International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 16s, 2025
https://www.theaspd.com/ijes.php

Biological And Biochemical Effects Of Thyme (Thymus Vulgaris L.) Plants Found In The Al-Baha Area Region In Reducing Weight In Obese Rats

Sultan Mashnafi[1*], Lobna Saad Mohammed Abd Elmeged[2], Ali Mahzari[3], Ali A. Zaeri[4], Abdulbaset Mohammad Mostafa Kabli[5]

[1]Department of Basic Medical Sciences, Faculty of Applied Medical Sciences, Al-Baha University, Saudi Arabia sqasem@bu.edu.sa*
[2a] Department of Nutrition and Food Sciences, Faculty of Home Economics, Menoufia University, Shibin el Kom, Menofia Governorate 6131567, Egypt .Email : Lobna_lolo_2007@yahoo.com
[2b]Department of Nutrition, Faculty of Applied, AL-Baha University, Saudi Arabia, Email :lobna@bu.edu.sa. ORCID iD: 0000-0003-1527-9457
[3]Department of Laboratory Medicine, Faculty of Applied Medical Sciences, Al-Baha University, Al-Baha, KSA-amoosa@bu.edu.sa
[4]Department of Laboratory Medicine, Faculty of Applied Medical Science, Al-Baha University, 65779, Saudi Arabia
[5]Department of Laboratory Medicine,Faculty of Applied Medical Sciences, Al-Baha University,Al-Baha, Kingdom of Saudi Arabia, email: akabli@bu.edu.sa.

Abstract
Natural products remain a significant resource for developing effective and innovative therapeutic agents.
Objectives: *The current research aims to illustrate the biological and biochemical effects of thyme plants from the Al-Baha area in reducing weight in obese mice.*
Materials and Methods: *Thirty white male albino mice of Sprague-Dawley strain, weighing around 150 ± 10 grams, have been utilized in this research. All mice have been fed a standard nutrition for one week prior to the commence of the trial as an adaptation duration. Six mice (control) were fed on the basal diet, while 24 mice have been nourished on a high-calorie regime containing 20% animal overweight to induce obesity for about three weeks. Feeding intervention continued for 28 days, where 2%, 4%, and 6% of thyme plant powder was added. After sacrificing rats, different biological and biochemical changes were recorded.*
Results: *Body weight gain (BWG), serum glucose, and thyroid gland function were increased significantly in obese mice, while feeding on dried powder of 2%, 4%, and 6% thyme decreased BWG greatly. The highest decrease was recorded for 4% of thyme powder.*
High levels of certain compounds, which are responsible for several diseases, especially cardiovascular disease, may be reduced by thyme, which contains bioactive compounds and positive biochemical effects. Therefore, powders of thyme may be recommended to be added to the ordinary diet.

KEYWORDS: - *Thyme - Al-Baha ~~area~~ region- Obese rats - Bioactive Compounds- Thymus Vulagrs*

INTRODUCTION

The occurrence of obesity has attained epidemic proportions in recent years. In comparison to malnutrition, obesity is gradually becoming a more serious issue, according to the World Health Organization, which has stated that obesity is the most significant worldwide chronic health issue among adults. **(Friihbeck et al., 2013).** One of the most crucial and frequently necessitated topics for discussion is obesity and its effect on the metabolic alterations resulting in disorders such as hypertension, cardiovascular diseases, diabetes, as well as chronic illnesses like stroke, some tumors, osteoarthritis, and inflammation-based pathologies. Currently, obesity is a serious socioeconomic issue that has become one of the major health issues globally, impacting people of all genders, ages, and races, in addition to ethnicities. Obesity is characterized by an excessive weight for height attributable to an enlarged fat deposition in the adipose tissue, which is because of a greater calorie intake than the energy expenditure **(Fruh, 2017).** obesity is considered an illness because of the environmental, genetic, and behavioral factors. The fundamental pathophysiological failure of neuroendocrine control of appetite and power function leads to increased death and morbidity, as well as impairments in physiological and physical functions,

according to (El-Newary et al. 2021). The American Medical Association (AMA) didn't identify obesity as an illness until 2013. Thyme is an aromatic herb frequently utilized to provide a flavorful and distinctive aroma to meals.–and either the leaves may be utilized as a spice, dried or fresh. (Fan et al. (2021). Thymus vulgaris has therapeutic characteristics and pharmacological impacts. It is frequently utilized for several benefits including hepatoprotective impact, antioxidant impact, antifungal impact, anti-dysmenorrhea, anti-cancer, toxicity, antimicrobial activity, antibacterial activity, antibacterial impact, anti-inflammatory impact, anti-Leishmaniasis impact, antimicrobial impact, antimicrobial and antioxidant activities, antifungal impact, antiadhesion activity, and larvicidal impact. People commonly use Thymus vulgaris for therapeutic purposes, demonstrating its immense usefulness (Miraj and Kiani, 2016). Thymus has a large number of flavonoids and vitamin E. The main phenolic compounds involve the rosmarinic a` , luteolin, luteolin glycosides, glycuronides of apigenin, eriodyctiol and quercetin. These plant extracts are intriguing as flavorings and natural food industry antioxidants (Diab et al., 2022). Thyme is a notable member of Lamiaceae family. It is known to contain fatty a` and essential oils that have significant biological and pharmacological activity, involving antibacterial and antioxidant characteristics (Al-Assaf, et al., 2023). All of the vitamins, phytonutrients, and minerals that are vital for optimal health can be found in thyme. These nutrients are well known for their health-promoting and disease-preventive characteristics. Specifically, thyme is rich in vitamins C and A. Vitamin A serves as an antioxidant, has a vital role in sustaining healthy mucous membranes, skin, vision, and integrity. . The extract of thymusvulgaris seed has shown an effectiveness in relieving overload of iron in mice with obesity (Foula, et al., 2020).). The noted reduction in anthropometric variables can be related to the elevated content of phenolic in extract of thymusvulgaris seed, which was illustrated to be a strong chelator of iron (Aljabeili, et al., 2018). The extract comprises numerous bioactive combinations, involving naringenin, quercetin, rutin, kaempferol, rosmarinic a` and apigenin, which demonstrated potent antioxidant activities (check Table 3). According to Deekshith et al. (2021), these outcomes were complementary to prior investigations that highlighted the anti-obesity impact of numerous plant extracts via the modulation of metabolism of the lipid and diminished levels of adiposity. The aim of this research is to illustrate the biochemical and biological impacts of thyme plants discovered in the Al-Baha region in reducing weight in mice with obesity**.**

MATERIALS and METHODS: -

Materials:

- Commercially dried thyme (Thymus vulgaris) has been gained from a local market in 2024 from an herbalist at a local market in Al-Baha city.
- Casein, starch, cellulose, a mixture of vitamins and mixture of salt have been bought from Gommhoryia Co.Cairo, Egypt

Methods:

Preparation of samples:

Following the removal of the damaged leaves, the dried thyme has been rinsed with tap water and then dried in an air-drying oven at a temperature of fifty degrees Celsius following the cleaning process. The vegetable peels and dried herbs have been ground into powder utilizing an electric mill made of stainless steel. The powder was then stored at a temperature of twenty degrees Celsius.

