Hypothyroidism and High Fat Diet Could Accelerates obesity and Aggravates inflammation in Albino Rats.

Jasem Hannon Hashim Al-Awadi Ph.D.

Science College, Al-Qadesiya University. Al-Qadesiya-Iraq.

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Abstract:

The present study was curried out to investigate the effect of high fat diet along with hypothyroidism on both body weight, some hormonal and inflammatory markers as well as thyroid gland histology. For this purpose twenty four adult rats divided into four groups of equal numbers. Body weight, thyroid function hormones(T3,T4 and TSH), and cytokines(IL-1β,IL-6 and TNF-α) were measured in all experimental groups. Histopathological study of thyroid gland was carried out.

Results of present study showed significant increase($p<0.005$) in both final and gain body weight of high fat diet feeding rats, and hypothyroidism along with high fat diet feeding rats.

Carbimazole decreased significantly ($p<0.005$) T3,T4 but increased significantly($p<0.005$) TSH in hypothyroidism and obese along with hypothyroidism groups. In all experimental groups cytokines significantly increased ($p<0.005$) as compared with control group.

Histological finding are in parallel with hormonal and inflammatory markers measurements, histology of thyroid gland in obese group noticed intact and similar to control group, but there were different histological changes in hypothyroidism and obese hypothyroidism groups, these changes represented by: increase height of epithelial cells lining follicles, decreased to completely lost the colloidal materials, papillary hypertrophy, hyperplasia, fibrosis of inter follicular tissue, infiltration of lymphocytes and in some cases adipocytes invaded inter follicular tissue. In conclusion a high fat diet if concomitant with hypothyroidism could accelerate and aggravate inflammation and induces histopathological changes in thyroid gland.

Introduction:

Thyroid gland well known to play vital roles in growth, development and metabolism, The main actions of thyroid hormones is exerted on different body activities which include: metabolism, oxygen consumption, energy expenditure and growth through the metabolism of protein and lipid to regulate different metabolic processes[1]. These actions appears to be regulated by Hypothalamus-Pituitary-Thyroid axis . Hypothalamus secrets what we called thyroid stimulating hormone-releasing hormone(TSH-RH)which induce pituitary gland(Adenohypophyses)to produces and secretes thyroid stimulating hormone(TSH), thyroid gland is a target organ of TSH hormone which produces thyroid hormones[2]. Thyroid hormones namely triiodothyronine (T3), thyronine has three iodine and the thyroxine (T4), thyronine has four iodine , thyroxine (T4) is the main thyroid gland hormonal secretion which then deiodinated to produce the most active thyroid hormone tri-iodothyronine (T3)[3].

The thyroid gland produces its hormones which called T3 and T4. This gland are storage its hormones in its follicles as a colloid materials which filled the spaces inside the follicles, colloid materials consist what we called thyroglobulin, a storage form of thyroid hormones which bind to its protein carrier [4]. Thyroid gland constitute one of the most important axis in the mammalian bodies , This axis control the secretion of thyroid hormones(T3&T4) by mechanism called feedback mechanism, according to this mechanism hypothalamus produce thyroid stimulating hormones-releasing hormone in specific neuron cells called the paraventricular nucleus which stimulates adenohypophysis of pituitary gland to release thyroid stimulating hormone (TSH) and this in turn, stimulates thyroid gland to synthesis and release its hormones, leading to increase thyroid hormones. High levels of thyroid hormones inhibit pituitary and hypothalamus to decrease tis secretions of (TSH and TSH-RH), respectively, this manner called feedback mechanism which responsible of synthesis and productions of thyroid hormones.[5].

Histologically, thyroid gland is composed of fundamental units called thyroid follicles with different size, these follicles was composed of peripheral epithelial cells surrounded a space filled with colloidal materials, which represent storage form of thyroid hormones [6].

Hypothyroidism is a metabolic disorders which is usually associated with decreased levels of thyroid hormones and increase of TSH concentrations in the blood, conditions lead in most cases to overweight and obesity[7].

Hypothyroidism is one of the most important thyroid gland disorders, which leads to impairments of multiple body activities, included: increase of body weight, oxygen consumption, imbalance of energy expenditure, decreases thyroid hormones levels(T3,T4), increase thyroid stimulating hormone(TSH), all of which reflect the central role of thyroid gland in regulating adipose tissue metabolism[8]. Some reports referred to inhibition effects of thyroid hormones of adipocytes proliferation , concomitant with its role in stimulate the differentiation of these cells which result in increments the fat mass of the body what we called obesity[9]. However to evaluate the effects of thyroid hormones on the metabolism of fat tissue and its relationship with inflammation, some researchers was used the high fat diet which induce obesity[10].

Food which contain high amount of fat could produces obesity with its consequent cardiovasicular disease(CVD). Several studies have been observed that a high fat diet rich in cholesterol or saturated fatty acids induced a marked increase in epididymal and perirenal adipose tissues in comparison with low-fat diet[11]. Consumption of high fat diet for eight week in rats resulted in high increase in weight of visceral organs and total weight increments all of which called obesity[12]. Rats fed on high fat diet for eight weeks successfully became obese with marked increase in body and visceral organ weight. Obesity development was accelerated in several models of experimental animals which fed high amount of fat along with special hormonal and drug treatments[13]. there is argumentation in many reports which referred to the effect of high fat diet on, obesity and hypothyroidism. Thus this study was designed to evaluate hormonal, inflammatory, and histopathological changes in hypothyroidism and obese animals.

Materials and Methods:

Twenty four male albino rats was purchased from animal house, college of Sciences , University, of Babylone, , their ages range between (3- 3.5) months, while weight were between (210- 280 g). Rats were placed in house in controlled condition of temperature (22 ± 5C°), and 12 light-dark cycles hours. Rats was acclimatized for one weeks and access to drink water *add libitum* and standard chow diet, then divided in to four groups, each of six rats.

