



## RESEARCH PAPER

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## Prevalence of hypothyroid disease: A cross sectional study at a higher rate among young male and female population of Balochistan, Pakistan

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### Abstract

Hypothyroidism is a condition in which the thyroid gland fails to function adequately as a result the level of thyroid hormone is reducing in body. Thyroid hormones rise up cellular activity across the body generally enhancing metabolism. Iodine deficiency resulting from insufficient intake of dietary iodine is the most common cause of hypothyroidism worldwide. One hundred and ninety seven patients were analyzed by radioimmunoassay in in this study. Out of total 197 hypothyroid patients 167 (84.77%) were female and 30 (15.55%) were male. The estimated male - female ratio were 1:6 respectively. Results show that about 28 (93.33%) male and 147 (88.02%) female were using simple salt while only (23.33%) male and 56 out of 167 females were using iodized salt.

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## Introduction

Hypothyroidism is a communal clinical disorder results from deficiency of thyroid hormones thyroxine (T<sub>4</sub>) and tri-iodothyronine (T<sub>3</sub>). It is a condition in which the thyroid gland fails to function adequately resulting in reduce levels of thyroid hormone in the body (Paynter *et al.*, 1988). Thyroid is a small butterfly shaped gland at the base of the front of neck just below the Adam's apple. It plays a key role in regulating the body metabolism (Society *et al.*, 2007). Thyroid hormones ramp up cellular activity throughout the body generally boosting metabolism. Dysfunction of thyroid gland causes physical, mental slowing, mental retardation and dwarfism (Malik and Butt, 2008). The pathological findings in hypothyroid patients are addition of hyaluronic acid and other glycosaminoglycan in the interstitial tissues. The principal hormones of thyroid gland are T<sub>4</sub> and T<sub>3</sub>; their concentration ratio is 93% and 7% respectively. Both T<sub>4</sub> and T<sub>3</sub> are iodine containing amino acids. T<sub>3</sub> is about four times potent as compare to T<sub>4</sub> but it is present in blood in much smaller quantities and persists for shorter time than does T<sub>4</sub> (Ahmed *et al.*, 2009). The incidence of hypothyroidism is about 3.5/1000 in females and 0.6/1000 in males (Vanderpump *et al.*, 1995). Various epidemiological surveys indicate that the female to male ratio in hypothyroidism ranges from 2:1 to 8:1 (Helfand and Crapo, 1990). The disorder becomes increasing common with advance age, affecting about 2-3% of older women (Sawin *et al.*, 1979).

Iodine deficiency resulting from insufficient intake of dietary iodine is the universal cause of hypothyroidism worldwide; in iodine-replete countries, the predominant cause of hypothyroidism is the autoimmune condition Hashimoto's disease. Other common causes of primary thyroid failure include idiopathic atrophy, previous treatment with radioiodine, thyroidectomy, anti-thyroid drugs, other drugs e.g. lithium amiodarone, sub-acute and silent thyroiditis. Uncommon causes include dyshomonogenesis, agenesis and infiltrative disease while cause of secondary thyroid failure is disease of the hypothalamus or pituitary (Franklyn, 2009).

Thyroid stimulating hormone (TSH) synthesis in the anterior pituitary is enthused by thyrotropinreleasing hormone (TRH) and inhibited by thyroid hormone in a classical endocrine negative feedback loop. Thyrotropin releasing hormone (TRH) is the last serious hormone, produced in the brain region called hypothalamus, which monitors the thyrotropin levels (Rosen 2001).

Iodine deficiency is common reason of thyroid dysfunction. In Pakistan iodine deficiency is a severe public health problem. According to UNICEF (1999) about 50 million people were suffering from iodine deficiency and women are mostly facing severe type of iodine deficiency. An about 70% of the total population in Pakistan is at threat of iodine deficiency disorder (Bellamy, 1999).

The aim of this cross-sectional study was to determine the prevalence of hypothyroidism in male and female population of Balochistan. Further to investigate the correlations of hypothyroidism with most prevalent clinical examinations, gender based clinical manifestations and family history of the subjects. Pathogenic relationships of hypothyroidism with high risk other medical problems, multiple direct and indirect actions of thyroid hormone, dietary influences and probable iodine deficiencies threats in different age groups of Balochistan. This current study also evaluates the effects of other factors like, education, family history, socio-economic status, smoking, maternal status, age and weight on hypo thyroid disorder.