Chemical analysis:

Determination of total phenols and total flavonoids dried thyme

Total flavonoids and phenols in dried thyme have been assessed according to **Deutsches Arzneibuch, (1996).**

Quantification and identification of phenolic composites:

Through the utilization of an Agilent 1200 chromatograph that has been prepared with a PDA model G1315B, an autosampler model G1313A, a Bin pump model G1312A, as well as an RR Zorbax Eclipse in addition to C18 column (1.8 pm, 150 millimeters x x4.6 millimeters), an examination of extracts has been carried out using high-performance liquid chromatography. The mobile phase B was acetonitrile and the mobile phase A was 0.2 percent formic a` in water. Elution has been carried out at 0.95 milliliters per min-1 with the subsequent gradient program of solvent B: zero to twenty minutes, five to sixteen percent; twenty to twenty-eight minutes, sixty to

forty percent; twenty-eight to thirty-two minutes, forty to seventy percent; thirty-two to thirty-six minutes, seventy to ninety-nine percent; thirty-six to forty-five minutes, ninety-nine percent; and forty-five to forty-six percent, minutes. 99.5%.30 of the volume of the injection was ten pL. For the purpose of discovery, wavelengths of 280 nanometers have been selected for flavan-3-ols and benzoic a` derivatives, while three hundred and sixty nanometers have been selected for flavonols and cinnamic a` derivative. Quantification of the compounds has been determined utilizing calibration curves gained by high-performance liquid chromatography of pure standards: gallic a`, caffeic a`, (+)- catechin, (-)-epicatechin, and ellagic a`. Rutin has been utilized as an internal standard. Certain compounds have been quantified as equivalents of the most comparable chemical structures: gallic a` for gallic a` glucoside, gentisic a` glucoside, protocatechuic a`, p-hydroxybenzoic a` and methyl gallate; caftaric a` as caffeic a`; (+)- -catechin for proanthocyanidin trimers and dimers and their monogallates; (-)-epicatechin for epicatechingallate; and ellagic a` for ellagic a` pentoside. The high-performance liquid chromatography technique has been utilized regarding **(Radovanovic et al., 2010)** with a little alteration (elution gradient as well as flow rate).

Biological study:

Basal diet

The following is the basal diet made utilizing the formula provided by **AIN ,.(1993)** as follows: ten percent protein, five percent cellulose, minerals, ten percent corn oil, one percent vitamin blend, 0.2 percent choline chloride, 0.3 percent methionine, and 69.5 percent cornstarch. **(Campell et al., 1963)** recommended the salt mix be utilized.

Obesity induction: The basal nutrient (AIN-93M) has been prepared in accordance with **(Reeves et al., 1993)** giving approximately 9.5 percent of its power from fat (forty grams of corn oil per kilogram of diet). To trigger obesity, a high-fat diet (HFD) has been employed, comprising at least forty-five percent of its energy from fat. Alterations have been made to the basal regimen, which involves forty grams of corn oil and two hundred grams of ghee per kilogram of diet. Additionally, the amount of saturated fat that has been substituted with an equivalent amount of cornstarch.

Experimental animal design:

Mice have been separated into 5 groups six mice in each group and nourished numerous regimes for twenty-two days as follows:

Group (1): Normal mice nourished on the basal regime; this group was utilized as a negative control group (-ve) (5rats).

Group (2): Obese mice nourished on basal regime only, this group was applied as a positive control group (+ve) (6rats).

Group (3): Obese mice nourished on the basal regime involving (2% thyme powder) (6rats).

Group (4): Obese mice nourished on the basal regime involving (4% thyme powder) (6rats).

Group (5); Obese mice nourished on the basal regime containing (6% thyme powder) (6rats).

Animals:

The animals were separated into five groups that are representative of each other. Cages made from stainless steel with wire mesh bottoms and fronts have been utilized to house the animals individually. These cages have been placed in a room that sustained a temperature of twenty-five to thirty degrees Celsius and a relative humidity of roughly fifty percent. The chamber has been lighted with an everyday photoperiod of twelve hours of light and twelve hours of darkness. Subsequently, they have been allocated to the various experimental regimes for a duration of four weeks. Throughout the conditioning duration and the experiment, nourishment and tap water were used.

Biological evaluation:

Throughout the duration of the experiment, each mouse has been weighed weekly, and the ingested regimes have been documented everyday (daily nutrition intake). Upon finishing the experiment, a biological assessment of

experimental regimes has been performed through the reorganization of body weight gain (BWG) and food efficiency ratio (FER) in agreement with Chapman et al. (1959) **(Chapman et al., 1959).**

Blood and organ collection:

A) Blood:

At the beginning of the experimental duration, the animals underwent a twelve-hour fast. Weekly blood samples were collected from the eyes. Blood samples have been collected in a sterile, dry centrifuge tube from the hepatic vein. At the finish of the four-week experimental duration, the animals underwent a twelve-hour fast. They have been anesthetized utilizing diethyl ether. Incision has been performed into the abdomen, and blood has been collected from the hepatic vein. A blood sample has been collected without anticoagulant for serum separation via centrifugation at 4000 RPM for ten minutes to evaluate the concentration of glucose, renal function, liver enzymes, thyroid hormones, total protein, albumin, in addition to a complete blood count and has been subsequently stored in a plastic vial until examination.

Biochemical examination:

The gathered serum samples have been examined for the subsequent biochemical variables.

Determination of glucose:

Concentrations of glucose in serum have been detected regarding the technique defined by **(Trinder, 1969).**

Determination of hepatic functions:

Determination of GPT (ALT), GOT (AST) in addition to (ALP) activity has been detected calorimetrically regarding the technique of **(Clinica Chimica Acta (1980) and Hafkenscheid (1979))**

Determination of renal functions:

Measurements of creatinine:

Serum creatinine has been detected through kinetic technique in accordance with **Henry (1974).**

Measurements of uric acid` :

Uric acidhas been identified by enzymatic colorimetric test utilizing kits in accordance with **Barham and Trinder (1972).**

Measurements of serum urea:

Enzymatic identification of urea in serum has been performed regarding the technique of **Patton and Coruch (1977).**

Determination of lipids profile in serum:

Measurement of TG in serum has been calorimetrically identified in accordance with **(Fossati and Prencip, 1982).**

Total cholesterol has been identified through colorimetric technique regarding **Allin (1974).**

HDL cholesterol has been identified in accordance with **Lopez (1977).**

LDL assessed in accordance with **Lee and Nieman (1996).**

Statistical analysis:

Statistical analysis is conducted regarding **Snedecor and Cochran (1972).** All outcomes have been expressed as the mean± SD. Statistical analyses have conducted out with statistical package for social science for windows (SPSS, version 11.0 Chicago, DL-United States of America). The information was analyzed by ANOVA. The P-value under 0.05 has been deemed statistically significant.

Ethical Approval

The Science Research Ethics Committee of the Faculty of Home Economics accepted the protocol of the research #11-SREC-06-2024.

RESULTS and DISCUSSION

Th aim of this study is to illustrate the impact of thymeplants from the Al-Baha region in reducing weight in mice with obesity.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 16s, 2025
https://www.theaspd.com/ijes.php

Chemical composition of Thyme (Thymus vulgaris L.)
The plant was examined for its chemical composition, i.e., fiber, fat, protein, and ash, in addition to carbohydrates. The gained outcomes are illustrated in fig (1) where 6.89 and 76.73 fiber, protein, fat, ash, and carbohydrates, correspondingly, it has been observed to contain 2.75, 10.75, 8.90, 10.35, and 67.25 percent fat, protein, fiber, ash, as well as carbohydrates, correspondingly

Figure (1): Chemical composition of thyme (on the basis of dry weight)

