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The Effect of Using Walnut Leaves, Iodine and Selenium to Improve Hypothyroidism for Thyroid Hormone in Rats.

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Abstract

Thyroid hormones are essential for normal growth and development. Nutritional factors are closely related to thyroid dysfunction due to deviation from normal physiology of the gland. Iodine, is the main constituent of thyroid hormones (T3 and T4), deficiency is one of the commonest causes of hypothyroidism in children and adults, worldwide. Therefore, the aim of the research is to study the effect of walnut leaves, iodine and selenium, either alone or with their mixtures, on improving hypothyroidism in rats versus the drug effect of thyroid hormone. To achieve this goal present study was performed to examine the effect of walnut leaves, iodine and selenium consumption on thyroid hormones (T3,T4 and TSH) on hypothyroidism rats induced by Propylthiouracil at a dose of 10 mg / kg bw one time a day for two weeks. This work was carried out on 54 adult male albino rats randomly classified into nine groups, for each (n = 6). Group 1 (negative control) fed on basal diet. The major groups consisting of 48 rats were injected with Propylthiouracil, then divided into eight subgroups. subgroup (1) fed on basal diet (positive control group), sub group (2)fed on basal diet +10 mg thyroxin,

subgroup (3)fed on basal diet + 10 µg selenium, subgroup (4)fed on basal diet + 10 µg iodine, subgroup (5)fed on basal diet + 10 mg walnut leaves, subgroup (6) fed on basal diet +5 mg walnut leaves and 5 mg thyroxin, subgroup (7)fed on basal diet + 5 mg walnut leaves+5 µg selenium, subgroup (8)feed on basal diet + 5 mg walnut leaves+5 µg iodine. The results showed that the groups that took walnut leaves powder, either alone or in combination with thyroxine, iodine, and selenium were significantly higher in the rate of recovery from hypothyroidism.,

Keywords: Thyroid gland. Thyroid hormones, Walnut leaves, Iodine, Selenium, Minerals content.

Introduction

The thyroid gland is located in the neck in front of the windpipe. It resembles a butterfly with unified wings and a reddish brown color. It consists of two lobes, and it contains special cells located in the lining called cystic cells, and these cells are responsible for the secretion of thyroid hormone. Thyroid gland is an endocrine gland whose secretions enter the blood directly without the need for special channels to transport it. ***(American Thyroid Asesesociation.,2013).***The primary function of the thyroid gland is the production, storage, and release of hormones to the blood. These hormones are T3 (Triiodothyronine), T4 (Tetra iodothyronine) and C cells responsible for calcitonin production**. (*Aleksandra et al., 2021).***Thyroid hormones are essential for brain maturation and function. Any imbalance in thyroid hormones due to iodine deficiency leads to hypothyroidism, which causes mental retardation and nervous system disturbance. ***(Banel and Frank.,2009).***Thyroid hormones have two main physiological effects, increasing protein

synthesis in nearly all tissues of the body. The increase in oxygen consumption is mainly in the tissues responsible for the primary oxygen consumption such as the liver, kidneys, heart, and muscles. ***(Harel et al., 2015).***Hypothyroidism affects 5.3% of the population. Under- and overtreatment are associated with increased somatic and psychiatric morbidity leading to earlier retirement and excess mortality***.(Endre et al., 2021).***

The defect of hypothyroidism is either hypothyroidism or an overactive thyroid gland. This thyroid gland reduces thyroid activity by reducing the levels of T3 and T4, and this slows down the body's metabolism, and it may make you feel tired, mentally weak and obese, and there are options. Treatment for hypothyroidism, including: thyroid hormone tablets) which are a synthetic version of the natural thyroid hormone T3 and T4, which are taken either T4 or T3 and take the two pictures together**.** ***(Wadia and Désirée.,2010).***Hypothyroidism is a human disease caused by autoimmune disorders and a lack of iodine in the daily diet. At present there are many studies confirming the use of walnut leaves (Juglansregia L.) in the treatment of hypothyroidism. ***(Habibpur et al., 2014).***

Walnut (Juglansregia L.) belongs to the Juglandaceae family. It is a deciduous tree, grown commercially throughout the world; (Juglansregia L.) is the most widespread nut in the world. It was cultivated in Europe as early as 1000 BC. Nowadays, nuts are grown commercially throughout southern Europe, North Africa, East Asia, the United States and Western South America where the global production of nuts was about 1.5 × 106 tons in 2008. ***(FAO.,2008).*** Walnut leaves serve as a source of health care compounds and have been extensively used as remedies in the conventional medicine. Dried walnut leaves are often used as an infusion. ***(Sharhriari et al., 2019).*** Previous studies have shown their anti-inflammatory, diarrheal, an thelmintic, antiseptic, and astringent links, different

types of infections, various endocrine diseases such as diabetes, anorexia, thyroid imbalances, various tumors and infectious diseases ***(Hosseinzadeh et al., 2011),*** lowers blood cholesterol ***(Joe and Kay., 2012).***

Thyroid disease affects millions of people in the United States. The thyroid gland is one of the most common endocrine disorders in the world (generally about 4% to 7% of thyroid nodules are symptomatic) as the thyroid gland produces the hormone at high or insufficient levels, and this can lead to problems ranging from weight changes to sensitivity to degree heartfor cardiovascular problems and mental retardation. Thyroid problems generally require medical treatment, but in some cases, adding more walnut leaves to the diet may improve thyroid function**. *(Wilhelm.,2014).***