## Materials and Methods

The study was conducted in CENAR (Centre for Nuclear Medicine and Radiotherapy), Cancer Hospital Quetta, Pakistan. All samples were collected from CENAR (Centre for Nuclear Medicine and Radiotherapy), Quetta, and Bolan Medical Complex Hospital, Quetta.

## Sampling

In the present hospital based study, 197 patients were enrolled from the cities of Balochistan, process between July 2012 to December 2013.

The enrolled subjects were interviewed by professional trained doctors, using a standard and detailed questionnaire that include participant's name, age, gender, height & weight, ethnic group, education; socio-economic measures, occupation and monthly income that was again divided into lower, middle and high classes according to their income. Family-related questions comprised of marital status, number of children and family system. Other categories of question sets were; general physical examinations (Symptoms), symptoms particularly related to women and symptoms related to men, either family history shows any thyroid disease or any auto-immune disease prevailing, information about current treatment of the disease, association with other medical problem/disease, age at which disease diagnosed, symptoms since, pregnancy after disease diagnosed, smoking habits, diet patterns especially of salt, sea food and dairy etc.

The subjects were divided on the bases of ages into five groups childhood (1-15), younger (16-25), middle (26-35) and (36-45) and old (46-55 and 55 above). And on the Basis of social economic status the subjects were dispersed into 03 classes: Poor class (Rs 10,000-20,000), middleclass (Rs 21, 0000-40,000) and upper class (Rs< 40,000).

#### Procedure

Radioimmunoassay (RIA) technique used to measure the ratio count. It is a very sensitive *in vitro* assay technique used to

Measure concentrations of antigens i.e., thyroid hormone levels in the blood by use of antibodies.

T3 and T4 were estimated by direct kit RIA method using percipient of RIA FT3 IM-1589-IM3320 and RIA FT4 IM1363-IM3321respectively by Beckman Coulter, Czech Republic. However TSH was estimated by RIAKEY TSH IRMA Tube RIA kit method made of Shin Jin Medics Inc, Korea

#### Results

The study was conducted during the period of 25.07.2012 to 26.12.2013 in CENAR Cancer Hospital Quetta. The patients from all over the Balochistan were referred for their thyroid tests. Total 1075 number of patients was visited during the mentioned study period. After blood test 197 subjects were diagnosed as hypothyroid patients.

Table No 1 shows that out of total 197 hypothyroid patients 167 (84.77%) were female and only 30 (15.55%) were male. The approximate male - female ratio would be 1:6 respectively. It was observed that mostly females belongs to young age group15-25 (23.95%), 26-35 (22.15%) and 36-45 (26.94) were affected by hypothyroid disease on the other hand in males also young group 26-35 years about (36%)were most affected by this disease.

**Table 1.** General Characteristic's hypothyroid male and female subjects.

Characteristics	Male N=30	(%)	Female N=167	(%)
Age (years)				
1-15	02	0.32	18	10.77
16-25	06	20	40	23.95
26-35	11	36	37	22.15
36-45	04	13.33	45	26.94
46-55	05	16.6	15	8.98
56 and above	2	0.32	12	7.18
Education				
Illiterate	2	0.32	70	41.91
Primary	13	43.3	34	20.35
Middle	2	0.32	21	12.57
Secondary	3	10	20	11.97
Intermediate	6	20	13	7.78
Graduate	5	16.6	4	2.39
Master	1	3.3	5	2.99
Family History				
	Yes			

Characteristics	Male N=30	(%)	Female N=167	(%)
No				
Location				
Urban	16	53.33	80	47.90
Rural	14	46.66	87	52.09
Socio-economic status				
Upper class	04	13.33	25	14.97
Middle class	15	50	99	59.81
Lower class	11	36.66	43	25.74
Smoking				
Smokers	25	83.33	36	21.55
Non smokers	05	16.66	131	78.44
Maternal Status				
Married	23		120	
Unmarried	7		47	
Disease diagnosed Before marriage	5		7	
Disease diagnosed after marriage	18		113	
Fertility				
After disease did not conceive child	5		80	
After marriage did not conceive child	4		15	

