.5%**
36-40	**24**	**7.4%**
41-45	**169**	**52%**
46-50	**1**	**0.3%**
Total	**323**	**100%**

From 323 cases 59 (18.3%) case have TSH reading above 4.0 mIU/L is considered high TSH levels and typically indicates an underactive thyroid gland, which produces too little thyroid hormone. This is known medically as hypothyroidism which only 13 (4%) case in this study when examined by consultation and collaboration with senior physician at Teaching hospital.

The most common reason cause hypothyroidism are Hashimoto's Thyroiditis, problems with the Thyroid Itself or thyroid has been surgically removed, Medications, abnormal Growths in the thyroid, Problems in the Pituitary and Genetic Defects. Replacing thyroid hormone and altering diet are crucial for the safe and effective treatment of an underactive thyroid (Pappa and Alevizaki, 2013). While TSH values were lower 0.4 mIU/L in 54 (16.7%) of cases. The reason was typically indicates an over active thyroid gland, which produces too much thyroid hormone, but medically the clinicians consultation only diagnosed 41(12.7%) cases as hyperthyroidism, it can be caused by an autoimmune disease (known as Graves' disease), excessive iodine in the body, or an overdose of synthetic thyroid hormone (Mahadevan, 2010). Statistical analysis showed significant differences ($P > 0.05$) as shown in Fig. (1) and non significant differences for TSH cases Fig. (2).

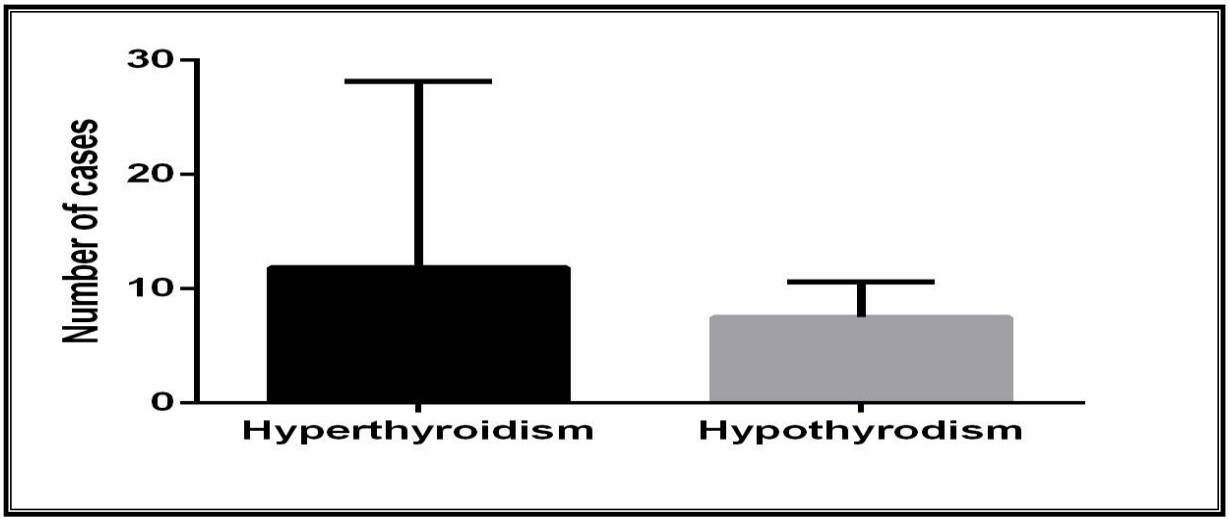

Fig. 1: T-test graph by (GraphPad Prism 6) for Hypothyrodism and Hyperthyroidism cases