In two thousand fifteen ***(Malik et al., 2015).***Reported that, the volume of the thyroid gland decreases after the age of 50 years. Thyroid dysfunction is common in the old populations. The primary hypothyroidism occurs in 10% of the females and 2% of the males above 60 years. Ten to 15% of the patients with hyperthyroidism are older than 60years***(Nammas et al., 2011).***In the countries with sufficient iodine, the prevalence of spontaneous hypothyroidism is between one and 2%, and is more common in the elderly women. The prevalence was higher in surveys of the old people in the community. Alower prevalence was observed in areas of iodine deficiency***(Vanderpu et al.,2011).***

Walnut leaves are a good source of selenium - one ounce of dried walnut leaves contains 5 micrograms of selenium (15 micrograms / 100 grams), about 7 percent of the recommended daily value for this mineral. The relationship between selenium and thyroid

function is still being researched. However, it has been found that people with hypothyroidism have low levels of selenium and it may be a causal factor for this condition, especially when iodine levels are low in tandem. Some scientists have indicated that adequate levels of selenium also reduce the risk of a swollen thyroid gland or an enlarged thyroid gland. ***(Stockler-Pinto et al., 2015).***

Iodine is an essential trace component required for the synthesis of thyroid hormones, thyroid hormone (T4), and triiodothyronine (T3). The human body contains 15-20 mg of iodine with 70-80% being present in the thyroid gland***.(Rajalakshmi and Begam., 2021).***

Iodine deficiency increases thyroid hormone (TSH) in response to decreased thyroid hormone production. Goitre develops as a result of TSH stimulation. Serious iodine deficiency also leads to functional and developmental abnormalities such as hypothyroidism. Endemic goiter is synonymous with prolonged iodine deficiency.. Control efforts have been directed towards treating or reducing goiter. With increased clinical and public health research, it is becoming clear that the consequences of iodine deficiency far exceed those of goiter and thyroid disease. ***(Zimmerman et al., 2008).***

Understanding of the primary role of selenium (Se) in thyroid hormone synthesis, metabolism and function, as well as normal thyroid function, has increased dramatically over the past decades. ***(Schomburg and KÖhrle., 2008& Anna., 2020).***The first clinical evidence that severe Se deficiency combined with other environmental factors harms the thyroid gland was found in Central Africa. Here, iodine supplementation alone was ineffective in restoring thyroid function.***(.American Thyroid Association., 2013).***

In healthy African schoolchildren with severe iodine and selenium deficiency, selenium versus placebo supplementation

resulted in a decrease in serum thyrotropin (TSH) concentrations and reversed T3 (RT3) concentrations, and the authors concluded that taking selenium plays a specific role in thyroid hormone metabolism Food in humansselenium is necessary for the biosynthesis process and the function of bilateral iodothyronine to control the conversion of T4 to T3 as well ***(Contempre et al., 1992&Arthur and Beckett., 2005).***

The reforthe aim of this research was to study the effect of walnut leaves, iodine and selenium, either alone or with their mixtures, on improving hypothyroidism in rats versus the drug effect of thyroid hormone.

Materials and methods

Materials

- **Propylthiouracil** was obtained from Al-Gomhoria Medicines Company, Assiut - Egypt.
- **Selenium** was obtained from the Pharmaceutical Company, Riyad - Kingdom of Saudi Arabia.
- **Thyroxin and iodine** was obtained from the local distributor of Al-Gomhoria Pharmaceutical Company, Cairo - Egypt.
- **Dry walnut leaves** were obtained from the local market in Cairo - Egypt.
- **Kits used to determine serum cholesterol, triglycerides, T3, T4, TSH, CL, Ca, K, Na** were obtained from the local distributor Sigma Pharmaceutical Company, Cairo, Egypt.
- **Basic diet** was obtained from Al Gomhoria Company, Cairo - Egypt.
- **Normal male albino rats (54) of Sprague Dawley Strain** were obtained from the National Research Centre, Cairo, Egypt.

- **Ethyl alcohol, formalin, distilled water, pure natural water, paraffin wax, 9% saline** were obtained from Zoology Department of the Faculty of Science - South Valley University.
- **Alcohol, Methyl Benzoate, (H and E) battery dye, DPX** were obtained from the Department of Histology of the Faculty of Veterinary Medicine - South Valley University.

Biological Investigation

Male albino rats Sprague Dawley Strain (54 rats) (age 6 to 8 weeks and about 110 to 150g body weight)were obtained from the National Research Centre, Cairo, Egypt. Were housed (6 rats per cage) in the animal room under controlled lighting (12-hour light:12-hour darkness) and temperature (20°C ± 2°C) conditions and had free access to laboratory food and tap water. They were kept under normal healthy conditions and fed on the commercial diet without any treatment for one week for acclimatization. Experimental food, water and fats were provided for the duration of the experiment.