Most of the subjects 72 out of 197 in which 2 (0.32%) male and 70 (41.91%) female were illiterate; while other 13 (23.3%) male and 34 (20.35%) female having only primary level education and 5 (16.6%) males and 4 (2.39%) female having graduate level of education. Only 5 out of 197 subjects having master degree. There were 135 women were house wives out of the total 167. Most of the 50% males and 59.81% females are among middle class having monthly income between Rs. 16000-30000. We found that 13.33% males and 14.97% females belongs to the upper class socio economic status. While 36.66% males and 25.74% females belong to lower class. In this study 25(%) males and 36(%) females hypothyroid patients who were using tobacco/cigarettes. About 04 (36%) male subjects belongs to nuclear and 26 (66%) belongs to combined family system. While 51 (30.53%) females having joint or combined family system and 116 (69.46%) had nuclear family system. There were a total number of 120 females who were married. There were only 20% (21) incidences when pregnancy had occurred after the disease (hypothyroid) diagnosed.

Whereas other 80 did not conceive child after the disease diagnosed. In 94% (113) women the disease was diagnosed after marriage and 7 (5.83%) before marriage while in men this ratio is 78% (18) where the disease diagnosed after marriage and 21.73% (5) before marriages. Out of a total 120 married women, 15 women having no children. There were 7 women whose disease was diagnosed before marriage. Out of these seven women four women had no children, while the remaining 3 had only one child. In men, there were 22% married and having no children. 4 men out of total 23 after marriage having no children.

Table 2 shows mean and standard deviation values of age, weight, height T3, and T4 and TSH variables. Only parameters like height ( $P > 0.001$ ) and T3 ( $P > 0.030$ ) shows statistically significant *p. value* between male and female population. Age, weight, T4 and TSH values indicate that there was no significant difference in these variables between male and female groups.

**Table 2.** Comparative cross sectional statistical analysis of age, weight, height, T3, T4 and TSH in Male and female hypothyroid patients.

Parameters	Male N=30 Mean + Std	Female N=167 Mean + Std	P Value
Age (year)	33.667± 13.847	33.579± 14.425	0.975
Weight (Kg)	69.233± 13.221	65.257± 16.914	0.223
Height (cm)	62.000± 6.017	58.771± 4.739	0.001*
T3	2.160± 0.687	2.665± 1.051	0.030*
T4	10.297± 4.463	11.695± 4.404	0.123
TSH	17.267 ± 15.004	15.843 ± 11.231	0.546

Table 3 shows the distribution of diet and food consumption frequency on hypothyroid patient's frequencies among male and female population. Our results demonstrate that about 28 (93.33%) male and 147 (88.02%) female hypothyroid patients using simple salt while only (23.33%) male and 56 out of

167 females using iodized salt. And only (22%) 43 of hypothyroid patients including male and females using sea foods and 78% (154) of the hypothyroid patients were exclusively not using the fish/sea food. Whichever they do not like it or cannot afford the higher price.

**Table 3.** Distribution of the hypo thyroid male and female subjects according to the nature of Dietary.

Male N =30		
Dietary Nature	Yes	No
Cabbage, Turnips Cauliflower	01 (3.33 %)	29 (17.36 %)
Dairy Products	12 (40 %)	22 (13.17%)
Sea Food	4 (13.33%)	26 (15.56 %)
Simple salt	28 (93.33%)	2 (1.19 %)
Iodized salt	7 (23.33 %)	23 (13.77%)
Female N=167		
Cabbage, Turnips Cauliflower	95(56.88 %)	72 (43.11 %)
Dairy Products	108 (64.67%)	59 (35.32 %)
Sea Food	39 (23.35 %)	128 (76.74 %)
Simple salt	147 88.02 %)	20 (11.97%)
Iodized salt	56 (33.53 %)	111 (66.46 %)

Table 4 presents different medical problems which were found in hypothyroid patients. High blood pressure was observed in 27 (16.16%) female and 7

(23.33%) in male subjects. There were 40 (23.95%) female hypothyroid patients having chest pain while 40 (23.95%) had high blood pressure.

**Table 4.** Hypothyroid patients having additional medical problems.

Symptoms % age	Male	Female
High Blood pressure	7 (23.33 %)	27 (16.16 %)
High Cholesterol	2 (6.66 %)	24 (14.37 %)
Heart Disease	1 (3.33 %)	6 (3.59 %)
Chest Pain	5 (16.66 %)	40 (23.95 %)

Table 5 shows the incidence of sign and symptoms such as fatigue, depression, unexplained weight loss, memory weak, increased sleeping, joint stiffness, dry skin, hard stool, unusual hair loss,

breathless ness, cracking nails, swelling at neck, sensation of lump in the throat, hand and feet numbness, hoarse voice in men and women hypothyroid patients.