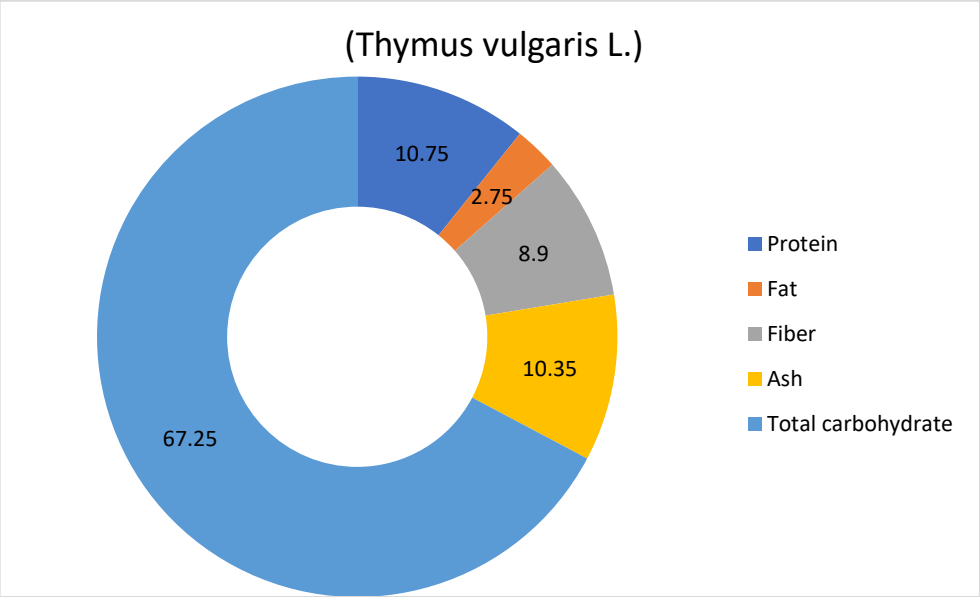
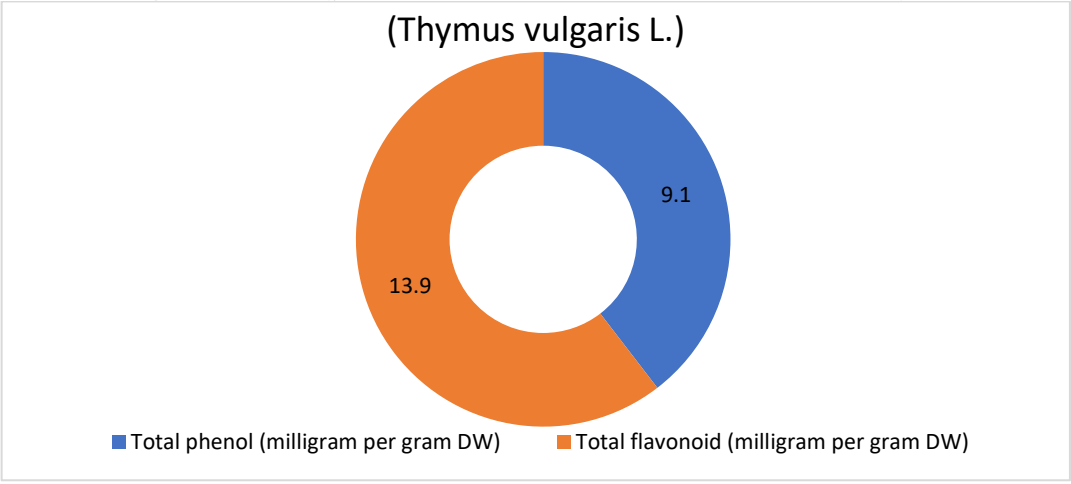


Figure (2) illustrates the overall phenols and overall flavonoid content of dried thyme. The total flavonoid compounds and total phenol for dried thyme values were 13.9±0.02 and 9.10 milligrams per gram DW, correspondingly.

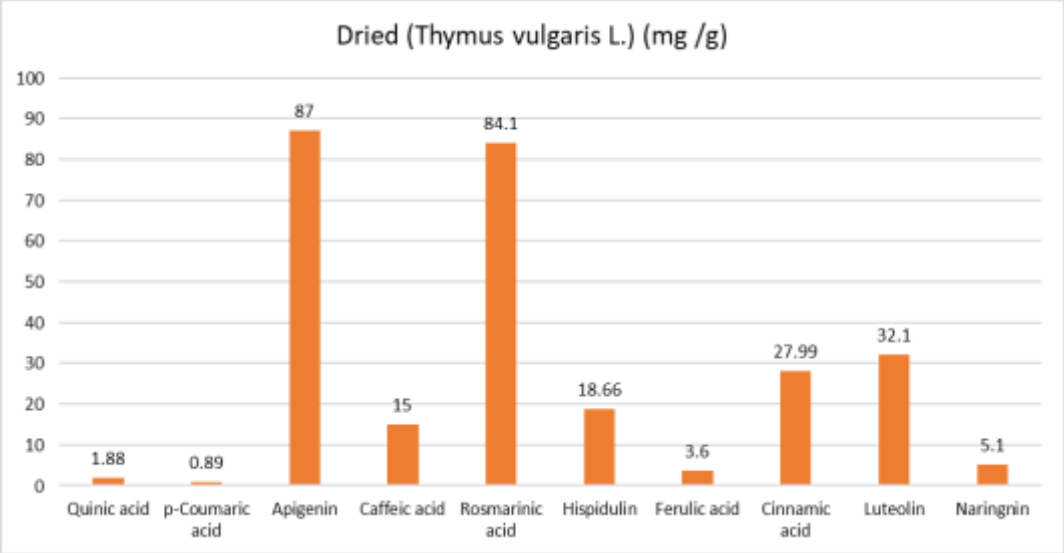
Figure (3): Phenolic compounds of dried thyme : It is obvious to mention that the greatest phenolic compounds of dried thyme are noted for apigenin and rosmarinic The values were 87.00 and 84.10 milligrams per gram, correspondingly,whereas, the lowest phenolic compounds of dried thyme have been documented for p-coumaric The values were 0.89 and 1.88 milligrams per gram, correspondingly.

Figure (2): Total phenols and total flavonoids content of dried thyme



International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 16s, 2025
https://www.theaspd.com/ijes.php

Figure (3): Identification of phenolics compounds in dried thyme



Effect of dried thyme powder on body weight gain, feed intake (FI) and feed efficiency ratio of obese mice

- **Body weight gain (gram per day)**

Figure 4 indicates the mean values of BWG (grams/day/rat) of the obese treated groups. Data discovered that mean value of the body weight gain (gram/day/rat) of the control negative group was lesser compared to the control positive group, being 0.3±0.02 versus 0.42±0.03 (gram/day/rat) correspondingly, illustrating a significant variance with a percent of enhancement of -0.28 % for the control (-ve) group in comparison with the control group. Regarding Each obese mouse nourished on various regimes demonstrated a significant decrease in mean values in comparison with the positive control group. The values were -0.098±0.017, -0.57±0.02, -0.12±0.01 for thyme (two percent, four percent, and six percent), respectively. The mean values of BWG (g/day/rat) for obese mice managed with thyme (2%) of the basal diet show a significant decline in mean values (P-value under 0.05) in comparison with the positive control group (+ve). The mean values were -0.57±0.02. and the percent decrease was -23.36%. Conversely, non-significant variances have been noticed between the obese groups treated with thyme (2%) and the positive control group. Numerically, optimum body weight gain has been noticed for the obese group treated with thyme (4%) group.

Feed Intake (FI) (g/day).

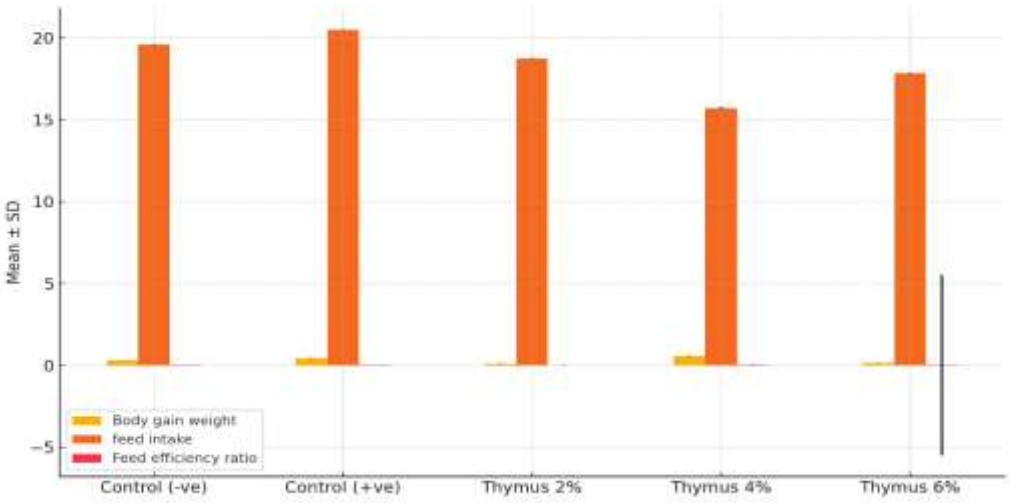
Figure (4) illustrates the mean values of FI (g/day) of the obese managed groups. It is important to notice that the mean values of FI for the obese mice fed with thyme (two percent, four percent, and six percent) illustrated a significant change when in comparison with the corresponding mean value in the control (+) group; the values were 18.75±0.03, 15.71±0.06, and 17.85±0.04 (g/day). On the other side, it was observed that there were non-significant differences among the groups managed with 2% thyme and 6% thyme. Finally, the best feed intake (g/day) has been documented for the obese group fed with thyme (4%). Compared to the positive control group, there was a percentage decrease of -23.36%.

