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# The Potential Effect of Seeds (*Portulaca O.–Linum Usitatissimum*) on Obesity in Experimental Animals

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## Abstract
Obesity is a chronic and complex disease, as it increases abnormal fat in the body, impairs health, leads to long-term medical complications, and reduces life span. Albino rats were divided into two main groups to study the potential effect of portulaca and flax seeds on obese rats; the first (1) group (5 rats) was fed as a normal control group on a basic, standard diet. The second main group (35 rats) was fed a high-fat diet. They were classified into seven equal subgroups: (2) As a positive control group, fed the standard diet, and groups (3 and 4) were fed the standard diet and purslane seed powder at a dose of 2.5% and 5%, respectively. Group (5 and 6) was fed a standard diet and flaxseed powder at a dose of 2.5% and 5%, respectively. The group (7, 8) was fed a mixture of purslane and flaxseed in addition to the standard diet at a dose of 2.5% and 5%, respectively. The results indicated significantly lower levels of LDLc, VLDLc, liver enzymes (ALT and AST), uric acid, urea, creatinine, and TSH compared to the positive control group. On the other hand, the coefficients significantly increased the values of T3 and T4 compared to the positive control group. In conclusion, purslane and flaxseed can improve lipids and thyroid hormones. The main aim of this study is to find the best ways to treat obesity.

Keywords: Portulaca seeds, flax seeds, body weight, liver function, kidney function, blood lipids, thyroid hormones.

## Introduction
Obesity has become the first non-infectious inflammatory disease in the history of mankind. It is defined as an excessive or abnormal accumulation of adipose tissue that may impair health [1].

Obesity is a risk factor for several of the leading causes of preventable death, including cardiovascular disease, diabetes mellitus, and many types of cancer. Thus, successful treatment and control of obesity should be major imperatives. However, multiple studies have shown that detection and counseling rates among physicians remain low [2,3]. The Dietary Guidelines are based on evidence that eating a LF (20-35%) diet helps manage weight, promote health, and reduce the risk of chronic disease.

Obesity causes or exacerbates many health problems, both independently and in association with other diseases [4]. Flax seeds are one of the potential oil seeds packed with excellent amount of nutrition and possess various health benefits. Interestingly, flax seeds' health benefits are mainly attributed to the omega-3 fatty acids, lignans and fiber they contain. It is used in different forms, such as whole and flour. The flour is used in bakery products and provides nutty flavor, nutritional and health benefits of the final product. Consumption of this oil seed may lower both total and LDL cholesterol because of its low content of saturated fat, high PUFA and phytosterol content. Processing of flax seeds makes its nutrients are bioavailable [5].

Among the functional foods, flaxseed has emerged as a potential functional food being good source of alpha-linolenic acid, lignans, high quality protein, soluble fiber and phenolic compounds [6,7,8].

Purslane is listed in the World Health Organization as one of the most used medicinal plants. It has been described as a "power food" of future because of its anti-oxidant properties and its high nutritive. Purslane has high content of protein, ash and fiber [9]. Also, it contains vitamin C, carotene, vitamin E and B complex vitamins like riboflavin, thiamin, niacin, and pyridoxine. It supplies highest dietary minerals such as potassium, magnesium, calcium, phosphorus, and iron [10,11] . Rejlah is a well-known plant for its antioxidant properties. Some studies have shown health benefits of Purslane in clinical conditions such as diabetic nephropathy, nephrotoxicity and hepatotoxicity [12]. The aim of this study was to study the potential effect of purslane and flax seeds on obese rats.

## Materials and Methods

## Materials

- Casein, all vitamins, all minerals, cellulose, cholinchloride and Methionine, were obtained from El-gomhoria Company, Cairo, Egypt.
- Tallow as an animal fat which used in obesity induction, were obtained from local market from Shebin EL-kom, Menoufia, Egypt.
- The kits were supplied by Bio diagnostics company Cairo, Egypt.

**Rats:** Forty albino rats (Sprague - Dawely) mean initial weight was 140±5g were obtained from Institute of Ophthalmology, Medical Analysis Dep., Giza, Egypt

## Methods

### Induction of obesity:

Thirty-five Rats fed on high fat diet to induce the obesity. High fat diet prepared from fine ingredients per 100g according to Negm [13].