1-Group A: (Normal control group)(normal diet, normal thyroid gland): The rats were caged in large polypropylene cages. The animals in this groups maintained on standard chow (table 1), (This group was administered orally once daily for four months by gastric gavages 1ml normal Saline /Animal/ day).

2-Group B: (normal diet with induce Hypothyroidism) The rats were caged in large polypropylene cages , animal in this groups maintained on standard chow (table 1), at the same time rats in this group administered orally of 1 ml of 1.35mg/kg/day carbimazole equivalent to the therapeutic dose for human[14]. (carbimazole) prepared in phosphate buffered).to induces hypothyroidism in this group.

3-group C (Obese rats with normal thyroid gland): Rats were caged in polypropylene cages (each cage contained six rats).Rats in this group were fed on high fat diet(HFD) listed in table (1) for four months, to induce obesity in this group (This group was administered orally once daily for four months by gastric gavages 1ml normal Saline /Animal/ day).

4-group D (Obese rat with induce Hypothyroidism) Rats were caged in polypropylene cages (each cage contained six rats).Rats in this group were fed on high fat diet(HFD) listed in table (1) for four months, to induce obesity in this group at the same time rats in this group administered orally of 1 ml of 1.35mg/kg/day. (carbimazole). prepared in phosphate buffered).to induces hypothyroidism in this group. All rats weighted at the beginning of experiment as well as twice monthly until the end of experiment.

At the end of experiment, all rats weighted and scarified after overnight fasting. then the following samples(blood and thyroid gland) were collected.

Blood

bout 5ml of Blood was collected by direct heart puncture after overnight fasting and after anesthetized of animal with chlooroform and ketaamin hydrochloride injection, blood was placed in geel tast tube and left to stand for 20 minutes at room temperature to allowing clotting. The serum samples were prepared by centrifugation at 4000 rpm for 15 minutes to estimate the levels of thyroid hormones, inflammatory markers were conducted as follows: (biochemical assays).

Biochemical assays:

1-thyroid hormones measurements:

Thyroid functions test (T3, T4 and TSH) estimating using the kits (for T4, T3 and TSH) were purchased from The (Biomerieux, France) assay employed a technique of radio-immunoassy(RIA) . [15].

2-inflammatory markers measurements:

Serum test ELISA by commercial kit (Biomerieux, France) as recommended for inflammatory cytokines (IL)-1β, IL-6, and tumor necrosis factor alpha (TNF)-α. [16].

Histopathology:

Tissue (thyroid gland)was obtained from rats in experimental groups to prepare cross-sections of thyroid tissue this preparation according to[17]. About 0.5 cm of thyroid was washed by saline and then fixed in 10% formalin solution for two days . thyroid tissues sectioned (5Mm thick sections) and stained with hematoxylin and eosin (H&E),slides examined under Olympus microscope and photomicrographs were taken.

Statistical analysis:

Statistical Pacckage for Social Science (SPpSS) system/ version 14 was used to analyze our results. The analysis of variance (ANOVA) and T test the paired sample were used for this purpose.

Table (1): The compositions and percentages of normal and high fat diet.

	Normal diet		High fat diet (HFD)	
N0.	Ingredients	Percentage (g)	Ingredients	Percentage (g)
1	Casein	20	Casein	20
2	Maize starch wheat starch	42 23	Maize starch wheat starch	27 23
3	Cane sugar	10	Cane sugar	10
4	Salt mixture(mineral mixture)	3.5	Salt or mineral mixture	3.5
5	Vitamin Mixture cholesterol	1	Vitamin Mixture cholesterol	1
6	Fat of plant origin(Palme oil) (saturated fatty acids)	-	Fat of plant origin(Palme oil) (saturated fatty acids)	10
7	Coconut oil	-	Coconut oil	5
8	Choline and Methionine	0.5	Choline and Methionine	0.5
	Total (g)	100		(100)

Results:

1-Body weight measurements:

Table 2:Changes of means body weight in study groups:

Groups	Body weighting (mean±S.D)		
	Initial weight (gm.)	Final weight (gm.)	Gain in weight (gm.)
1-groupA	240.2±21.68^{a}	395.62±37.37 ^{a}	158.45±31.56 ^{a}
2-group B	257.63±24.28^{a}	475.34±24.20^{*b}	220.06±12.33^{*b}
3-group C	249.15±20.50^{a}	545.30±20.34^{**bc}	300.08±15. 25 ^{**bc}
4-group D	255.3±25.15^{a}	650.45±22.43^{***bcd}	400.37±25.50^{***bcd}

All values represent mean±S.D (N=6), * Significant differences ($p<0.05$), **Significant differences ($p<0.005$)), ***Significant.. differences ($p<0.0005$), A = not, significant differences, B = significant differences .. when compare ..group B with group A. bc=significant differences when compare group C with group B and A. bcd=significant differences when compare group D with group B,C and A.

As shown in table2,results of this study show body weight changes in experimental animals and the changes representing, by a gain in body weight, between the initial and final body weight. there was no significant differences($p>0.05$)if compared the initial body weight of all experimental groups between each other's .But there was significant increase in final body weight as well as in gain body weight of group B as compared with group A. Group C showed high significant increase($p<0.005$)in gain body weight and final body weight as compared with group B and A. Animals of group D which feed high fat diet and treated by carbimazole to induce hypothyroidism showed high significant increase($p<0.0005$)in gain and initial body weight as compared with all experimental groups.

