Employment of Pumpkin Fruit and Seeds in Treatment of Hypothyroidism Albino Rats

استعمال ثمار وبذور اليقطين لعلاج الفئران المصابة بقصور الغدة الدرقية

أ.د/ حامد محمد عماره

قسم الاقتصاد المنزلي

كليه التربيه النوعيه – جامعه دمياط

أ.د/ دينا حامد البشوتي

قسم الاقتصاد المنزلي

كلية التربية النوعية – جامعة دمياط

م.م. / أسماء أحمد صديق عبله

قسم الاقتصاد المنزلي

كلية التربية النوعية – جامعة دمياط

المجلة العلمية لكلية التربية النوعية – جامعة دمياط

عدد (١٠) – ديسمبر ٢٠٢٤

Employment of Pumpkin Fruit and Seeds in Treatment of Hypothyroidism Albino Rats

Hamed Mohamed Emara* Dina Hamed EL Bushuty*Asmaa Ahmed Sdeak Abla*
***Home Economics Dept.,Fac. of Specific Education,Damietta Univ., Egypt**

Abstract: This study was conducted to investigate the possible health effect of whole pumpkin fruit and seeds on hypothyroidism albino rats treated with carbimazole. Forty-eight albino rats weighing (150-200) B.Wt. Each was used and divided into 8 equal groups, one was kept as a control negative group. The other 7 groups were orally given carbimazole (1.35 mg/kg b.w) equivalent to the therapeutic dose for humans, dissolved in water, daily for 8 weeks to induce hypothyroidism in laboratory animals. The whole pumpkin and seed were given at 5,10, and 15%. At the end of the experimental period (6 weeks), animals were sacrificed. Blood samples were collected to determine the following parameters: serum thyroid gland hormones (T3, T4, and TSH), and antioxidant enzymes (SOD, CAT, and GST). Pumpkin seeds (15%) showed the best treatment for Triiodothyronine (T3), Thyroxine (T4), and TSH., as well as total cholesterol, triglycerides, and LDL. On the other hand, pumpkin seeds (15%) recorded the best results in the improvement of serum antioxidation enzymes. Histopathological examination also showed that pumpkin fruits and seeds have an improving effect on thyroid function and help in treating hypothyroidism. The cake, which included pumpkin fruits and seeds at concentration of 10% and 15%, showed a very good degree of acceptance. The study recommends the necessity of including whole pumpkin fruits and seeds in the diet of patients with hypothyroidism.

Key words: Thyroid, hypothyroidism, lipid profile, Pumpkin, Pumpkin seed, Antioxidant Enzymes, TSH

Introduction

The thyroid is one single gland it is anatomically divided into right and left lobes, with the middle of the gland between the two lobes referred to as the isthmus. The principal function of the thyroid gland is the synthesis and secretion of thyroid hormones, which circulate in the body through the blood stream and exert their effects through interaction with specific cellular proteins known as thyroid hormone receptors. There are two principal thyroid hormones made and secreted by the thyroid, thyroxine (T4) and triiodothyronine (T3). The majority of hormone secreted by the thyroid is T4, but the major active form of thyroid hormone is T3. T4 that circulates in the blood can be converted into T3 in many tissues by a specific enzyme known as a deiodinase, which removes one of the 4 iodine molecules from T4 (**Jameson and Weetman, 2010).**

Diseases of the thyroid may be arbitrarily categorized into problems of thyroid hormone production (too much = Hyperthyroidism) or (not enough = Hypothyroidism) or thyroid growth or enlargement (diffuse symmetrical enlargement, single or multiple benign nodules or thyroid cancer). Some patients may have both a disturbance in thyroid function and an enlarged thyroid with one or more thyroid nodules. When thyroid disease develops as a result of problems with the thyroid gland itself, it is referred to as Primary Thyroid Dysfunction (hypo or hyperthyroidism, etc.). Alternatively, if thyroid hormone levels are abnormal as a consequence of hypothalamic or pituitary problems, this is referred to as Secondary Thyroid Dysfunction (hypo or hyperthyroidism) **(mythyroid, 2023).**

pumpkin is a member of the squash family, and it's rich in beta-carotene, Beta-carotene is a carotenoid and antioxidant. Our bodies can naturally convert beta-carotene into vitamin A- an essential vitamin that helps promote good eye health and vision, healthy skin, and proper development, according to **(USDA ,2023).**

Pumpkin seeds, considered a source of proteins, oil, and considered a valuable source of minerals, dietary fiber, health-benefiting vitamins and mono-unsaturated fatty acids. Next to the sensorial aspects, pumpkin seeds are consumed for their anti-diabetic, antifungal, antibacterial, anti-inflammatory and antioxidant effects, according to **(Nkosi *et, al.*, 2006).**

Zinc improves thymic and immune functions in children with Down's syndrome**, (Bucci *et al.*, 1999).** Zinc is an essential trace metal for catalytic activities of many enzymes involved in the metabolism of hormones and thyroid hormones (**Arthur and Beckett ,1999)**.

Materials and Methods

Materials:

1- **Plants:** The plant parts (pumpkin, and Pumpkin seeds) were selected in the present work for the treatment of hypothyroidism. Pumpkin Fruit & seeds (*Cucurbita maxima*), were obtained from a local market, dried by sun and milled.

2- **Carbimazole:** Carbimazole Tablets B.p 2007 was obtained from Pharmacy, Damietta, Egypt, as a medicine to cause hypothyroidism according to **(Paget., G. E. and Barnes., J., M. ,1964)**, dissolved in water.

3- **Animals:** This study was carried out on 48 adult male Sprague Dawley rats weighing 150-200 g. Rats were obtained from the Medical Experimental Research Center, Faculty of Medicine, Mansoura University. Rats were housed under standard conditions (12 h. light dark cycles, 6 rats per 1500 cm2 cage in 22 ± 3 C◦) for one week to acclimate before the experimental study, during this period, rats were fed on a standard rat diet with free access to food and water.

4- **Basal Diets**: consisted of casein (12%), corn oil (10%), Choline Chloride (0.25%), vitamins mixture (1%), cellulose (5%), salt mixture (4%), corn starch (up to100%) according to **(Campbell,1963)**. The used salt and vitamins mixture was according to **(Hegested *et al.*, 1941)**

Methods:

5- **Induction to Cause Hypothyroidism:** Forty-two (42) male albino rats (Spargue-Dawley strain) weighing (150 -200g) were orally given carbimazole (1.35 mg/Kg b.w) equivalent to the therapeutic dose for humans, dissolved in water, daily for 8 weeks according to the method described by **(Paget., G. E. and Barnes., J., M. 1964)**

6- **Experimental Designs and Animal Groups:** Forty-eight (48) (Spargue-Dawley strain) male albino rats were distributed into 8 groups each of 6 rats which means of rat weight for all groups was nearly equal. All the groups of rats were housed in wire cages and fed on the experimental diet for 8 weeks according to the following groups:

Group Name	Rats Number	Protocol	Duration
Negative group	6	Maintained on Normal Diet	6 weeks
Positive group	6	Maintained on Normal Diet	6 weeks
5 % Fruit	6	Maintained on Normal Diet + 5% *Cucurbita maxima* Dried Fruit Powder	6 weeks
10 % Fruit	6	Maintained on Normal Diet + 10% *Cucurbita maxima* dried fruit powder	6 weeks
15 % Fruit	6	Maintained on Normal Diet + 15% *Cucurbita maxima* dried fruit powder	6 weeks
5 % Seeds	6	Maintained on Normal Diet + 5% *Cucurbita maxima* Dried Seeds Powder	6 weeks
10 % Seeds	6	Maintained on Normal Diet + 10% *Cucurbita maxima* Dried Seeds Powder	6 weeks
15 % Seeds	6	Maintained on Normal Diet + 15% *Cucurbita maxima* Dried Seeds Powder	6 weeks

They were fed ad libitum and all procedures were conducted in respect of the acceptable humane methods in the use of laboratory animals in medical research. Each of the above groups was kept in a single cage. The diets were introduced to rats in special non-scattering feeding cups to avoid loss of food and contamination. Taps of water provided to rats by means of glass tubes projecting through wire cages from inverted bottles supported to one side of the cage. The weight of each animal and food intake were recorded daily.

7- **Blood Sample and Organs collection**: at the end of the experimental period, rats were sacrificed using an over-dose of thiopental sodium (ip 75mg/kg) method by **(Damiani *et al.*, 2003)**. The blood was withdrawn from the hearts of rats using 5 ml syringe and collected in a dry test tube for serum preparation. From all the previously mentioned groups, blood samples were collected after 12 hours of fasting at the end of the experiment. Using the retro-orbital method, by means of a microcapillary glass, blood was collected into a dry clean centrifuge tube, and left to clot at room temperature for half an hour. The blood was centrifuged for 10 minutes at 3000 r.p.m to separate the serum. Serum was carefully aspirated and transferred into clean quit fit plastic tubes and kept frozen at (-20co) until the time of analysis. for assay of Serum T3, T4, TSH, T.G, T.C, HDL, LDL, GSH, SOD activity and Catalase. The organs (liver, kidney, and heart,) were removed and washed in saline solution, weighed and stored in (10%) formalin solution according to methods described by **(Drury and Wallington ,1980).**

8- Biological Indices Calculation

Biological evaluation of the different diets was carried out by determination of food intake daily, body weight gain g (BWG g/day) and food efficiency ratio (FER) according to **(Chapman *et al.*, 1959) .**

- **using the following equations:**

Body Weight Gain = Final weight (g) - Initial Weight (g)

Feed efficiency ratio (FER) = gain in body weight (g)/ Feed intake (g).