### Biological experiment Diet

Basal diet was prepared according to Reeves et al., [14] which provide about 10% of its energy from fat. In order to used high fat diet (HFD), the study was used in which at least 40% of its energy comes from fat (corn oil + ghee) as reported by Bhatt et al., [15] and the amount of add saturated fat was substituted from the amount of corn starch. Portulaca and Flax seeds were added to the diet as a powder after milled.

### Experimental design and animal groups

The experimental was done in the Faculty of Home Economics, Menoufia University, Shibin El-Kom. Forty albino Male rats mean weight was 140 ± 5g were used. All rats were fed standard diet for a week as an adaptation period. Then, rats were distributed into 8 groups each of 5 rats. All the groups of rats were housed in wire cages and fed on the experimental diet for 4 weeks.

**Rats were divided into 8 groups; each group contain 5 rats.**

**Group (1):** Negative control group.
**Group (2):** Positive control group.
**Group (3):** Use 2.5% Purslane seeds
**Group (4):** Use 5 % Purslane seeds
**Group (5):** use (2.5%) Flax seed.
**Group (6):** use (5%) flax seed.
**Group (7):** Use mixture of compost and maize (2.5%).
**Group (8):** A mixture of manure and linen is used by (5%).

During the experimental period, the body weight and feed intake were estimated weekly and the general behavior of rats was observed. The experiment period was take 28 days at the end of the experimental period each rat weight separately then, rats are slaughtered and collect blood samples. Blood samples were centrifuged at 4000 rpm for ten minute to separate blood serum and then kept in deep freezer till using.

### Blood samples and organs collection

Blood samples were collected after 12 hour fasting at the end of the experiment. Blood was collected into dry clean centrifuged for 10 minutes at 4000 rpm to separate the serum. Serum was carefully aspirated and transferred into clean quit fit plastic tubes and kept

frozen at (-20°C) until the time of analysis. The organs (liver, spleen and kidney) were removed and washed in saline solution [16].

**Biological evaluation:**

The body weight gain (B.W.G.) and feed efficiency ratio (F.E.R) were determined according to Chapman et al., [17]. Using the following equations:

**B.W.G. =** (Final weight - Initial weight)

$$\mathbf{F.E.R.} = \frac{\text{Grams gain in body weight}}{\text{Grams feed consumed}}$$

**Biochemical analysis:**

Total cholesterol, triglycerides and HDL were determined according to Allen [18] Fassati, Prencipe [19] and Lopez [20] respectively. The determination of LDL and VLDL was carried out according to the method of Lee, Nieman [21] as follows:

*VLDLv= TG/5 and LDLc= TC – (HDLc + VLDLc).*

Alkaline phosphates (ALP), aspartate amino transferees (AST) and alanine amino transferees (ALT) were determined as U/L according to the methods described by Belfied, Goldberg [22] Tietz [23] and Yound [24]. Serum urea, creatinine and uric acid were determined by enzymatic method according to Patton, Crouch [25], Henry [26], Schultz [27]. Respectively. Triiodothyronine (T3) according to Ahmed et al., [28] and leptin hormone was measured according to the method of Guillaume, Bjorntorp [29].

Malondialdehyde (MDA) was estimated in kidney tissues according to the method of Lefevre et al., [30]. Catalase (CAT), Glutathione peroxidase (GSH.Px) and Superoxide dismutase (SOD) activities were assayed using the methods described by Aebi [31], Necheles et al., [32], Massayasu, Hiroshi [33] respectively.

**Ethical consideration:**

This study has been approved by the department of nutrition and food sciences, faculty of home economics, Menoufia university, Shibin El-Kom, Egypt

## Result and Discussion

The data in table (1) indicated that the mean value of feed intake, body weight gain and FER for normal and obesity rats. It was clear that the feed intake value showed non-significant in groups supplement with 2.5% Portulaca powder and 5% Flax powder compared with positive group. While 5% Portulaca powder and 2.5% mixture of Portulaca and Flax powder recorded significant ($P<0.05$) decreased compared with positive group. But 2.5% Flax powder and 5% mixture of Portulaca and Flax powder recorded high significant ($P<0.01$) decreased compared with positive group. On the other hand, body weight gain recorded high significant ($P<0.01$) decreased in groups which

supplement with 2.5% Portulaca powder and 5% Flax powder. While groups fed on 5% Portulaca powder and 2.5% mixture of Portulaca and Flax powder recorded high significant increasing at (P<0.01). But groups fed on 2.5% Flax powder and 5% mixture of Portulaca and Flax recorded the highest significant increasing at (P<0.001). Our result are in harmony with those obtained by [34, 35, 36, 37].