FER:

Figure 4 evaluates the mean values of the FER of the obese managed groups. It might be observed that the mean value of FER in the control (+ve) group (0.02±0.001) was significantly
(P <0.05).higher when compared to corresponding mean value in the control (-ve) group, that was (0.015±0.001). In addition, mean values of the obese groups treated with thyme 2%, thyme 4%, and thyme 6% were changed significantly (P <0.05).compared to the obese positive control group. The rate of change among thyme treatments was better than in the obese control group. Also, we noticed a significant difference between the obese groups treated with thyme 2% and thyme 6%, which were (-0.005±0.001), (-0.0066±5.50) respectively. The best management for FER noted for the obese group was managed with thyme (4%) (-0.036±0.03) when compared to the often two radish treatments.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 16s, 2025
https://www.theaspd.com/ijes.php

Figure (4): Effect of thyme powder on BWG (g/d/rat) and FI (gram per day) of obese mice

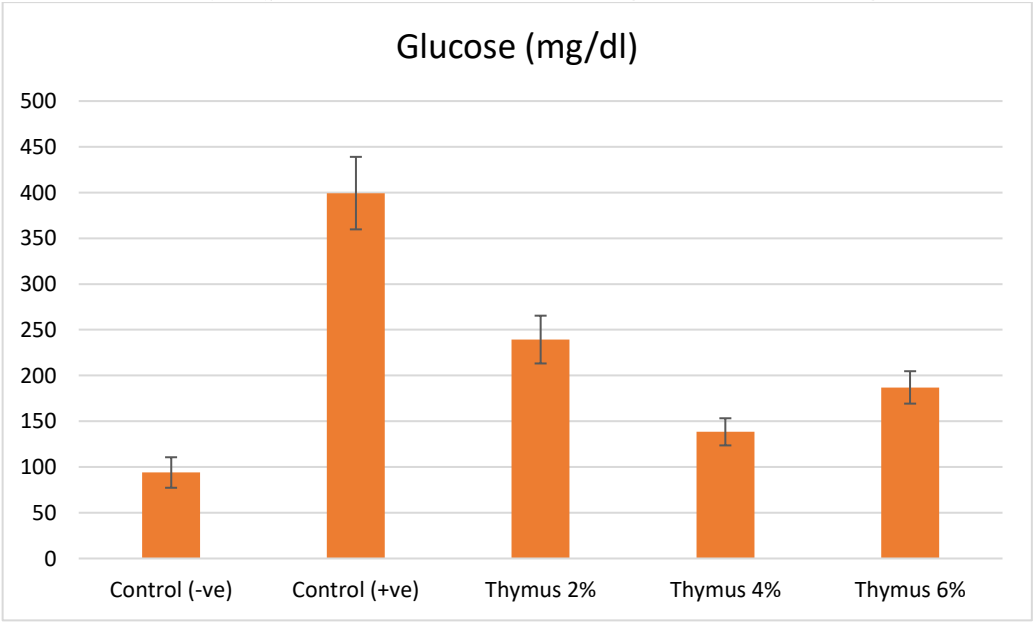


Impact on metabolic parameters

Effect of thyme powders on serum glucose (mg / dl) of obese mice

Figure (5) demonstrates the mean values of glucose in serum (milligrams per deciliter) of the obese treated groups. It was clear that the mean value of serum glucose in the positive control group (399.3 8±39.64mg/dl) was significantly different (P <0.05). greater compared to the negative control group, which was (93.99±16.68mg/dl), showing a significant variance with a percent of diminish of -76.46% for the control (-ve) group as in comparison with the control (+ve) group. As illustrated in the table, the mean values of the obese groups treated with thyme (4%) powder of the basal diet were reduced significantly different (P <0.05). compared to positive control group, the value 138.43±14.83 (milligrams per deciliter). In addition, the normal control group and the obese groups managed with (thyme 2%), (thyme 4%), and (thyme 6%) have no significant differences; the mean values were 239.3±26.11 and 186.99±17.7 (mg/dl), correspondingly. The best management has been noted for serum glucose (mg /dl) for the obese group treated with thyme powder (4%) once compared to the normal control group .

Figure (5): Effect of thyme powders and their mixture on glucose in serum (mg /dl) of obese mice



Effect of thyme powders on thyroid function serum total triiodothyronine, thyroxin and thyroid stimulating (ng/ml)

The influence of thyme powders on serum thyroid stimulating (TSH), total triiodothyronine (T3), and thyroxin (T4) (ng/ml) of the obese rats were presented in the Figure (6).

- Serum total Triiodothyronine (T3) (ng/ml)

Information in Figure (6) indicates the mean values of serum (T3) (ng/ml) of obese treated groups. Concerning the mean value of serum (T3), the obese control group was more than the normal control group, being 0.51±0.10 and 3.06±1.00 (ng/dl), correspondingly, showing a significant ($P<0.05$) variance with a percent of diminution of 5% for the normal control group than obese control group. On the other side, the groups that managed and the normal control group have non-significant variances. Non-significant variances have been noticed among the groups managed with 2% thyme) of the basal diet. The groups managed with thyme (6%) were similar to the group supported with thyme (2%) of the basal diet and have no significant differences; the values were 0.94±0.08, 1.14±0.12 (ng/dl), respectively. The best group seems to be value of thyme (4%).

- Serum thyroxin (T4) (ng/ml)

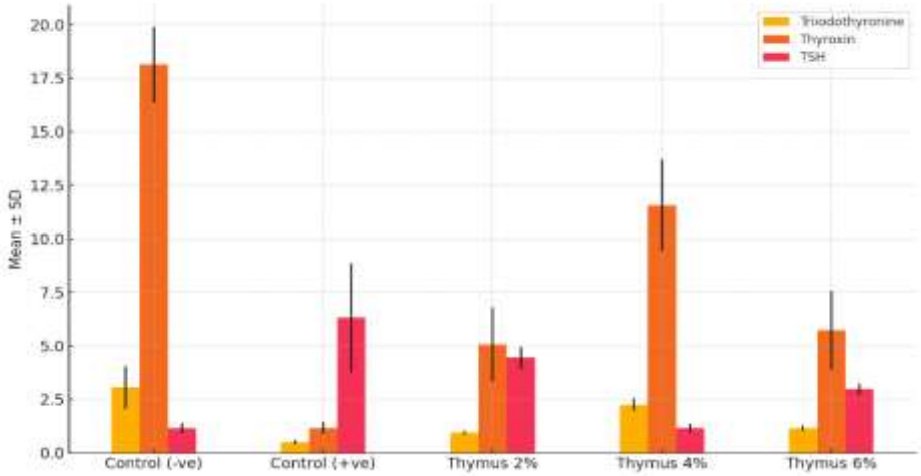
Figure (6) shows the mean values of serum (T4) (ng/ml) of obese treated groups. It might be discovered that mean value of the positive control group was less compared to negative control group, being 1.17±0.27 and 18.14±1.77 (ng/dl), respectively, illustrating a significant ($P<0.05$) variance with a percent of diminution of 145.43% for the negative control group compared to the positive control group. From the same table, the mean values of the obese groups treated with thyme (4%) of basal diet were increased significantly (P-value below 0.05) in comparison with positive control group; the mean values were 11.58±2.14 ng/dl, with a present increase of 889.74% in comparison with the positive control group. In addition, the normal control group and the obese groups treated with thyme (2%) and thyme (6%) have no significant differences. Non-significant variances showed among the mean values were 5.07±1.72, 5.73±1.82 (ng/dl), respectively.