9- Biochemical Analysis of Serum

A-Determination of Thyroid Hormone:

-Thyroid Stimulating Hormone (TSH): carried out according to **(Walker *et al.*, 1990).**

- Determination of Thyroid Hormones (free T4 and free T3): was estimated in serum using Radioimmunoassay (RIA) as described by **(Surks ,1981).**

B-Determination of Enzymatic Antioxidant:

- Superoxide Dismutase (SOD): was carried out according to the method of **(Sun *et al.*, 1988).**

- Glutathione peroxides (GPX): was carried out according to the method of **(Zhao, 2001).**

- Catalase (CAT): was carried out according to the method of **(Diego, 2011).**

C- Determination of Lipid Profile

- Determination of serum total triglyceride was carried out according to **(Fassati and Prencipe ,1982).**

- Determination of serum total Cholesterol according to **(Allian, 1974).**

- Determination of Serum HDL-Cholesterol determined by the same method used for total cholesterol, according to **(Lopez, 1977).**

- Calculation of serum VLDL and LDL –Cholesterol was carried out according to the method of **(Lee and Nieman ,1996)** as follows:

VLDL = TG / 5

LDL = Total Cholesterol - [(VLDL-C) + (HDL-C)].

-Atherogenic Index was calculated according to **(Nakabayashi *et al.*, 1995)** as follows**:** Atherogenic Index (AI) = LDL + VLDL / HDL

10-Statical Analysis: Statistical analysis was achieved by using computer of statistical package for social science (SPSS version 11.0). The results are given as means ±SD. One way analysis of variance (ANOVA) was used to test the differences between groups **(SPSS, 1999).**

Result and Discussion

The current study focused on the possible health effects of whole pumpkin fruit and seeds on impaired On Albino Rats Suffering from hypothyroidism by carbimazole.

A- Effect of pumpkin fruit and seed on body weight gain (BWG), and feed efficiency ratio (FER) of Hypothyroidism rats.

Table (1) Shows the mean value of body weight gain of Hypothyroidism rats fed on various diets. It could be noticed that the mean value of BWG (g) of the Control (+) group was bigger than the control (-) group, being 4.91 ± 0.19 [d] and 2.16 ±0.29 [a], respectively. Rats fed on pumpkin fruit at 5%, 10% and 15% showed significant differences between them. Rats fed on pumpkin seeds at 5%, 10% and 15% showed significant differences between them. The best BWG was recorded for groups Pumpkin Fruit (15%).

Data in table (1) illustrates the mean value of FER of Hypothyroidism rats fed on different diets. Data show that the mean value of FER of the control (+) group was higher than that in the control (-) group, being 0.103 ± 0.07 [d] and 0.085 ± 0.01[a] respectively. All rats fed on various diets showed significant increases in mean values as compared to control (+) group. All rats in the groups of Pumpkin Fruit (5,10, and15%) showed significant differences among them. Rats in groups Pumpkin seeds (5,10,15) % showed significant differences among them, Numerically. The best FER was recorded for the group (Hypothyroidism rats fed on Pumpkin seeds 15) % when compared to the control (-) group.

Table (1): Effect of Pumpkin Fruit and Seeds on serum BWG, and FER of Hypothyroidism Rats

Variables	Negative control	Positive control	*Pumpkin Fruit*			*Pumpkin Seeds*		
			5%	10%	15%	5%	10%	15%
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
BWG (g)	2.16 ± 0.29 [a]	4.91 ± 0.19 [d]	4.02 ± 0.53[c]	3.82 ± 0.14[c]	2.95 ± 0.38[b]	3.52 ± 0.36[c]	2.66 ± 0.26[a]	2.28 ± 0.98[a]
F.E. R	0.085 ± 0.01[a]	0.103 ± 0.07[d]	0.160 ± 0.02[d]	0.151 ± 0.00[cd]	0.118 ± 0.01[abc]	0.143 ± 0.01[ab]	0.108 ± 0.01[ab]	0.91 ± 0.03[a]

B-Effect of Pumpkin Fruit and Seeds on the Serum Thyroid Gland Hormone of Hypothyroidism Rats.

Table (2) Shows the mean value of serum Triiodothyronine (T3) in Hypothyroidism rats fed on different diets. It could be noticed that the mean value of Triiodothyronine in the control (+) group was lower than that in the control (-) group, being 148.72 ± 3.68e and 278.63 ±7.48 a. All Hypothyroidism rats fed on various diets showed significant decreases in mean values as compared to control (+) group, the values were 159.56 ± 7.85d, 159.80 ± 2.18d, 171.68 ± 4.40cd , 164.83 ± 4.35 d ,177.15 ± 8.08c , 190.86 ±7.20 b for

Pumpkin Fruit at (5,10, and 15 %), and Pumpkin seeds (5,10, and15 %). Pumpkin Seeds (15) % revealed the best treatment when compared to control (-) group considering (T3) activity.

Data in Table (2) Shows the mean value of serum Thyroxine (T4) of Hypothyroidism rats fed on different diets. It could be noticed that the mean value of Thyroxine of the control (+) group was lower than that in control (-) group, being 2.15 ± 0.25 ^{f} and 7.35± 0.76 ^{a}. All Hypothyroidism rats fed on various diets showed significant decreases in mean values as compared to the control (+) group, The values were 2.35 ±0.25^{df} , 2.41 ± 0.15^{cdf} , 5.65 ± 0.10^{cd}, 2.60 ± 0.16^{cd} , 2.93 ± 0.28^{c}, 3.56 ± 0.56^{b} for Pumpkin Fruit at (5,10, and 15 %), and Pumpkin seeds at (5,10, and 15 %). Pumpkin Seeds (15 %) revealed the best treatment when compared to control (-) group considering (T4) activity.

Table (2) Shows the mean value of serum TSH of Hypothyroidism rats fed on different diets. It could be noticed that the mean value of TSH in control (+) group was higher than that in control (-) group, being 8.70 ± 0.08^{e} and 2.73 ± 0.35^{a}. All Hypothyroidism rats fed on various diets showed significant decreases in mean values as compared to control (+) group, The values were 7.26 ± 0.43^{d} , 6.93 ± 0.37^{d} , 4.83 ± 0.28^{c} , 5.13± 0.46^{c} , 4.76 ± 0.28^{c}, 4.03 ± 0.45^{b} for Pumpkin Fruit at (5,10, and 15 %), and Pumpkin seeds at (5,10, and 15 %). Pumpkin Seeds (15%) revealed the best treatment when compared to the control (-) group considering (TSH) activity.

In this respect **(Faroogi *et al*., 2000**) show that zinc depresses TSH levels in healthy subjects. Also, **(chen *et al*., 2002)** showed reduced thyroid function was strongly related to low serum zinc level. **(Gossell *et al*., 2006)** reported that Pumpkin seed is used as trace elements, such as zinc and selenium. Also, **(King and Cousins ,2006)** reported that Zinc works as co-enzyme factor for many enzymes which are involved in various metabolic processes and essential for sensitizing the tissues to thyroid hormone.

In addition to **(Combs *et al*., 2009)** showed that active thyroid hormone, requires zinc binding proteins for its formation and function, zinc can active thyroid hormone function, making it crucial for hypothyroidism sufferers, Selenium, a micronutrient essential for thyroid function. Also, **(Nabeel and Jassim ,2018)** reported that the pumpkin seed showed improvement parameters in thyroid stimulating hormone (TSH) and thyroxin (T4) and triiodothyronine (T3) hormones compared with control group.

On the other hand, **(Amara *et al*., 2008**). **(Amin *et al*., 2019)** found Bioactive chemicals in pumpkin seeds are zinc, phosphorous, magnesium, potassium, and selenium. **(Ambooken *et al*., 2013)** showed that the Zinc and other trace elements such as copper and selenium are required for the synthesis of thyroid hormones, and deficiency of these can result in hypothyroidism. But, **(Maret ,2013)** reported that the efficiency of zinc in the body may result in increased levels of secretion of thyroid hormones which affects the normal metabolism of the body and metabolic rate.