**Table 5.** Sign and symptoms of hypothyroid patients.

S. No	Sign and Symptoms	Male N=30	Female N=167
1.	Fatigue	07 (23.33%)	41 (24.55%)
2.	Depression/Anxiety	26 (86.66%)	126 (75.44%)
3.	Unexplained Weight Gain	23 (76.66%)	75 (44.91%)
4.	Memory very weak/Loss	09 (30%)	58 (34.76%)
5.	Increased Sleeping	20 (66.66%)	101 (60.47%)
6.	Joint Stiffness & Pain	13 (43.33%)	70 (41.91%)
7.	Dry Skin	15 (50%)	85 (50.89%)
8.	Hard Stool	24 (80%)	81 (48.50%)
9.	Unusual Hair Loss	07 (23.33%)	49 (29.34%)
10.	Breathlessness	24 (80%)	119 (71.25%)
11.	Cracking Nails	04 (13.33%)	39 (23.35%)
12.	Swelling at the Front of Neck	11 (36.66%)	74 (44.31%)
13.	Sensation of a lump in the throat	06 (20%)	42 (25.14%)
14.	Hand & Feet Numbness	16 (53.33%)	81 (48.50%)
15.	Hoarse Voice	24 (80%)	50 29.94%)

Table 6 shows that erectile dysfunction and premature and late ejaculation (56.66%) and (60%) respectively observed in male hypothyroid patients.

And in females irregular menstrual and high menstrual was observed 45.50% and 79.04% respectively.

**Table 6.** Disease associated to men and women only.

S. No	Sign and Symptoms	Number (N)	Percentage (%)
Men only			
1.	Erectile Dysfunction	17	73.91%
2.	Premature and late Ejaculation	18	78.26%
Female only			
3.	Irregular Menstrual	76	45.50%
4.	High Menstrual	132	79.04%

## Discussion

This study majorly focused on hypothyroid incidence and prevalence of this disorder with other variables like gender, age, locality in different ethnic segments of Balochistan. Besides this socio-economic status, family system, number of children and stress was also investigated. Co-relation of hypothyroidism with most prevalent clinical examinations, gender based clinical manifestations and family history of the subjects. Pathogenic relationships of hypothyroidism with high risks other medical problems and multiple direct and indirect actions of thyroid hormone, dietary influences and probable iodine deficiencies threats in different ethnic groups of Balochistan.

Literacy in other word awareness level was very poor among the subjects. Those who were first time diagnosed as thyroid disorder did not know anything about the disease. Most of the subjects 72/197 were illiterate; while other 24% having only primary level education. Only 3% subjects had graduate-level education.

Hundred and ninety seven hypothyroid patients were identified through biochemical tests out of total thousand and seventy five subjects referred for thyroid test. The incidence of hypothyroid found in Balochistan in the duration of this study was 8%. Sawin *et al* 1985 reported that hypothyroidism affects 0.5-2.4% population (Sawin *et al.*, 1985).

The incidences of hypothyroidism are about 3.5/1000 in females and 0.6/1000 in males (Vanderpump *et al.*, 1995). Various epidemiological surveys showed that female to male ratio ranges from 2:1 to 8:1 (Helfand and Crapo, 1990).

In consistence with this ratio our study also shows an approximate female to male ratio 6:1 respectively. Out of total 197 hypothyroid patients 167 were female and only 30 were males; showing 85% representation of female and remaining 15% representation of males.

Sawin *et al.*, 1979 investigated that thyroid disorder becomes increasing common with advance age, affecting 2-3% of older women. In contrary to this study showed greater frequency about 53% among ages of 21-35 years in females and in another adjacent group 20% among ages of females between 35-50 years were affected. It was concluded that mostly females of 'young age group' was affected from hypothyroid disease. On the other hand males of the 'young age group' between 21-35 years also had a greater percentage of 53% of the total (Sawin *et al.*, 1979). The same findings were also observed in this study the young female age groups 16-25 and 26-35 about 24% and 22.15% respectively affected by this disease. And similarly in male's young age group 26-35 were also highly affected.