- Serum thyroid stimulating (TSH) (ng/ml)

Figure (6) demonstrated the mean values of serum (TSH) (ng/ml) of the obese managed groups. It might be discovered that the mean value of the positive control group with elevated compared to the negative control group, being 9.32±2.53 and 1.15±0.24 (ng/ml), respectively, illustrating a significant ($P<0.05$) variance with a percent of diminution of 87.66% for the negative control group compared to positive control group. From the same table, the mean values of the obese groups treated with thyme (4%) of basal diet were reduced significantly (P-value below 0.05) compared to the positive control group; the mean values were 1.16±0.20 and 9.32±2.53 (ng/ml), respectively. In addition, the normal control group and the obese groups managed with thyme 2% and thyme 6% have nonsignificant variances; the mean values were 4.45±0.51 and 2.99±0.26 (ng/ml), corresponding to present of decrease -0.52%, -0.67%, correspondingly. Numerically, the best serum (TSH) (ng/ml) has been documented for the obese group managed with (thyme 2%) 1.16±0.20. They evaluated the preventive and curative impact of thyme as a natural product on liver and thyroid conditions in hypothyroid mice that have been created by propylthiouracil (PTU).

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 16s, 2025
https://www.theaspd.com/ijes.php

Figure (6): Effect of thyme powders on serum total triiodothyronine, thyroxin and thyroid stimulating hormone of obese mice.



The effect of thyme powders on serum triglycerides and total cholesterol, lipoprotein- cholesterol (VLDL-c) and lipoprotein-cholesterol (LDL-c, HDL-c) serum of obese mice has been presented in Figure (7).

- Serum total cholesterol (milligram per deciliter)

Figure (7) indicated the mean values of serum total cholesterol (milligrams per deciliter) of obese managed groups. Concerning the mean value of serum total cholesterol of the obese positive control group, it was more compared to the normal control group, being 248.72±14.45 and 116.99±18.87 (milligrams per deciliter), correspondingly demonstrating a significant (P<0.05) variance with a percent reduction of reduce -52.96% for the normal control group than the obese control group. It is important to notice that, all obese managed groups illustrated significantly different (P <0.05). decline in the mean values of serum total cholesterol in comparison with the obese control group. Treating obese mice with (thyme 4%) improved markedly the serum total cholesterol to 136.57±18.35 with a present decrease of -45.09%, correspondingly, compared to the obese control group. In contrast, the groups managed with thyme 2% and thyme 6% have no significant differences; the mean value was 192.3±13.03, 171.5±18.59 correspondingly. The superior serum total cholesterol (milligrams per deciliter) has been observed for the group treated with thyme (4%) (136.57±18.35 milligrams per deciliter) when in comparison with the normal control group (116.99±18.87 milligrams per deciliter).

- Serum total cholesterol (T.G) (milligrams per deciliters)

Figure (7) demonstrates the mean values of serum total cholesterol (milligrams per deciliter) of the obese treated groups. It might be discovered that the mean value of the positive control group was greater compared to negative control group, being 207.65±17.78 and 102.85±17.42 (mg/dl), respectively, illustrating a significant (P-value under 0.05) variance with a percent of reduction of -50.47% for the negative control group compared to the positive control group. From the same table, the mean values of the obese groups treated with thyme (4%) of basal diet have been diminished significantly (P <0.05) when compared to positive control group; the mean values were 129.5±10.54 mg/dl. In addition, the (thyme 2%) and (thyme 6%) have no significant differences. Non-significant variances have been noticed among the groups managed; the mean values were 164.17±15.36, 152.88±38.20 mg/dl correspondingly. Numerically the best serum (T.G.) (mg/dl) has been documented for the obese group treated with (thyme 4%) when compared to the control (+ve) group.

- Serum high density lipoprotein-cholesterol (milligrams per deciliters)

Figure (7) illuminates the mean values of serum (HDL-c) (milligrams per deciliter) of the obese treated groups. Information demonstrated that the mean value in the control (+ve) group (41.14±3.27 mg/dl) was significantly (P-value under undr0.05) less when compared to the corresponding mean value in the control (-ve) group, which was (51.36±1.47 mg/dl. It is worth revealing that, the mean values of HDL-c in the obese managed mice have been markedly enhanced, a significantly different (P <0.05).when in comparison with the obese control group.

The alteration rate in serum HDL-c increased for the obese groups managed with (thyme 4%) and recorded (0.21%) with a value of 50.08±1.86 mg/dl in comparison with the control (+ve) group. In contrast, we observed insignificant differences between the obese groups treated with (thyme 2%) and (thyme 6%) of the basal diet. The groups recorded 44.0±1.02, 48.39±0.93 milligrams per deciliter, correspondingly when in comparison with the positive group. Numerically the best serum high density lipoprotein-cholesterol has been recorded for the group managed with (thyme 4%) when in comparison with the negative control group.

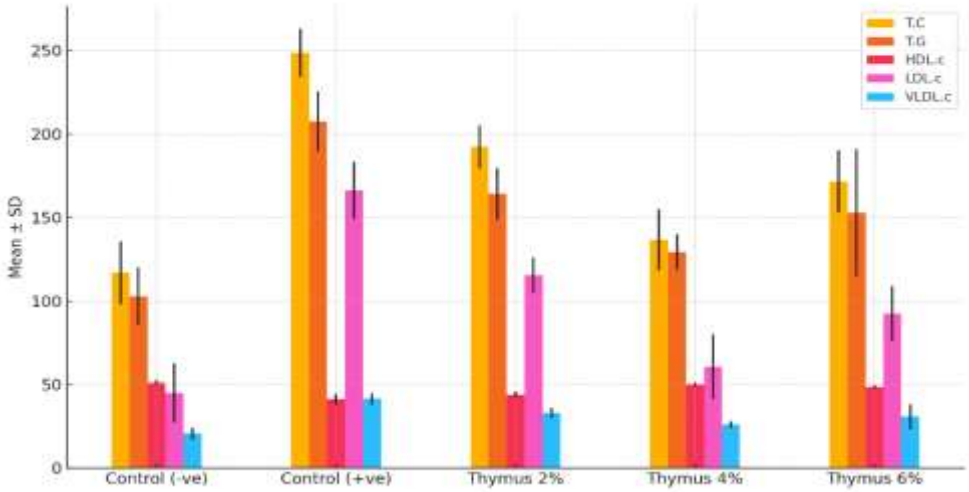
- Serum low density lipoprotein-cholesterol (milligrams per deciliters)

Figure (7) presents the mean values of serum (LDL-c) (mg/dl) of the obese treated groups. It was obvious that the mean value of serum low density lipoprotein-cholesterol of the positive control group was higher compared to the negative control group, being 166.05±17.14 and 45.06±17.86. (milligrams per deciliter) correspondingly, illustrating a significant (P<0.05) variance with a percent decrease of -72.88% for the negative control group as compared to the positive control group. Regarding the obese groups treated with (thyme 4%) demonstrated a significantly (P <0.05) diminution in the mean values when compared to the positive control group; the values were 60.59±19.38 mg/dl, with a present of decrease -63.54%, respectively in comparison with the positive control group. In addition, we discovered insignificant variances among the groups managed with (thyme2%) and (thyme 6%). No significant changes have been discovered among the obese groups treated the mean value were 115.46±10.54, 92.53±16.38, respectively. The superior serum (LDL-c) has been discovered for the obese group treated with (thyme 4%) when in comparison with the control positive group.

- Serum very low-density lipoprotein-cholesterol (mg/ dl).