Similarly, (**Salma *et al*., 2015)** investigated the effects of Zn and Se supplementation on thyroid function of overweight or obese female hypothyroid patients and found an effect of Zn alone or in combination with Se on thyroid function of overweight or obese female hypothyroid patients. Also, **(Naeem Rabeh ,2016)** showed that the supplementation with Zinc significantly increased the level of thyroid hormones. Alongside β-carotene, selenium is an antioxidant that is associated with TSH levels, and decreasing oxidative stress, boosting thyroid function, **(Bahareh et al., 2023).**

(Lei *et al*., 2023) showed that selenium and zinc intakes have a beneficial in preventing of hypothyroidism. **(Falah *et al*., 2023)** showed a zinc have a role to a significant increase in thyroid hormones and thyroid stimulating hormone (TSH), as well as, **(Hu and Rayman ,2017)** showed that the Iodine and selenium are involved in the synthesis and metabolism of thyroid hormones. **(Danailova *et al*., 2022)** told those Anti-inflammatory nutrients, such as antioxidants, magnesium, and zinc, are important to reduce thyroid inflammation., But **(Josef Köhrle, 2023)** showed the essential trace elements, iodine, selenium and iron, provide the basic requirements for the function and action of the thyroid hormone system in humans.

(Aleksandra *et al*., 2020) told that the elements selenium (Se) and iodine (I) are both crucial for the normal functioning of the thyroid. Selenium is to be a cofactor of the enzyme iodothyronine deiodinase, which converts hormone T4 to the active T3.

<u>Table (2):</u> Effect of Pumpkin Fruit and Seeds on the serum Thyroid Gland Hormone of Hypothyroidism Rats.

Variables	**Negative control**	**Positive control**	***Pumpkin Fruit***			***Pumpkin Seeds***		
			5%	**10%**	**15%**	**5%**	**10%**	**15%**
	Mean ± SD	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**
Triiodothyronine T3 (ng/ml)	278.63 ± 7.48 [a]	148.72 ± 3.68[e]	159.56 ± 7.85[d]	159.80 ± 2.18[d]	171.68 ± 4.40[cd]	164.83 ± 4.35 [d]	177.15 ± 8.08[c]	190.86 ± 7.20 [b]
Thyroxine (T4) (ng/ml)	7.35 ± 0.76 [a]	2.15 ± 0.25 [f]	2.35 ± 0.25[df]	2.41 ± 0.15[cdf]	5.65 ± 0.10[cd]	2.60 ± 0.16[cd]	2.93 ± 0.28[c]	3.56 ± 0.56[b]
TSH (uIU/ml)	2.73 ± 0.35[a]	8.70 ± 0.08[e]	7.26 ± 0.43[d]	6.93 ± 0.37[d]	4.83 ± 0.28[c]	5.13 ± 0.46[c]	4.76 ± 0.28[c]	4.03 ± 0.45[b]

C- Effect of Pumpkin Fruit and Seeds on the Serum Antioxidation Enzymes of Hypothyroidism Rats.

Table (3) indicate the mean value of serum GST of Hypothyroidism rats fed on different diets. It could be noticed that the mean value of GST of control (+) group was lower than that in control (-) group, being 1.33 ±0.10[e] and 5.73 ±0.66[a]. All Hypothyroidism rats fed on various diets showed significant increases in mean values as compared to control (+) group. Group Pumpkin Fruit (15) %, and Pumpkin seeds (15%) recorded the best treatment for increasing GST.

Data in table (3) shows the mean value of Serum SOD of Hypothyroidism rats fed on different diets. It could be noticed that the mean value of SOD in control (+) group was lower than that in control (-) group, being 13.33 ± 2.04f and 31.81 ± 3.59a. All Hypothyroidism rats fed on various diets showed significant increases in mean values as compared to control (+) group, The values were 14.78 ± 1.37 [ef] **,** 17.20 ± 1.92[de] **,** 19.51 ± 1.13[cd] **,** 16.88 ± 0.93[e] **,** 20.16 ±1.32[c] , 29.06 ± 2.93[b] , at Pumpkin Fruit (5,10,and 15%), and Pumpkin seeds (5,10, and 15 %) . Group Pumpkin seeds (15%) recorded the best treatment for increasing SOD.

Table (3) illustrate the mean value of serum Catalase of Hypothyroidism rats fed on different diets. It could be noticed that the mean value of Catalase in control (+) group was lower than that in control (-) group, being 1241.13 ± 194.04[d] and 2495.70 ± 85.71[a]. All Hypothyroidism rats fed on various diets showed significant increases in mean values as compared to control (+) group. Numerically, group (rats fed on diet containing Pumpkin Seeds (15) %) showed maximum improvement as regards catalase enzyme.

In this respect**, (Azarkan *et al*., 2003)** demonstrated that antioxidant properties of pumpkin are related to their content in phenolic compounds. Pumpkin has an antioxidant activity towards oxidative stress **(pearson,2003).** On the other hand, **(Mahan *et al*., 2003)** showed that pumpkin contains numerous compounds recognized as antioxidants which include carotenoids, tocopherols, ascorbic acid and syringic acid. According to the result of **(leja *et al*., 2003)** Pumpkin contains 7.2 mg/100g of total phenolics**. (Murcia *et al*., 2004**) showed that pumpkin contain many phenols which are very efficient scavengers of peroxy radicals.

Pumpkin is a fruit which being rich in phenolic compounds, flavonoids and vitamins, according to, **(Fu *et al*., 2006**). However, Antioxidant properties of pumpkin are related to the content in phenolic compounds some of which are glycosides such as oleuropein and ligstroside **(yuon *et al*., 2006).**

The pumpkin seeds are immensely nutritional and fortified with nutraceuticals such as carotenoids, phytosterols, phytoestrogens, triterpenes, tocopherols, lignans, and saponins; these compounds termed as phenolic compounds with significant antioxidative capacity. **(Caili *et al*., 2006)**. Also, **(Pinto et al., 2007)** analyzed that the total phenolic content ranged from 7.2 to 9.2 mg/100 g for pumpkin extract respectively, a significant positive correlation was found between total phenolic content and antioxidant activity for the ethanolic extracts. The essential trace mineral zinc in pumpkin seeds acts as an antioxidant which is attributed to its ability to neutralize free radical generation or directly engross the iron or copper binding sites of lipids, proteins, and DNA molecules, according to **(Amara *et al*., 2008).**

Similarly, **(Al-Anoos *et al*., 2015)** showed that pumpkin has polyphenols, and flavonoids that are gaining importance due to their antioxidant activity. Thus, pumpkin has β-Carotene is an important functional ingredient among the carotenoid compounds, due to its pro-vitamin A- activity and its antioxidant action by scavenging oxygen radicals and reducing oxidative stress in the organism (**Zahra *et al*., 2016**).

(Montesan *et al*., 2018) found that pumpkin seed contains remarkable bioactive such astriterpenoids, sesquiterpenoids, tetraterpenoids (carotenoids), tocopherols, polyphenols, saponins, and cucurbitacin's.

(Bartosz and Anna ,2019) compared the chemical composition of the pulp and analyses the content of bioactive compounds such as carotenoids, polyphenols (flavonols and phenolic acids), tocopherols, and showed high diversity in the concentration of individual components pumpkin pulp was a source of carotenoids and another bioactive compounds.

(Amin *et al*., 2019) reported that the pumpkin seed in Cucurbita maxima is rich in natural antioxidants. pumpkin seeds (Cucurbita maxima) are rich in phytochemicals like terpenoids, glycosides, alkaloids, saponins, tannins, steroids, which are responsible for the therapeutic effect, according to **(Pulok *et al*., 2022).**

Table (3): Effect of Pumpkin Fruit and Seeds on the Serum Antioxidation Enzymes of Hypothyroidism Rats.

Variables	Negative control	Positive control	*Pumpkin Fruit*			*Pumpkin Seeds*		
			5%	10%	15%	5%	10%	15%
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
GST (ng/mL)	5.73 ± 0.66[a]	1.33 ± 0.10[e]	2.48 ± 0.17[d]	3.80 ± 0.32[c]	4.33 ± 0.76[c]	3.76 ± 0.53[c]	4.07 ± 0.22[c]	4.67 ± 0.67[b]
(SOD) ninhibition %	31.81 ± 3.59[a]	13.33 ± 2.04[f]	14.78 ± 1.37[ef]	17.20 ± 1.92[de]	19.51 ± 1.13[cd]	16.88 ± 0.93[e]	20.16 ± 1.32[c]	29.06 ± 2.93[b]
Catalase (nM/ml/min)	2495.70 ± 85.71[a]	1241.13 ± 194.04[d]	1302.28 ± 225.85[d]	1459.80 ± 239.25[d]	1460.15 ± 239.16[d]	1720.11 ± 113.14[c]	1899.25 ± 227.90[c]	2148.10 ± 190.62[b]

D- Effect of Pumpkin Fruit and Seeds on the Serum lipid profile of Hypothyroidism Rats.

Table (4) shows the mean value of Total cholesterol of Hypothyroidism Rats fed on different diets. It could be observed that the mean value of (T.C.) in the control (+) group was higher than that in control (-) group, being 190.43 ± 6.42[g] and 99.10 ± 5.56[a] respectively, showing significant difference. All Hypothyroidism Rats fed on different diets revealed significant decreases in mean values as compared to control (+) group. Numerically, the better serum (T.C) was showed for Pumpkin Seeds (15%) when compared to control (-) group.