Worldwide, iodine deficiency resulting from insufficient intake of dietary iodine is the most common cause of hypothyroidism (Franklyn, 1999). In Pakistan iodine deficiency is a serious public health issue. According to UNICEF around 50 million people were suffering from iodine deficiency. A relatively current global report on vitamin and mineral deficiency in children estimated that in Pakistan for 2002-2007 period, on average only 17% households were consuming adequately iodized salt and nearly 64% school-aged children are iodine-deficient (Bellamy, 1999).



This research showed that 68% hypothyroid patients were using simple unfortified salt and only 32% using iodized salt. Especially in the rural areas of Balochistan where there is no concept of iodized salt or its benefits rather people having myths and misconceptions about it.

There is a correlation between maternal thyroid deficiency and future neurological development of the child especially possible importance of FT4 in first trimester (Morreale de Escobar *et al.*, 2000). Age based data of this study of hypothyroid group of newborn -15 years of age has revealed that such children having very low concentrations in their daily routine and subsequently were weak in studies as compare to other euthyroid siblings of the same parents.

Normal thyroid function is essential to keep normal reproduction either in females or in males. Experiments showed that hypothyroidism effects female ovarian function be decreasing levels of sex-hormone-binding-globulin and increasing the secretion of prolactin (Poppe *et al.*, 2008). Fetal loss was significantly greater in pregnant women with abnormal TSH values as compare to normal TSH values (Hallengren *et al.*, 2009). Observational measures of this study also suggest that there is a possible association between hypo active thyroid disorder and fetal loss. And those women whose disease was diagnosed before marriage 4 out of 07 had no children after marriage. Only one child was reported in remaining 03 women.

It was investigated during the research in past many decades that there is a possible role of thyroid autoimmunity (TAI) in the context of these disorders of infertility and pregnancy loss (Poppe *et al.*, 2008). This research study strongly in agreement with this view point of other researchers of the world. A larger number of married women, approximately 80% had no pregnancy after the hypothyroid disease diagnosed according to this research finding, only 20% had pregnancy. All of these women either had pregnancy or not, had complaints of miscarriages, even some times recurrent miscarriages.

Out of total 120 married women 15 (12.5%) women's married at child bearing age had never got pregnant and have no children. Male reproduction is adversely affected by hypothyroidism (Krassas *et al.*, 2010). In consistent with this, this study also showed that in men there were 5 (21.73%) ratio of married person who had no children.

It was found that in men with thyroid disorders may also experience some sexual dysfunctions. Erectile dysfunction reported to affect as many as 20-30 million men in the United States and 152 million men worldwide (Ayta *et al.*, 1999). In hypothyroid men, the prevalence of hypoactive sexual desire (HSD), delayed ejaculation (DE) and erectile dysfunction (ED) was 64.3% and premature ejaculation was 7.1% (Carani *et al.*, 2005). It was suggested that despite of the associated changes in sex hormones levels, the high prevalence of ejaculatory disorders and after treatment of thyroid disorder, their prompt reversibility suggests a direct involvement on thyroid hormones in the physiology of ejaculation (Carani *et al.*, 2005). This study in consistence with showing 17 (56.66%) hypothyroid men having erectile dysfunction (ED) disorder, all of these men had hypoactive sexual desire as well while 18 (60.00%) had premature or late ejaculation disorder.

There are several cross sectional studies that have suggested that subclinical hypothyroidism confers an elevated risk of atherosclerosis and coronary heart disease (Tieche *et al.*, 1981; Hak *et al.*, 2000). It was studied that clinical explanations of subclinical hypothyroidism include cardiac dysfunction (Biondi *et al.*, 1999). This study also indicates that 17.25% (34) hypothyroid subjects with high blood pressure, 3.5% having heart disease and 9% having chest pain. Tanis *et al.* (1996) analyzed that there is a co-relationship between sub clinical hypothyroidism and hypercholesterolemia. (Tanis *et al.*, 1996). In this study results shows that most of the people did not have idea for cholesterol results indicated that about 13.9% (26) higher cholesterol found among the patients.

Martin *et al.* 2002 reported that there is a decreased risk of thyroid cancer with consumption of fresh fruits and vegetables (Mack *et al.*, 2002). In this study about 17.25% (34) hypothyroid patients both male and females were using dairy products either in the form of milk or mostly yogurt. And nearly 15.22% (30) hypothyroid patients were often using raw vegetables like cabbage, cauliflower, radishes, and turnip.