Figure (7) demonstrates the mean values of serum (VLDL-c) (mg /dl) of the obese treated groups. As shown in the table, the mean value of serum (VLDL-c) of the obese control group was elevated compared to the normal control group, being 41.41±3.55 versus 20.57±3.48 (mg /dl), correspondingly showing a significant (P<0.05) variance with a percent reduction of reduce -50.32% for the normal control group than the obese control group. From the same table, the mean values in the obese groups treated with (thyme 4%) was lesser compared to the obese control group, these variances reached the significantly different (P <0.05) the mean values were 25.9±2.10, (mg/dl) with percent of decrease -37.66% respectively. Conversely, it could be noticed that there were insignificant variances among the positive control group and the obese groups managed with (thyme 2%) and (thyme 6%) the mean values were 32.83±3.07, 30.58±7.59 (mg/dl); correspondingly. The best management has been documented for serum (VLDL-c) (mg/dl) for the groups managed with (thyme 4%) when compared to the control (-ve) group.

Figure (7): The effect of thyme powder on serum total cholesterol and triglycerides, lipoprotein-cholesterol (HDL-c, LDL-c) and lipoprotein- cholesterol serum of obese rats



International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 16s, 2025
https://www.theaspd.com/ijes.php

The effect of thyme powder on enzymes of liver (aspartate aminotransferase AST, alanine aminotransferase ALT and alkaline phosphatase ALP) unit per liters of obese mice are presented in Figure (8).

- Serum aspartate aminotransferase AST (U/L).

Figure (8) indicates the mean values of serum (Aspartate Aminotransferase) (units per liter) of the obese managed groups. It might be noted that the mean value of serum (Aspartate Aminotransferase) of the control (+ve) group was more than the control (-ve) group, being 184.6±0.81 and 68.41±0.91 (Units per Liter) correspondingly, illustrating a significant (P<0.05) variance with a percent of reduced -62.95% for the control (-ve) group compared to the control (+ve) group. It is important to notice that the obese groups treated with (thyme 4%) illuminated a significantly different (P <0.05). diminution in the mean values as compared to the control (+ve) group; the mean value was 99.49±0.72 (U/L), correspondingly. The best serum (AST) (U/L) has been documented for the obese group treated with (thyme 4%) when than the negative control group.

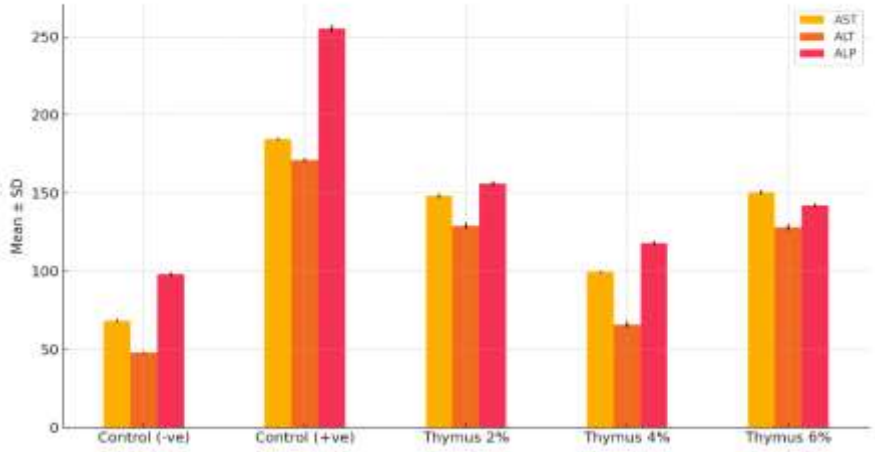
- Serum alanine aminotransferase ALT (U/L).

Figure (8) demonstrates the mean values of serum alanine aminotransferase (units per liter) of the obese treated groups. It was obvious that the mean value of serum (Alanine Aminotransferase) in the obese control group, 171.053±1.16 (U/L), was significantly greater when in comparison with the corresponding value in the normal control group, which was 48.01±0.41 (U/L), showing a significant (P<0.05) variance with a percent reduction of reduce -71.9 percent for the control (-ve) group when compared to the control (+ve) group. It is worth mentioning that, the mean values of the obese managed groups were significantly (P <0.05) reduce when in comparison with the mean value in the positive control groups. The rate of change markedly decreased for the obese groups treated with ((thyme 4%) in comparison with the obese control group. In contrast, we noticed insignificant differences noticed between the obese groups treated with (thyme 2%) and (thyme 6%) the mean values were (129.02±1.8 ,128.07±1.9 U/L) Correspondingly. Finally, the best serum (ALT) (unit per liters) has been documented for the obese group treated with (thyme 4%) (66.01±2.1 U/L) once compared to the control (-ve) group (48.01±0.41 U/L).

- Serum alkaline phosphatase ALP (U/L)

Figure (8) reveals the mean values of alkaline phosphatase (units per liter) of the obese managed groups. It might be discovered that mean value of serum (ALP) of the positive control group was more compared to negative control group, being 255.2±2.40 and 98.02±1.2 (U/L), correspondingly indicating a significant (P-value below 0.05) variance with a percent of decrease -61.59% for the negative control group compared to the positive control group. The obese groups treated with (thyme 4%) demonstrated a significant significantly different (P <0.05) decline in the mean values in comparison with the positive control group; the mean value was 118.04±1.4 (U/L), with precent decrease of -53.75%, respectively. The best management for serum (ALP) (U/L) has been documented for the group managed with (thyme 4%) when in comparison with the control (-ve) group.

Figure (8): The influence of thyme powder on liver enzymes; aspartate aminotransferase, alanine aminotransferase as well as alkaline phosphatase unit per liter of obese mice



The effect of thyme powder on renal functions involving uricacid, urea and creatinine milligram per deciliter of the obese mice are presented in Figure (9).

- **Serum creatinine (milligram per deciliter):**

Figure (9) illuminates the mean values of serum creatinine (milligram per deciliter) of the obese treated groups. According to the table, the mean value of the control (+ve) group (1.72±0.24) (mg/dl) was significantly (P <0.05).higher when in comparison with the corresponding mean value in the control (-ve) group which was 0.74±0.19 (mg/dl). From the same table, the mean values in the obese managed groups were significantly (P below 0.05) reduce when compared to the mean value in the obese non-treated group. In addition, the rate of increase in the serum creatinine for the obese groups managed with (thyme 4%) was lowered and recorded (0.79±0.13 mg/dl) with precent of decrease -54.06%, respectively, when in comparison with the control (+ve) group. Conversely, we noticed insignificant variances in both obese groups treated with (thyme 2%) and (thyme 6%) of the basal diet, with no significant variances compared to the mean values G3 and G5 were (1.29±0.09, 1.04±0.05 milligrams per deciliter, correspondingly. The superior serum creatinine (mg /dl) has been discovered for the obese group treated with (thyme 4%) (0.79±0.13 mg /dl) once compared to the negative control group (0.74±0.19 (mg /dl).

- Serum uric acid (milligram per deciliter):

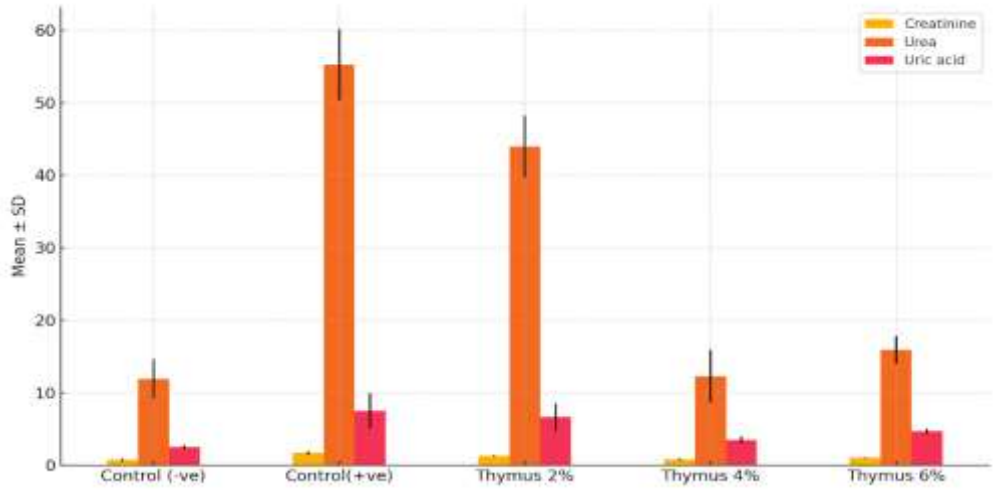
Figure (9) demonstrates the mean values of the serum uric acid (mg /dl) of the obese treated groups. It was obvious that the mean value of serum uric a` of positive control group was higher compared to negative control group, being 7.52±2.44 and 2.49±0.24 (milligrams per deciliter) correspondingly, illustrating a significant (P<0.05) variance with a percent reduction of -66.89% for the negative control group compared to the positive control group. As revealed in the table, the mean values of obese groups treated with (thyme 4%) were significantly (P <0.05).lower in comparison with the positive control group; the mean value was 3.45±0.46 (mg/dl). On the other side, it might be discovered that, there were insignificant variances among the obese group treated with (thyme 2%) and (thyme 6%) the mean values were 6.63±1.92 and 4.68±0.35 (mg/dl), respectively. Also, we noticed insignificant differences between the obese groups treated with (thyme 2%) and (thyme 6 percent). Numerically the best serum uric a1 (milligram per deciliter) was documented for the obese group treated with (thyme four percent) when compared to the negative control group.

