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Thyroid Hormones and Pregnant Women

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Abstract

Background: Thyroid illness is a group of disorders affecting the thyroid gland. The thyroid is a small, butterfly-shaped gland at the front of your neck that produces thyroid hormones, since thyroid hormones regulate how our bodies use energy; they have an impact on practically every physical organ, including the pulse. The hormones thyroid creates play a key role in regulating our metabolism the way our body uses energy along with temperature, weight, cholesterol levels and other key body functions. Thyroid disorders may be present before pregnancy, or they may develop during pregnancy. Being pregnant does not change the symptoms of thyroid disorders. How the fetus is affected depends on which thyroid disorder present and which medications are used for treatment. Because thyroid hormones are essential for the healthy development of the baby's brain and nervous system, babies who are dependent on other sources for their thyroid hormones during the first trimester may be born with neurological development issues.

Objectives: the purpose of the study of thyroid hormone and pregnancy are to emphasis on the relationship between thyroid hormone and pregnancy, and the impacts of thyroid dysfunction on maternal and fetal health during pregnancy.

Method: This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Review (PRISMA-ScR) guidelines. Using search keywords like prostate cancer, risk factors, screening, and preventative approaches, scholarly papers published in electronic databases including PubMed, Scopus, and Google Scholar from 2004-2025 were obtained for the review

Conclusion: thyroid dysfunction during pregnancy is a key area of focus in clinical endocrinology. For babys brains and neurological system to develop normally, thyroid hormones are essential, they depends on thyroid hormone supply, which is delivered by the placenta during the first trimester. Healthy women can develop slightly high thyroid hormone during pregnancy. Thyroid problems can be hard to diagnose in pregnancy due to higher levels of thyroid hormones and other symptoms that occur in both pregnancy and thyroid disorders. Thyroid hormones that are high can harm the mother's health and the baby's.

Keywords:

Thyroid, Hormones, Pregnant, Women.

Introduction

Thyroid illness is a group of disorders affecting the thyroid gland. The thyroid is a small, butterfly-shaped gland at the front of your neck that produces thyroid hormones. Since thyroid hormones regulate how our bodies use energy, they have an impact on practically every physical organ, including the pulse [1]

The thyroid gland, located at the front of the neck just below the voice box, is part of the endocrine system, which produces all of the hormones in the body. The hormones thyroid creates play a key role in regulating our metabolism the way our body uses energy along with temperature, weight, cholesterol levels and other key body functions [2]. Production of thyroid hormones, in turn, is regulated by levels of thyroid-stimulating hormone (TSH), generated by our pituitary gland (in our brain). The levels of thyroid hormones in our blood naturally fluctuate throughout the day; usually, the pituitary gland responds by creating more or less TSH [2].

Sometimes the thyroid makes too much or too little of these hormones. Too much thyroid hormone is called hyperthyroidism and can cause many of our body's functions to speed up. "Hyper" means the thyroid is overactive. Too little thyroid hormone called hypothyroidism and can cause many of our body's functions to slow down. "Hypo" means the thyroid is underactive [1]

Thyroid disorders may be present before pregnancy, or they may develop during pregnancy. Being pregnant does not change the symptoms of thyroid disorders. How the fetus is affected depends on which thyroid disorder is present and which medications are used for treatment. [3]

Hyperthyroidism and hypothyroidism are easy for physicians to miss in pregnant people because the symptoms are so similar to those of a "normal" pregnancy. But proper diagnosis and treatment are critical to both mother and baby [2].

