بسم الله الرحمن الرحيم

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Determination of Haematological Changes Among Females with Thyroid Disease in Shendi Town

A thesis Submitted for partial fulfillment for the Degree of MSc in Medical Laboratory Sciences (Haematology)

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الآيـــة

بسم الله الرحمن الرحيم

قال تعالى:

﴿ وَلَوْ أَنَّمَا فِي الْأَرْضِ مِن شَجَرَةٍ أَقْلَامٌ وَالْبَحْرُ يَمُدُّهُ مِن بَعْدِهِ سَبْعَةُ أَبْحُرٍ مَّا نَفِدَتْ كَلِمَاتُ اللَّهِ إِنَّ اللَّهَ عَزِيزٌ حَكِيمٌ ﴾

" صدق الله العظيم "

ســـوره لقمـــان الآيـــة (27)

Dedication

To my parents …

Who encouraged me at all stages of life

To my husband …

To my brother and sisters …

For their unlimited support …

ACKNOWLEDGEMENT

I would like to express my sincere gratitude and thankfulness to my supervisor

Dr. Omkalthoum Osman Hamad

For his guidance, meticulous supervision, revising and discussing all aspects of this study. His valuable advices and comments are highly appreciated.

My great thanks also extend to the patients, others who contributed in a way or another for the success of this study especially.

List of abbreviation

Abbreviation	Term
CHO	Carbohydrate
CNS	Central nervous system
CBC	Complete blood count
DIT	Diiodotyrosine
GIT	Gastric intestinal tract
HCG	Hemoglobin
IgG	Immunoglobulin gama
MCV	Mean cell volume
MCHC	Mean corpuscular hemoglobin concentration
MCH	Mean corpuscular hemoglobin
MIT	Mono iodotyrosine
MPV	Mean platelet volume
SLE	systemic lupus erythro mat us
T3	Tri iodothyronine
T4	Thyroxin
TRH	Thyrotropin releasing hormone
TSH	Thyroid stimulating hormone

Abstract

This is adescriptive cross sectional study was conducted in Shendi town in the period from April l2018 to July 2018 to determine the correlation between thyroid disease and some hematological changes.

Forty patients thyroid disease were selected as volunteers according to inclusion criteria and considered as case, and other forty apparently health individual, were selected and considered as control group.

3ml of fresh venous blood were collected from each volunteer, after filling the questionnaire, in glass container containing EDTA solution as anticoagulant was mixed and the hematological indices was counted immediately used hematology analyzer, and 3ml in glass container containing lithium heparin as anticoagulant mix and immediately measure thyroid hormone using Ichroma instrument.

The result were analyzed by independent T test of the statistical package for social sciences [SPSS] computer program.

The result of cases showed that TWBCs mean=6.5x10^{9}/L, Hb mean=10.6g\dl, RBCs mean=4.4x10^{12}\L, Pcv mean=30.8%, Mcv mean=70.5fL, McH mean=25pg, MCHC mean=35.6g\dl, PLt mean=271x10^{9}\L and the MPV=7.6Fl, when compared with result of control group revealed that TWBCs mean=5.8x10^{9}/L, Hb mean=11.2g\dL, RBCs mean=4.6x10^{12}\L, PCV mean=32%, MCV mean=70 fL, MCH mean 25.4pg, MCHC mean=35.9g\dL, PLt mean=264 × 10^{9}/L and MPV mean=7.5fL.

This is study showed significant variation in TWBCs count [p.value>0.05], and insignificant variation in RBCs, RBCs indices [MCV, MCH, MCHC], HB, PCV, PLt and mpv [p.value <0.05].

ملخص البحث

هذه الدراسة الوصفية أجريت لمعرفة علاقة مرض الغدة ببعض التغيرات الدموية في مدينة شندي في الفترة مابين ابريل 2018 إلى يوليو 2018م.

تم اخذ 40 عينة من المرضي المتطوعين الذين تم اختيارهم علي حسب المعايير الاستثنائية وتم اعتبارهم المشكلة، كما تم اخذ 40 عينة أخرى من غير المصابين بالغدة كمجموعة ضابطة.

تم اخذ 3مل من الدم الوريدي من المتطوعين بعد ملء الاستبيان المعد مسبقاً في حاوية تحتوي علي ثلاثي سترات الصوديوم كمانع تجلط، ثم اخذ العينة مباشرة إلي جهاز التحليل الدموي لمعرفة تعداد معاملات الدم. كما تم اخذ 3مل أخري في حاوية تحتوي علي مضاد التجلط الليثيم هيبرين لقياس هرمونات الغدة بواسطة جهاز. ichroma.

تم تحليل النتائج بواسطة برنامج الحزم الإحصائية للعلوم الاجتماعية توصلت الدراسة إلي متوسط نتائج المرضي: متوسط كريات الدم البيضاء =$6.5x10^{9}$\L، متوسط الهيموغلوبين= 10.6 جم/ ديسليتر، متوسط كريات الدم الحمراء=$4.4x10^{12}$\L.، متوسط الهيماتوكرت 30.8%، متوسط حجم كريات الدم=Fl 70.5، متوسط هيموغلوبين الكرية = Pg 25، متوسط تركيز هيموغلوبين الكرية= 35.6g\d.، متوسط تعداد الصفائح=$271x10^{9}$\L، متوسط حجم الصفائح=7.6fL.، متوسط هرمون T3 = 2.76، متوسط هرمون T4 = 137.9، متوسط هرمون TSH = 9.5 ، مقارنة مع نتائج المجموعة الضابطة التي إشارة إلي:

متوسط كريت الدم البيضاء=$5.8x10^{9}$\L.، متوسط الهيموغلوبين= 11.2g\dL.، متوسط كريات الدم الحمراء=$4.6x10^{12}$\L، متوسط الهيماتوكرت=32%، متوسط حجم كرية الدم= 70 Fl، متوسط هيموغلوبين الكرية= 25.4pg. ، متوسط تركيز هيموغلوبين الكرية =35.9g\dl. ، متوسط تعداد الصفائح=$264x10^{9}$\L، متوسط حجم الصفائح= 7.5FL.، متوسط هرمون T3=1.73، متوسط هرمون T4=106.6، متوسط هرمون TSH=1.46.

هذه الدراسة أظهرت انه توجد علاقة بين تعداد كريات الدم البيضاء ومريض الغدة P.Value ,[0.05> بينما لا توجد علاقة بين كريات الدم الحمراء والصفائح وبعض المعاملات الأخرى مثل الهيموغلوبين، والهماتوكرت ومتوسط حجم الكرية ومتوسط هيموغلوبين الكرية ومتوسط تركيز هيمو غلوبين الكرية.[p.value<0.05]

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1-1 Introduction

Thyroid hormones play an important physiological role in humans. Thus may regulate human hematopoietic in the bone narrow [1].