The basal diet consists of 14 % protein from casein (≥ 80 %), 5% soya oil , 0. 25 % choline chloride, 1 % vitamin mixture, 3.5% salt mixture, 5 % cellulose, 0.18 % L – cystine and the remainder (71.07 %) is corn starch ***(Reeves et al ., 1993).*** The salt mixture was prepared according to ***(Hegested et al., 1941).***and the vitamin mixture was prepared according to ***(A.O.A.C., 2005)***

Experimental design:

Fifty four rats were divided to nine groups, six rats for each group,

Group (1) :- (negative control) fed on basal diet.

The second major groups, consisting of 48 rats, were injected with Propylthiouracil at a dose of 10 mg / kg bw one time a day for two weeks to cause Insufficient thyroid hormone***(Hwang et al., 2017).***A

blood sample is then taken to measure the level of T3,T4,and TSH to confirm the disease.

Then was divided into eight subgroups starting from 1 up to 8 subgroup consists of (6rats),each rat in each subgroup took the suggested treatment once a day with an oral syringe, after dissolving it in 2ml of distilled water.

Sub.group(1) : fed on basal diet (positive control group).
Sub.group (2) :fed on basal diet +10 mg thyroxin.
Sub.group (3) :fed on basal diet + 10 *µg* selenium.
Sub.group (4) :fed on basal diet +10 *µg* iodine.
Sub.group (5) :fed on basal diet +10 mg **walnut leaves.**
Sub.group (6) :fed on basal diet +5 mg**walnut leaves+**5 mg thyroxin.
Sub.group (7) :fed onbasal diet +5 mg **walnut leaves+**5 *µg* selenium.
Sub.group (8):fed on basal diet +5 mg **walnut leaves+5***µg* iodine.

At the end of the experiment of 6 weeks the rats were anesthetized with ether and sacrificed then,blood samples were collected into plain tubes and centrifuged at 3000 rpm for 10 min at 4°C, to obtain clear serum. Serum was frozen at -18^{o}C until analyzed.

Methods:

Preparation of walnut leaves

Walnut leaves were cleaned, washed, filtered and dried at 50 °C in a hot air oven for 12 h, according to ***(Adejuyitan., 2011).***then ground and sieved to obtain a molecular size of <1.0 mm.

Analytical methods

Protein, fat, ash, dry matter and organic matter were determined according to the method of***(AOAC., 2007).***All determinations were done in triplicate.

Total carbohydrate contents were tested quantitatively according to *(**Kostas et al., 2016).***

Biological Evaluation

Biological evaluation of the different tested diets and **walnut leaves,** thyroxin, selenium and iodine extract was carried by determination of food intake (FI), weight of rats in the(initial and final of the experiment), body weight gain% (BWG%) and organs weight / body weight% according to ***(Chapman et al.,1959).***

Biochemical Analysis of Serum:

Seurm T3 (normal values: 40-180ng/dL), free T4 (FT4) (normal values: 0.7-1.8 ng/dL) and TSH levels (normal values: 0.5-5.0 uUI/mL) were measured by immunoenzymatic assay using Bioclin commercial kits (K101 and K098 Bioclin, Quibasa Químicaltda, Brazil) and the ratio T4/T3 were calculated to verify the hormone levels changes after supplementation***.(Meuwese et al., 2012).***

Statistical analysis:

The statistical analysis was carried out by using SPSS, PC statistical software (version 10.0; SPSS Inc, Chieago, USA).

The results were expressed as mean ± SD. Data were analyzed by one way analysis of variance (ANOVA). The differences between means were tested for significance using least significant difference (LSD) test at ($P<0.05$) ***(Steel and Torri., 1980).***

Results and discussion

Analytical methods:

The data in Table (1) indicated that, the chemical composition (%) of the dry matter content of walnut leaves was 16.62±0.30 protein, while fat was 5.63±0.08, carbohydrates and ash were 20.94±0.01 and

12.89±0.02, respectively, and moisture 29±0.71 Finally, the percentage of fibers was 14.92±0.04 of the total dry matter. These results are close to the results of ***(O.O. P. Faboya, et al., 2013).***

Biological Evaluation:

The results in Table (2) revealed that, feed intake among treated subgroup No.2,3,5,6 and 7 were significantly lower than the control group. The same observation was noticed for, final weight, initial weight and body weight gain according ***(Bayley et al., 1980& De La Rosa et al., 1997).***Once hypothyroidism is achieved, the metabolic rate reduces in association with decrease in serum thyroid hormone concentrations ***(Abid et al., 1999).***

The data of relatively organs weight were present in Table (3) feed on walnut leaves; iodine and selenium were significantly higher in positive control of relative weights of thyroid and significantly lower in relative weights of liver, kidney heart, lung, spleen than the all experiment groups.

While the relative weight of liver and spleen in subgroup(8) were significantly higher than those of positive control group. The relative weight of heart and lung in subgroup (2) was significantly higher than that of positive control group. While, relative weights of kidney was significantly higher in subgroup(4, 5) and significantly lower in subgroup(3, 7) than that of positive control group. A relative weight of thyroid was significantly higher in subgroup(3) was significantly lower in subgroup(8)than that of positive control group. Thyroid weight increase in the control group. Results were agree with ***(Tatliseven, P, et al., 2009).*** Besides, the reason for heavy thyroid organ could result from the deterioration of T3 hormone level and consequently more requirement for thyroid and I in the control group than the experimental group, since the control group.