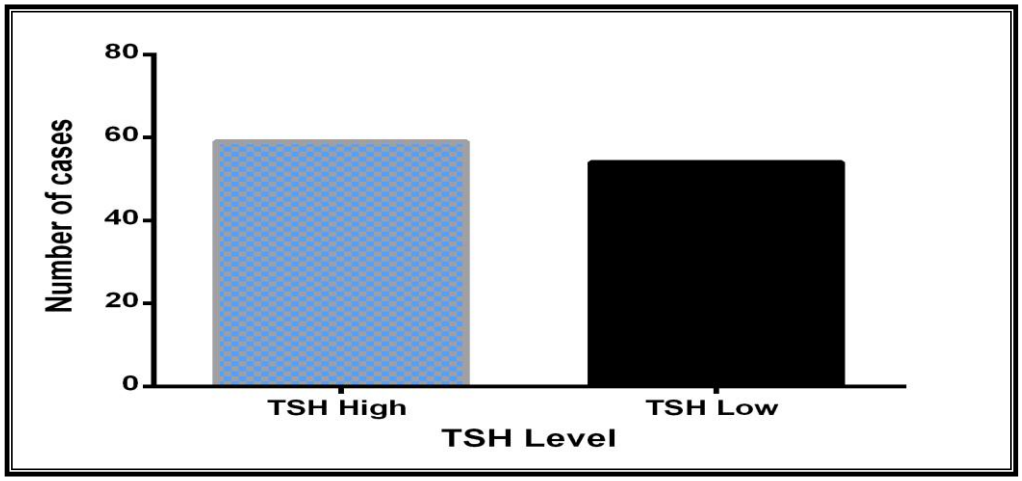

Fig. 2: T-test graph (by GraphPad Prism 6) for TSH Level in study cases

In our study 4 (1.7%) case have T3 reading above 6.5 pmol /L and 52 (16.09%) case less than 3.5 pmol /L. While 26(8.04%) case have T4 reading above 20 pmol /L and 61 (18.9%) case less than 10 pmol /L .Statistically chi square indicate significant differences (<0.05) p-value 0.0013 as shown in Fig. (3).

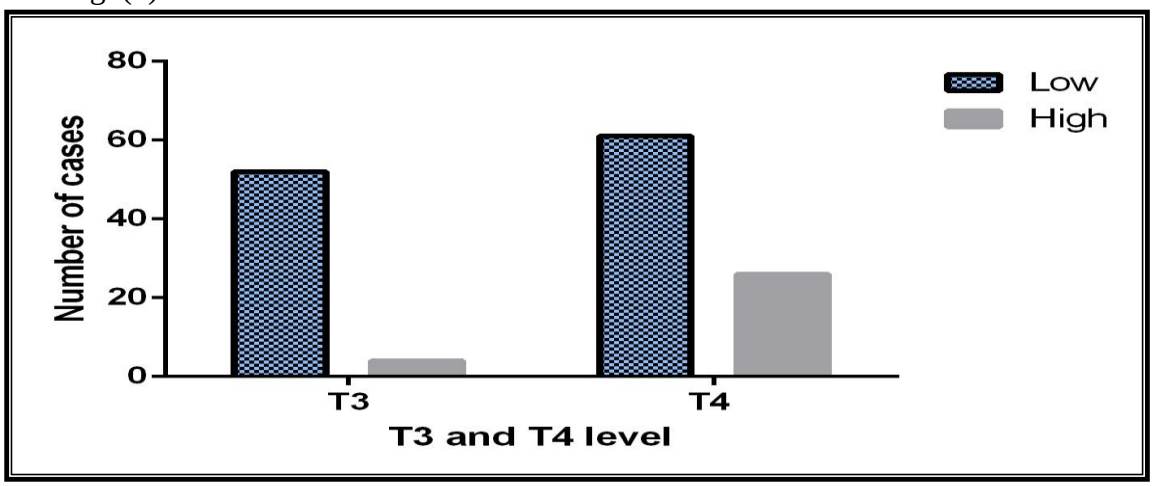

Fig. 3: chi square by (GraphPad Prism 6) for T3 and T4 Level in study cases

Some clinical studies have found that both T3 and TSH levels can decline at the same time, particularly in obese individuals that lose weight (Dietlein *et al*., 2008; Kok *et al*., 2005). The results of (Al-Kattan *et al*., 2018) showed positive effects as a significant increase ($P \leq 0.0001$) in thyroid stimulating hormone and Thyroid hormones T4 and T3 in rabbit's serum that drenched 6ml pomegranate juice /Kg body.