The association of thyroid disorders and abnormalities in hematological parameters is well known. In 1979 fein showed that Graves disease is associated with Anemia[2].

Hypothyroidism can cause certain forms of anemia on the one hand or hyper proliferation of immature erythroid progenitor on the other hand .the anemia is usually macrocytic hypo chromic anemia of moderate severity [3].

In contrast , anemia is not frequently observed in patients with hyperthyroidism, where as erythrocytosis is fairly common [2,4].

It has been found that all hematological parameters return to normal when a euthyroid state is achieved [5]

As for as white blood cues and thrombocytes are con earned , a slightly depressed total leucocyte count netropaenia, and thrombocytopenia have been observed in hypo thyroid patients [6].

These observations confirmed the association between thyroid gland dysfunction and haematopoiesis.

Previously studies suggested that there is an essential relationship between the hypo thyroid state and low levels of iron, vitaminB12 and folic acid in the human body[3,7].

Furthermore it has been postulated that the influence of thyroid hormons [THS] on haematopoiesis involves an increased production of erythropoietin or haematopoietic factors by non erythroid cell s [8,9]. However, a growing number of studies have demonstrated Direct vole of THs in normal human and animal erythropoiesis . [1,10,11].

1-2 Rationale

In mammals, thyroid hormones are essential for normal growth and maturation, there fore, thyroid hormones are major anabolic hormones.

Epidemiologic studies were found relationship between thyroid disease and some hematological changes.

Thyroid disease induces different effects on blood cells such as anemia, erythrocytosis, leucopenia, thrombocytopenia, and in rare cases cause pancytopenia, it also alter in red blood cell indices include MCV, MCH, MCHC.

So this study was conducted to determine correlation between thyroid disease and some hematological changes in Shendi town..

1-3 Objectives

1-3-1General objective:

Determination of Haematological Changes Among Females with thyroid disease in Shendi Town.

1-3-2Specific objectives:

1-To measure Hb, PCV, RBCs, RBCS indices count in thyroid disease.

2-To determine TWBCs count in thyroid disease.

3-To estimate platelet count and MPV in thyroid disease.

4-To measure T3 – T4 – TsH in thyroid disease.

5-To compare the obtained results between females with thyroiddisease and control.

Chapter Tow

Literature review

2. Literature review

2-1 The thyroid gland:

The thyroid gland is the largest endocrine gland in the body, weighing about (20 - 259). It lies on the trachea at the anterior aspect of the neck and moves with swallowing.

In the embryo, at the 3rd or 4th week of pregnancy, the thyroid originates from the floor of the pharynx at the base of the tongue, at appoint latter indicated by the foramen cecum, subsequently the thyroid descends to its position through the thyroglossal cyst.

it consists of two lobes that are connected by the thyroid isthmus .in addition, an extra pyramidal lobe may be found some times.

- concerning its histology, it is made up of multiple acini (or follicles). Each follicle is surround by single layer of cells and filled with a protein material(known as the colloid).

- The type of protein in the colloid is known as the Thyroglobulin. The activity of the gland is indicated by…

The amount of colloid[abundant when the gland is inactive, small amount when it is active.

- The shape of follicular cells [flat when the gland is inactive, columnar when it is active].

- The thyroid gland sysnthesizes the following hormones:

- Thyroid hormones [T_3 and T_4] by the follicular cells.

- Calcitonin by the Para follicular cells. [12]

T_3 [tri-iodothyronine] is about 3to5 times more active than T_4 [tetra-iodothronine or thyroxin] each hormone is synthesized form two molecules of tyrosine and 3or4 atoms of iodide [12].

2-2 Physiologic anatomy of the thyroid gland:

The thyroid gland is composed of large numbers of closed follicles (100 to 300 micrometers in diameter) filled with a secretary substance called colloid and lined with cuboidal epithelial cells that secrete into the interior of the follicles. The major consitituent of colloid is the large glycoprotein thyroglobulin, with contains the thyroid hormones, once the secretion has entered the follicles, it must be absorbed back through the follicular epithelium into the blood before it can function in the body.

The thyroid gland has a blood flow about five times the weight of the gland each minute, which is a blood supply as great as that of any other area of the body, with the possible exception of the adrenal cortex. [13]

2-3 Physiologic functions of the thyroid hormones:

Thyroid hormones increase the transcription of large numbers of genes. There fore, in virtually all cells of the body, great numbers of protein enzymes, structural proteins, transport proteins, and other substances are synthesized, the net result is generalized increase in functional activity throughout the body. [13]

2-4 Classification of thyroid disease:

2-4-1 Multi nodular goiter (non toxic goiter):-

Definition: goiter refers to enlargement of thyroid.

Females > males.

- Multinodular goiter is frequently a symptomatic, and the patient is typically euthyroid.
- Goiter (enlarged, nodular thyroid gland).
- Plummer syndrome: development of hyperthyroidism (toxic multi nodular goiter).
- Lab: normal T_4, T_3 and TSH.

2-4-2 Graves disease:

Definition: auto immune disease characterized by production of IgG auto antibodies to TSH receptor.

- General features:
- Females > males; age 20 – 40.
- Hyperthyroidism.
- Diffuse goiter.
- Ophthalmopathy: exophthalmus.
- Dermopathy: pretiial myxedema.

2-4-3 Latrogenic hypothyroidism:

- Most common cause of hypothyroidism in the united states.
- Secondary to thyroidectomy or radioactive iodine treatment.
- Treatment: thyroid hormone replacement.

2-4-4 Congenital hypothyroidism (cretinism):

Etiology:

- Endemic regions: Iodine deficiency during intrauterine and neonatal life.
- Non endemic regions: thyroid dysgensis.

Presentation:

- Failure to thrive.
- Stuntent bone growth and dwarfism.
- Spasticity and motor incordination.
- Mental reyardation.
- Goiter is present in endemic cretinism.

2-4-5 Thyroiditis:

Hashimoto thyroiditis:

Definition: chronic auto immune disease characterized by immune destruction of the thyroid gland and hypothyroidism.

Clinical presentation:

- Females > males; age 40 – 65 years.
- Painless goiter.
- Hypothyroidism.
- Initial inflammation may cause transient hyperthyroidism. (hashitoxicosis).
- May be associated with other auto immune diseases (SLE – SS) (Siogren syndrome).
- Complication: increased risk of non – Hodgkin B-cell lymphoma.

Subacute thyroiditis:

- Synonyms: dequervain thyroiditis, granulomatous thyroiditis.

Clinical features:

- Second most common form of thyroiditis.
- Females > males; age 30 – 50 years.
- Preceded by aviral illness.
- Tender, firm, enlarged thyroid gland.
- May have transient hyper thyroidism.