(P<0.01.according ***(Pınar et al., 2009)***Highest relative heart weight was obtained with T3 hormone supplementation in comparison with other supplements. The data suggests that the positive effect of antioxidants on thyroid gland could be due to direct involvement of antioxidants on thyroid gland. Results were agree with***(Deshpande, et al.,2002).***

The data of organ weight / body weight (%) of rats suffering from hypothyroidism were present in Table (4) feed on walnut leaves, iodine and selenium were significantly higher in positive control of organ weight / body weight % of thyroid and significantly lower in organ weight / body weight %of liver, kidney, heart lung, spleen than the all experiment groups.

While the organ weight / body weight % of liver, heart and lung in subgroup(5) were significantly lower than those of positive control group also organ weight / body weight % of kidney and spleen in subgroup(3) was significantly lower than that of positive control. While, organ weight / body weight %of liver, heart and spleen was significantly higher in subgroup(8) and also significantly higher in subgroup(2) of organ weight / body weight % kidney and lung than that of positive control group. A relative weight of thyroid was significantly higher in subgroup(3) and was significantly lower in subgroup(8) than that of positive control group. Results were agree with***(Steven et al., 2004).***

Biochemical Analysis of Serum :

On the other hand, chloride also influence the thyroid hormone synthesis by modulating thyroid transcription factors which contain chloride at its cysteine residues as well as its metabolism by increasing thyroxine binding proteins. ***.(Dhawan et al., 2007)***

The data present in Table (5,6) showed that the serum Ca both of the result initial and finial the experiment of rats suffering from hypothyroidism were feed on walnut leaves, iodine and selenium were significantly lower in the subgroup (4) in the initial experiment and the subgroup (8) in the finial experiment than those of positive control group. On other hand, the serum Ca was significantly higher in the subgroup (6) in the initial experiment and the subgroup (2) in the finial experiment than those of positive control group. A statistically significant negative correlation was found between serum TSH and serum calcium (p-value <0.05) in hypothyroid cases. Serum magnesium and serum phosphorus were also having significant positive correlation with serum TSH. On the contrary, no correlation between serum zinc and TSH was observed. According***(Saxena,et al., 2020).***

Results in Table (5,6) revealed that the serum K both of the result initial and finial the experiment of rats suffering from hypothyroidism were feed on walnut leaves, iodine and selenium were significantly lower in the subgroup (3) in the initial and finial experiment than those of positive control group. On other hand, the serum K was significantly higher in the subgroup (2) in the initial experiment and the subgroup (7) in the finial experiment than those of positive control group. Results were agree with ***(Russell W et al., 2008).***

The results of the initial and finial of the experiment of rats suffering from hypothyroidism were present in Tables (5,6) which fed on walnut leaves, iodine and selenium were significantly lower in the subgroup (4) in the initial and finial experiment than those of positive control group. On other hand, significantly higher in the subgroup (6) in the initial and finial experiment than those of positive control group

Serum sodium was significantly lower in patients with high TSH levels ($p < 0.01$). There was a significant correlation between serum TSH and phosphate level ($p < 0.05$). Phosphate levels were higher in rats with elevated TSH than in rats with normal TSH ($p < 0.01$). Serum calcium and magnesium correlated significantly with TSH ($p < 0.05$). fT3 levels correlated significantly with calcium ($p < 0.05$).

Hyponatraemia was present in rats with high TSH and was significantly more common than in the group with normal TSH levels of had hyponatraemia ($p < 0.01$). Hypokalaemia was more common in the group with elevated TSH than in those with normal TSH. Hyperkalaemia was more common in the group with high TSH levels than in those with normal TSH $p < 0.01$**).**Results were agree with***(Schwarz,et al., 2012).***

Thyroid hormones

Results in Table (7,8) revealed that serum T4 of both initial and finial the experiment of rats suffering from hypothyroidism were fed on walnut leaves, iodine and selenium were significantly lower in the subgroup (3) in the initial and finial experiment than those of positive control group. On other hand, the serum T4 was significantly higher in the subgroup (9) in the initial and the subgroup (8) in the finial experiment than those of positive control group. Iodine salt, are common dietary sources of iodine .In routine clinical practice, patients will often inquire about dietary changes they can make to treat or reverse their thyroid dysfunction. In general, there is reasonable evidence that adequate but not excessive iodine intake is beneficial for thyroid health as well as selenium supplementation for patients with Graves' disease. Aside from these, the scientific data showing that dietary changes can significantly benefit hypo- or hyperthyroidism is sparseresults were agree with***(Menon, 2019).***

Data of the same table showed that the serum T3 both of the result initial and finial the experiment of rats suffering from hypothyroidism were feed on walnut leaves, iodine and selenium were significantly lower in the subgroup (2) in the initial and the subgroup (8) in the finial experiment than those of positive control group. On other hand, the serum T3 was significantly higher in the subgroup (5) in the initial and the subgroup (3) in the finial experiment than those of positive control group.High iodine intake is associated with autoimmune thyroid disease. According ***(Laurberg et al., 2010).*** A sudden increase in iodine intake in an iodine-deficient population may induce thyroid autoimmunity. People with antithyroid antibodies have a higher risk of developing thyroid dysfunction when the iodine intake is high according***(Li et al., 2008).*** The overall incidence of thyroid carcinoma in populations does not appear to be influenced by iodine intake.according***(Hye. R.Ch, 2014).***Excessive iodine intake in children in high iodine areas is associated with impaired thyroid function***(Sang et al.; 2013).***