Seafood is the only class of food that provides major of all those elements in order to overcome potentially major public health issues. Seafood provides 25% of vitamin D, 56% of vitamin B-12, 28% iodine and 23% selenium (Bourre and Paquette 2008). In this study results showed that 78% (154) both male and female hypothyroid patients were exclusively not using the fish/seafood. Either they do not like it or cannot afford the higher price.

Subclinical hypothyroidism which is defined as presence of elevated TSH level but normal free T4 levels. The prevalence of sub clinical hypothyroidism increases with age (Helfand and Crapo, 1990; Surks and Hollowell, 2007) The prevalence of subclinical hypothyroidism in general population is 1-10% but on the other hand it approaches about 15% in women who were 60 years of age (Canaris *et al.*, 2000). A study on age specific distribution of serum thyrotropin and antithyroid antibodies in US population was made in 2007. It was calculated that TSH distribution progressively shifts towards its higher concentration with age (Surks and Hollowell, 2007). The effect of smoking on thyroid function is controversial for years. It was revealed through study that smoking increases the metabolic effects of hypothyroidism (Müller *et al.* 1995). Present study also showed that about 83.33% male and 21.55% female hypothyroid patients were cigarette/tobacco smokers.

Krassas *et al.*, (1999) reported that hypothyroidism in women is less frequently associated with menstrual disturbances than previously described. Further menstrual irregularities tend to be more frequent in severe hypothyroidism in comparison with mild cases where no significant value found (Krassas *et al.*, 1999).

In this study we observed that 85% women had high menstrual flow while 49% women patients were having irregular menstrual periods.

### Conclusion

A high prevalence of hypo function of thyroid has been found in Balochistan during term of this study, greater than previous studies, with male-female ratio of 6:1 respectively. Contrarily to previous ones, this research has shown a higher frequency amongst young age group of 16-35 years both in males and in females. Whereas findings of the immunoassay results in this study strongly supported the previous idea of increased serum T3 and T4 concentrations during elderly and TSH distribution progressively shifts towards its higher concentration with age. Iodine deficiency which is an established cause of hypothyroidism; this study illustrated that 79% hypothyroid patients are using simple unfortified salt and only 30% using iodized salt on one hand. And on the other a strong agreement with other investigations regarding reproductive health of both males and females i.e., ovulatory dysfunction (Infertility), fetal loss, erectile dysfunction, late or premature ejaculation and hypoactive sexual desire, this study found a co-relationship.

### References

- Ahmed Z, Khan MA, Haq A, Rehman S.** 2009. Effect of race, gender and age on thyroid and thyroid stimulating hormone levels in north west frontier province, Pakistan. *J. Ayub Med Coll Abbottabad* **21(3)**.
- Bellamy C.** 1999. The state of the world's children 1999. Unicef.
- Biondi B, Fazio S, Palmieri EA, Carella C, Panza N, Cittadini A, Bone F, Lombardi G, Sacca L.** 1999. Left ventricular diastolic dysfunction in patients with subclinical hypothyroidism. *The Journal of Clinical Endocrinology & Metabolism* **84(6)**, 2064-2067.
- Bourre J-M, Paquette P.** 2008. Seafood (wild and farmed) for the elderly: contribution to the dietary intakes of iodine, selenium, DHA and vitamins B12 and D. *The Journal of Nutrition Health and Aging* **12(3)**, 186-192.