Data in table (4) illustrate the mean value of serum Triglycerides (mg/dl) of Hypothyroidism rats fed on different diets. It could be noticed that the mean value of (T.G) in the control (+) group was higher than that in control (-) group, being It could be noticed that the mean value of (T.G) of control (+) group was higher than that in the control (-) group, being 114.41 ± 3.32[f] and 68.33 ± 4.88[a]. All Hypothyroidism rats fed on different diets revealed significant decreases in mean values as compared to control (+) group. Rats fed on Pumpkin Seeds (15%) showed the best serum (T.G) when compared to control (-) group.

Table (4) Indicate the mean value of serum (HDL-c) (mg/dl) of Hypothyroidism rats fed on different diets. It could be observed that the mean value of (HDL-c) in control (+) group was lower than in the control (-) group, being 27.73 ± 5.19[f] & 64.95 ± 4.77[a] (T.G) mg/dl. All Hypothyroidism rats fed on different diets revealed significant increases in mean values as compared to control (+) group. Rats fed on Pumpkin Fruit (5,10, and 15 %) showed significant differences between them. Rats fed on Pumpkin seeds (5,10, and

15 %) showed significant differences between them. Numerically, the best serum (HDL-c) was observed for group Pumpkin Seeds15 %.

Data in table (4) shows the mean value of serum (LDL-c) (mg/dl) of Hypothyroidism rats fed on different diets. It could be observed that the mean value of (LDL-c) in the control (+) group was higher than in the control (-) group, being 139.81 ± 2.44[h] and 20.48 ± 1.46[a]. All Hypothyroidism rats fed on different diets revealed significant increases in mean values as compared to control (+) group. Rats fed on group Pumpkin seeds (15%) % recorded the best result of serum (LDL-c).

Table (4) Indicate the mean value of serum (VLDL-c) (mg/dl) of Hypothyroidism rats fed on different diets. It could be observed that the mean value of (VLDL-c) in the control (+) group was higher than in the control (-) group, being 22.88 ± 0.66[e] and 13.66 ± 0.97 [a] mg/dl. All Hypothyroidism rats fed on different diets showed significant decreases in mean values as compared to control (+) group. The best treatment serum (VLDL-c) was recorded for group Pumpkin Seeds 10 and 15 %, Respectively.

Data in table (4) Revealed the mean value of serum Atherogenic Index (AI) (mg/dl) Hypothyroidism rats fed on different diets. It could be noticed that the mean value of (A.I.) in control (+) group was higher than in the control (-) group, being 6.04 ± 1.12[f] and 0.52 ± 0.03[a]. All Hypothyroidism rats fed on various diets showed significant decreases in mean values as compared to control (+) group. Numerically, the best treatment was recorded for group Pumpkin Seeds (15%) considering serum (AI).

(Amint *et al*., 2005) reported that the pumpkin has been shown to decrease LDL and increase HDL to reduce development of atherosclerosis. Also**,** **(Getr *et al*., 2005)** showed that the pumpkin ethanol extract caused a significant reduction in blood cholesterol level. **(Tsai *et al*., 2006)** found that pumpkin has high β-sitosterol content. B-Sitosterol has been indicated to reduce cholesterol. Phytosterols are present in pumpkin seed oils, can beneficial health effects in lipid-associated disorders like atherosclerosis, **(Fruhwirth and Hermetter,2007).**

On the other hand, **(Dretg ,2007)** showed the pumpkin reduce serum cholesterol, as well as, **(Asplund *et al*., 2008)** reported that pumpkin ethanol extract decreased plasma LDL-c, VLDL-c and HDL-c reversed to normal. **(Makni *et al*., 2008)** told that the Pumpkin seeds are a rich source of unsaturated fatty acids, and fibers, known to have anti-atherogenic. **(Danese *et al*., 2009)** showed that pumpkin extract influenced the lipid profile through a significant increase in HDL-c levels which resulted in a concomitant decrease in the LDL-c.

In this respect, (**Kandutsch *et al*., 2009)** indicated that pumpkin extract reduces blood lipid and plasma cholesterol concentrations in cholesterolemic Rats.

(Gossell *et al*., 2011) shown that Pumpkin seed oil administration has been shown to ameliorate blood lipids disorders, and elevating high density lipoprotein cholesterol (HDL-C), which helps in alleviating the risk of cardiovascular complications. (**Martínez *et al*., 2012)** reported that the pumpkin seed is reduced the total cholesterol and the harmful fatty acids. **(Abuelgassim and Showayman ,2012)** showed that treatment of atherogenic rats with pumpkin seeds significantly decreased serum concentrations of TC and LDL-C.

(Phillips, 2012) stated that pumpkin seeds retain estrogenic-like effects comprising the lipid metabolism regulation, since phytoestrogen compounds have a vital role to suppress the cardiovascular problems and control blood lipid levels. Also, **(Ashok et al., 2013)** found administration of Cucurbita maxima significantly decreased serum total cholesterol, LDL, VLDL, Triglycerides and at the same time markedly increased HDL-cholesterol levels.

On the other wise, (**Xin *et al*., 2014)** reported the polysaccharide from pumpkin decrease the levels of plasma triacylglycerol (TG), total cholesterol (TC), and plasma low-density lipoprotein cholesterol, and plasma high-density lipoprotein cholesterol. Therefore, results suggest that pumpkin had a high hypolipidemic activity. **(Ali ,2015)** reported that pumpkin lowers the cholesterol and LDL level and increases the HDL level**. (Likewise, Martine *et al*., 2015)** showed that the pumpkin seed oil improved dyslipidemia, with decreased LDL-cholesterol and triglyceride levels.

(Atefe *et al*., 2017) showed that Pumpkin extract decreased triglycerides and low-density lipoprotein while high-density lipoprotein was markedly increased. Also, **(García-Parraa *et al*., 2017)** reported that a high intake of carotenoids from the diet reduces a risk of cardiovascular diseases. pumpkin Seeds are rich in tocopherols (δ tocopherols), triterpene and unsaturated fatty acids, which have shown anti-inflammatory, and antihyperlipidemic, (**Mythili and Kavitha ,2017).** Also, (**Beni and Meiyanto ,2018)** showed that the Pumpkin seeds contain the important phytoestrogen compounds, i.e., secoisolariciresinol and lariciresinol that have estrogenic-like effect such as preventing hyperlipidemia.

(Ayman *et al*., 2019) showed that the pumpkin seed oil decreased the serum total cholesterol, triglycerides, LDL-C, VLDL-C, phospholipids, and total lipids while and increase in HDL-C. Also, **(Xue *et al*., 2019)** showed lipid-lowering activity by reducing the total cholesterol, triglycerides, and low-density lipoprotein levels, and improving the high-density lipoprotein level by pumpkin polysaccharides. Similarly, **(Azmat *et al.*, 2020)** reported the pumpkin seed possessed hypolipidemic activity as its lowered LDL and increased HDL levels.

<u>Table (4):</u> Effect of Pumpkin Fruit and Seeds on the serum Total cholesterol in Hypothyroidism Rats.

Variables	Negative control	Positive control	*Pumpkin Fruit*			*Pumpkin Seeds*		
			5%	10%	15%	5%	10%	15%
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Total Cholesterol (T.C.) mg/dl	99.10 ± 5.56[a]	190.43 ± 6.42[g]	183.50 ± 5.32[f]	166.70 ± 1.59[e]	151.76 ± 1.63[d]	170.66 ± 4.64[e]	139.80 ± 4.01[c]	121.68 ± 4.87[b]
Triglycerides (mg/dl)	68.33 ± 4.88[a]	114.41 ± 3.32[f]	102.91 ± 3.51[e]	90.16 ± 4.52[c]	88.16 ± 4.47[c]	93.08 ± 6.02[d]	81.83 ± 4.32[b]	81.41 ± 4.91[b]
HDL-c (mg/dl)	64.95 ± 4.77[a]	27.73 ± 5.19[f]	28.68 ± 2.01[ef]	32.28 ± 2.39[de]	35.10 ± 2.39[cd]	32.21 ± 1.32[de]	36.50 ± 3.64[c]	50.61 ± 3.57[b]
LDL-c (mg/dl)	20.48 ± 1.46[a]	139.81 ± 2.44[h]	134.23 ± 3.29[g]	116.38 ± 1.17[e]	99.03 ± 1.48 [d]	119.83 ± 3.27[f]	86.93 ± 1.47[c]	54.78 ± 0.97[b]
VLDL -c (mg/dl)	13.66 ± 0.97 [a]	22.88 ± 0.66[e]	20.58 ± 0.70[d]	18.03 ± 0.90[c]	17.63 ± 0.89[c]	18.61 ± 1.20[c]	16.36 ± 0.86[b]	16.28 ± 0.98[b]
Atherogenic Index (AI)	0.52 ± 0.03[a]	6.04 ± 1.12[f]	5.41 ± 0.31[e]	4.18 ± 0.33[d]	3.33 ± 0.26[c]	4.30 ± 0.20 [d]	2.85 ± 0.32[c]	1.41 ± 0.08[b]

Sensory Evaluation

Color:

In this regard, Data in the table (5) revealed that the color in all fortified cakes with different level of pumpkin Fruit (10 and 15) %, pumpkin powder (10 and 15) %, pumpkin seeds (10 and 15) %, decreased significantly ($p<0.05$), as compared with the control (un-fortified Cake). pumpkin fruit 10%, pumpkin fruit 15% and pumpkin powder 10% showed nonsignificant differences between them. Pumpkin powder 15%, pumpkin seeds 10%, and pumpkin seeds 15% showed a significant difference between them. The highest score of color was recorded for the cake fortified with pumpkin fruit 10%.