Feed efficiency ratio recorded non-significant in group which supplement diet with 2.5% Portulaca powder. Whereas groups fed on 5% Portulaca powder, 2.5 & 5% Flax powder and 2.5 & 5% mixture of Portulaca and Flax powder recorded significant increasing at (P<0.05).

**Table (1): Effect of Portulaca, Flax and their mixture on feed intake, body weight and feed efficiency ratio of obesity rats**

| Parameters | FI (g) | BWG (g) | FER(g) |
|---|---|---|---|
| Groups | Mean ± SD | Mean ± SD | Mean ± SD |
| Control –ve | 13.4±1.47* | 7.86±1.52** | 0.07±0.001** |
| Control +ve | 17.75±1.12 | 12.15±1.01 | 0.029±0,002 |
| 2.5% Portulaca powder | 15.67±1.72 | 10.82±0.67** | 0.039±0.005 |
| 5% Portulaca powder | 13.37±1.88* | 12.33±1.11** | 0.045±0.002* |
| 2.5% Flax powder | 11.87±1.17** | 15.27±1.45*** | 0.053±0.003* |
| 5% Flax powder | 15.23±1.76 | 11.55±0.59** | 0.052±0.003* |
| 2.5% mixture of Portulaca and Flax | 12.67±1.29* | 14.86±1.26** | 0.054±0.002* |
| 5% mixture of Portulaca and Flax | 11.52±1.34** | 17.16±1.13*** | 0.057±0.004* |

** P<0.05, ** P<0.01 FI: Feed intake, BWG: Body weight gain, FER; Feed efficiency ratio*

The data in table (2) demonstrated that, AST was high in positive control and low in the negative control. It was clear that AST value showed non-significant in groups supplement with 2.5% Portulaca powder and 5% Flax powder compared with positive group. While groups fed on 5% Portulaca powder and 2.5% mixture of Portulaca and Flax powder recorded significant (P<0.05) decreased in AST. But AST value showed high significant (P<0.01) decreased in groups supplement with 2.5% Flax powder and 5% mixture of Portulaca and Flax powder. These results are in agreement with [38].

ALT was high in positive control and low in the negative control. It was clear that ALT value showed non-significant in group supplement with 2.5% Portulaca powder compared with positive group. While groups fed on 5% Portulaca powder and 5% Flax powder recorded significant (P<0.05) decreased in ALT. But ALT value showed high significant (P<0.01) decreased in groups supplement with 2.5% Flax powder and 2.5% mixture of Portulaca and Flax powder. Group fed on 5% mixture of Portulaca and Flax powder recorded the highest significant decreasing at (P<0.001). One study [39] indicated

that the anti-obesity actions of purslane ethanoic extract may be due to increased energy expenditure-related fatty liver degradation and decreased fatty acid synthesis and fat intake in the liver. The melatonin concentration in purslane was found to exceed that reported in a number of other fruits and vegetables [40]. Melatonin has a variety of important functions including direct free radical scavenging and anti-inflammatory properties [41].

**Table (2): Effect of Portulaca, Flax and their mixture on Liver functions of obesity rats**

| Parameters<br>Groups | AST (U/L)<br>Mean ± SD | ALT (U/L)<br>Mean ± SD |
|---|---|---|
| Control –ve | 29.69±2.19*** | 35.22±2.28*** |
| Control +ve | 50.16±1.73 | 54.21±4.53 |
| 2.5% Portulaca powder | 43.59±2.15 | 46.7±2.12 |
| 5% Portulaca powder | 39.14±1.22* | 43.22±3.49* |
| 2.5% Flax powder | 34.42±1.12** | 40.11±3.97** |
| 5% Flax powder | 40.09±4.43 | 43.18±2.15* |
| 2.5% mixture of Portulaca and Flax | 37.74±3.55* | 40.84±2.34** |
| 5% mixture of Portulaca and Flax | 33.74±1.11** | 37.53±1.19*** |

** P<0.05, ** P<0.01, and *** P<0.001*

The data in table (3) demonstrated that levels of urea was non-significant in groups fed on 2.5 & 5% Portulaca powder and 5% Flax powder. While groups fed on 2.5% Flax powder and 2.5% mixture of Portulaca and Flax powder recorded significant (P<0.05) decreased in urea. Group fed on 5% mixture of Portulaca and Flax powder recorded high significant decreasing at (P<0.01).