Thyroid dysfunction during pregnancy has emerged as a pivotal focus in clinical endocrinology, standing as the most prevalent endocrinological disorder during this critical period, second only to diabetes [4]. The well-established impact of thyroid function on both mater¬nal and fetal outcomes underscores the imperative for a comprehensive understanding of its dynamics. The alterations in thyroid physiology initiate upon the estab¬lishment of pregnancy, persist throughout gestation, and are reversible postpartum [5]. Factors such as height¬ened thyroxine-binding globulin (TBG), increased renal iodine loss, peripheral metabolism changes in thyroid hormones, and shifts in iodine transfer to the placenta collectively prime the maternal thyroid gland to meet augmented physiological demands [6]. Due to physiological and hormonal changes brought on by pregnancy and human chorionic gonadotropin (HCG), a woman's daily iodide intake must increase by 50% as her synthesis of thyroxin (T4) and triiodothyronine (T3) increases by 50% [7]. While these adaptations are well-tolerated in iodide-sufficient areas due to sufficient inner thyroid iodide storage, iodide-deficient regions experience significant physiological shifts during pregnancy [8]. Thyroid iodide storage, iodide-deficient regions experience significant physiological shifts during pregnancy [8]. Women with pre-existing thyroid dysfunction face heightened hor¬monal changes during pregnancy, potentially leading to adverse outcomes if not appropriately treated. The mode of delivery further adds complexity, potentially impacting the fetal-pituitary-thyroid axis. Notably, the prevalence of thyroid dysfunction in pregnant women is significant, with overt thyroid dysfunction occurring in 2–3% of pregnancies, subclinical dysfunction in 10% of pregnancies, and an even higher prevalence of thyroid [4].

Hypothyroidism is a deficiency of the thyroid hormone thyroxine due to an underactive thyroid gland. During pregnancy, the condition which occurs in about two to three of every 500 expecting women is usually caused by Hashimoto's disease, an autoimmune disorder that causes chronic inflammation of the thyroid gland and interferes with its ability to produce hormones. Women who have been diagnosed with hypothyroidism in the past and those who have a family history of thyroid disorders have the highest risk of experiencing the condition during pregnancy [3].

Because thyroid hormones are essential for the healthy development of the baby's brain and nervous system, babies who are dependent on other sources for their thyroid hormones during the first trimester may be born with neurological development issues [3].

The objectives of the study are to emphasis on the relationship between thyroid hormone and pregnancy, and the impacts of thyroid dysfunction on maternal and fetal health during pregnancy.

Physiology of maternal and fetal thyroid in pregnancy

The thyroid undergoes physiological changes during pregnancy, such moderate enlargement of the gland and increasing of vascularization. Beta-Human chorionic gonadotropin (β-HCG) causes thyroid stimulation since the first trimester, due to structural analogy with thyroid-stimulating hormone (TSH), The thyrotropic activity of β-hCG causes also a decrease in serum TSH in the first trimester so that pregnant women have lower serum TSH concentrations than non-pregnant women [9].

The circulating levels of thyroid-binding globulin (TBG) are also increased by estrogen stimulation. On the other hand the increased renal clearance both fetal intake and placenta metabolism induce a relative decline in the availability of iodide [10].

The circulating level of TBG increases, thanks to increased hepatic synthesis and estrogen mediated prolongation of TBG half-life from 15 minutes to 3 days, a few weeks after conception and reaches a plateau during mid-gestation [11].

Total concentrations of thyroxine (T4) and of triiodothyronine (T3) increase in early pregnancy and achieve a plateau early in the second trimester, reaching a concentrations value of 30-100% greater than pre pregnancy, primarily following the rise in TBG [9]. T3 concentrations, whereas others have reported no change or even an increase; therefore changes in free hormone during pregnancy are controversial, though pregnant women in general have lower free-hormone concentrations at term than non pregnant women [9]. During pregnancy, thyroglobulin levels often rise, indicating increased thyroid gland activity. After 12 weeks of pregnancy, the fetal thyroid starts to concentrate iodine and produce thyroid hormones; prior to this, maternal reserves provide any thyroid hormones needed to support the physiological development of the fetal brain. [9,12].

There are two main kinds of thyroid conditions:

Hyperthyroidism ("hyper" means too much). When your thyroid is overactive and produces too much thyroid hormone, it can cause many bodily functions to speed up. The most common cause of hyperthyroidism during pregnancy is Graves' disease, an autoimmune condition in which your immune system produces antibodies that cause your thyroid to produce too much thyroid hormone. [13].

Hypothyroidism ("hypo" means too little or not enough). Many bodily functions slow down when the thyroid is underactive and produces insufficient thyroid hormones. The most common cause of hypothyroidism during pregnancy is an autoimmune condition known as Hashimoto's disease, in which your immune system produces antibodies that attack and damage your thyroid, preventing it from producing thyroid hormones [13].