2-Levels of thyroid hormones

Table 3: Changes of means of thyroid hormonal measurements in study groups:

Groups	Thyroid hormones measurements (mean ±S.D)		
	T4(pg/ml)	T3(pg/ml)	TSH(mIU/L)
1-groupA	26.20 ± 1.22^{a}	3.86 ± 0.55^{a}	3.65 ± 1.38^{a}
2-group B	$0.55\pm0.03^{**b}$	$0.70\pm0.12^{*b}$	$20.25\pm4.3^{**b}$
3-group C	26.60 ± 1.75^{a}	4.03 ± 0.70^{a}	3.5 ± 1.53^{a}
4-group D	$0.73\pm0.61^{**cd}$	$0.65\pm0.05^{*cd}$	$19.56\pm3.85^{**cd}$

All values represent mean ±S.D(N=6), * Significant differences ($p<0.05$), **Significant differences ($p<0.005$), A = not significant different , B = significant different when compare group B with group A. cd =significant different when compare ,,group D. with group A and C.

As shown in table 3 the levels of thyroid hormones function test showed different significant differences among all study groups. Animals in group B which treated by carbimazole showed significant decrease in levels of T3 and T4, but there was significant increase in the level of TSH if compared control group. T3 and T4 decreased significantly, but TSH increased significantly in animals of group D which fed high fat diet and treated by carbimazole if compared with control group as well as animals of group C which fed high fat diet only.

3-Levels inflammatory cytokines:

Table 4: Levels of serum inflammatory cytokines among study groups:

Groups	Inflammatory markers measurements (mean±S.D)		
	IL-1β(pg/ml)	IL-6(pg/ml)	TNFα (pg/ml)
1-groupA	9.90±1.20[a]	11.30±3.60 [a]	60.40±10.20 [a]
2-group B	15.20±2.5[*b]	16.70±3.30[*b]	78.92±5.35[*b]
3-group C	28.10±6.20[**bc]	73.60±10.15 [**bc]	163.85±20.13 [**bc]
4-group D	39.35±2.50[**bcd]	94.76±8.30[**bcd]	215.40±18.68[**bcd]

All values represent mean±S.D(N=6), * Significant differences ($p<0.05$) **Significant differences ($p<0.005$), A = not significant different, B = significant different when compare group B with group A. bc=significant differences when compare group B and C with group A bcd=significant differences when compare group B,C and D. with group A.

Table 4 represent the levels of inflammatory markers which included(Interleukin one beta, Interleukin six and Tumor Necrosis Factor Alfa) these inflammatory cytokines increased significantly(($p<0.05$) in group B,C and D as compared with control group A. also there is high significant increase(($p<0.005$) in cytokines inflammatory markers of group C if compared with group A and group B. as well as IL-1β, IL-6 and TNFα increased significantly in group D as compared with all experimental groups.

4-Histopathological changes in thyroid gland:

Figure 1(A1,A2)represent thyroid gland histology of control group, clearly it composed of follicles with different sized, filled by colloid surrounded by low cuboidal epithelial cells without any abnormal appearance at the levels of follicles, colloid and epithelial cells.

Microscopic examination of cross sections of thyroid gland of group B(rats treated by carbimazole) showed different degree of histopathological changes represented by: increase the height of epithelial cells which surrounded the follicles, decrease the colloidal materials, most follicles appeared empty compared to control.