Certain medications, such as metformin, are also known to independently lower TSH levels in diabetics and polycystic ovary syndrome (PCOS) patients with thyroid issues (Pappa and Alevizaki, 2013). This means that overall external stressors are known to influence TSH levels, independently of thyroid hormone levels, and TSH on it's own is not always a reliable indicator of thyroid health.

TSH levels can also be used to effectively monitor patients being treated with thyroid hormone. However, it should be noted that TSH results may be misleading during the several months required for full equilibration of thyroid physiology following initiation or significant alteration of a treatment regimen. Total or free T4 generally serve as the front-line assays during this period. Once equilibration has occurred, high TSH levels usually indicate under-treatment, while low values usually indicate over-treatment. Again, abnormal TSH values should be interpreted with the measurement of free thyroid hormone before modifying therapy because serum thyroid hormone levels change more quickly than TSH levels. Thus patients who have recently been started on thyroid hormone, or who have been noncompliant until shortly before an office visit may have normal T_4 and T_3 levels, though their TSH levels are still elevated. TSH levels may be affected by acute illness and several medications, including dopamine and glucocorticoids (Roelfsema *et al*., 2009).

The high prevalence rate of thyroid disorders around the world and also in Iraq seem to associate with iodide deficiency, other factors such as environmental contamination and genetic defect should be more effect. Then the governments in most countries have policy to use iodizing salt, also starting in Iraq since 1990 (Faisal, 2010). Thyroid diseases are more prevalent in women particularly between puberty and menopause, and women are more susceptible to the goitrogenic effect of iodine deficiency (Santin and Furlanetto, 2011).

These epidemiological studies suggested the role of female hormones such as oestrogen hormone in the pathogenesis of thyroid diseases. Oestrogen has a well-known to have indirect effect on thyroid gland by increasing the thyroxin binding globulin (Ben *et al*., 1987), and it's need with thyroid hormone in hypothyroid women (Arafah, 2001).

CONCLUSION

The diagnosis of thyroid dysfunction in these patients may be difficult because of different interpretation of thyroid function tests. There was a higher crude prevalence of hyperthyroidism as compared with hypothyroidism in the female with thyroid diseases in our study.

REFERENCES

Al-Kattan, M.M.; Muna, H.J.; Abeer, A.A. (2018). Effect of pomegranate juice (Punica granatum L.) on some hormones and histological features of aorta in healthy and ovariectomized white female New Zealand rabbits (Oryctolagus cuniculus). *Raf. J. Sci*., **27**, 35-48.

Arafah, B.M. (2001). Increased need for thyroxine in women with hypothyroidism during strogen therapy. *New Eng. J. Mede*., **344**,1743–1749.

Beers, M.H.; Porter, R.S.; Jones, T.V. (2006). "The Merck Manual". 18th ed., Whitehouse Station: Merck Research Laboratories, pp. 99-103.

Ben, R.Z.; Struass, J.F.; Arendash, D.B.; Mastroianni, L.; Flickinger, G.L. (1987). Changes in thyroid function tests and sex hormone binding globulin associated with treatment by gonadotropin. *Ferti. and Ster. J.*,**48**, 318–320.

Devdhar, M.; Ousman, Y.H.; Burman, K.D. (2007). Hypothyroidism endocrinology and metabolism. *Clinics of North America*., **36**, 595–615.

Dietlein, K.G.; Kobe, C.S.; Derwahl, K.SH. (2008). Obesity, energy regulation and thyroid function: is borderline elevated TSH-level the cause or secondary phenomenon of obesity. *Nuklearmedizin* ., **47**(5), 181-7.