Odor:

furthermore, data showed that, odor in all fortified cake with different level of pumpkin fruit (10 and 15) %, pumpkin powder (10 and 15) %, pumpkin seeds (10 and 15) %, decreased significantly ($p<0.05$), as compared with the control (un- fortified Cake). Pumpkin fruit 10%, pumpkin fruit 15%, and pumpkin powder 10% showed nonsignificant differences between them. Pumpkin powder 15%, pumpkin seeds 10%, and pumpkin seeds 15% showed a significant difference between them. The highest score of color was recorded for the cake fortified with pumpkin fruit 10%.

Taste:

Data showed that, taste in all fortified cake with different level of pumpkin fruit (10 and 15) %, pumpkin powder (10 and 15) %, pumpkin seeds (10 and 15) %, decreased significantly ($p<0.05$), as compared with the control (un-fortified Cake). Pumpkin fruit 10%, pumpkin fruit 15%, and pumpkin powder 10% showed nonsignificant differences between them. Pumpkin powder 15%, pumpkin seeds 10%, and pumpkin seeds 15% showed a significant difference between them. The highest score of color was recorded for the cake fortified with pumpkin fruit 10%.

Texture:

Also, Data revealed that, texture in all fortified cake with different level of pumpkin fruit (10 and 15) %, pumpkin powder (10 and 15) %, pumpkin seeds (10 and 15) %, decreased significantly ($p<0.05$), as compared with the control (un-fortified Cake). Pumpkin fruit 10%, pumpkin fruit 15%, and pumpkin powder 10% showed nonsignificant differences between them. Pumpkin powder 15%, pumpkin seeds 10%, and pumpkin seeds 15% showed a significant difference between them. The highest score of color was recorded for the cake fortified with pumpkin fruit 10%.

Over all acceptability:

Data revealed that, general acceptability in all fortified cake with different level of pumpkin fruit (10 and 15) %, pumpkin powder (10 and 15) %, pumpkin seeds (10 and 15) %, decreased significantly ($p<0.05$), as compared with the control (un-fortified Cake). Pumpkin fruit 10%, pumpkin fruit 15%, and pumpkin powder 10% showed nonsignificant differences between them. Pumpkin powder 15%, pumpkin seeds 10%, and pumpkin seeds 15% showed a significant difference between them. The highest score of color was recorded for the cake fortified with pumpkin fruit 10%.

According to results of **(Jacqueline *et al*., 2018)**, the cupcake which fortified with pumpkin seed flour up to 50% level providing greater texture, cohesion, pH, soluble solids, contributing to a protein increase and without substantial changes in the original characteristics of the product.

(Anant and Dinesh ,2013) examined the impact of substituting refined wheat flour with pumpkin powder on biscuit texture and taste, found Increasing pumpkin powder from 0 to 10% enhanced biscuit hardness and fracturability and the optimal substitution level was found to be 2.5%, improving both texture and sensory qualities. So, the findings suggest pumpkin powder as a beneficial ingredient for nutrient-enriched biscuits.

(Amani Hamzah Aljahani & Amal Nassir Al-Khuarieef ,2017) showed that the Cakes prepared using pumpkin puree, the best in terms of sensory analysis, all quality attributes, also rich in crude fiber and protein and had less fat and energy content. So, Pumpkins is a good source for the development of food products because of their ability to improve the appearance, nutritional value and overall acceptability of cakes.

Table (5): Sensory evaluation of cake fortified with different levels of pumpkin Fruit, pumpkin powder, and Pumpkin Seeds .

Parameter	Color	Odor	Taste	Texture	Over all Acceptability	Total
Groups	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD**
Cake (A) Control	19.16 ± 0.83[a]	19.43 ± 0.72[a]	19.36 ± 0.71[a]	19.36 ± 0.71[a]	19.29 ± 0.79[a]	96.60 ± 3.31[a]
Pumpkin Fruit 10%	18.65 ± 0.60[a]	19.22 ± 0.64[a]	19.19 ± 0.40[a]	19.16 ± 0.69[a]	19.21 ± 0.64[a]	95.43 ± 1.90[a]
Pumpkin Fruit 15%	18.53 ± 0.73[a]	19.06 ± 0.61[a]	19.12 ± 0.50[a]	19.13 ± 0.48[a]	19.15 ± 0.62[a]	94.97 ± 1.72[a]
Pumpkin Powder 10%	18.51 ± 0.74[a]	19.05 ± 0.55[a]	19.07 ± 0.57[a]	19.04 ± 0.45[a]	19.12 ± 0.50[a]	94.80 ± 1.43[a]
Pumpkin Powder 15%	16.97 ± 1.15[b]	17.51 ± 1.27[b]	17.57 ± 1.02[b]	18.11 ± 0.97[b]	17.24 ± 1.24[b]	87.40 ± 3.81[b]
Pumpkin Seeds 10%	17.57 ± 1.31[b]	17.51 ± 1.20[b]	17.71 ± 1.30[b]	17.93 ± 1.31[b]	17.77 ± 1.11[b]	88.49 ± 4.92[b]
Pumpkin Seeds 15%	17.25 ±1.14[b]	17.05 ± 1.13[b]	17.92[b] ± 1.01[b]	17.85 ± 0.97[b]	17.27 ± 1.02[b]	87.35 ±3.44[b]

Histopathological Results.

Thyroid Gland

Histological section of thyroid gland. X200 stained with H&E (1) Photomicrograph of normal control group shows normal tissue architecture and regular morphology of cell with good store of colloid. (2) Photomicrograph of hypothyroidism induced group shows structure alteration and depletion of colloid. (3,4,6,7) Photomicrograph of fruit 5%, fruit 10%, seed 5% and seed 10% groups respectively shows the same structure alteration as positive control group, no significant enhancement was observed. (5, 8) Photomicrograph of fruit 15 % and seed 15 % respectively shows structure partial restoration and relative high store of colloid.

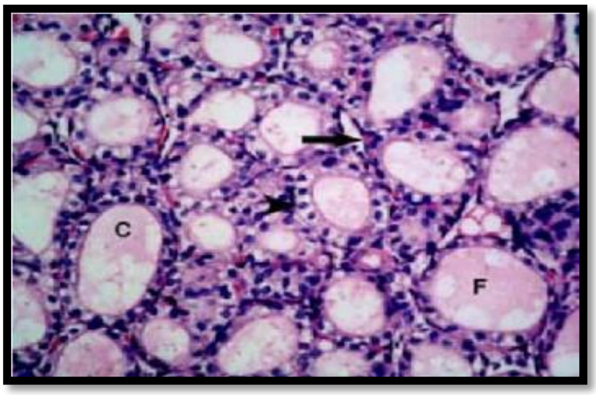

Photo (1): Photomicrograph of a section of the thyroid gland of negative control group demonstrating thyroid follicles (F) lined by cubical follicular cells that exhibit rounded nuclei (arrow head). Note the vacuolated colloid (C) and minute blood capillaries (arrow). H&E, × 200.

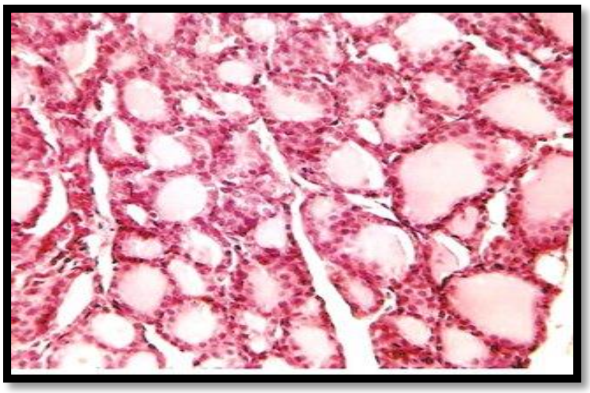

Photo (2): Photomicrograph of a section of the thyroid gland of positive control group shows Hyperplasia and Hypertrophy follicles, follicles empty of colloid. X200.

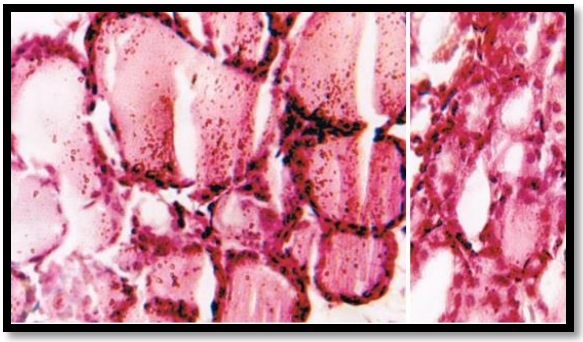

Photo (3): Thyroid gland of rats of (5 % of pumpkin fruit) shows Hyperplasia and Hypertrophy follicles, follicles empty of colloid. X200.