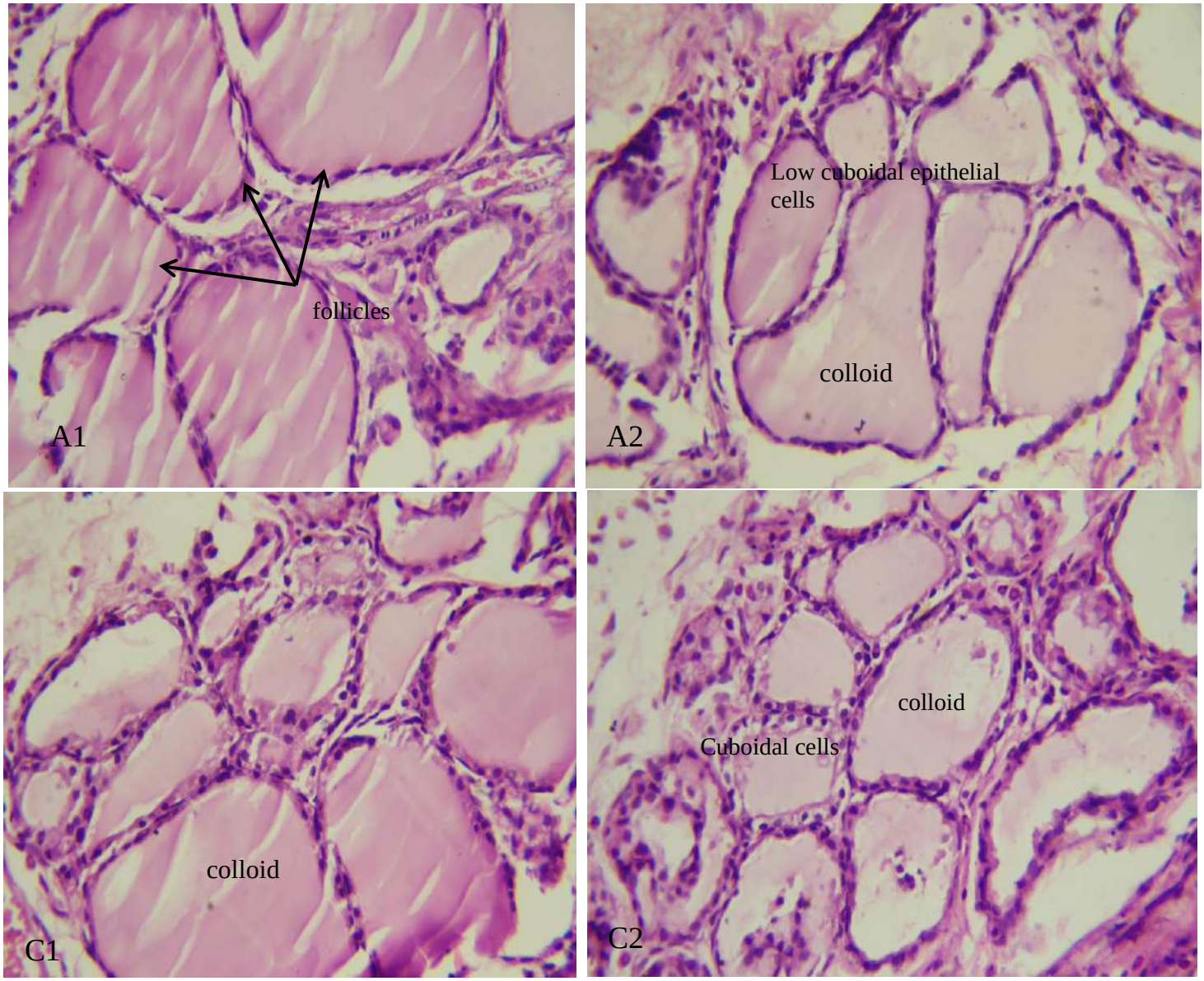

Figure 1 (A1,A2) represent cross-section of thyroid gland of control group(A),notice normal architecture of the follicles filled by homogenous colloid surrounded by squamous epithelial cells,(C1,C2) cross-section of thyroid gland of group (C) animals which fed high fat diet thyroid tissue appeared to be normal follicles ,filled by homogenous colloid surrounded by cuboidal epithelial cells with present lymphocyte infiltration. 400 X

The most sever histopathological changes noticed in cross sections of thyroid gland of group D rats in this group treated by carbimazole 1.35 mg/kg/day along with high fat diet, these sections showed completely distortion the normal architecture of thyroid gland represented by: papillary hypertrophy, hyperplasia, completely colloidal materials lost(most follicles appeared empty), marked lymphocyte infiltrations, with marked inter follicular tissue invade by adipocytes and fibrosis of inter follicular tissue.

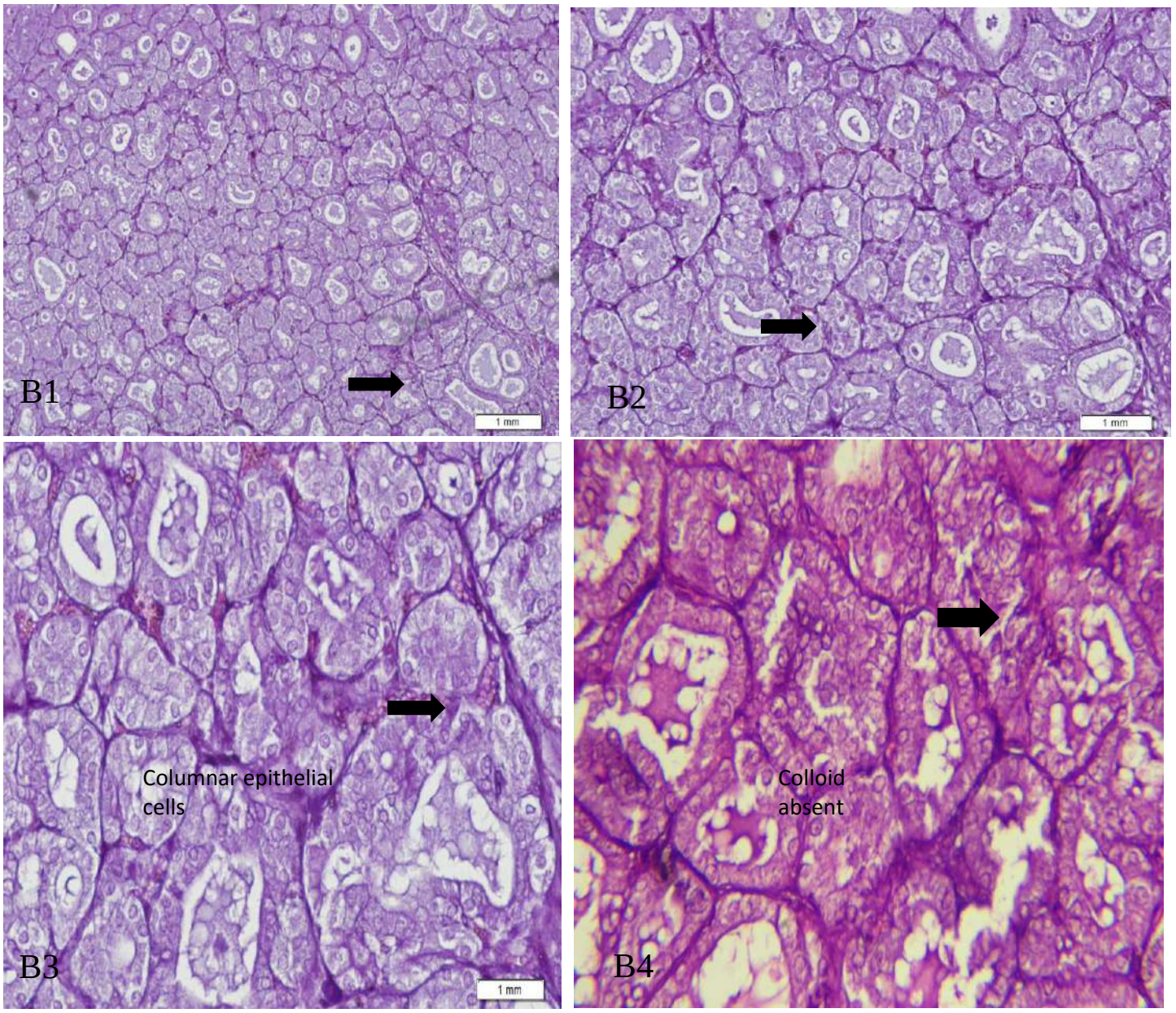

Figure 2 cross-section of thyroid gland of group B(rats treated by carbimazole 1.35 mg/kg/day) follicles appeared to be empty (most colloid absent) increase the height of epithelial cells (columnar) most follicles showed small lumina (black arrow) with little colloidal material compared to control hematoxyline- eosin stain (20-40X)