The data in Table (7,8) showed that serum TSH in both the primary and final outcome of the trial of hypothyroid rats fed walnut leaf, iodine and selenium was significantly lower in the subgroup (6) in the beginning and in the subgroup (8). In the final experiment of that positive control group. On the other hand, serum TSH was significantly higher in subgroup (3) in the initial and final trial than that of the positive control group. Another micronutrient that affects thyroid function is selenium. Mice that received selenium supplements showed temporary improvement in thyroid function. However, they cannot be part of standard treatment until further supporting evidence is providedresults were agree with***(Zheng et al., 2018).***

Conclusion

The present study concluded that consumption of walnut leaves, iodine and selenium may modify the risk of hypothyroidism patient physiological disorder. Where the walnut leaves, iodine and selenium has effect of significant lowering on the fraction lipid, fraction cholesterol and liver function while significant higher on the minerals and thyroid hormones in the rats infected hypothyroidism.

Table (1): The Chemical composition (%) of walnut leaves

Chemical composition %	Sample
	walnut leaves
protein	16.62±0.30
moisture	29 ±0.71
Fat	5.63±0.08
Carbohydrates	20.94±0.01
Ash	12.89±0.02
fibers	14.92±0.04

Table (2): Effect of walnut leaves, iodine and selenium on feed intake and body weight gains of rats suffering from hypothyroidism.

Groups	Parameters			
	body weight (g) $\bar{x}$ ± S.D	Feed intake (g/day) $\bar{x}$ ± S.D	Initial weight (g) $\bar{x}$ ± S.D	Final weight (g) $\bar{x}$ ± S.D
Group (1) negative control	80^{a}± 23.211	185^{a}± 1.022	147.17^{a}± 6.371	180^{a}± 13.281
Sub .Group (1) positive control	66.83^{b}± 14.960	204^{a}± 0.587	150.33^{a}± 10.50	$166.83^{a,b}$± 8.260
Sub .Group (2) 10 mg thyroxin	62.17^{c}± 15.321	179^{b}± 0.256	140.5^{b}± 5.391	162.17^{b}± 4.491
Sub .Group(3) 10 µg selenium	$60.83^{c,d}$± 7.420	170^{c}± 2.654	$145.67^{a,b}$± 9.142	160.83^{b}± 11.57
Sub .Group (4) 10 µg iodine.	60.67^{d}± 9.199	190^{a}± 1.470	147.67^{a}± 9.460	$160.67^{b,c}$± 8.091
Sub .Group (5) 10 mg walnut leaves	61.5^{c}± 18.740	174^{b}± 0.570	136^{c}± 11.871	161.5^{b}± 5.211
Sub .Group (6) 5 mg walnut leaves+5 mg thyroxin	55.83^{d}± 14.730	168^{c}± 2.144	135^{c}± 17.621	155.83^{c}± 4.401
Sub .Group (7) 5 mg walnut leaves+5 µg selenium	54.5^{d}± 11.431	171^{c}± 2.696	$138.33^{b,c}$± 12.311	154.5^{c}± 4.555
Sub .Group (8) 5 mg walnut leaves+5 µg iodine.	61.83^{c}± 17.682	$180^{a,b}$± 1.852	136.83^{c}± 8.731	161.83^{b}± 9.561

- Mean with different letters in the same column are statistically significant ≤ 0.05.

Table (3): Effect of walnut leaves, iodine and selenium on relative organs weight of rats suffering from hypothyroidism.

Groups	Parameters					
	Relative weights of Liver (g)	Relative weights of kidney (g)	Relative weights of Heart (g)	Relative weights of Lung (g)	Relative weights of spleen (g)	Relative weights of Thyroid (mg)
Group (1) negative control	14.75^{a}± 0.354	2^{a}± 0.283	1.9^{a}± 0.424	3.7^{a}± 0.141	2.2^{a}± 0.141	17^{b}± 1.414
Sub .Group (1) positive control	9.65^{c}± 0.2124	1.14^{c}± 0.354	1.11^{d}± 0.071	2.68^{b}± 0.735	1.45^{b}± 0.071	30.5^{a}± 2.121
Sub .Group (2) 10 mg thyroxin	11.75^{b}± 1.061	1.5^{b}± 0.141	1.55^{b}± 0.071	4.35^{a}± 0.919	1.8^{a}± 0.141	16.5^{b}± 2.121
Sub .Group(3) 10 µg selenium	10.5b± 0.849	1.2c± 0.141	1.4c± 0.141	3.4a,b± 1.273	1.55b± 0.071	17b± 1.414
Sub .Group (4) 10 µg iodine.	12.45a± 0.637	1.75a± 0.354	1.25d± 0.212	3.6a± 0.424	1.9a± 0.141	16a,b± 1.414
Sub .Group (5) 10 mg walnut leaves	10.25b± 1.909	1.75a± 0.354	1.15d± 0.071	2.8b± 0.424	1.7b± 0.283	15.5b± 0.707
Sub .Group (6) 5 mg walnut leaves+5 mg thyroxin	12.75a± 1.909	1.6a,b± 0.141	1.55b± 0.071	3.65a± 0.636	1.8a± 0	15b± 0
Sub .Group (7) 5 mg walnut leaves+5 µg selenium	12.45a± 1.485	1.2c± 0.141	1.45b,c± 0.354	2.7b± 0.566	1.8a± 0.141	15b± 1.414
Sub .Group (8) 5 mg walnut leaves+5 µg iodine.	13.3a± 0.989	1.5b± 0.141	1.335c± 0.092	2.8b± 0.141	2.05a± 0.071	14b± 1.414

- Values are expressed as mean ± SD.
- Values which have different letters in each column are significantly, $p \leq 0.05$.