Riedel thyroiditis:

Definition: rare disease of unknown etiology characterized by destruction of the thyroid gland by dense fibrosis and fibrosis of surrounding structures (trachea and esophagus).

Clinical features:

- Females > males; middle age.
- Irregular, hard thyroid that is adherent to adjacent structures.

2-4-6 Thyroid Neoplasia:

1- Adenomas: follicular adenomas are the most common.

Clinical features:

- Usually painless, solitary nodules.
- " Cold nodule " on thyroid scans.

- May be functional and cause hyperthyroidism. (toxic edenoma).

2- Papillary carcinoma:

- Account for 80% of malignant thyroid tumors.
- Female > males; age 20 – 50 years.
- Risk factor: radiation exposure.
- Lymphatic spread to cervical nodes is common.

Treatment: Resection is curative in most cases.

Radio therapy with iodine 131 is effective for metastases.

Prognosis: excellent; 20 year survival = 90% due to slow growth and metastasis to regional cervical lymph nodes.

3- Follicular carcinoma:

- Accounts for 15% of malignant thyroid turmors.
- Female > males; age 40 – 60 years.
- Hemato genous metastasis to the bones or lung is common.

4- Medullary carcinoma:

- Accounts for 5% of malignant thyroid tumors.
- Arises from cells (para follicular cell) and secretes calcitonin.

5- Anaplastic carcinoma:

- Females > males; age > 60 years.
- firm, enlarging, buiky mass.
- Dyspnea and dysphagia.
- Tendency for early wide spread metastasis and invasion of the trachea and esophagus.
- Prognosis: very aggressive and rapidly fatal. [19]

2-5 Type of thyroid diseases:

Hyperthyroidism (or thyrotoxicosis):

Primary hyper thyroidism is caused by toxic tumors, inflammation, drugs, or auto antibodies that activate the thyroid.

Hyperthyroidism is called (Graves disease).

- Secondary hyperthyroidism is caused by pituitary tumors that increase production of TSH.

- Features of hyperthyroidism:

- Intolerance to hot.
- Nervous ness.
- Increased appetite (hyperphagia).
- Diarrhea and weight loss.
- Fine tremor.
- Warm, soft skin and sweating.
- Eye signs (only in erraves, disease). [12]

Hypothyroidism (or myxedema).

Primary hypothyroidism is caused by thyroid problems (common) where as secondary hypothyroidism is caused by pituitary or hypothalamic problems (rare).

Thyroid problems include:

- Congenital deficiency of enzymes involved in thyroid hormone synthesis.
- Severe Iodine deficiency or excess.
- Tumors.
- Inflammation.
- Surgical removal.
- Auto antibodies that destroy thyroid.
- Anti thyroid drugs.

Features of hypothyroidism:

- Intolerance to cold.
- Hair changes.
- Skin dry.
- Voice becomes characteristically husky and slow.

- Brady cardia.
- Constipation.
- High cholesterol level in plasma. [12]

2-6 Synthesis and secretion of the thyroid metabolic hormones:

-iodine is required for formation of thyroxin.

To form normal quantities of thyroxin, about 50mili grams of ingested iodine in the form of iodides are required year, or about 1mg/ week. To prevent iodine deficiency, common Table salt is iodized with about part sodium iodide to every 100.000 parts sodium chloride.

Fat of ingested iodides:

10 dides ingested orally are absorbed from the gastro intestinal tract in to the blood in about the same manner as chlorides.

Normally .most of the iodides are rapidly excreted by the kidneys but only after About one fifth are selectively removed 1from the circulating blood by the cell s of the thyroid gland and used for synthesis of the thyroid hormones. [13]

Steps of thyroid hormones synthesis:

Iodide Trapping:

The first stage in the formation of thyroid hormones, is transport of iodides from the blood in to the thyroid glandular cells and follicles. The basal membrane of the thyroid cell has the specific ability to pump the iodide activity to the interior of the cell. This is achieved by the action of a sodium iodide sym porter, which co-transports one iodide ion along with tow sodium ions across the basolateral (plasma) membrane in to the cell. The energy for trans porting iodide against concentrates ion gradient comes from the sodium – potassium AT p as e pump. which pumps sodium out of the cell.

This process of concentrating the iodide in the cell is called iodide trapping . in a normal gland, the iodide pump concentrates the iodide to about 30 times its concentrates in the blood . [13]

2 – oxidation of iodide in to iodine the follicular cells:

- Iodide (1) is converted to iodine [(12)].

- This is catalyzed by the enzyme thyroid pre oxide se.

-then iodine diffuses to the colloid down its chemical and electrical gradients.

3-synthes is of thy rogl0bulin by thy follicular cells:

- Glycoprotein made up of two sub units (Mwt = 660.000).

- Each molecule contains 123 tyro sine residues (but only 4-8 are involved in synthesis of Hormones). It is secreted in to the colloid by exocytose is.

4- iodination:- iodine is add to thy tyrosine residues in thyroglobulin (to carbon number 3 and or 5). This either mono – 10 do-tyrosine (MiT) and\or di-10do – tyrosine (DLT) residues.

10 dination occurs as the 10dine and thy rog10bul in are transported through the cell membrane towards the colloid and it is catalyzed by the enzyme thyroid peroxides.

5-coupling (condensation)inside the colloid:

- Coupling of the iodinated tyrosine within the thymoglobulin also catalyzed by the enzyme thyroid peroxides.

- Tyrosine +tyrosine = ((thyronine)); and 10 dine molecules are also summated as **Follows:**

Mit+DiT = T3 =(7do).

DiT+DiT=T4=(35do).

DiT+MiT=reverse T3 “RT3’’ (= trace).

uncoupled residues “MiT8DiT” = (56%).

6- Release of thyroid hormones:

The sol10id is ingested by the follicular cells by the process of endocytosis. The 10 dinated residues are detached from thy rogiobulin by the lysosomal enzymes: ((proteases)); giving T3, T4, RT3, miT and DiT.

7-peripheral conversion of T4 in to T3 about one third of T4 (thyroxin) is converted to T3 by de-iodinase enzymes found in peripheral tissues including the liver, kidney and brain. That the thyroid gland secretes only 13% of the circulating T3. The rest is formed by peripheral de-iodination.

-in the above states the low T3 guards against rapid loss of calories and protein [12]

2-7 Regulation of thyroid hormones secretion:

1-Hypo thalamic-pituitary control-TRH-TSH.

A-TRH is secreted by the hypo thalamus and stimulates the secretion of TSH by the anterior pituitary.

B-TSH increases both the synthesis and secretion of thyroid hormones by the follicular cells via An adenylatecyclase cAMp mechanism. Chronic elevation of TSH causes hypertrophy of the thyroid gland.