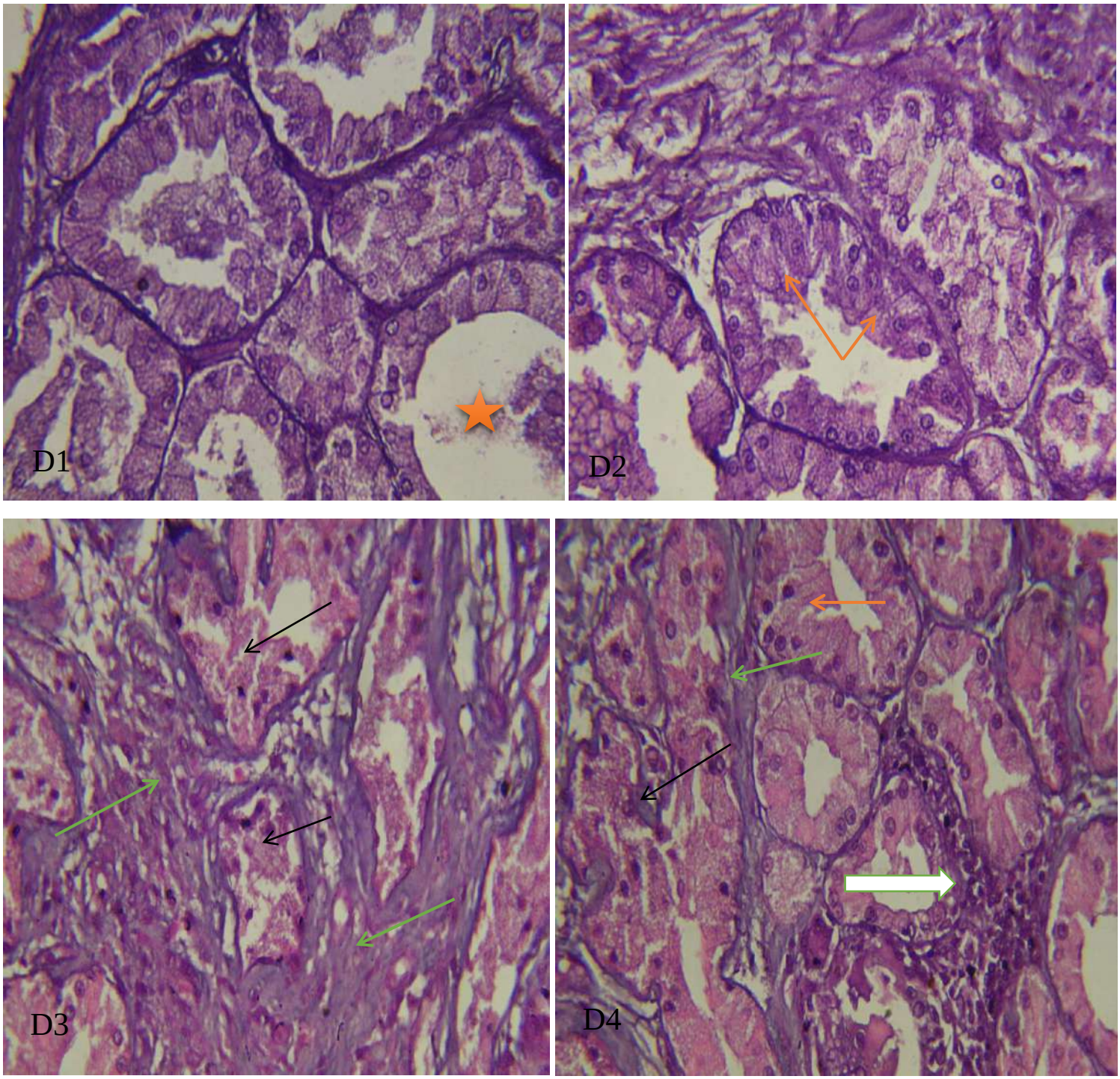

Figure 3 cross-section of thyroid gland of group D(1,2,3,and 4)(rats treated by 1.35mg/kg/day carbimazole along with feeding high fat diet) these sections showed lost the normal architecture and follicular structure .papillary hypertrophy(yellow arrow),hyperplasia (black arrow),fibrosis of inter follicular tissue(green arrow) with marked lymphocyte infiltration and lost most colloidal materials(yellow star) increase the height of follicular epithelial cells(columnar). hematoxyline-eosin stain 400X .