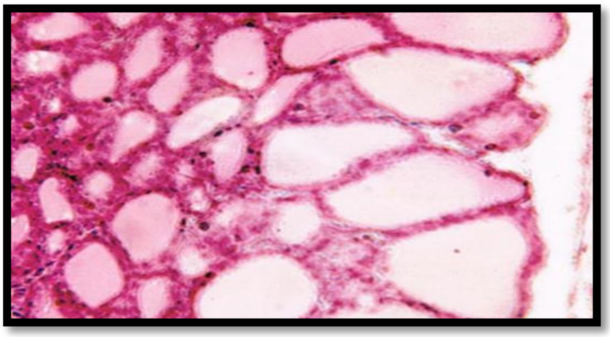

Photo (4): Thyroid gland of rats of (10 % of pumpkin fruit) shows Hyperplasia and Hypertrophy follicles, follicles empty of colloid. X200.

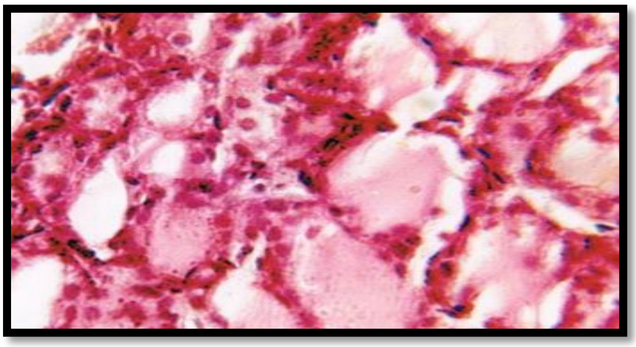

Photo (5): Thyroid gland of rats of (15 % of pumpkin fruit) more or less to normal size, follicular arrangement appeared normal. Follicles are lined with high cubical cells and good store of colloid (H&E ×200).

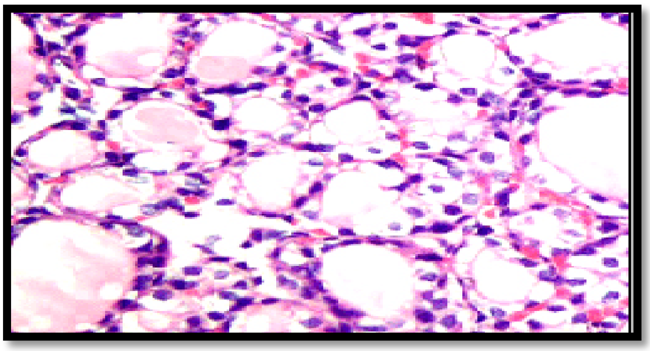

Photo (6): Thyroid gland of rats of (5 % of pumpkin seeds) shows Hyperplasia and Hypertrophy follicles, follicles empty of colloid. X200

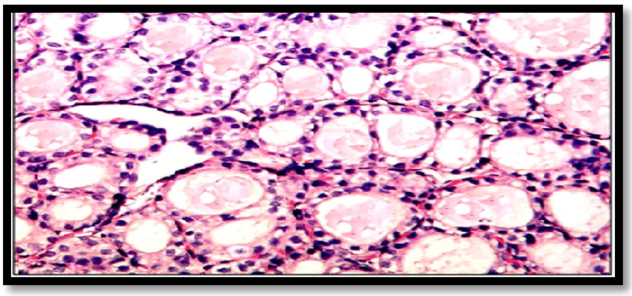

Photo (7): Thyroid gland of rats of (10 % of pumpkin seeds) showing multiple follicles with a crescent of colloid (*) and few follicles devoid of colloid (arrows) (H&E, ×200).

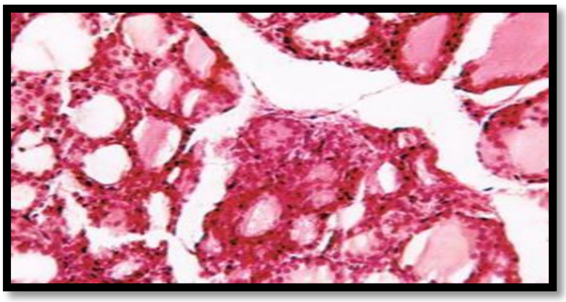

Photo (8): Thyroid gland of rats of (15 % of pumpkin seeds) more or less to normal size, follicular arrangement appeared normal. Follicles are lined with high cubical cells and good store of colloid (H&E, ×200).

References

Abuelgassim O., A. and Showayman A., Al. (2012): The effect of pumpkin (*cucurbita maxima)* seeds and l-arginin supplementation on serum lipid concentrations in atherogenic rats. Afr J Tradit Complement Altern Med. 9(1):131-137.

Al-Anoos, I.M., El-dengawi, R., Hasanin, H.A. (2015): Studies on Chemical Composition of Some Egyptian and Chinese pumpkin (Cucurbita maxima) Seed Varieties. Journal of Plant Science and Research, 2(2), 137.

Aleksandra, G.; Ana, K.; Ana, J.; Nina, K. M.; Helena, Š.; Vekoslava, S.and Mateja, G. (2020): Response of Pumpkin to Different Concentrations and Forms of Selenium and Iodine, and their Combinations. Plants (Basel).9(7): 899.

Ali, W., S. (2015): Nutrition with Pumpkin (Cucrbita pepo) Cake as Lowering Cholesterol in Rats. Middle East J. Appl. Sci.5:10–18.

Amani Hamzah Aljahani & Amal Nassir Al-Khuarieef (2017): Effect of Mixing Wheat Flour with Pumpkin and Dates on the Nutritional and Sensory Characteristics of Cake. Pakistan Journal of Nutrition.16 (4) 273-278.

Amara, S.; Abdelmelek, H.; Garrel, C.; Guiraud, P. and Douki, T. (2008): Preventive effect of zinc against cadmiuminduced oxidative stress in the rat testis”. J Reprod Dev;54(2):129134.

Amara, S.; Abdelmelek, H.; Garrel, C.; Guiraud, P. and Douki, T. (2008): Preventive effect of zinc against cadmiuminduced oxidative stress in the rat testis. J Reprod Dev;54(2):129134.

Ambooken, B.; Binitha, M.P. and Sarita, S. (2013): Zinc Deficiency Associated with Hypothyroidism: An Overlooked Cause of Severe. Alopecia.Int J Trichology. 5(1): 40–42.doi: 10.4103/0974-7753.114714.

Amin M.Z.; Islam T.; Mostofa F.; Uddin M.J.; Rahman, M.; Satter, M.A. (2019): Comparative assessment of the physicochemical and biochemical properties of native and hybrid varieties of pumpkin seed and seed oil (*Cucurbita maxima Linn.*). Heliyon.5: 02994.

Amint, K. H.; Groff, J. L.; Gropper, S. S. and Hunt, S. M. (2005): Advanced nutrition human metabolism. West Publishing Co. Journal of Cereal Science.,32:115-128.

Anant Kulkarni and Dinesh C. Joshi (2013): Effect of replacement of wheat flour with pumpkin powder on textural and sensory qualities of biscuit. January 2013 International Food Research Journal 20 (2):587-591.

Arthur, J.R. and Beckett, G. J. (1999): Thyroid function. British Medical Bulletin. 55: 658-668.

Ashok, Sh.; Ashish, K., Sh.; Tara, C.; Manoj, K. and Kailash, C., Y. (2013): Antidiabetic and Antihyperlipidemic Activity of Cucurbita maxima Duchense (Pumpkin) Seeds on Streptozotocin Induced Diabetic Rats. Journal of Pharmacognosy and Phytochemistry. 1(6) 2278- 4136.

Asplund, J., M.; Orskov, E., R.; Hovell, F. D. and Macleod, N. A. (2008): The effect of intragastric infusion of glucose, lipids or acetate on fasting nitrogen excretion and blood metabolites in sheep. Brit. J. of Nut., 54(1):189-195.

Atefe, G.; Reza, H.; Mina, H.; Maryam, M. and Zabihullah, M. (2017): The beneficial effects of pumpkin extract on atherogenic lipid, insulin resistance and oxidative stress status in high-fat diet-induced obese rats. Journal of Complementary and Integrative Medicine, De Gruyter 10 (24).

Ayman, E.; Ayman, F. and Khalid, F. (2019): Effect of pumpkin seed oil on lipid metabolism in experimental hyperlipidemic rats. Benha Veterinary Medical Journal.36, (1):302-309.

Azarkan, D. S.; Tritschler, H. J.; Bretzel, R. G. and Federlin, K. (2003): Functional properties of edible mushrooms. Nutrition, 16:694-696.