C- T3 down – regulates TRH receptors in the anterior pituitary and thereby inhibits TSH secretion.

2- Thyroid –stimulating immune g10 bulins e ((IgG)) Fraction of plasma proteins and are antibodies to TSH receptor son the thyroid gland. Bind to TCH receptors and, like TSH, stimulate the thyroid g10nd to secrete T3 and T4. circulate in high concentrations in patients with Graves disease, which is characterized by high circulating levels of thyroid hormones and, according lye, low concentrations of TSH ((caused by feedback inhibition of thyroid hormones on the anterior pituitary.)) [14]

2-8 TRANSPORT of THYROID HORMONES IN BLOOD:

Equilibrium between Bound and free circulating thyroid hormones T4 has the higher affinity for binding proteins; therefore, it binds more tightly to protein than T3 does, and consequently the half –life of T4 is greater than that of T3. Most circulating thyroid hormone is T4 normally, there is 50 times more T4 them T3

T4 half – life =6 days.

T3 half – life = 1 days.

The normal total T4 level in adults is 8mgldl ((103nmol /l)). And the plasma T3 level is 0.15mg/dl (2.3 nmol /L) [18].

- Sites of metabolism: Liver- kidney and other tissues [12].

The amount of circulating thyroid hormone is about 3times the amount normally secreted by the thyroid gland each day thus, circulating protein-bound thyroid hormones act as significant reserve. [15]

2-9 THYROID HORMONES ACTION:

Thyroxin (T_4) is converted to triiodothyronin ((T_3) at target tissues. T3 binds to a nuclear receptor, resulting in transcription of a host of cellular proteins and enzymes –the net effect is an increase in metabolic rate and O2 consumption .these effects are associated with increased heart, lung and kidney function. T3 is also important for normal growth and development. [16]

2-10 EFFESTS OF THYROID HORMONES:

1- Growth:

Thyroid hormones have both general and specific effects on growth. In humans the effect of thyroid hormone on growth is Manifest mainly in growing children. In those who are hypo thyroid, the rate of grow this greatly retard end-in those who are hyper thyroid ,excessive skeletal growth often occurs, An important effect of thyroid hormone is to promote growth and dive 10 pent of thy brain during fetal life and for thy first few years of postnatal life.

2- Stimulation of carbohydrate metabolism:

Thyroid hormone stimulates almost all aspects of carbohydrate metabolism including rapid uptake of Glucose by the cells, en ha need glycol yes sis ,en handed glucose endogens is, in creased rat of absorption from the gastro in test in attest in al tract ,and even increased insulin secretion with its resultant secondary effects on CHO metabolism.

3- Stmulation of fat metabolism:

Essentially all aspects of fat metabolism are also enhanced under the influence of thyroid hormone in particular, lipids and mobilized rapidly from thy fat tissue.

Which decrease the fat stores of thy body to greater extent than almost any other tissue dement.

Also increases the free fatty acid concentration in thy plasma and greatly accelerates the oxidation of free fatty acids by the cells.

4-Effect of thyroid hormones on the cardiovascular system:

Increased Blood flow and cardiac output. Increased metabolism in thy tissues causes more rapid utilization of oxygen than normal and release of greater than normal quantities of metabolic and products from the tissues. These effects cause vase dilation in most body tissues, thus in ceasing blood flow.

Also cardiac output is increases, sometimes rising to 60 per cent or more above normal when excessive thyroid hormone is present and falling to only 50 per cent of normal in very severe hypothyroid ism. In creased Heart rate, the heart rate increases considerably.

- More under the influence of thyroid hormones than would be expected from the increase in cardiac output.
- Increased heart strength, the increased enzymatic activity caused by increased thyroid hormone production apparently increases the strength of the heart when only as light excess of thyroid hormone is secreted. The heart muscle strength becomes depressed because of long. Term excessive protein catabolism.
- Normal Arterial pressure, the mean arterial pressure usually remains about normal after administration of thyroid hormones. Because of increase blood flow through the tissues between heart beats, the pulse pressure is often increased. [17]

5- Effects on the nervous system:

In hypothyroidism, mentation is slow and the cerebra spinal fluid (csf) protein level elevated.

Thyroid hormones reverse these changes, and large doses cause rapid mentation. Thyroid hormones have marked effects on brain development .the parts of the central nervous system (cNs) most affected are the cerebral cortex and the basal ganglia. In addition, the cochlea is also affected. Thyroid hormones also exert effects on reflexes .the reaction time of stretch reflexes is shortened in hyper thyroidism and prolonged in hypothyroidism. (18)

6- Effects on the protein metabolism:

Thyroid hormones increase both protein catabolisms (In high levels) and increase portion anabolism ((in Low to mode rate levels)).

- The increase proton catabolism may seen in thyro toxico sis.
- In hypothyroidism, variety of portions and polysaccharides accumulate in the skin producing the characteristic puffiness of the skin ((=my edema)) .However, it is also associated with myopathy.

7- Effects on the GIT:

- increase appetite and intestinal motility.
- Hypo thyroid patients suffer from constipation where as hyper thyroid patients suffer from diarrhea. (12)

8- Effect on sleep:

Because of the exhausting effect of thyroid hormone on the musculature and on the central nervous system, the hyper thyroid subject often has a feeling of constant tiredness, but because of the excitable effects of thyroid hormone on the synapses, it is difficult to sleep. Conversely, extreme somnolence is characteristic. Of hypo thyrodism, with sleep some-times lasting 12 to 14 hours a day.

9- Effect on sexual function:

For normal sexual. Function, thyroid secretion needs to be approximately normal .in men, lack of thyroid hormones is likely to cause loss of libido; great excesses of the hormone, sometimes cause impotence.

- in women – lack of thyroid hormone often causes menorrhgia and poly menorrhea.

Hypo thyroid woman, like amen, is likely to have greatly decreased libido. To make the picture still more confusing, in the hyper thyroid women , oligo menorrhea. [17]

2-11 Hemopoiesis:

Hemopoiesis is the process where by blood cells are made the yolk sac, and later the liver and spleen, are important in fetal life but after birth normal haemopoiesis is restricted to the bone marrow. Infants have haemopoiestic marrow in all bones but in adults it is in the central sketeton and proximal ends of long bones (normal fat to haemopoietic tissue ratio of about 50:5).

Expansion of haemopoiesis down the long bones may occur, e.g. in leukoemias and chronic haemolytic anaemias. The liver and spleen can resume extra medullary haemopoiesis when there is marrow replacement, e.g. in myelofibrosis, or excessive demand, e.g. in severe haemolytic anamias [6].