Table (4): Effect of walnut leaves, iodine and selenium on organ weight / body weight (%) of rats suffering from hypothyroidism.

Groups	Parameters					
	organ weight / body weight % of liver	organ weight / body weight % of kidney	organ weight / body weight % of heart	organ weight / body weight % of lung	organ weight / body weight % of spleen	organ weight / body weight %of Thyroid
Group (1) negative control	$8.19^{a}\pm$ 5.087	$1.11^{a}\pm$ 0.0786	$1.06^{a}\pm$ 0.039	$2.06^{b}\pm$ 0.746	$1.22^{a}\pm$ 0.157	$9.44^{b}\pm$ 5.971
Sub .Group (1) positive control	$5.78^{c}\pm$ 3.383	$0.75^{c}\pm$ 0.177	$0.75^{c}\pm$ 0.177	$1.51^{c}\pm$ 0.429	$0.87^{c}\pm$ 0.093	$18.28^{a}\pm$ 12.220
Sub .Group (2) 10 mg thyroxin	$7.25^{a,b}\pm$ 4.416	$1.092^{a}\pm$ 0.053	$0.96^{a}\pm$ 0.031	$2.68^{a}\pm$ 1.189	$1.11^{a,b}\pm$ 0.078	$10.17^{b}\pm$ 6.487
Sub .Group(3) 10 µgselenium	$6.53^{b}\pm$ 3.909	$0.76^{b}\pm$ 0.179	$0.87^{a,b}\pm$ 0.092	$2.11^{a}\pm$ 0.788	$0.96^{b}\pm$ 0.026	$10.57^{b}\pm$ 6.767
Sub .Group (4) 10 µg iodine.	$7.75^{a,b}\pm$ 4.772	$0.92^{b}\pm$ 0.063	$0.78^{b}\pm$ 0.157	$2.24^{a}\pm$ 0.877	$1.18^{a}\pm$ 0.129	$9.96^{a,b}\pm$ 6.334
Sub .Group (5) 10 mg walnut leaves	$6.35^{b}\pm$ 3.781	$1.08^{a,b}\pm$ 0.059	$0.76^{b}\pm$ 0.204	$1.61^{b}\pm$ 0.519	$1.05^{b}\pm$ 0.037	$9.59^{b}\pm$ 6.079
Sub .Group (6) 5 mg walnut leaves+5 mg thyroxin	$8.18^{a}\pm$ 5.078	$1.03^{b}\pm$ 0.019	$0.82^{b}\pm$ 0.004	$2.34^{a}\pm$ 0.949	$1.15^{a}\pm$ 0.109	$9.63^{b}\pm$ 6.099
Sub .Group (7) 5 mg walnut leaves+5 µg selenium	$8.06^{a}\pm$ 4.991	$0.78^{b}\pm$ 0.158	$0.94^{a}\pm$ 0.043	$1.62^{b}\pm$ 0.483	$1.17^{a}\pm$ 0.117	$9.71^{b}\pm$ 6.158
Sub .Group (8) 5 mg walnut leaves+5 µg iodine.	$8.22^{a}\pm$ 5.104	$0.93^{b}\pm$ 0.052	$0.99^{a}\pm$ 0.124	$1.63^{b}\pm$ 0.429	$1.27^{a}\pm$ 0.189	$8.65^{c}\pm$ 5.410

- Values are expressed as mean ± SD.
- Values which have different letters in each column are significantly , $p \leq 0.05$.

Table (5): Effect walnut leaves, iodine and selenium at the initial of the experiment on concentrations of some mineral of rats suffering from hypothyroidism.