Eskes, S.A.; Endert, E.; Fliers, E.; Wiersinga, W.M. (2010). Prevalence of growth hormone deficiency in hashimoto's thyroiditis. *J. Clin. Endocrinol. Metab.*, **95**(5), 2266-2270.

Faisal, A.H. (2010). Study of thyroid hormones among female Iraqi thyroid disorders. *The 2nd Annual International Conference of Northeast Pharmacy Research, Thailand*., **2**, 250-255.

Ilse, T. (2011). Clinical review: hyper- and hypothyroidism. evidence-based Pharmacy Practice. *S Afr. Pharm. J*.,**78**(6), 10–14.

Khattak, Kh.N.; Shahmim, A.; Alam, Kh.M.; Mohsin, S.; Gul, N. (2001). Distribution of thyroid patients between age groups, sex and seasons in the thyroid patients referred to irnum peshawar. *J. Medl. Sci*., **1** (6), 400-403.

Kok, P.; Roelfsema, F.; Langendonk, J.; Frölich, M.; Burggraaf, J.; Meinders, A.; Pijl, H. (2005). High circulating thyrotropin levels in obese women are reduced after body weight loss induced by caloric restriction. *J. Clin. Endocrinol. Metab.*, **90**(8), 4659-63.

Levy, E.G.; Ridgway, E.; Wartofsky, L. (2012). Algorithms for diagnosis and management of thyroid disorders. http://www.thyroidtoday.com.

Mahadevan, S. (2010). "Graves' Diseases In Text Book of Endocrinology". Dharmalingam Jaypee Brothers Medical Publishers Ltd India. pp. 83-96.

Meng, Zh.; Ming, L.; Qing, Z.; Li, L.; Kun, S.; Jian, T.; Qiang, J.; Guizhi, Z.; Renfei, W.; Yajing, H.; Xiaojun, Ren.; Mei, Z.; Qing, H.; Shen, W.; Xue, Li.; Tianpeng, H.; Na, L.; Arun, U.; Pingping, Z.; Jianping, Z. (2015).Gender and age impacts on the association between thyroid function and metabolic syndrome in Chinese. *Medicine (Baltimore).*, **94**(50), e2193.

Muller, A.F.; Berghout, A.; Wiersinga, W. (2008). Thyroid function disorders – guidelines of the netherlands association of internal medicine. *Neth. J. Med*., **66**(3), 134-142.

Pappa, T.; Alevizaki, M. (2013). Metformin and thyroid: an update. *Eur. Thyroid. J.*, **2**(1), 22-8.

Rieben, C.; Segna, D.; da, C.; Bruno, R.; Collet, T.; Chaker, L.; Aubert, C.E.; Baumgartner, C.; Almeida, O.P.; Hogervorst, E.; Trompet, S.; Masaki, K.; Mooijaart, S.P.; Gussekloo, J.; Peeters, R.P.; Bauer, D.C.; Aujesky, D.; Rodondi, N. (2016). Subclinical thyroid dysfunction and the risk of cognitive decline: a meta-analysis of prospective cohort studies. *J. Clin. Endocrinol. Metab*., **101**(12),4945-4954.

Roelfsema, F.; Pereira, A.M.; Veldhuis, J.D. (2009). Thyrotropin Secretion Profiles are not Different in Men and Women. *J. Clin. Endocrinol. Metab*., **94**(10), 3964-3967.

Santin, A.P.; Furlanetto, T.W. (2011). Role of estrogen in thyroid function and growth regulation. *J. Thyroid Res.*, 1-7.

Senthil, N.; Sneha Th.; Santosh, S. (2015). A study of prevalence of thyroid dysfunction in patients with metabolic syndrome. *Int. J. Res. Med. Sci*., **3**(11), 3171-3176.

Venkateshwarlu, N.; Gandiah, P.; Sivarajappa, P. Indira, G. (2013). Thyroid disorders in type 2 diabetes mellitus. *Inter. J. Recent. Trends. in Sci. and Tech*., **9**, 250-255.