The life long production of blood cells occurs in haemopie tissue. This involves a very high level of cell turnover, demand by the need to replace mature circulating blood cells at ararate, and is necessitated by the limited lifespan of the mat cells.

Granulocytes survive for only a few hours and erythrocyte a few months, so that some 1013 new cells must be replace, each day to maintain steady. State blood counts. This is equivalent to an annual number of cells approximating the total be weight, but the total bone marrow of an adult human contra around 1012, 10- fold less than daily needs, from these satiates it is clear that the blood cells required for the lifelong haemopoiesis can not be preformed in the body. [23]

The bone marrow, which is the major site of haemopoiesis adult humans, contains cells that represent the stages in development of the different types of blood cells the later stages are recognizable as be longing to the major leages of haemopoiesis (granulocytes, erythrocytes, monocytes, macrophages, megakaryocytes, eosinopils, basophils and Blymphocytes). They are the myelocytes, meta myelocyte, erythroblasts, reticulocytes, etc. earlier stages of develop become progressively less morphologically distinct in their leage affiliation and fever in number, where as the least frequ cells. Which can not be discriminated morphologically, are committed progenitor cell populations and the stem cells. [23].

All blood cells are derived in to three lineages:

Erythroid cells are oxygen carrying red blood cells both reticulocyte reticulocyte count estimates the rate of erythropoiesis and erythrocyte are functional and are released in to blood. In fact lymphocyte are the cornerstone of the adaptive immune system the they are derived from common lymphoid progenitors. The lymphoid lineages is abundant cells in vertebrate blood are red blood cells. These contain haemoglobin an ion contaiming protein which facilites transportation of oxygen by reversibly binding to this respiratory gas and greatly increasing it is solubility in blood in contrast. Carbon dioxide is almost entirely transport extra cellularly dissolved in plasma bicarbonate ion vertebrate blood it is bright red when it is hemoglobin is oxygenated. Some animals such as crustaceeins and mollusks ase hemocyanin to carry oxgen. In stead of hemoglobin.

2-11-1 Site of haemopiesis:

The first few weaks of gestation the yolk sac is the main site of haemopiesis. How ever, definitive haemopiesis derives from ain population of stem cells first observed on the dorsal aorta termed the AGM (aorta – gonads – mesonphros) region.

These common precursors of endothelial and haemopietic cells (haemangioblasts) are beloved to seed the liver, spleen and bone marrow and from 6 week {u} til 6 – 7

months of fetal life the liver and spleen are the major haemopietic organs and continue to produce blood cells until about 2 weeks birth the bone marrow is the most important site from 6 to 7 months of fetal life. In infancy all the bone marrow is haemopoietic but during child hood there is progressive fatty replacement of marrow tlu-oughout the long bones so that in adult life haemopietic marrow is confined to the control skaeton and proximal ends of the femus and humeri – even in these haemopietic areas, approximately 50% of the marrow consists of fat the remaining fatty marrow is capable of reversion to haemopiesis and in many diseases there is also expansion of haemopiesis down the long bones, more over, the liver and spleen can resume their fetal haemopietic role (extramedullary haemopiesis). [21]

Stromal cells:

Growth and differentiation of hematopoietic cells in the bone maroww is regulated by the extracellular matrix and microenvironment provided by stromal alls.

These cells, includeing macrophages, fibroblasts in various stages of differentiation, endothelial cells, fat cells, and reticulum cells, nurture hemopietic stem cells and progenitor cells by producing growth factors like granulocyte macrophage colony – stimulating factor (GM – CSF), granulocyte colony – stimulating factor (G. CSF), interleukin (IL)-6, or stem cell factor. Other cytokines secrete by stromal cells regulatate the adhesion molecules present on hamatopoitic cell sallowing them to remain in the bone marrow or migrate to an area where there spective cell type is needed. [21]

2-11-2 Regulation of haemopoiesis:

Haemopiesis starts with stem cell division in which one cell replaces the stem cell (self – renewal) and the other is committed to differentiation. These early committed progenitors express low levels of transcription factors that may commit them to discrete cell lineages. Which cell lineage is selected for differentiation may depend both on chance and on the external signals received by progenitor cells.

Several transcription factors have beeri isolated that regulate differentiation a long the major cell lineages. For instance, PD.1 commits cells to the myeloid lineages where as GATA -1 has an essential role in erythropoietic and megakaryocytic differentiation. [20]

2-11-3 Haemopoitic growth factors:

The haemopoietic growth factors are glycoprotein hormones that regulate the proliferation and differentiation of haemopoietic progenitor cells and the function of mature blood cells. They act may locally at the site where they are produced by cell – cell contact or circulate in plasma. They also bind to the exh a cellular matrix to form niches to which stem and progenitor cells adhere, the growth factors may cause cell proliferation but can also stimulate differentiation, maturation, prevent a poptosis and affect the function of mature cells. [22]

These factors maintain a pool of haemopoietic stem and progenitor cells on which later acting factors erythropoietin, G-CSF, M-CSF, IL-5 and thrombopoietin act to increase production of one or other cell lineage in response to the body's need. Granulocyte and monocyte for mation. For example, can be stimulated by infection or inflammation through release of IL -1 and tumour necrosis factor (TNF) which then stimulate stromal cells to produce growth factors in an interacting network. In contrast, cytokines such as transforming growth factor (TGF) and { interferon FN-7} can exerta negative effect on haemopoiesis and may have role in the development of aplastic anaemia. [22]

Assessment of haemopoiesis:

Haemopoiesis can be assessed clinically by performing a full blood count on peripheral blood. Bone marrow aspiration also allows assessment of the later stages of maturation of haemopoiestic cells. Trephine biopsy provides acore of bone and bone marrow to show architecture. [22]

2-12 Erythropoiesis:

Red blood cell are specialized cells that deliver oxygen to tissues and remove carbon dioxide from the human body.

Erythropoiesis, the " making of red cells " involves many different genes and gene products that lead to the production of the mature cell. Erythropoiesis begins at the level of the multipotent stem cell, which them under goes commitment and differentiation.

Listed as follows are the stages of erythrooid differentiation:

- stem cell.
- B Fu – E (burst. Forming unit, erythrooid; immature erythroid progenitor).
- CFU – E (colony – forming unit, erythroid; more mature erythroid progenitor). Proerythroblasts, erythroblasts, normoblasts (morphologically recognizable red cell precursors, they still have anucleus, multiply by cell division, and progressively decrease in size as hemoglobin content increases).