Groups	Parameters			
	CL mg	Ca mg	K mg	Na mg
Group (1) negative control	$97.97^{a}\pm 2.757$	$9.11^{a}\pm 0.361$	$3.83^{a}\pm 0.551$	$140.93^{a}\pm 1.882$
Sub .Group (1) positive control	$78.67^{c}\pm 1.528$	$5.83^{c}\pm 0.17$	$2.13^{c}\pm 0.157$	$120.33^{c}\pm 1.528$
Sub .Group (2) 10 mg thyroxin	$92.33^{b}\pm 2.309$	$8.03^{b}\pm 0.404$	$3.64^{a}\pm 0.991$	$129.33^{b}\pm 4.041$
Sub .Group(3) 10 µg selenium	$90.33^{b}\pm 0.577$	$7.83^{b}\pm 0.404$	$2.43^{b}\pm 0.481$	$128.33^{b}\pm 1.528$
Sub .Group (4) 10 µg iodine.	$91.33^{b}\pm 1.528$	$7.77^{b}\pm 0.306$	$2.66^{b}\pm 0.543$	$125^{b}\pm 4$
Sub .Group (5) 10 mg walnut leaves	$91.33^{b}\pm 1.528$	$7.8^{b}\pm 0.529$	$3.04^{b}\pm 0.13$	$136.67^{b}\pm 2.082$
Sub .Group (6) 5 mg walnut leaves+5 mg thyroxin	$96^{b}\pm 1$	$8.43^{b}\pm 0.416$	$3.28^{b}\pm 0.291$	$137.33^{b}\pm 2.517$
Sub .Group (7) 5 mg walnut leaves+5 µg selenium	$92.67^{b}\pm 2.517$	$8.067^{b}\pm 0.252$	$3.23^{b}\pm 0.066$	$132.67^{b}\pm 2.082$
Sub .Group (8) 5 mg walnut leaves+5 µg iodine.	$95.67^{b}\pm 1.528$	$8.17^{b}\pm 0.306$	$3.07^{b}\pm 0.064$	$131.33^{b}\pm 2.309$

- Values are expressed as mean ± SD.
- Values which have different letters in each column are significantly , $p \leq 0.05$.

Table (6): Effect walnut leaves, iodine and selenium at the final of the experiment on concentrations of some mineral of rats suffering from hypothyroidism.

Groups	Parameters			
	CL mg	Ca mg	K mg	Na mg
Group (1) negative control	100.77^{a}± 4.347	8.84^{a}± 0.295	5.17^{a}± 0.321	143.33^{a}± 2.178
Sub .Group (1) positive control	74.67^{c}± 0.577	5.6^{c}± 0.361	1.81^{c}± 0.111	119.67^{c}± 0.578
Sub .Group (2) 10 mg thyroxin	96.67^{b}± 2.517	8.9^{a}± 0.2	4.2^{b}± 0.436	139.33^{b}± 0.577
Sub .Group(3) 10 µg selenium	100^{b}±3	$8.77^{a,b}$± 0.513	3.87^{b}± 0.404	133.67^{b}± 1.528
Sub .Group (4) 10 µg iodine.	100^{b}±1	$8.77^{a,b}$± 0.306	4.03^{b}± 0.416	131.67^{b}± 2.082
Sub .Group (5) 10 mg walnut leaves	99.67^{b}± 1.528	8.43^{b}± 0.451	4.2^{b}± 0.361	138^{b}±1
Sub .Group (6) 5 mg walnut leaves+5 mg thyroxin	100.67^{a}± 1.155	8.8^{a}± 0.361	4.37^{b}± 0.306	142^{a}± 2.646
Sub .Group (7) 5 mg walnut leaves+5 µg selenium	103.33^{b}± 2.082	8.47^{b}± 0.379	$4.63^{a,b}$± 0.306	135.67^{b}± 6.028
Sub .Group (8) 5 mg walnut leaves+5 µg iodine.	100.33^{b}± 1.528	8.33^{b}± 0.0577	4.03^{b}± 0.153	133.67^{b}± 1.155

- Values are expressed as mean ± SD.
- Values which have different letters in each column are significantly , $p \leq 0.05$

Table (7): Effect walnut leaves, iodine and seleniumat the initial of the experiment on thyroid hormones of rats suffering from hypothyroidism.

Groups	Parameters		
	T4 ng/dL	T3 ng/dL	TSH ulU/mL
Group (1) negative control	$0.91^{a}\pm$ 0.057	$2.96^{a}\pm$ 0.145	$1.24^{c}\pm$ 0.281
Sub .Group (1) positive control	$0.49^{c}\pm$ 0.06	$1.8^{c}\pm$ 0.182	$4.33^{a}\pm$ 0.502
Sub .Group (2) 10 mg thyroxin	$0.66^{b}\pm$ 0.042	$2.44^{b}\pm$ 0.309	$2.84^{b}\pm$ 0.124
Sub .Group(3) 10 µg selenium	$0.61^{b}\pm$ 0.068	$2.49^{b}\pm$ 0.538	$3.54^{b}\pm$ 0.486
Sub .Group (4) 10 µg iodine.	$0.67^{b}\pm$ 0.047	$2.99^{a}\pm$ 0.177	$3.06^{b}\pm$ 0.428
Sub .Group (5) 10 mg walnut leaves	$0.66^{b}\pm$ 0.062	$3.02^{a}\pm$ 0.199	$2.957^{b}\pm$ 0.160
Sub .Group (6) 5 mg walnut leaves+5 mg thyroxin	$0.69^{b}\pm$ 0.044	$2.86^{b}\pm$ 0.346	$2.72^{b}\pm$ 0.308
Sub .Group (7) 5 mg walnut leaves+5 µg selenium	$0.71^{b}\pm$ 0.015	$2.75^{b}\pm$ 0.646	$3.17^{b}\pm$ 0.547
Sub .Group (8) 5 mg walnut leaves+5 µg iodine.	$0.7^{b}\pm$ 0.036	$2.89^{b}\pm$ 0.199	$3.057^{b}\pm$ 0.488

- Values are expressed as mean ± SD.
- Values which have different letters in each column are significantly , $p \leq 0.05$

Table (8): Effect walnut leaves, iodine and seleniumat the final of the experiment on thyroid hormones of rats suffering from hypothyroidism.