Uric acid recorded non-significant in group which supplement diet 2.5% Portulaca powder. Whereas groups fed on 5% Portulaca powder and 5% Flax powder recorded significant decreasing at (P<0.05). Groups fed on 2.5% Flax powder and 2.5 & 5% mixture of Portulaca and Flax recorded high significant decreasing at (P<0.01).

It was clear that creatinine value showed non-significant in groups supplement with 2.5% Portulaca powder and 2.5% Flax powder compared with positive group. While 5 % Portulaca powder, 2.5% Flax powder and 2.5% mixture of Portulaca and Flax recorded significant (P<0.05) decreased compared with positive group. But 5% mixture of Portulaca and Flax powder recorded high significant (P<0.01) decreased compared with positive group. Decreased levels of urea and creatinine in the Portulaca treated animals may be due to its antioxidant potential [42].

**Table (3): Effect of Portulaca, Flax and their mixture powder on urea, uric acid and creatinine of obesity rats**

| Parameters<br>Groups | Urea (mg/dl)<br>Mean ± SD | Uric acid (mg/dl)<br>Mean±SD | Creatinine (mg/dl)<br>Mean ± SD |
|---|---|---|---|
| Control –ve | 34.9±2.43** | 1.44±0.18** | 0.66±0.21*** |
| Control +ve | 50.8±5.19 | 2.69±0.65 | 1.28±0.34 |
| 2.5% Portulaca powder | 47.02±4.67 | 2.45±0.96 | 1.06±0.74 |
| 5% Portulaca powder | 44.01±4.86 | 2.24±0.11* | 0.89±0.14* |
| 2.5% Flax powder | 40.93±3.23* | 2.02±0.16** | 0.86±0.01* |
| 5% Flax powder | 44.27±3.93 | 2.26±0.18* | 0.98±0.83 |
| 2.5% mixture of Portulaca and Flax | 40.88±1.24* | 2.04±0.27** | 0.88±0.01* |
| 5% mixture of Portulaca and Flax | 37.06±1.17** | 1.86±0.13** | 0.78±0.01** |

** P<0.05, ** P<0.01, and *** P<0.001*

The data in table (4) demonstrated that, CAT was high in positive control and low in the negative control. It was clear that CAT value showed non-significant in groups supplement with 2.5% Portulaca powder and 5% Flax powder compared with positive group. While groups fed on 5% Portulaca powder, 2.5% Flax powder and 2.5 & 5% mixture of Portulaca and Flax recorded high significant (P<0.01) increased in CAT.

SOD was high in positive control and low in the negative control. It was clear that SOD value showed non-significant in groups supplement with 2.5% Portulaca powder and 5% Flax powder compared with positive group. While group fed on 2.5% mixture of Portulaca and Flax powder recorded significant (P<0.05) increased in SOD. But SOD value showed high significant (P<0.01) increased in groups supplement with 5 % Portulaca powder, 2.5% Flax powder and 5% mixture of Portulaca and Flax powder.

MDA was high in positive control and low in the negative control. It was clear that MDA value showed non-significant in groups supplement with 2.5% Portulaca powder and 5% Flax powder compared with positive group. While group fed on 2.5% mixture of Portulaca and Flax powder recorded significant (P<0.05) decreased in MDA. But MDA value showed high significant (P<0.01) decreased in groups supplement with 5 % Portulaca powder, 2.5% Flax powder and 5% mixture of Portulaca and Flax powder.

The data in table (5) demonstrated that, T3 value showed non-significant in groups supplement with 2.5% Portulaca powder, 5% Flax powder and 2.5% mixture of Portulaca and Flax compared with positive group. While groups fed on 5% Portulaca powder and 5% mixture of Portulaca and Flax recorded significant (P<0.05) decreased in T3. But T3 value showed high significant (P<0.01) decreased in groups supplement with 2.5% Flax powder.