- Serum urea (milligram per deciliter):

Figure (9) demonstrates the mean values of urea in serum (mg /dl) of the obese managed groups. It might be discovered that mean value of serum urea of the obese control group was greater compared to the normal control group, being 55.23±4.91 versus 11.9±2.73 (milligrams per deciliter) correspondingly, presenting a significant (P<0.05) variance with a percent of reduction of -78.54% for the normal control group than the obese control group. It is important to notice that the mean values of the obese groups treated with (thyme 4%) have been reduced significantly (P <0.05).when in comparison with the obese positive control group. The percent of change gradually reduced for the obese groups treated with (thyme 4%) the mean value was 12.29±3.62 with -0.77%, respectively compared to the obese control group. Finally, the best management for the serum urea (milligrams per deciliter) has been documented for the group treated with (thyme 4%) when compared to the negative control group.

International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 16s, 2025
https://www.theaspd.com/ijes.php

Figure (9): The impact of thyme powder on serum creatinine, urea and uric a` of obese mice



- DISCUSSION

Thymus has a large number of flavonoids and vitamin E. The main phenolic compounds involve the rosmarinic, luteolin, luteolin glycosides, glycuronides of apigenin, eriodictyol, and quercetin. These plant extracts are intriguing as flavorings and natural food industry antioxidants. These compounds offer several health benefits, including anti-inflammatory and antioxidant properties that help protect the body from oxidative stress and reduce the risk of chronic diseases, and can also lead to improved metabolic health and potentially aid in weight management. Flavonoids like quercetin and luteolin are known to support cardiovascular health and enhance the immune system. Additionally, rosmarinic acid has been shown to have antimicrobial and neuroprotective effects, contributing to overall well-being. **(Surbhi, Kumar et al., 2023),** They mentioned that the rosmarinic a` is the main compound in all analyzed spices and the content of other phenolic compounds is very low. The findings of this study is in line with **(Khani et al., 2017)** who showed that triglyceride (TG) accumulation has been inhibited by 42.6 percent in 0.1 percent thyme extract. \ this outcome is in line with **(Fruebis, et al., 2001)** they demonstrated that the extract of thymus seeds was effective in reducing the levels of iron overload in mice that were obese. This investigation illustrated that the treatment with the extract of the seed of Thymus vulgaris, at high and low doses, significantly enhanced anthropometric variables, including body weight, circumference of the waist, and BMI in mice with obesity in comparison with controls. Both doses of extract of T Loss of the weight correlated significantly with a elevation in the whole concentration of adiponectin and a decrease in insulin resistance. **(Galovicova et al., 2021).** Researchers have demonstrated that thyme and its bioactive compounds might have antidiabetic activity by modulating uptake of glucose. Oral taking of thyme is proposed to enhance insulin resistance in Sprague-Dawley mice by reducing blood viscosity, hence raising the binding affinity of insulin receptors and improving uptake of glucose. Also **(Goyal et al ., 2020)** discovered that management with the thymus extract has been observed to be significantly efficient in controlling hyperglycemia and enhancing insulin and tolerance of glucose. In addition, the restorative effect was established in terms of the morphology of cells through the use of histopathological examinations of the kidney, liver, and pancreas. Based on the findings, it was determined that oral administration of an aqueous extract from Thymus serpyllum has the potential to decrease hyperglycemia in hepatic muscle of streptozotocin (STZ)-induced diabetic mice. **(Osman et al. 2019)**. In this study evaluate serum LDL, high-density lipoprotein, TC, alkaline phosphatase, triglycerides, aspartate aminotransferase, alanine aminotransferase, albumin, total protein, urea, creatinine, K+, Na+, GSH-px, GSH, Superoxide dismutase, Malondialdehyde, tumor necrosis factor-alpha, serum thyroxine (T4), and triiodothyronine (T3) have been assessed. Propylthiouracil injection led to a significant rise in LDL, total cholesterol, ALT, ALP, AST, triglycerides, urea and creatinine, MDA, and tumor necrosis factor-alpha, while albumin, total protein, HDL, Na+, K+, GSH, GSH-px, Superoxide dismutase, thyroxine, and triiodothyronine diminished significantly in comparison with the control. The elevated dose of extract of thyme (ten percent) ameliorated most of harmful impact of propylthiouracil; this increase might be because of its contents of thymol, luteolin, and flavonoids. **(Tan et al., 2020).** As a result, management of thyme powder significantly diminished

(VLDL-c) (202.5 milligrams per deciliter). In detail, thyme powder enhanced the concentration of total cholesterol (219.3 milligrams per deciliter) and high-density lipoprotein-cholesterol (64.3 milligrams per deciliter) and thus significantly reduced atherogenic index (3.47) and cardiac risk factor (4.47Table (10): Effect of white and red germinated radish seed powders on lipoprotein-cholesterol (LDL-c, HDL-c) and lipoprotein-cholesterol (VLDL-c) serum of mice with obesity). **(Elbaset et al., 2023).** Following an eight-week monitoring duration, the research outcomes illustrated that the consumption of thyme significantly (P below 0.05) suppressed the raises in body weight (~twelve percent), serum cholesterol (~27.5 percent decrease), serum triglycerides (~thirty-three percent decrease), AST and ALT (~thirty-three percent and twenty-one percent decrease correspondingly), and glucose (~seven percent decrease). This work reveals the possible anti-obesity and hypolipidemic role of thyme in adult women. **(Emad M. El-Kholie et al., 2020).** They demonstrated that obese mice managed with (five percent) mixtures of basil leaves and thyme had enhanced lipid profiles and renal and liver functions compared to rats treated with various levels of basil leaves or thyme each alone.

CONCLUSION

The current research aimed to examine the biological and biochemical effects of thyme plants in the Al-Baha region in reduction weight in mice with obesity. The goal was achieved through biochemical analysis (blood sugar, blood lipids, liver enzymes, as well as kidney functions) and also analysis performed on total phenols, total flavonoids, and classification of phenolic compounds in dried thyme to highlight bioactive compounds in the thyme plant. Finally, thyme plants from the Al-Baha area have shown potential for reducing weight in obese rats, this could be related to their bioactive compounds and positive biochemical effects.