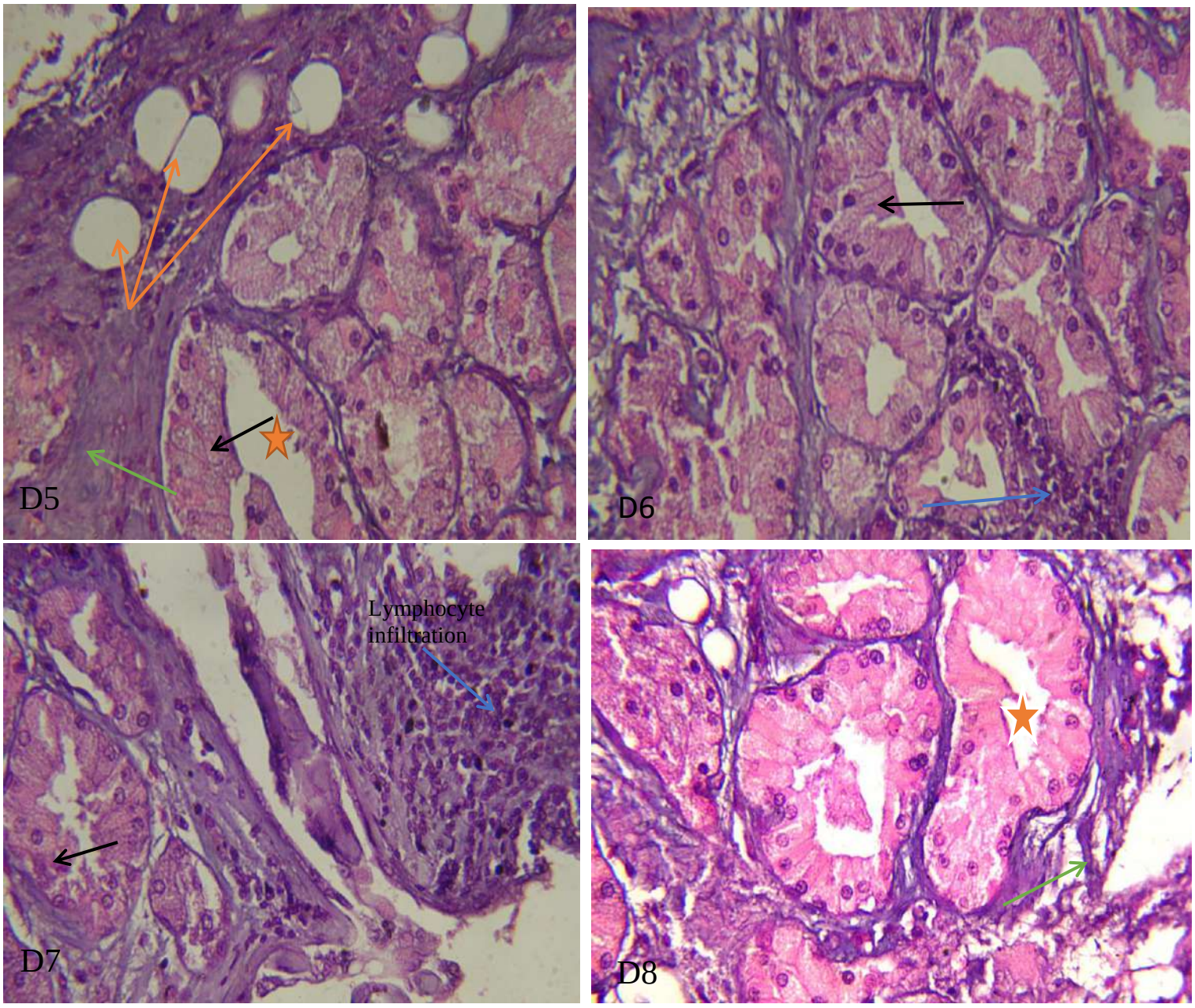

Figure 4 cross-section of thyroid gland of group D(5,6,7 and 8).rats which treated by carbimazole 1.35mg/kg/day and fed high fat diet, these sections showed completely distortion the normal architecture of thyroid gland represented by: papillary hypertrophy(black arrow), hyperplasia, completely colloidal materials lost(most follicles appeared empty)(yellow star),marked lymphocyte infiltrations(blue arrow) ,with marked inter follicular tissue invade by adipocytes(yellow arrow) and fibrosis of inter follicular tissue(green arrow).hematoxyline-eosin stain. 400X.

Discussion:

In the present study carbimazole was used to induce hypothyroidism, high fat diet administered to induce obesity both alone and in combination with each other to induce hypothyroidism and obesity in experimental animals as a model of obesity which may be concomitant with hypothyroidism. Thus for this purpose our model included high fat diet feeding animals for four months. High-fat diet causes increase levels of cholesterol to in people and experimental animals, which leads to obesity. The weight gain in high fat diet group of rats was significantly higher than control rats showing the influence of high cholesterol diet[18]. Similarly, in present study there was significant weight gain in group(B and D) which fed on (HFD) for four months as compared to control group. high fat diet feeding rats caused significant increase in both final and gain body weight compared with control rats. It has been shown that High fat diet (HFD) induce body weight gain and adiposity in animals and humans [19]. Similarly, we found that high fat diet fed animals for four months caused significant increases in body weight gain and adiposity may be due to increased intra-abdominal fat pad mass, this increase may be attributed to increase in food intake as well as to increase of subcutaneous, visceral and abdominal adiposity(such as abdominal, perirenal, epididymal, retroperitoneal white adipose tissues)[20]. Body weight gain and obesity may be attributed to decrease thyroid hormones(T3,T4).which well known to decrease body weight with accesses of the levels of thyroid hormones[21].

This study was consistent with study of [22], who reported that high fat diet caused high increase in body weight gain, and they pointed out this increase due to high increase of lipid contain in visceral organs(epididymal, kidney and abdominal fats).

Carbimazole, hypothyroid drug rapidly metabolized in the body into the active form, methimazole, this metabolized form exert its role in induce hypothyroidism by decreasing the amount of thyroid hormones(T3,T4) which produced by thyroid gland. More accurate this drug inhibits the enzyme what we called thyroperoxidase, which normally acts in synthesis of thyroid hormones by oxidizing the iodide to iodine, facilitate the addition of iodine to tyrosine residue on the hormone precursor thyroglobuline in colloid materials of thyroid follicles , which in turn decrease the levels of thyroid hormones[23].

Result in the present study revealed that carbimazole treated rats showed decrease in thyroid hormones(T3,T4) accompanied with increase in TSH levels. This finding was in line with result of [24] pointed out that Carbimazole, like thiouracil and propylthiouracil, is one of the thionamide

group of goitrogens and it indirectly increases TSH output from the anterior pituitary by blocking the formation of thyroid hormones.

Thyroid hormones regulating and secreting controlled by hypothalamus-pituitary-thyroid axis, TSH produced by pituitary gland to regulate synthesis and secreting thyroid hormones. Low levels of thyroid hormones reduced by carbimazole, resulting in increased of TSH levels in the blood of rats by feed-back mechanism, which in turn indicate induce hypothyroidism in experimental rats [5].