- Canaris GJ, Manowitz NR, Mayor G, Ridgway EC.** 2000. The Colorado thyroid disease prevalence study. *Archives of Internal Medicine* **160(4)**, 526-534.
- Franklyn JA.** 1999. Thyroid disease and its treatment: short- and long-term consequences. *J R Coll Physicians Lond* **33(6)**, 564-567.
- Franklyn JA.** 2009. Thyroid gland: Antithyroid therapy--best choice of drug and dose. *Nat Rev Endocrinol* **5(11)**, 592-594.  
DOI: 10.1038/nrendo.2009.201nrendo.2009.201 [pii].
- Hak AE, Pols HA, Visser TJ, Drexhage HA, Hofman A, Witteman JC.** 2000. Subclinical hypothyroidism is an independent risk factor for atherosclerosis and myocardial infarction in elderly women: the Rotterdam Study. *Annals of internal medicine* **132(4)**, 270-278.
- Hallengren B, Lantz M, Andreasson B, Grennert L.** 2009. Pregnant women on thyroxine substitution are often dysregulated in early pregnancy. *Thyroid* **19(4)**, 391-394.
- Helfand M, Crapo LM.** 1990. Screening for thyroid disease. *Annals of internal medicine* **112(11)**, 840-849.
- Krassas G, Pontikides N, Kaltsas T, Papadopoulou P, Paunkovic J, Paunkovic N, H Duntas L.** 1999. Disturbances of menstruation in hypothyroidism. *Clinical endocrinology* **50(5)**, 655-659.
- Krassas G, Poppe K, Glinoe D.** 2010. Thyroid function and human reproductive health. *Endocrine reviews* **31(5)**, 702-755.
- Mack WJ, Preston-Martin S, Bernstein L, Qian D.** 2002. Lifestyle and other risk factors for thyroid cancer in Los Angeles County females. *Annals of epidemiology* **12(6)**, 395-401.
- Malik BA, Butt MA.** 2008. Is delayed diagnosis of hypothyroidism still a problem in Faisalabad, Pakistan. *JPMA The Journal of the Pakistan Medical Association* **58(10)**, 545.
- Morreale de Escobar G, Jesús Obregón Ma, Escobar del Rey F.** 2000. Is Neuropsychological Development Related to Maternal Hypothyroidism or to Maternal Hypothyroxinemia? 1. *The Journal of Clinical Endocrinology & Metabolism* **85(11)**, 3975-3987.
- Muller B, Zulewski H, Huber P, Ratcliffe JG, Staub JJ.** 1995. Impaired action of thyroid hormone associated with smoking in women with hypothyroidism. *New England Journal of Medicine* **333(15)**, 964-969.
- Paynter O, Burin G, Jaeger R, Gregorio C.** (1988) Goitrogens and thyroid follicular cell neoplasia: evidence for a threshold process. *Regulatory toxicology and pharmacology* **8(1)**, 102-119.
- Poppe K, Velkeniers B, Glinoe D.** 2008. The role of thyroid autoimmunity in fertility and pregnancy. *Nature Clinical Practice Endocrinology & Metabolism* **4(7)**, 394-405.
- Rosen RC.** 2001. Psychogenic erectile dysfunction: classification and management. *Urologic Clinics of North America* **28(2)**, 269-278.
- Sawin CT, Castelli WP, Hershman JM, McNamara P, Bacharach P.** 1985. The aging thyroid: thyroid deficiency in the Framingham Study. *Archives of Internal Medicine* **145 (8)**, 1386-1388.
- Sawin CT, Chopra D, Azizi F, Mannix JE, Bacharach P.** 1979. The aging thyroid: increased prevalence of elevated serum thyrotropin levels in the elderly. *JAMA* **242(3)**, 247-250.
- Society E, Endocrinologists AAoC, Asia, Association OT, Association AT, Association ET, Association LAT.** 2007. Management of thyroid dysfunction during pregnancy and postpartum: an Endocrine Society Clinical Practice Guideline. *Thyroid: official journal of the American Thyroid Association* **17(11)**, 1159.
- Surks MI, Hollowell JG.** 2007. Age-specific distribution of serum thyrotropin and antithyroid antibodies in the US population: implications for the prevalence of subclinical hypothyroidism. *The Journal of Clinical Endocrinology & Metabolism* **92(12)**, 4575-4582.

**Tanis BC, Westendorp RG, Smelt AH.** 1996. Effect of thyroid substitution on hypercholesterolaemia in patients with subclinical hypothyroidism: a reanalysis of intervention studies. *Clinical endocrinology* **44(6)**, 643-649.

**Tieche M, Lupi G, Gutzwiller F, Grob P, Studer H, Burgi H.** 1981. Borderline low thyroid function and thyroid autoimmunity. Risk factors for coronary heart disease? *British heart journal* **46(2)**, 202-206.

**Vanderpump M, Tunbridge W, French J, Appleton D, Bates D, Clark F, Evans JG, Hasan D, Rodgers H, Tunbridge F.** 1995. The incidence of thyroid disorders in the community: a twenty-year follow-up of the Whickham Survey. *Clinical endocrinology* **43(1)**, 55-68.