Azmat, K.; MAJID, Z., A. and Rezzan, K. (2020): Effect of pumpkin seed oil on cholesterol fractions and systolic/diastolic blood pressure. Food Sci. Technol, 40 (3).

Bahareh, F. F.; Nima, B.; Hossein, G.; Hadi, S.; Golnaz, M.; and Arian, K.R. (2023): Is beta-carotene consumption associated with thyroid hormonelevels?. Front Endocrinol.,(14)https://doi.org/10.3389/fendo.2023.1089315.

Bartosz, K. and Anna, G. (2019): The Profile of Carotenoids and Other Bioactive Molecules in Various Pumpkin Fruits (Cucurbita maxima Duchesne) Cultivars. Molecules, 24(18):3212. doi: 10.3390/molecules24183212.

Beni, L. and Edy, M. (2018): A Review: The Emerging Nutraceutical Potential of Pumpkin Seeds. Indonesian journal of cancer chemoprevention. 9: (2).

Bucci, I.; Napolitano, G.; Giuliani, C. (1999): Zinc sulphate supplementation improves thyroid function in hypozincemic Down children. Biol Trace Elem Res 67: 257-268.

Caili, F.; Huan, S. and Quanhong, L. (2006): A review on pharmacological activities and utilization technologies of pumpkin. Plant Foods Hum Nutr, 61: 70- 77.

Campbell, J. A. (1963): Methodology of Protein Evaluation. PAG Nutr. Document R. 101 Add .37, June, Meeting, Newyork.

Chapman, D. G.; Castilla, R. and Campbell, J. A. (1959): Evaluation of Protein in Food. I.A method for the determination of protein efficiency ratio. Can. J. Biochem.Phosiol.,37:679-686.

Chen, S.M.; Kuo, C.D.; Ho, L.T.and Liao, J.F. (2002): Effect of hypothyroidism on intestinal zinc absorption and renal zinc disposal in five-sixth nephrectomized rats. Jpn J Physiol 55: 211-219.

Combs, G. F.; Midthune, D. N.; Patterson, K. Y.; Canfield, W. K.; Hill, A. D.; Levander,0.OA.; Taylor, P. R.; Moler, J. E.; Patterson, B. H. (2009): Effects of selenomethionine supplementation on selenium status and thyroid hormone concentrations in healthy adults. Am J Clin Nutr 89: 1808–1814.

Danailova, Y.; Velikova, T.; Nikolaev, G.; Mitova, Z.; Shinkov, A.; Gagov, H.; Konakchieva, R. (2022): Nutritional Management of Thyroiditis of Hashimoto”. Int. J. Mol. Sci., 23, 5144.

Danese, S. K.; Jialal, I. S. and Grundy, S. M. (2009): Effect of combined supplementation with alpha-tocopherol, ascorbate, and beta carotene on low-density lipoprotein oxidation. Center for Hurman Nutrition, University of Texas Southwestern Medical Center, Dallas 75235-9052.

Diego, S. (2001):Oxiselect Catalase Activity Assay Kit,Colorimetric. Cell Biolabs, Inc.1-9.

Dretg, A., I. (2007): Dietary Fibers, Fiber analogues and glucose tolerance, importance of viscosity. British Medical Journal, 81: 1392-1394.

Drury, R. A. and Wallington, E. A. (1980): Carlton's Histological Technique. 5th Ed., Oxford Univ.

Falah, S.; Mahmood, A. and Hadeel, M., H. (2023): Nano-zinc Oxide and Zinc Sulfate in Broilers: Effect on Thyroid Hormones and Internal Intestinal Environments. Egypt. J. Vet. Sci. 54(3), pp. 347-358.

Faroogi, L.; Mazeto, G.M.; Shuhama, T.and Brandao-Neto, J. (2000): Effects of single venous dose of zinc on thyroid status in healthy individuals and patients with Graves' disease. Met Based Drugs, 7: 151-155.

Fassati,P. and Prencipe, L. (1982): Triglycride Enzymatic Colorimetric Method .J. of Clin. Chem., 28:2077.

Fruhwirth, G., O. and Hermetter, A. (2007): Seeds and oil of the Styrian oil pumpkin: Components and biological activities. Eur. J. Lipid Sci. Technol, 109: 1128-1140.

Fu, C. L.; Shi, H. and Li, Q. H. (2006): A review on pharmacological activities and utilization technologies of pumpkin. Plant Foods Hum. Nutr. 61, 70-77.

García-Parraa, J., González-Cebrinoa, F., Delgado Adámeza, J., Cavab, R., Martín-Bellosoc, O., Elez Martínezc, P., Ramírez, R. (2018): Application of innovative technologies, moderate-intensity pulsed electric fields and high-pressure thermal treatment, to preserve and/or improve the bioactive compounds content of pumpkin. Innovative Food Science and Emerging Technologies. 45, 53–61, http://dx.doi.org/10.1016/j.ifset.2017.09.022.

Getr, E. U.; Davison, M. H.; Dugan, L. D.; Burns, J. H.; Bova, J.; Story, K. and Drennan, K.B. (2005): The hypocholesterolemic effects of a dose- controlled stud. JAMA, 1991, 265 (14): 1833-1839.

Gossell,W.M.; Davis, A. O.and Connor, N. (2006): Inhibition of testosterone-induced hyperplasia of the prostate of Sprague–Dawley rats by pumpkin seed oil. J Med Food 9:284–286.

Gossell-Williams, M.; Hyde, C.; Hunter, T.; Simms-Stewart, D.; Fletcher, H.; McGrowder, D. and Walters, C. (2011): Improvement in HDL cholesterol in postmenopausal women supplemented with pumpkin seed oil: pilot study". Climacteric, 14: 558-564.

Hegested, D., Mills, R. and Perkins, E. (1941): Salt Mixture". J. Boil. Chem., 138:459.

Hu, S.; Rayman, M.P. (2017): Multiple Nutritional Factors and the Risk of Hashimoto's Thyroiditis". Thyroid 27, 597–610.

Jameson, J. L. and Weetman, A. P. (2010): Disorders of the thyroid gland, In: Harrison's Endocrinology, Jameson,JL., 62 69),The McGraw-Hill Companies, Inc., 978-0-07-174147-7.

Jaqueline Eduarda, Rodrigues Batista, Lucas Pereira Braga, Renata Corrêa De Oliveira, Edson Pablo Silva, Clarissa Damiani (2018): Partial replacement of wheat flour by pumpkin seed flour in the production of cupcakes filled with carob. Food Sci. Technol 38 (2) .Apr-Jun 2018

Josef, Köhrle (2023): Selenium, Iodine and Iron–Essential Trace Elements for Thyroid Hormone Synthesis and Metabolism. Int J Mol Sci. 24 (4): 3393. doi: 10.3390/ijms24043393.

Kandutsch, A.; Pedersen, K.T. and Kastelein, J. J. (2009): The Effect of pumpkin extract on Hyperglyceic and hypercholesterolemic rats. J. of Separation Science., 27(7/8): 619-623.

King, J.C. and Cousins, R.J. (2006): Modern nutrition in health and disease. J Med Food 271-285.

Lee, Mary (2009)*:* Basic Skills in Interpreting Laboratory Data. ASHP. pp. 259–. ISBN 9781585281800.

Lei, L.u.; Zhiqi, H.; Xinyang, W. and Jinpeng, C. (2023): Interaction Between Dietary Selenium and Zinc Intakes on Hypothyroidism. Biological Trace Element Research (201) 4667–4676.

Leja, E. L.; Taske, J. R. and Roy, E.W. (2003): Dietary Guidlines for Americans. United States Department of Agriculture. J Women's Health (Larchmt) 13 (1): 41-53.

Lopez, M.F. (1977): HDL-Cholesterol Colorimetric Method.J. of Clin. Chem. (23):882.

Mahan, F. L.; Ellison, R. C.; Castelli, W. P. and Stump, R. E. (2003): Anti-diabetic effects of pumpkin and its components, trigonelline and nicotinic acid on Goto-Kakizaki rats, J Cereal Chem., 69:469.

Makni, M., H., Fetoui, N.,K.; Gargouri, E.H.; Jaber, J.; Makni, T. and Boudawara, N.Z. (2008) : Hypolipidemic and hepatoprotective effects of flax and pumpkin seed mixture rich in ω-3 and ω-6 fatty acids in hypercholesterolemic rats". Food and Chemical Toxicology.46: (12), 3714-3720.

Maret W. (2013): Zinc in Human Disease. Met Ions Life Sci. 2013; 13:389-414.

Martine, C. M.; Petra, Mulder, P.; M.; Stavro, M., S.; Anna, A.; Wim, v.; Duyvenvoorde, T., K.; Peter, Y. W. and Robert, K. (2015): Replacement of Dietary Saturated Fat by PUFA-Rich Pumpkin Seed Oil Attenuates Non-Alcoholic Fatty Liver Disease and Atherosclerosis Development, with Additional Health Effects of Virgin over Refined Oil. Journal of Pharmacognosy and Phytochemistry. 1(6) 2278- 4136.