Role thyroid hormones play during pregnancy

For a baby's brain and neurological system to develop normally, thyroid hormones are essential. Baby depends on thyroid hormone supply, which is delivered by the placenta, during the first trimester, or the first three months of pregnancy. Baby's thyroid begins to function independently at 12 weeks, but it doesn't produce enough thyroid hormone until 18 to 20 weeks. Elevated thyroid hormone levels in the blood are caused by two pregnancy-related hormones: estrogen and human chorionic gonadotropin (hCG). Healthy women's thyroids enlarge slightly during pregnancy, but typically not enough for a medical professional to feel during a physical examination.

Thyroid problems can be hard to diagnose in pregnancy due to higher levels of thyroid hormones and other symptoms that occur in both pregnancy and thyroid disorders. Some symptoms of hyperthyroidism or hypothyroidism are easier to spot and may prompt doctor to test for these thyroid diseases [2].

Hyperthyroidism in pregnancy

An autoimmune condition called Graves' disease is typically the cause of hyperthyroidism during pregnancy. The immune system produces antibodies in this condition, which leads to the thyroid producing excessive amounts of thyroid hormone. Thyroid stimulating immunoglobulin, or TSI, is the name of this antibody.

Pregnancy may be the first time Graves' disease manifests. However, the second and third trimesters may see an improvement in Graves' disease symptoms. The immune system produces less TSI later in pregnancy because some of its components are less active. Perhaps this explains why symptoms get better. When TSI levels rise in the first few months after delivery, Graves' disease frequently worsens once more [2]. Doctor will probably test thyroid function every month during pregnancy if there is Graves' disease, and might need to treat hyperthyroidism.

Thyroid hormone levels that are too high can harm the mother health and the baby's.

Hyperthyroidism effects mother and the baby

Untreated hyperthyroidism during pregnancy can lead to:

i. Miscarriage
ii. Premature birth
iii. Low birth weight
iv. Preeclampsia—a dangerous rise in blood pressure in late pregnancy
v. Thyroid storm—a sudden, severe worsening of symptoms
vi. Congestive heart failure

An overactive thyroid in a newborn can lead to:

i. a fast heart rate, which can lead to heart failure
ii. early closing of the soft spot in the baby's skull
iii. poor weight gain
iv. irritability

Hypothyroidism

Hypothyroidism (underactive thyroid disease) is a condition that happens when thyroid gland doesn't make or release enough hormones into the bloodstream. As a result, the metabolism slows down. This can cause unintentional weight gain and make you feel exhausted all the time. The majority of people can control their hypothyroidism with medicine and routine endocrinologist checkups, but if treatment is not received for extended periods of time, the illness can become fatal.

Causes hypothyroidism in pregnancy

Hypothyroidism in pregnancy is usually caused by Hashimoto's disease and occurs in 2 to 3 out of every100 pregnancies. Hashimoto's disease is an autoimmune disorder. In Hashimoto's disease, the immune system makes antibodies that attack the thyroid, causing inflammation and damage that make it less able to make thyroid hormones [2,14].

Hypothyroidism effect on the mother and the baby

i. Untreated hypothyroidism during pregnancy can lead to:
ii. Preeclampsia—a dangerous rise in blood pressure in late
iii. pregnancyAnemia
iv. Miscarriage
v. Low birth weight
vi. Stillbirth
vii. Congestive heart failure, rarely

Because thyroid hormones are so important to baby's brain and nervous system development, untreated hypothyroidism—especially during the first trimester—can cause low IQ and problems with normal development [2,14].

Postpartum Thyroiditis

Postpartum thyroiditis is an inflammation of the thyroid that affects about 1 in 20 women during the first year after giving birth1 and is more common in women with type 1 diabetes. The inflammation causes stored thyroid hormone to leak out of the thyroid gland [14]. At first, the leakage raises the hormone levels in the blood, leading to hyperthyroidism. The hyperthyroidism may last up to 3months. After that, some damage to the thyroid may cause it to become underactive. The hypothyroidism may last up to a year after the baby is born. However, in some women, hypothyroidism doesn't go away. Not all women who have postpartum thyroiditis go through both phases. Some only go through the hyperthyroid phase, and some only the hypothyroid phase [14].

Risk of thyroid condition during pregnancy

Risk for thyroid conditions during pregnancy if you:

i. Are already being treated for a thyroid condition.
ii. Have had a thyroid condition in the past (including after giving birth).
iii. Have an autoimmune disorder or you have a family history of autoimmune
iv. Thyroid disease, like Graves' disease or Hashimoto's disease.
v. Have type 1 diabetes.
vi. Have had high-dose neck radiation or treatment for hyperthyroidism [13].