Groups	Parameters		
	T4 ng/dL	T3 ng/dL	TSH ulU/mL
Group (1) negative control	0.94^{a}± 0.087	3.34^{a}± 0.3047	2.02^{b}± 0.738
Sub .Group (1) positive control	0.45^{c}± 0.060	1.90^{c}± 0.245	2.83^{a}± 0.289
Sub .Group (2) 10 mg thyroxin	0.77^{b}± 0.035	3.08^{b}± 0.168	1.29^{b}± 0.272
Sub .Group(3) 10 µg selenium dried	0.75^{b}± 0.051	3.19^{b}± 0.314	1.92^{b}± 0.062
Sub .Group (4) 10 µg iodine.	0.77^{b}± 0.047	2.92^{b}± 0.271	1.35^{b}± 0.062
Sub .Group (5) 10 mg walnut leaves	0.76^{b}± 0.044	3.16^{b}± 0.165	1.46^{b}± 0.314
Sub .Group (6) 5 mg walnut leaves+5 mg thyroxin	0.76^{b}± 0.057	3.05^{b}± 0.585	1.14^{b}± 0.057
Sub .Group (7) 5 mg walnut leaves+5 µg selenium	0.77^{b}± 0.047	2.94^{b}± 0.655	1.76^{b}± 0.070
Sub .Group (8) 5 mg walnut leaves+5 µg iodine.	0.807^{b}± 0.040	2.75^{b}± 0.544	1.1^{c}± 0.11

- Values are expressed as mean ± SD.
- Values which have different letters in each column are significantly , $p \leq 0.05$.

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تأثيراستخدام أوراق عين الجمل وعنصرياليود والسلينيوم علي تحسين قصورالغدة الدرقية لدي فئران التجارب0

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الملخص العربى

تعتبر هرمونات الغدة الدرقية ضرورية للنمو الطبيعي والتطور عند الأطفال،و ترتبط العوامل الغذائية ارتباطًا وثيقًا بقصور الغدة الدرقية.كما أن اليود ، أحد المكونات الرئيسية لهرمونات الغدة الدرقية (T3 و T4) ، يعد نقص اليود أحد الأسباب الأكثر شيوعًا لقصور الغدة الدرقية لدى الأطفال والبالغين في جميع أنحاء العالم.لذلك فإن الهدف من البحث هو دراسة تأثير أوراق عين الجمل واليود والسيلينيوم ، سواء بمفردها أو مختلطة ، على تحسين قصور الغدة الدرقية في الجرذان مقابل التأثير الدوائي لهرمون الغدة الدرقية. و لتحقيق هذا الهدف أجريت الدراسة الحالية لفحص تأثير استهلاك أوراق عين الجمل واليود والسيلينيوم على نسبة المعادن (الكلوريد والكالسيوم والبوتاسيوم والصوديوم) وهرمونات الغدة الدرقية (T3 و T4 و TSH) ووزن الاعضاء الداخلية (الكبد , القلب , الطحال ،الكلى ، الرئتين) تبعاً للغدة الدرقية على الفئران التي تم إصابتها بقصور الغدة الدرقية بإعطائهامادةPropylthiouracil بجرعة 10 مجم / كجم من وزن الجسم مرة واحدة في اليوم لمدة اسبوعين. اجري هذا العمل على 54 من ذكور الجرذان البيضاء تم تصنيفها عشوائيا الى تسعة مجموعات لكل منها (ن = 6) المجموعة 1 (المجموعة الضابطة السلبية) تم تغذيتها على النظام الغذائي الأساسي ، المجموعة الرئيسية المكونة من 48 جرذ تم حقنها بالبروبيلثيوراسيل إلي ظهور المرض ثم قسمت إلي إلي 8 مجموعات فرعية كل المجموعات غذيت علي الغذاء الاساس طول فترة التجربة. المجموعة (2) غذيت على النظام الغذائي الأساسي (المجموعة الضابطة الإيجابية) ، المجموعة (3) تناولت 10 مجم ثيروكسين ،

المجموعة (4) تناولت 10 ميكروجرام من السيلينيوم ، المجموعة (5) تناولت 10 ميكروجرام من اليود ، المجموعة (6) تناولت 10 ملجم من أوراق عين الجمل ، المجموعة (7) تناولت 5 ملجم من أوراق عين الجمل و 5 ملجم ثيروكسين ، المجموعة (8) تناولت 5 ملجم من أوراق عين الجمل + 5 ميكروجرام من السيلينيوم ، المجموعة (9) تناولت 5 ملجم من أوراق عين الجمل + 5 ميكروجرام من اليود، أظهرت النتائج أن المجموعات التي تناولت مسحوق أوراق عين الجمل ، سواء بمفردها أو مع هرمون الغدة الدرقية ، واليود ، والسيلينيوم كانت أعلى بشكل ملحوظ في معدل الشفاء من قصور الغدة الدرقية 0

الكلمات المفتاحية: الغدة الدرقية. هرمونات الغدة الدرقية ، أوراق عين الجمل ، اليود ، السيلينيوم ، محتوى المعادن.