Reticulocytes; mature red blood cells (erythrocyte). [21]

Erythropoietin:

Erythropoiesis is regulated by the hormone erythropoietin. The erythropoietin gene contains a hypoxia response element at its 3 end. Erythropoietin is a heavily glycosylated polypeptide of 165 amino acids with a molecular weight of 34 KDa. Normally, 90% of the hormone is produced in the hormone is produced in the peritubular interstitial cells of the kidney and 10% in the liver and else where. There are no preformed stores and the stimulus to erythropoietin production is the oxygen (O_2) tension in the tissues of the kidney. Erythropoietin production there fore increases in anaemia, when haemoglobin for some metabolic or structural reason is unable to give up O_2 normally, when at mospheric O_2 is low or when defective cardiac or pulmonary function or damage to the renal circulation affects O_2 delivery to the kidney.

Erythropoietin stimulates erythropoiesis by increasing the number of progenitor cells committed to erythropoiesis.

The transcription factors GATA-1 and FOG-1 are activated by erythropoietin receptor stimulation and are important in enhancing expression of erythroid. Specific genes (e.g. haembiosynthetic and red cell membrane proteins) and also enhanceing expression of antiapopotic genes and of the transferring receptor (CD71). Late BFU_E and CFU_E which have erythropoietin receptors are stimulated to proliferate, differentiate and produce haemoglobin. The proportion of erythroid cells in the marrow increase and the chronic state, there is anatomical expansion of erythropoiesis in to fatty marrow and sometimes in to extra medulary sites.

In infants, the marrow cavity may expand in to cortical bone resulting in bone deformities with frontal bassing and prorusion of the maxilla. [20]

Red cells (erythrocytes):

Red cell contain haemoglobin (Hb) which allows them to carry oxygen (O_2) and carbon dioxide (CO_2). Haemoglobin is composed of four polypeptide globin chains each with an iron. Containing haemmolecule. Embryonic haemoglobin is (port land, Gower land 11) are present in early fetal life. Fetal haemoglobin (HbF) dominatcs by late fetal life. As switch occurs at 3 – 6 months in the neonatal period to normal adult haemoglobin (HbA), low levels of HbF (α_2 δ_2) and the minor adult hjaemoglobin Hb A_3 (α_2 δ_2) are present in normal adults. The avility of haemoglobin to bind O_2 is measured as the haemoglobin – O_2 dissociation curve. Raised concentrations of 2,3 DPC, H+ ion or CO_2 decrease O_2 affinity.

Allowing more O2 delivery to tissues. HbF has a higher, and sickle Hb (HbS) a lower, O2 affinitiy than Hb A. Erythropoietin controls the production of red cells. It is produced in the peritubular complex of the kidney (90%), liver and other organs. Erythropoietin stimulates mixed lineage and red cell progenitors as well as pronor moblasts and early erythroblasts to proliferate, differentiate and produce

hemoglobin. Erythropoietin secretion is stimulated by reduced O supply to the kidney receptor. [22]

Haemoglobin:

Haemoglobin synthesis:

The main function of red cells is tocarry O_2 to the tissues and to return carbon dioxide (CO_2) from the estimates of erythropoietin in plasma and haemoglobin concentration. Anemia's exclude condition shown to be associated with impaired production of erythropoietin tissues e.g. lungs. In order to achieve this gaseous exchange they contain the specialized protein hemoglobin. Each red cell contains approximately 640 million hemoglobin molecules. Each molecule of normal adult hemoglobin (Hb- A) (the dominant hemoglobin in blood after the age of 3.6 months) consists of four poly peptide chain, α_2 β_2 each with its ownhaem group. The molecular weight of Hb A is 68.000. normal adult blood also contains small quantities of two other hemoglobin is: HbF and A_2. these also contain α chains, but with, and chains in the fetus and adult is discussed in more detail in chap, the blood granulocytes and monocytes are formed. [20]

2-13 White blood cells (leucocytes):

The white blood cells (leucocytes) may be divied in to two broad group: the phagocytes and the immunocytes. Granulocutes, which include three types of cell – neutrophils, eosinophils and basophils, together with monoeytes compreise the phagocytes.

The function of phagocytes and immunocytes in protecting the body against infection is closely connected with two soluble protein system of the body: immunoglobulins and complement.

These proteins which may also be involved in blood cell destruction in a number of diseases [20].

Granulocytes:

Neutrophil (Poly morph):

This cell has a characteristic dense nucleus consisting of between two and five lobes, and apale cytoplasm with an irregular out line containing many fine pink blue (a zurophilic) or grey. Blue granules. The lifes span of netrophils in the blood is only 6 – 10h. [20]

Neutrophil precursors:

These do not normally appear in normal peripheral blood but are present in the marrow, the earliest recognizable precursor is the myeloblast, a cell of a variable size which has a large nucleus with fine chromatin and usually two to five nucleoli the cytoplasm is basophilic and no granules, the normal bone marrow contains up to 4% of myeloblasts.

Myeloblasts give rise by cell division to promyelocyles which are slightly larger cells and have developed primary granules in the cytoplasm (the granules myeloperoxidase – acidphosphatase and other acid hydrolases) these cells then produce myelocytes which have specific or secondary granules (collagenase lactoferrin and lysozyme).

The nuclear chromatin is now more condensed and nucleoli are not visible. Separate myelocytes of the neutrophil, eosinphil and basophil series can be indentified. The myelocytes give rise by cell divison to metamylocytes, non dividing cells, which have an in dented or horseshoe- shaped nucleus and a cytoplasm filled with primary and secondary granules, netrophil forms between the metamyelocyte and fully mature netrophil are termed " band" " stab" or " juvenile" these cells may occur in normal peripheral blood. [20]

Monocytes:

These are usually larger than other peripheral blood leucocytes and possess a large central oval or indented nucleus with clumped chromatin, the abundant cytoplasm stains blue and contain many fine vacuoles, cytoplasmic granules are also often

present. The nonocyte precursors in the marrow (monoblasts and promonocytes) are difficult to distinguish from myelo blasts and monocytes.

Monocytes spend only a short time in the marrow and, after circulating for 20 – 40h, leave the blood to enter the tissues where they mature and carry out their principle functions their extra vascular lifespan after their transformation to macrophages may be as long as several months or even years. Gm – CSF and M-CSF are involved in their production and activation [(20)].

Eosinophils:

These cells are similar to netrophils, except that the cytoplasmic granules are coarser and more deeply red staining and there are rarely more than three nuclearlobes. Eosinophil myelocytes can be recognized but earlier stages are indistinguish able from neutrophil precursors. The blood transit time for eosinphils longer than for neutrophils.

They enter inflammatory exudates and have a special role in allergic responses, defense against parasites and removal of fibrin formed during inflammation [(20)].

Basophils:

These are only occasionally seen in normal peripheral blood. They have many dark cytoplasmic granules which overlie the nucleus and contain heparin and histamine. In the tissues they become mast cells. They have immunoglobulin E (IgE) attachment sites and their degranulation is associated with histamine release [(20)].