Screening

The introduction of screening for thyroid dysfunction for all pregnant women is controversial. The possibility of reducing the rate of adverse events is evident for overt thyroid disease, but less clear for subclinical one. In particular long-term potential benefits of treatment are also associated with the chance to minimize the risk of intellectual impairment in the offspring due to undiagnosed and untreated maternal hypothyroidism. The potential negative effect of a screening strategy is mainly due to the chance of finding abnormal results. Another point of concern is the risk that healthy patients may be wrongly treated with anti-thyroid drugs by inexperienced clinicians [15]. It is challenging to reach a consensus due to the dearth of randomized prospective double blind placebo controlled trials, particularly with reference to subclinical hypothyroidism. Everyone agrees about the need to treat overt thyroid disease, while do not exists a consensus regarding the usefulness of treating subclinical hypothyroidism; just one prospective study has demonstrated a benefit in treating subclinical hypothyroid pregnant women, and these findings are yet to be confirmed It is challenging to reach a consensus due to the dearth of randomized prospective double blind placebo controlled trials, particularly with reference to subclinical hypothyroidism [16]

Two recent researches assessed how cost-effective it is to test pregnant women for thyroid function. Three strategies were compared in the first study:

1) no screening, 2) one-time anti-TPOAb screening, and 3) one-time TSH screening [17]. Screening using TSH results cost-saving compared with no screening; while screening using anti-TPOAb was cost-effective compared with TSH screening. Screening remained highly cost-effective in scenarios where no improvement of offspring IQ outcomes by levothyroxine treatment was assumed.

In the second study, Thung et al. developed a decision analysis model to compare the cost-effectiveness of no routine screening with routine screening of TSH levels

[18]. Current guidelines recommend a case-finding strategy that focuses on thyroid function testing in high-risk populations because there isn't enough data to justify universal thyroid screening during pregnancy. [19].

The significant issue of patients without risk factors going undiagnosed and untreated is not resolved by the case-finding approach. It is evident from all of the published research that most people with thyroid dysfunction are overlooked when a case-finding approach is used. One prospective randomized trial by Negroet al. examined the effectiveness of a case-finding approach and universal screening in identifying thyroid disorders. [9]. A total of 4562 pregnant women were randomized to universal screening or case-finding. The study confirmed that the case-finding strategy missed the majority of patients with thyroid dysfunction but universal screening compared with case finding

didn't result in a decrease in adverse outcomes [9]. While a decreased rate of negative outcomes was linked to treating hypothyroidism or hyperthyroidism found by screening a low-risk category [16]

Diagnostic accuracy and practical applicability

There is a universal opinion about the usage of TSH, concerning the tests to be applied for diagnosis of thyroid dysfunction. This test is widely repeatable, reliable and not expensive, however assessment of the data requires trimester specific reference ranges to avoid underestimate of hypothyroidism and exaggerate of hyperthyroidism [20]. This suggests that the upper limit for TSH should be 2.5mIU/L in the first trimester, and 3.0 mIU/L in the second and third trimesters. Furthermore, the lower physiological limit could be 0.1 mIU/L in the first trimester, 0.2 mIU/L in the second, and 0.3 mIU/L in the third [21]. Thyroid peroxidase antibody (TPOAb) allows for the identification of women who are more likely to develop thyroid illness and should be evaluated for thyroid function once every trimester.

The application of serum FT4 measurement during pregnancy is controversial since it is conditioned by elevated TBG and decreased albumin concentrations, which may compromise the accuracy of immunoassay measurement [22, 23].

Management

Treatment for mild pregnancy-related hyperthyroidism is usually not necessary. Treatment for hyperthyroidism and hyperemesis gravidarum should only address dehydration and vomiting. Antithyroid medications, which reduce thyroid hormone production, may be prescribed by a doctor if hyperthyroidism is more severe. By using this medicine, too much thyroid hormone is kept out of the baby's circulation.

Treatment for hypothyroidism entails supplementing the hormone that you thyroid can no longer manufacture. Levothyroxine, a thyroid hormone medication that is identical to T4, one of the hormones the thyroid typically produces, is most likely to be prescribed by a doctor. Levothyroxine is safe for infants and is particularly necessary until the infant is able to produce thyroid hormone on their own.