REFERENCES

1. .Al-Assaf, M.J. Mohammed, I.J. Mohamad, F.F. Ali Essential oils and fatty acids of Thymus vulgaris seeds: Chemical composition, antioxidant and antimicrobial activity, Egyptian Journal of Chemistry, 66 (3) (2023), pp. 459-464.
2. Aljabeili, H. Barakat, H.A. Abdel-Rahman. Chemical composition, antibacterial and antioxidant activities of thyme essential oil (Thymus vulgaris), Food and Nutrition Sciences, 9 (5) (2018), pp. 433-446.
3. Allain, C. C, (1974). Cholesterol enzymatic colorimetric method. J. of Clin. Chem., (20):470.
4. Barham, D. and Trinder, P. (1972): Determination of uric acid. Analyst, 97: 142
5. Campbell, J. A. (1963): Methodology of Protein Evaluation. RAG. Nuti. Document R. 10.37, June Meeting. New York.
6. Chapman, D. G.; Castilla, R. and Campbell. J. A. (1959): Evaluation of protein in food. I. A method for the determination of protein efficiency atio. Can. J. Biochem. Physiol., 37:679-686.
7. Clinica Chimica Acta (1980): Chemical kits, Clin. Chem., 105: 147-172.
8. Dauqan, A. and Abdullah . Medicinal and functional values of thyme (Thymus vulgaris L.) herb, Journal of applied biology and biotechnology, 5 (2) (2017), pp. 017-022.
9. Deekshith, M. Jois, J. Radcliffe, J. Thomas . Effects of culinary herbs and spices on obesity: A systematic literature review of clinical trials, Journal of Functional Foods, 81 (2021),
10. Deutsches Arzneibuch (1996): Amtliche Ausgabe. Stuttgart, Deutscher Apotheker Verlag.
11. Diab, H. Zbeeb, F. Baldini, P. Portincasa, M. Khalil, L. Vergani. The potential of Lamiaceae herbs for mitigation of overweight, obesity, and fatty liver: Studies and perspectives . Molecules, 27 (15) (2022), p. 5043.
12. Elbaset, B.M. Mohamed, P.E. Moustafa, D.F. Mansour, S.M. Afifi, T. Esatbeyoglu, S.S. Abdelrahman, H.M. Fayed. Erythropoietin suppresses the hepatic fibrosis caused by thioacetamide: Role of the PI3K/Akt and TLR4 signaling pathways. Oxidative Medicine and Cellular Longevity, 2023 (1) (2023), p. 5514248
13. El-Newary, S.M. Afifi, M.S. Aly, R.F. Ahmed, A.-E.-N.-G. El Gendy, A.M. Abd-ElGawad, M.A. Farag, A.M. Elgamal, A.I. Elshamy. Chemical profile of Launaea nudicaulis ethanolic extract and its antidiabetic effect in streptozotocin-induced rats. Molecules, 26 (4) (2021), p. 1000.
14. Emad M. El-Kholie, Naglaa A. El-Sheikh , Noha A. Kasaab(2020). Effect Of Basil (Ocimum Basilicum) And Thyme (Thymus Vulgaris) Leaves On Biological And Biochemical Changes In Induced Obese Rats . Journal of Home Economics, Volume30, Number (4), 2020
15. Fan, J.-I. Lee, Y.-B. Ryu, Y.-J. Choi, Y. Tang, M. Oh, S.-H. Moon, B. Lee, E.-K. Kim Comparative analysis of metabolite profiling of Momordica charantia leaf and the anti-obesity effect through regulating lipid metabolism, International Journal of Environmental Research and Public Health, 18 (11) (2021), p. 5584.
16. Fassati, P. and Prencipe, L. (1982). Triglyceride enzymatic colorimetric method. J. of Clin. Chem., 28: 2077.

17. Foula, R.H. Emara, M.K. Eldeeb, S.A. Mokhtar, F.A. El-Sahn. Effect of a weight loss program on serum adiponectin and insulin resistance among overweight and obese premenopausal females, Journal of the Egyptian Public Health Association, 95 (2020), pp. 1-8.
18. Friihbeck, G.; Toplak, H.; Woodward, E.; Yumuk, V.; Maislos, M. and Oppert J.M. (2013): Executive Committee of the European Association for the Study of Obesity. Obesity: The Gateway to Ill Health - an EASO Position Statement on a Rising Public Health, Clinical and Scientific Challenge in Europe. Obese Facts,6 A 17-20.
19. Fruebis, T.S. Tsao, S. Javorschi, D. EbbetsReed, M.R.S. Erickson, F.T. Yen, B.E. Bihain, H.F. Lodish. Proteolytic cleavage product of 30-kDa adipocyte complement-related protein increases fatty acid oxidation in muscle and causes weight loss in mice, Proceedings of the National Academy of Sciences, 98 (4) (2001), pp. 2005-2010
20. Fruh, S. M. (2017): Obesity. Risk factors, complications, and strategies for sustainable long-term weight management. Journal of the American association of nurse practitioners, 29:3-14.
21. Galovicova L., Borotova P., Valkova V., Vukovic N.L., Vukic M., Terentjeva M., Stefanikova J., Duranova H., Kowalczewski P.Ł., Kacaniova M. Thymus serpyllum Essential Oil and Its Biological Activity as a Modern Food Preserver. Plants. 2021;10:1416. doi: 10.3390/plants10071416.
22. Goyal S., Pathak R., Pandey H.K., Kumari A., Tewari G., Bhandari N.S., Bala M. Comparative study of the volatile constituents of Thymus serpyllum L. grown at different altitudes of Western Himalayas. SN Appl. Sci. 2020;2:1208. doi: 10.1007/s42452-020-2938-2.
23. Hafkenscheid, J.C. (1979): Determination of GOT. Clin. Chern., 25:155.
24. Hegested, D. M.; Mills, R. C.; Elvehjem, C. A. and Hart, E. B. (1941): Choline in the nutrition of chicks. J. B. Biol. Chem.; 138:459- 470.
25. Henry, R. J. (1974): Creatinine Colorimetric Method. Principles of Techniquss, 2nd Ed., Harcer and Row Pub, P.525.
26. Khani, P. Motamedi, M.R. Dehkhoda, S. Dabagh Nikukheslat, P. Karimi . Effect of thyme extract supplementation on lipid peroxidation, antioxidant capacity, PGC-1α content and endurance exercise performance in rats. Journal of the International Society of Sports Nutrition, 14 (2017), pp. 1-8.
27. Lee, R. and Nieman, D. (1996): Nutrition Assessment. 2nd Ed., Mosby, Missouri, U.S.A.
28. Lopez, M.F. (1977). HDL-cholesterol colorimetric method. J. of Clin. Chem, 23:882.
29. Miraj, S. and Kiani, S. (2016): Study of pharmacological effect of Thymus vulgaris: A review. Der Pharmacia Lettre., 8 (9):315-320.
30. Osman H.F., El-Mahdey A.A., El-Sherbiny E.M. Role of Thyme Extract against Some Biochemical Alterations Induced by Propylthiouracil in Male Rats. Journal of Food and Nutrition Research. 2019, 7(11), 794-800. DOI: 10.12691/jfnr-7-11-6
31. Patton,C.J. (1977):Urea enzymatic method.J.of Anal.Chem.,49:464-546.
32. Radovanovic, B. and Radovanovic, A. (2010): Free radical scavenging activity and anthocyanin profile of Cabernet Sauvignon wines from the Balkan Region. Molecules, 15: 4213-4226.
33. Reeves, P.G.; Nielson, F. II. and Fahmy, G.C. (1993): Reports of the American Institute of Nutrition, adhoc wiling committee on reformulation of the AIN 93. Rodent Diet.J. Nutri., 123:1939- 1951.
34. Snedecor and, Cochran (1967): Statestical Methods 6th Ed. Ioea Stat University press ames Iowa USA.
35. Surbhi, Kumar, A., Singh, S., Kumari, P., and Rasane, P. (2023). Eucalyptus: phytochemical composition, extraction methods and food and medicinal applications. Advances in Traditional Medicine, 23(2), 369-380.
36. Tan, T. Y. C., Lee, J. C., Yusof, N. A. M., Teh, B. P., and Mohamed, A. F. S. (2020). Malaysian herbal monograph development and challenges. Journal of Herbal Medicine, 23, 100380
37. Trinder, P. (1969): Glucose and triglycerides enzymatic colorimetric methods. J. of Ann. Clin. Biochem., 6:24-27.
38. Vassiliou, E., Awoleye, O., Davis, A., and Mishra, S. (2023). Anti-inflammatory and antimicrobial properties of Thyme oil and its main constituents. International Journal of Molecular Sciences, 24(8), 6936.