Control of granulopoiesis: myeloid growth factors:

The granulocyte series arises from bone marrow progenitor cells which are increase ingly specialized. Many growth factors are involved in this maturation process including inter leuk in -1 (IL – 1), IL – 3, IL -5 (for eosinphils), IL -6, IL -11, granulocyte – macrophage colony – stimulating factor (GM – CSF), granulocyte CSF (G – CSF) and monocyte CSF (M – CSF), the growth factors stimulate proliferation and differentiation and also affect the function of the mature cells on which they act (e.g. phagocytosis, superoxide generation and cyto-toxicity in the

case of neutrophil; phogocytosis cytotoxicity and production of other cytokines by monocytes) [20].

Lymphocytes:

Lymphocyles are the immunologically competent cells that assist the phagocytes in defence of the body against infection and other foreign invasion.

In postnatal life, the bone marrow and thymus are the primary lymphoid organs in which lymphocytes develop. The secondary lymphoid organs in which specific immune responses are generated are the lymphnodes, spleen and lymphoid tissues of the alimentary and respiratory tracts [20].

B and T lymphocytes:

The immune response depends upon two types of lymphocytes, B and T cells, which derive from the haemopietic stem cell. B cells mature in the bone marrow and circulate in the peripheral blood until they under go recognition of antigen.

T cells develop from cells that have migrated to the thymus where they differentiate in to mature T cells during passage from the cortex to the medulla during this process, self reactive T cell are deleted (negative selection) whereas T cell with some specificity for host human leucocyte antigen (HLA) molecules are selected (positive selection) [20].

Lymphocyte circulation:

Lymphocytes in the peripheral blood migrate through post capillary venules in to the substance of the lymph nodes or in to the spleen or bone marrow. [20]

2-14 Platelets:

Platelet production:

Platelet are produced in the bone marrow by fragmentation of the cytoplasm of megakaryocytes, one of the largest cells in the body. The precursor of the megakaryocyte. The megakaryoblast arises by a process of differentiation from the haemopoietic stem cell. The megakarycyte matures by endo mitotic synchronous replication [20].

Mature megakarycytoes are extremely large, with an eccentric placed single lobulated nucleus and a low nuclear to cytoplasmic ratio, Platelets form by fragmentation of megakaryocyte cytoplasm, approximately each megakaryocyto giving rise to 1000 – 5000 Platelets.

The time interval from differentiation of the human stem cell to the production of Platelets averages approximately 10 days.

Thrombopoetin is the major regulator of Platelet production and is constitutively produced by the liver and kidney the normal Platelet life span is 7 – 10 days [20].

Platelet function:

The main function of Platelet is the formation of mechanical plugs during the normal haemostatic response to vascular injury. The immobilization of Platelets at the sites of vascular injury requires specific Platelet- vessel wall (adhesion) and Platelet – Platelet (aggregation) interactions. [20]

2-15 Previous Study:

1- In study by Geeth a J and srikrishna R in IRAN 2012, RBCs indices were compared in patients with hypothyroidism and hyperthyroidism and revealed MCV and RDW in these two groups of patients in comparison to euthyroid difference but other RBCs parameters like HB and HCT did not show any significant difference in comparison with euthyroid status but in our study, these parameters were statistically different between patients and control group except for MCV. [24]

2- Kawa MP and *et al* in IRAN ,2010 reported that RBCs, HB and HCT in patients with hyperthyroidism were significantly higher than control groups while RBC and HB were decreased in hypothyroidism, while HCT was increased. They also showed that MCH and MCHC were lower in both group in comparison with control group and MCV was in increase in two groups of hypothyroidism and hyper thyroidism. [25]

Chapter Three

Materials and Methods

Materials and methodology

Study design:

This is a cross sectional descriptive study conducted in Shendi town during the period from April 2018 to July 2018 to evaluate the correlation between thyroid disease and some haematological changes.

Study area:

The study was conduct at Shendi town in Sudan, Shendi is a town in northern Sudan, situated on the east bank of the Nile 150 km north east of Khartoum.

Study population:

This study will include forty patients with thyroid disease from Shendi town, and forty as control group.

Inclusion criteria:

Any femals with thyroid disease[hypo or hyper thyroid].

Exclusion criteria:

Any patients with hematological disease.

Ethical consideration:

Permission was take from college research committee and purpose of study will explain to the participant and permission was take from them verbally.

Data collection tools:

By using questionnaires.

Data analysis:

The data was analyzed by using statistical package for social science (SPSS).

Blood sampling:

5ml of venous blood was take from patients and transferred into an EDTA and heparin lithium container.

Requirement:

- EDTA container.
- Cotton – Alcohol (70%).
- Syringes and tourniquet.
- Complete blood count (CBC) are carry out follow a simple procedures.

Complete blood count (CBC):

Principle:

Blood cells can be broadly divided into three calegories, red blood cells, white blood cells and platelet.

The analyzer measures the number of cells and distinguishing between their types according to size using sheath flow DC detection, electrical currents passed through a solution. This method measures the changes in electrical resistance that occurs when blood cells pass through detection aperture.

Procedures of (CBC):

HGB measurement:

Is determined by the colorimetric method. The WBCs / HGB dilution is delivered to the WBCs bath where it is bubble mixed with a certain I amount of lyses. Which converts Hb to Hb complex that is measurable at 525 nm.

RBCs: RBCs / PLts are counted and size by the coulter method. The method is based on measurement of changes in electrical resistance.

MCV and other RBCs indices based on the RBCs histogram, this analyzer calculates the mean cell volume (MCV) and expresses the result in fl. This analyzer calculates the HCT (%), MCH (Pg) and MCHC (g/l) as follows.

$$HCT = \frac{RBC \times MCV}{10}$$

$$MCH = \frac{HGB}{RBC \times 10^6}$$

$$MCHC = \frac{HGB \times 100}{PCV}$$

$$MCV = \frac{HCT}{RBCs \times 10}$$

$$MPV = \frac{PCT}{PLT \times 10}$$

WBCs:

Counted in the WBCs chamber after the addition of stromatolyger which actsto:

- Lyse the RBCs.
- Modify the WBCs to suit the differential counting thresholds.

Thyroid hormone measurement:

Ichroma:

Principle:

The test uses a competitive immunodetection method. In this method, the target material in the sample binds to the fluorescence (FLI – labeled detection antibody in detection buffer, to form the complex as sample mixture). This complex is loaded to migrate on to the nitro cellulose matrix, where the covalent couple of and bovine serum albumin is immobilized on a test strip, and interferes with the binding of target material and fluorescence labeled antibody.