Treatment of hypothyroidism should be initiated as soon as possibile. The starting dose of levothyroxine is 1-2∝g/kg/day and should be adjusted every 4 weeks. Women who are affected before pregnancy should increase their dose by approximately 30-50%. Levothyroxine requirements should increase as the pregnancy progresses, secondary to the greater demand for T4 with the progression of pregnancy as well as its inadequate intestinal absorption caused by ferrous sulfate replacement [19, 24].

Thyroid Disease and Eating During Pregnancy

During pregnancy, iodine is a vital mineral because the thyroid utilizes it to produce thyroid hormone. The infant receives iodine from the food during pregnancy. Approximately 250 micrograms of iodine per day are required during pregnancy. Dairy products, seafood, eggs, meat, poultry, and iodized salt—salt that has had iodine added are all excellent sources of iodine. To ensure adequate intake, experts advise taking a prenatal vitamin that contains 150 micrograms of iodine, particularly if iodized salt is not being used.

. Since the infant receives iodine from breast milk, more iodine is required during breastfeeding. Thyroid issues, however, can result from consuming excessive amounts of iodine from supplements like seaweed.

Conclusion

As the most common endocrinological condition at this crucial time, second only to diabetes, thyroid dysfunction during pregnancy has become a key area of focus in clinical endocrinology. The known influence of thyroid function on fetal and maternal outcomes emphasizes the need for a thorough comprehension of its dynamics. Thyroid physiological changes begin when pregnancy is established, continue during pregnancy, and can be reversed after delivery. Together, these factors prime the maternal thyroid gland to meet higher physiological demands: elevated thyroxine-binding globulin (TBG), increased renal iodine loss, peripheral metabolism alterations in thyroid hormones, and changes in iodine transfer to the placenta. Pregnancy and human chorionic gonadotropin (HCG) cause physiological and hormonal changes that require a woman's daily iodide intake to rise by 50% in tandem with a 50% increase in her synthesis of

thyroxin (T4) and triiodothyronine (T3). Pregnant women with pre-existing thyroid disease experience increased hormone shifts, which could have negative consequences if left untreated. The fetal-pituitary-thyroid axis may be impacted by the delivery method, which further complicates matters. Thyroid hormones are necessary for a baby's brain and neurological system to develop appropriately. During the first trimester, or the first three months of pregnancy, the placenta delivers thyroid hormones, which the baby needs. Although the baby's thyroid starts to work on its own at 12 weeks, it takes 18 to 20 weeks for it to create enough thyroid hormone. The infant receives iodine from the food during pregnancy, Approximately 250 micrograms of iodine per day are required during pregnancy. Human chorionic gonadotropin (hCG) and estrogen, are hormones linked to pregnancy, are the reason of elevated thyroid hormone levels in the blood. During pregnancy, healthy women's thyroids grow slightly, although usually not enough for a doctor to feel during a physical examination.

Thyroid problems can be hard to diagnose in pregnancy due to higher levels of thyroid hormones and other symptoms that occur in both pregnancy and thyroid disorders. Thyroid hormones that are high can harm the mother’s health and the baby’s.