Martínez, Y., M. Valdivié, G. Solano, Mirna Estarrón, O. Martínez and J. Córdova (2012): Effect of pumpkin (Cucurbita maxima) seed meal on total cholesterol and fatty acids of laying hen eggs. Cuban Journal of Agricultural Science, 46(1).

Montesano, D., Rocchetti, G., Putnik, P., Lucini, L., (2018): Bioactive profile of pumpkin: an overview on terpenoids and their health-promoting properties. Current Opinion in Food Science 22, 81–87, https://doi.org/10.1016/j.cofs.2018.02.003.

Murcia, D.L.; Mishra, T. N.; Pathak, S.Y.; Sriram, S. S.; Bhande, A.U. and Panneerdoss, R. (2004): Anti proliferative activity of pure lycopene compared to both extracted lycopene and juices from watermelon (Citrullus vulgaris) and papaya (Carica papaya) on human breast and liver cancer cell lines" Avian Dis., 36: 1022-1027.

Mythyroid (2023): http://www.mythyroid.com

Nabeel, M. A. and Jassim, M. A. Alkalby (2018): Ameliorative Effect of Pumpkin Seed Oil on Alterations in Thyroid Gland Functions Induced by Chlorpyrifos in Adult Male Rats". Basrah Journal of Veterinary Research, 17(3).

Naeem M. Rabeh (2016): Effect of Iron, Zinc, Vitamin E and Vitamin C Supplementation on Thyroid Hormones in Rats with Hypothyroidism". January International Journal of Nutrition and Food Sciences 5(3):201.

Nakabayashi, A.; Kitagawa, Y.; Suwa, Y.; Akimoto, K. (1995): Tocopherol enhances the hypocholesrolemic action of sesamens in rats. Internet J.Vit Nutr. Res .,65(3): 162-168.

Nkosi C.Z.; Opoku, A.R.; Terblanche, S, E. (2006): Antioxidative effects of pumpkin seed (Cucurbita pepo) protein isolate in CCl4- induced liver injury in low-protein fed rats. Phytother Res 20:935–940.

Paget, G. E. and Barnes, J. M. (1964): Toxicity Tests in Evaluation of Drug Activities Pharmacometries, D. R. Laurence and A. L. Bacharach, Eds., London and New York: Academic Press.

Pearson, D.L. (2003). Do sterols reduce proton and sodium leaks through lipid bilayers. Prog. Lipid Res. 40 (4): 299-324.

Phillips, S.M. (2012): Dietary protein requirements and adaptive advantages in athletes. Br. J. Nutr., 108(S2): S158-S167.

Pinto, W. O.; Mda, H. L.; Jialal, H. I. and Fuller, C. J. (2007): Effect of vitamin E, vitamin C and beta-carotene on LDL oxidation and atherosclerosis. Center for Human Nutrition, University of Texas Southwestern Medical Center, Dallas 75235-9052.

Pulok K.; Mukherjee. S.; Singha, A.; Kar, J.; Chanda, S.; Banerjee, B.; Dasgupta, P. (2022): Therapeutic importance of Cucurbitaceae: A medicinally important family. Journal of Ethnopharmacology 282 (10) 114599.

Salma, M.; Mohammadreza, V.; Fatemeh, G.; Mohsen, K.; Mahmoodreza, G.; Zahra, S. and Mahmood, D. (2015): Effects of Zinc and Selenium Supplementation on Thyroid Function in Overweight and Obese Hypothyroid Female Patients: A Randomized Double-Blind Controlled Trial. J Am Coll Nutr. 2015;34(5):391-9. doi: 10.1080/07315724.2014.926161.

Sun, V. I.; Larry, w.; Oberely, A. and Ving, U. (1988): A simple Method for Clinical Assay of Superoxide Dismutase. Clin. Chem 34/3, 497-500.

Surks, M., I. (1981): Assessment of thyroid function.Ophthalmology.88(6):476-8. doi:10.1016/s0161-6420(81)35000-3.PMID:6791080DOI: 10.1016/s0161-6420(81)35000-3.

SPSS (1999): SPSS-PC for the IBM PC/XT Computer. Version 11.0 SPSS Inc., U.S.A.

Tsai, Y.S.; Tong, Y.C.; Cheng, J.T.; Lee, C.H.; Yang, F.S. and Lee, H.Y. (2006): Pumpkin seed oil and phytosterol-F can block testosterone/prazosin-induced prostate growth in rats. Urol Int.77:269–274.

USDA (2023): https://www.usda.gov/media/blog/2023/10/08/pumped-pumpkin.

Walker, H.K.; Hall W.D.; Hurst, J.W, (1990): Clinical Methods: The History, Physical, and Laboratory Examinations. 3rd edition.

Xin, Z.; Li, Q.; De-Lu, Y. and Zhou, Y.(2014): Hypolipidemic effect of the polysaccharides extracted from pumpkin by cellulase-assisted method on mice". International Journal of Biological Macromolecules, 64 :137-138.

Xue, C.; Lei, Q.; Bujiang, W.; Zhijun, Z.; Han, L.; Yeni, Z. and Jinfu, L.(2019): Synergistic Hypoglycemic Effects of Pumpkin Polysaccharides and Puerarin on Type II Diabetes Mellitus Mice. Molecules; 24(5): 955.

Yuon, R.o.; Dongowski, R.; Drzikova, B.; Senge, B.; Blochwitz, R.; Gebhardt, E. and Habel, A. (2006): Assessment of Phenolic Acid Content and Antioxidant Properties of the Pulp of Five Pumpkin Species Cultivated in Southeastern Poland.J. Clin Nutr., 56:622-628.

Zahra N., Nisa A., Arshad F. (2016): Comparative study of beta carotene determination by various methods. *Biological Bulletin*.2(1):74–106

Zhao, N.N.; Zhang, H.; Zhang, X.,C.; Luan, X.B.; Zhou, C.; Liu, Q.Z.; Shi, W., P. and Liu, Z., L. (2013): Evaluation of acute toxicity of essential oil of garlic (Allium sativum) and its selected major constituent compounds against overwintering Cacopsylla chinensis (Hemiptera: Psyllidae. J Econ Entomol. 106(3):1349-54.

Damiani, M., Ż.; Katarzyna, M., Szymon, B. (2010): Comparison of Thiopental, Urethane, and Pentobarbital in the Study of Experimental Cardiology in Rats In Vivo. Journal of Cardiovascular Pharmacology 56(1):38-44.

Allain, C., C. (1974): "Cholesterol Enzymatic Colorimetric Method".J.of Clin. Chem.,(20) : 470.

Mythili Md. P., T. Kavitha M., d. (2017): Overview on Cucurbita Maxima Seed". Journal of Dental and Medical Sciences. 16 (3) PP 29-33

استعمال ثمار وبذور اليقطين لعلاج الفئران المصابة بقصور الغدة الدرقية

الملخص العربى

أجريت هذه الدراسة لمعرفة التاثير الصحى المحتمل لثمار وبذوراليقطين على الفئران البيضاء المصابه بقصور الغدة الدرقية باستخدام الكاربيمازول. تم استخدام ٤٨ فأرابيض بـــالغ يتروواح وزن كل منها (١٥٠ ± ١٠) جم وتم تقسيمهم الى الى ٨ مجموعات متساويه، وتركت احداها كمجموعه ضابطه سالبه اما المجموعات السبع الاخرى فتم احداث قصور للغدة الدرقية باستخدام كاربيمازول عن طريق الفم (١,٣٥ ملغم/كغم من وزن الجسم) مذاب في الماء، يومياً لمدة ٨ أسابيع. واضيف مسحوق ثمرة اليقطين وبذورها المستخدمة بنسبة ٥ و١٠ و١٥٪ . وفى نهايه فتره التجربه (٦ اسابيع) تم تجميع عينات الدم من الفئران لقياس العوامل التاليه :هرمونات الغدة الدرقية في الدم (T3، T4، TSH)، انزيمات الاكسده (SOD,CAT,GST). أظهرت بذور اليقطين بنسبة (١٥%) أفضل معاملة لثلاثي يودوثيرونين (T3)، الثيروكسين (T4)، TSH. والكوليسترول الكلي، الدهون الثلاثية، والليبوبروتين منخفض الكثافه (LDL). ومن ناحية أخرى، سجلت بذور اليقطين (١٥%) أفضل النتائج في تحسين إنزيمات الأكسدة .كما أظهر الفحص الهستوباثولوجي أن ثمار اليقطين وبذوره له تأثير أفضل في وظيفه الغده الدرقيه والمساعده في علاج قصور الغده الدرقيه. هذا وقد أظهرت نتائج التقييم الحسي أن الكيك الذي تم اعداده باستخدام ثمار اليقطين وبذوره بتركيز ١٠% و ١٥% درجه تقبل جيده جدا . وتوصي الدراسه بضروره ادخال ثمار اليقطين الكامل وبذوره ضمن أغذيه مرضي قصور الغدة الدرقية.

الكلمات المفتاحيه : الغدة الدرقية ، قصور الغدة الدرقية ، اليقطين ، بذور اليقطين ، انزيمات الاكسدة ، البروتينات الدهنية