Procedure:

1. Transfered 75 ml of sample (Human serum, plasma, control) used a transfer pipette to a tube containing the solution A.
2. Mixed well by pipetting 10 times.
3. Added 75 ml of solution B to the tube containing the solution A and sample mixture.
4. Closed the lid of solution A tube and mix the sample by shaking it about 10 times.

5. Incubated the solution A + solution B + sample mixture at room temperature for 8 minites.
6. Pipette out 75ml of sample mixture and load it in to the sample well on the cartridge.
7. Insert the sample loaded test cartridge in to the slot of the I chamber or an incubator (25^0c) and incubator for 8 minutes.
8. Insertit into the cartridge holder of the instrument for I chroma tests.
9. Read the test result on the display screen of the instrument for ichroma tests.

Normal value:

RBCs: 3.9 – 5.6 × 10^{12} / L

Hb Female: 11.5 – 15.5 g/dL

Hb male: 13.5 – 17.5 g/dl

PCV: 35 – 50 %

MCV : 80 – 95 FL.

MCH: 27 – 34 Pg

MCHC: 20 – 35 g/dl.

WBCs: 4.0 – 11.0 × 10^9 / L

Platelet: 150 – 400 × 10^9 / L

MPV: 8 – 12 FL.

TSH: 0.4 – 4.2

T3: 1.2 – 3.1 n mol/L

T4: 57.9 – 150.6 nmol/L.

Chapter Four

Results

4. Results

Table (4-1): Mean of (TSH, T3, T4) in test and control

Elements	Samples	Mean	P.value	The correlation
TSH(U	Test	9.52	0.00	Significant
	Control	1.46		
T3 (nmol/L)	Test	2.76	0.002	Significant
	Control	1.73		
T4 (nmol/L**)**	Test	137.9	0.00	Significant
	Control	106.6		

Table (4-2): Mean of TWBCs count in test and control

Elements	Samples	Mean	P.value	The correlation
TWBCs	Test	6.5	0.032	Significant
	Control	5.8		

Table (4-3): Mean of (HB, RBCS, PCV, MCV, MCH, MCHC) count's in test and control:

Elements	Samples	Mean	P.value	The correlation
HB(g/dL)	Test	10.6	0.677	No significant
	Control	11.2		
RBCS($\times 10^{12}$)	Test	4.4	0.318	No significant
	Control	4.6		
PCV (%)	Test	30.8	0.210	Not Significant
	Control	32.0		
MCV(FL)	Test	70.5	0.609	Not Significant
	Control	70.0		
MCH(Pg)	Test	25.0	0.665	Not Significant
	Control	25.4		
MCHC(g/dL)	Test	35.6	0.279	Not Significant
	Control	35.9		

Table (4-4): Mean of (PLT, MPV) count in test and control

Elements	Samples	Mean	P.value	The correlation
PLT	Test	271	0.376	No Significant
	Control	264		
MPV	Test	7.6	0.198	No Significant
	Control	7.6		

Chapter Five

Discussion

Conclusion

Recommendations

5.1 Discussion

This across sectional descriptive study was done in Shendi Town to determine the correlation between thyroid disease and haemtological changes.

The study include 80 samples (40) of them with thyroid disease and (40) healthy as control groups.

The results of this study revealed the mean of (TSH: 9.52, T3 : 2.76, T4 : 137.9) in test while in control were(1.46, 173, 106.6) respectively, when compared between these results the thyroid hormone have significant variation with (P.value = 0.00, 0.002, 0.00) respectively.

The result obtained from this study demonstrated significant variation in the mean of TWBCs count in thyroid disease was $6.5x10^9$ and control was $5.8x10^9$ with (P.value 0.032) this result show that the thyroid these have effect on TWBcs.

The result Showed the mean RBCs was $4.4x10^{12}$, MCV 70,5,MCH 25.0, MCHC 35.6 when compared with control the RBCs 4.6x10,PCV 32.0,MCV 70,0,MCH 25.0,MCHC 35.9 were insignificant variation with (P.value :0.31, 0.06, 0.66, 0,27) respectively ,also this result was agreed with finding reported by Geeth J and srikrishna in some parameter such as (Hb and HCT) and disagreed with other parameter (RBCs and RBCs indices).[24]

This study showed the mean of platelet count was $271x10^9$\l and MPV was 7.6 and in control $264x10^9$\l and MPV 7.6 when compared between them there were no significant variation with (P.value0.37 and 0.198) so the thyroid disease don't effect on platelet count and MPV.

5.2 Conclusion

The result obtained from this study concluded that:

1- The mean of TWBCS=6.5X10^{9}\L while in control 5.8 × 10^{9}/L.

2- The mean of Hb and RBCS Indices not affected by thyroid disease.

3- The mean of Platelet and MPV were similar in test and control.

4- The mean of thyroid hormone (T3, T4 ,TSH, were 2.76 nmol\L, 137.9nmol\L, = 9.5 μm/l) while in control(T3, T4, TSH were 1.73 nmol/L, 106.6 nmol/L, 1.46 5 μm/l).

5-TWBCs count was significantly increased among patient with thyroid dysfunction, while the other haematological parameters were not affected.

5.3 Recommendations

1. According to obtained data we suggested that all patients with thyroid disease should be periodically evaluated for probably hematological changes.
2. This study should be repeated with increase sample size.
3. Other studies are needed to determine haematological changes among subgroup of thyroid disease (hypo and hyper thyroid patients).

Chapter Six

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Appendices

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Faculty of Graduate Studies and Scientific Research

Questionnaire about Determinatiom of Haematological Changes Among Female with Thyroid Disease in Shendi Town

Name: .....

1. **Do you currently have any of these symptoms?**
   - **Palpitations (rapid or forceful heart beat):** Yes ( ) No ( )
   - **Difficulty sleeping:** Yes ( ) No ( )
   - **Excessive need for sleeping:** Yes ( ) No ( )
   - **Fatigue:** Yes ( ) No ( )
   - **Depression:** Yes ( ) No ( )
   - **Frequent bowel movements or loose stools**: Yes ( ) No ( )
   - **Infrequent bowel movements or hard stools:** Yes ( ) No ( )
2. **Are you menstrual change:**

   Yes ( ) No ( )
3. **Did you suffer from history of thyroid diseases?**

   Yes ( ) No ( )

If yes, identify type of disease:

Hyper thyroid ( ) hypo thyroid ( )

4. **Are you currently being treated for a thyroid disease?**

   Yes ( ) No ( )

If yes please indicate:

Thyroid hormone therapy ( ) anti thyroid drug therapy ( ) other ( )

5. **Hove you been miscarried during past period?**

   Yes ( ) No ( )

6. Do you suffer from bleeding?

Yes ( ) No ( )

7. Do you suffer from anemia?

Yes ( ) No ( )