Reference

1) Thyroid Disease & Pregnancy – NIDDK https://www.niddk.nih.gov/health-information/endocrine-diseases/pregnancy-thyroid-disease
2) Jennifer Wu, M.D., F.A.C.O.G. (2021) Thyroid Conditions in Pregnancy: Hyperthyroidism & Hypothyroidism When Pregnant https://www.whattoexpect.com/pregnancy/pregnancy-health/complications/thyroid-disorder.aspx
3) Lara A. Friel, (2024) Thyroid Disorders During Pregnancy - Women's Health Issues - MSD Manual Consumer Version https://www.msdmanuals.com/home/women-s-health-issues/pregnancy-complicated-by-disease/thyroid-disorders-during-pregnancy
4) Roshni Vamja1, Yogesh M, Monika Patel, Vijay Vala, Arya Ramachandran, Bhumika Surati1 and Jay Nagda (2024) Impact of maternal thyroid dysfunction on fetal and maternal outcomes in pregnancy: a prospective cohort study https://doi.org/10.1186/s40842-024-00212-6
5) Sahay R. Nagesh (2012) Hypothyroidism in pregnancy. Indian J Endocrinol Metabol. 2012;16(3):364.
6) Alemu A, Terefe B, Abebe M. Biadgo (2016) thyroid hormone dysfunction during pregnancy: a review. Int J Reprod Biomed. 2016;14(11):677–86.
7) Yamamoto T, Amino N, Tanizawa O, Doi K, Ichihara K, Azukizawa M. Longitudinal study of serum thyroid hormones, chorionic gonadotrophin and thyrotrophin during and after normal pregnancy. Clin Endocrinol (Oxf). 1979;10:459–68.
8) Glinoer D, de Nayer P, Bourdoux P, Lemone M, Robyn C, van Steirteghem A. Regulation of maternal thyroid function during pregnancy. J Clin Endocri¬nol Metab. 1990;71:276–87.
9) Pietro Cignini, Ester Valentina Cafà, Claudio Giorlandino, Stella Capriglione, Anna Spata, Nella Dugo Thyroid physiology and common diseases in pregnancy: review of literature Journal of Prenatal Medicine 2012; 6 (4): 64-71
10) Casey B, Leveno K. Thyroid disease in pregnancy. Obstet Gynecol. 2006; 108(5):1283-1292.
11) Skjoldebrand L, Brundin J, Carlstrom A, Pettersson T. Thyroid associated components in serum during normal pregnancy. Acta Endocrinol 1982; 100(4): 504-511.
12) Glinoer D. The regulation of thyroid function in pregnancy: pathways of endocrine adaptation from physiology to pathology. Endocr Rev 1997; 18(3):404-433.
13) March of Dimes (2025). Thyroid conditions during pregnancy https://www.marchofdimes.org/find-support/topics/pregnancy/thyroid-conditions-during-pregnancy
14) Alexander EK, Pearce EN, Brent GA, (2017) guidelines of the American Thyroid Association for the diagnosis and management of thyroid disease during pregnancy and the postpartum. Thyroid. 2017;27 (3):315–389.
15) Negro R, Mestman JH. Thyroid disease in pregnancy. Best practice & research. Clinical endocrinology & metabolism. 2011 Dec;25 (6):927-43.

16) Negro R, Schwartz A, Gismondi R (2010) . Universal screening versus case finding for detection and treatment of thyroid hormonal dysfunction during pregnancy. Journal of Clinical Endocrinology and Metabolism 2010; 95: 1699-1707.31. Abalovich M, Amino N, Barbour
17) Dosiou C, Sanders GD, Araki SS (2008). Screening pregnant women for autoimmune thyroid disease: a cost-effectiveness analysis. European Journal of Endocrinology 2008; 158: 841-851.
18) Thung SF, Funai EF, Grobman WA (2009). The cost-effectiveness of universal screening in pregnancy for subclinical hypothyroidism. American Journal of Obstetrics and Gynecology 2009; 200: 267.e1-267.e7.
19) Abalovich M, Amino N, Barbour LA (2007). Management of thyroid dysfunction during pregnancy and postpartum: an endocrine society clinical practice guideline. Journal of Clinical Endocrinology and Metabolism 2007; 92: S1-S47.
20) Stricker R, Echenard M, Eberhart R (2007). Evaluation of maternal thyroid function during pregnancy: the importance of using gestational age-specific reference intervals. European Journal of Endocrinology 2007;157: 509-514.
21) Haddow JE, Knight GJ, Palomaki GE (2004). The reference range and within-person variability of thyroid stimulating hormone during the first and second trimesters of pregnancy. Journal of Medical Screening 2004; 11: 170-174.
22) Kahric-Janicic N, Soldin SJ, Soldin OP (2007). Tandem mass spectrometry improves the accuracy of free thyroxine measurements during pregnancy. Thyroid 2007; 17: 303-311.
23) Soldin OP, Hilakivi-Clarke L,Weiderpass E (2004). Trimester-specific reference intervals for thyroxine and triiodothyronine in pregnancy in iodine-sufficient women using isotope dilution tandem mass spectrometry and immunoassays. Clinica Chimica Acta 2004; 349: 181-189.
24) Alexander EK, Marqusee E, Lawrence J (2004). Timing and magnitude of increases in levothyroxine requirements during pregnancy in women with hypothyroidism. The New England Journal of Medicine 2004; 351: 241-249.