In the present study we were used inflammatory cytokines markers to evaluate the effect of high fat diet alone as well as along with hypothyroidism to induces inflammation, our fending indicate increase of the levels of cytokines in both obese and hypothyroidism rats, but there is heights significant increase in the levels of cytokines in hypothyroidism if concomitant with high fat diet, this increment could be attributed to inflammation which caused by both decrease in thyroid hormones and obesity which caused by high fat diet .

Cytokines(IL-1ß, IL-6, TNF-α)were reported to secreted by macrophages, damaged cells, as well as damaged and apoptotic in hyperlipidemic liver cells which lead to activation of complement system. The most important cells that secrete IL6 , IL1ß and TNF-α were stimulated monocytes and macrophages, endothelial cells, fibroblast cells and plasma cells all of which were contributed in hyperlipidemia and early atherosclerosis events[25].

In obese animals, these macrophages are activated and produce cytokines such as IL1, IL6, TNF-α, these cytokines are released into the circulation and elevated cytokine levels have been found in these obese subjects[26].

Histopathological examination of thyroid gland in the present study revealed that hypothyroidism was effectively induced by carbimazole. Drug in this study equivalent to the therapeutic dose for human if given for prolonged period could result in marked inhibition of thyroid hormones synthesis with subsequent increase in TSH levels, thus TSH which in turn was well known to work on thyroid gland follicular epithelial cells resulting in hypertrophy and hyperplasia, as a condition which known as nodular goiter[27]. carbimazole induced hypothyroidism was reported by[28] to induce oxidative stress in rats in thyroid follicles resulting tissue damage and apoptosis which in turn increased the inflammatory cells infiltration (lymphocytes infiltration) in the thyroid tissue.

On the other hand high fat diet feeding for long periods well known to induce obesity which in turn induce oxidative stress by increasing free radicals(reactive oxygen species) which the main

stimulators to recruitments inflammatory cells with increase its secretions of inflammatory cytokines. Thus we can concluded if concomitant of hypothyroidism with high fat diet, this condition could accelerate and aggravate obesity and inflammation.

References:

1-Abdelatif A.N. and Elkhair M.N. (2009). Effect of seasonal change in the thermal environment on physiological responses of unsexed broilers to dietary supplementation of antithyroid drug carbimazole. *Middle-East J. Scientific Res*. 4(2), 122-126.

2-Moravej H., Khazali H., Shivazad M. and Yeganeh H.M. (2006). Plasma concentrations of thyroid hormone and growth hormone in Lohmann male broilers fed on different dietary energy and protein levels. *Int. J. Poult. Sci*. 5(5), 457-462.

3-Silvestri, E., Schiavo, L., Lombardi, A. and Goglia, F.(2005). Thyroid hormones as molecular determinants of thermogenesis. *Acta Physiol Scand* 184, 265-83.

4-Basseett J H, Harvey C B and Williams G R(2003) Mechanisms of thyroid.. hormone, action receptor-specific nuclear and nuclear actions. *Mol Cell Endocr*. 213 1-11.

5-Luvizotto R.M., Conde S. J., Miriane O., Sibio M. T., Keize N. J. and Nogueira C. R.(2012). Obesity and Weight Loss: The Influence of Thyroid Hormone on Adipokines.INTECH.Thyroid Hormones 213-250 http://dx.doi.org.

6-Al-Aamery, R. A. and Dauod, H. A.(2016). Anatomical and Histological Study of Thyroid Gland in Weasel (Herpestes javanicus) (E.Geoffroy saint.Hilaire,1818). *Ibn Al-Haitham J. for Pure & Appl. Sci*. 29 (1):40-48.

7-Hamid, W.J.(2014). Oxidative Stress Induced Histological Changes in Thyroid of Hypothyroidism Patients. *AJPS*. 14(1):43-51.

8-Lobotkova, D. , Staníkova, D., Staník J., Cervenová, O., Bzdúch, V. and Tich, L. (2014).Lack of Association Between Peripheral Activity of Thyroid Hormones and Elevated TSH Levels in Childhood Obesity. *J Clin Res Pediatr Endocrinol*.6(2):100-104

9-Khalawi, A.A., Al-Robai, A.A., Khoja S.M. and Ali S.S.(2013). Can Nigella Sativa Oil (NSO) Reverse Hypothyroid Status Induced by PTU in Rat? Biochemical and Histological Studies**.** *Life Science J.*;10(2).

10-Tuffery, A.R. and Predmond, O.(1981). Thyroid proliferation, body weight,TSH and thyroid hormones in chronic anti thyroid treatment in rats. *J.Anat*. 133(1), 37-47.

11- Amin, K. A. and Nagy, M. A. (2009). Effect of carnitine and herbal mixture extract on obesity induced by high fat diet in rats. *Diabe Meta Synd. J*. 1: 1-17.

12-Kolawole, O.T.; Kolawole, S.O.; Ayankunle, A.A. and Olaniran, I.O. (2012). Methanol Leaf Extract of Persea Americana Protects Rats against Cholesterol-Induced Hyperlipidemia. *Brit J Med & Medical Res*. 2(2): 235-242.

13-Carr, M. C. and Brunzell J. D. (2004).Abdominal Obesity and Dyslipidemia in the metabolic syndrome: Importance of Type 2 Diabetes and Familial combined Hyperlipidemia In Coronary Artery. J. Clin. Endocrinol. Metab.89 (6): 2601-2607.

14-Sakr S. A., Mahran H. A.and Nofal A. E.(2012). Effect of Selenium on Carbimazole-Induced Histo- pathological and Histo -chemical Alterations i of Albino Rats. *Ameri. Jour. of Med. and Med. Sci.*. 2(1): 5-11.

15- Joshi, S. R.(2011). Laboratory Evaluation of Thyroid Function. *JAPI* ;59,14-20

16- Bienve.u, J., Monneret, G., Fabien, N.and Revillard J. P.(2000). The Clinical Usefulness of the Measurement of Cytokines. *Clin Chem Lab Med*; 38(4):267–285.

17-Bancroft, D.J. and Stevens, A.(1982). Theory &practice of histological techniques. 2nd edition. Chrchill Livingstonee. Medical Division. of Longman. Group Limitted.

18-Sethupathy, S.; Vasudevan, K.; Rajagopal, G. and Elanchezhiyan, C. (2002). Anti atherogensis. Effect. of taurinee in high fat diet fed rats. *Indian J Exp Biol. Oct.* 1169-1172.

19-Shapiro, R.; Nuss, M.E.& Kaszubska, W.(2001).Effects of of treatments of mice fed high fat vs. low fat diets with metformin or rosiglit azone on adiposity, food intake, hyper glycemia and insulin resist ance. Poster presented at: 83 Ann. Met. of Endoc. Soci.. Denver, Colo.

20-Akbay, E.;Ulusu, N.N.;Toruner, F.;Ayvaz, F.; Taneri, G.; Akturk, M.; and Karasu, C. Arslan, M. (2004).Effect of rosiglitazone,, treatment on the pentose phosphate pathway and glutathione-dependent enzyme in liver and kidney of rats fed a high fat diet. *Curr Therap Res*. 65(1):79-89.

21- Dutta, P., Bhansali, A., Walia, R., Khandelwal, N., Das, S. and Masoo.di, S. R.(2012) Weight homeostasis & its modulators in hyperthyroidism before & after treatment with carbimazole. *Indian J Med Res* .136, 242-248.

22-Sumbul, S. and Ahmed, S. I. (2012). Anti-hyperlipidemic Activity of *Carissa carandas* (Auct.) Leaves and Myo pathy in Rats.,*Am.Soci.Pharm.Exp. Ther.*. 38(10): 1655-1664.

23-Soni, M. and Soni, P.(2015). Pregnancy and maternal hyperthyroidism: A review. *IJSAR*, 2(2); 08-14.

24- Ranjan, S. D, Rao, R. M. and Rao, E. S.(2015). Carbimazole-induced histomorphological changes simulating malignancy in toxic goiter. *Thy. Res. and Prac.*; 12 (1).29-31.

25-Haarala, A. (2012).Inflammation and Early Atherosclerosis, University of Tampere school of Medicine, Finland, Msc. Thesis, 92 pp.

26-Wang, Z. and Nakayama, T. (2010). Inflammation, a link between cardio vascular. disease and obesity. *Mediators Inflamm*. 53:591-598.

27-Amin, A., Dhillo, W.S.,and Murphy, K.G.(2011). The Central Effects of Thyroid Hormones on Appetite. *J. of Thy. Res.* Vol.2011.7 pp.

28-Barakat, H. and El-Masry, S.(2015). Impact of Folic acid on the Neurotransmitters and Oxidant-antioxidant Balance in Hypothyroid and Hyperthyroid rats. *Int J Pharm Bio Sci*.6(3):1155 -1165.

انخفاض فعالية الغدة الدرقية والغذاء ذات النسبة المرتفعة من الدهن يمكن ان يعجل السمنة ويفاقم الالتهاب في الجرذان المهق

جاسم حنون هاشم العوادي دكتوراه

جامعة القادسية ,كلية العلوم, القادسية-العراق

الخلاصة:

صممت هذه الدراسة لاكتشاف تأثير تزامن الغذاء عالي الدهن مع انخفاض فعالية الغدة الدرقية على كل من وزن الجسم وبعض المعايير الهرمونية والالتهابية وكذلك نسيج الغده الدرقية .لذلك قسم لهذا الغرض 24 من ذكور الجرذان البالغة الى اربعة مجاميع متساوية العدد. حسب كل من وزن الجسم, هرمونات وظيفة الغدة الدرقية وهي (الثيروكسين والثيرونين ثلاثي اليود والهرمون المحفز للدرقية)وكذلك السايتوكاينات الالتهابية وهي كل من (انتر ليوكين واحد بيتا, انترليوكين سته, وعامل تنخر سرطان الفا).والتي حسبت في جميع مجاميع التجربة. كما كشفت التغيرات النسجية المرضية للغده الدرقية.

اظهرت نتائج الدراسة الحالية زياده معنويه في كل من وزن الجسم النهائي والمكتسب في كل مجاميع التجربة اذا ما قورنت بمجموعة السيطرة.

قلل عقار الكابيمازول هرموني الغده الدرقية الثيروكسين والثيرونيين ثلاثي اليود معنويا ,فيما زاد الهرمون المحفز للدرقية معنويا في كل من المجموعة المنخفضة فعالية الغدة الدرقية ومجموعة الجرذان البدينة ومنخفضة فعالية الغده الدرقية.

زادت السايتوكاينات الالتهابية معنويا في كل مجاميع التجربة اذا ما قورنت بمجموعة السيطرة.

كانت نتائج الفحص النسجي للغده الدرقية متوازية مع القياسات الهرمونية والمعاير الالتهابية شوهد نسيج الغده الدرقية في الجرذان البدينة سليما وكان مشابها لما موجود في مجموعة السيطرة, لكن وجدت مختلف التغيرات النسجيه في كل من مجموعتي الجرذان منخفضة فعالية الغدة الدرقية والبدينة حيث تمثلت هذه التغيرات بزيادة في ارتفاع الخلايا الطلائية المبطنة للجريبات, قلة للمادة الفروانية قد تصل الى الفقدان الكامل لهذه المادة, فرط تنسج حلمي في بطانة بعض الجريبات مع تنكز بعض الخلايا , تليف مع ارتشاح للخلايا اللمفية في النسيج بين الجريبات. وفي بعض الحالات تواجد للخلايا الدهنية في النسيج بين الجريبات. .نستنتج مما ورد ان تزامن الغذاء عالي الدهن مع انخفاض فعالية الغدة الدرقية يعجل ويزيد عملية الالتهاب سوءً كما يستحث تغيرات مرضيه عديده في نسيج الغدة الدرقية.