**Table (4): Effect of Portulaca, Flax and their mixture powder on CAT, SOD and MDA of obesity rats**

| Parameters / Groups | CAT (mg/dl) Mean ± SD | SOD (mg/dl) Mean ± SD | MDA (mg/dl) Mean ± SD |
|---|---|---|---|
| Control –ve | 30.76±1.16*** | 28.79±1.55*** | 31.86±1.42*** |
| Control +ve | 10.43±2.24 | 8.36±1.96 | 65.95±4.61 |
| 2.5% Portulaca powder | 13.7±1.52 | 11.86±1.42 | 58.91±4.23 |
| 5% Portulaca powder | 23±1.33** | 20.54±1.75** | 48.54±1.72** |
| 2.5% Flax powder | 25.18±1.09** | 24.17±1.26** | 40.86±1.11** |
| 5% Flax powder | 12.7±1.46 | 10.18±1.12 | 60.15±3.13 |
| 2.5% mixture of Portulaca and Flax | 20.65±1.11** | 27.25±1.32* | 35.26±2.37* |
| 5% mixture of Portulaca and Flax | 24.71±1.13** | 20.22±1.11** | 45.62±2.12** |

** P<0.05, ** P<0.01, and *** P<0.001*

It was clear that T4 value showed non-significant in group supplement with 5% Flax powder compared with positive group. While groups fed on 2.5% Portulaca powder and 2.5 & 5% mixture of Portulaca and Flax recorded significant (P<0.05) decreased in T4. But T4 value showed high significant (P<0.01) decreased in groups supplement with 5% Portulaca powder and 2.5% Flax powder.

**Table (5): Effect of Portulaca, Flax and their mixture powder on Hormones of obesity rats**

| Parameters / Groups | T3 (U/L) Mean ± SD | T4 (U/L) Mean ± SD | TSH (U/L) Mean ± SD |
|---|---|---|---|
| Control –ve | 66.93±2.18*** | 2.2±1.17*** | 0.67±00.12*** |
| Control +ve | 95.22±3.29 | 3.33±1.34 | 1.11±0.44 |
| 2.5% Portulaca powder | 86.31±4.85 | 2.84±1.12* | 1.03±0.11 |
| 5% Portulaca powder | 79.62±1.71* | 2.58±1.17** | 0.95±0.02* |
| 2.5% Flax powder | 74.43±1.14** | 2.37±1.15** | 0.84±0.02** |
| 5% Flax powder | 90.54±5.62 | 2.95±1.72 | 1.07±0.36 |
| 2.5% mixture of Portulaca and Flax | 86.52±5.35 | 2.83±1.11* | 0.99±0.03* |
| 5% mixture of Portulaca and Flax | 81.93±2.28* | 2.78±1.05* | 0.94±0.01* |

** P<0.05, ** P<0.01, and *** P<0.001*

On the other TSH recorded non-significant in groups supplement with 2.5% Portulaca powder and 5% Flax powder compared with positive group. While groups fed on 5% Portulaca powder and 2.5 & 5% mixture of Portulaca and Flax recorded significant decreasing at (P<0.05). But group fed on 2.5% Flax powder recorded high significant decreasing at (P<0.01). In this respect, there are agreement with our results and [43] who

indicated that, experiments on animals have shown a correlation between thyroid hormones and changes in weight

The data in table (6) demonstrated that TC was non-significant in groups fed on 2.5 & 5% Portulaca powder and 5% Flax powder. While groups fed on 5% Flax powder and 4 mixture of Portulaca and Flax powder recorded significant (P<0.05) decreased in TC. Groups fed on 5% mixture of Portulaca and Flax recorded high significant decreasing at (P<0.01).

TG recorded non-significant in groups which supplement diet 4% & 5% Portulaca powder. Whereas groups fed on 2.5% & 5 % Flax powder and 2.5% mixture of Portulaca and Flax recorded significant decreasing at (P<0.05). Group fed on 5% mixture of Portulaca and Flax recorded high significant decreasing at (P<0.01).

It was clear that HDL value showed non-significant in group supplement with 2.5% Portulaca powder compared with positive group. While 5 % Portulaca powder recorded significant (P<0.05) increased compared with positive group. Groups fed on 2.5% & 5% Flax powder and 2.5% & 5% mixture of Portulaca and Flax recorded high significant decreasing at (P<0.01).

On the other hand, LDL recorded non-significant in group supplement with 2.5% Portulaca powder compared with positive group. While groups fed on 5 % Portulaca powder & Flax powder recorded significant decreasing at (P<0.05). But groups fed on 2.5% Flax powder and 2.5% & 5% mixture of Portulaca and Flax recorded high significant decreasing at (P<0.01).

**Table (6): Effect of Portulaca, Flax and their mixture powder on lipid profile of obesity rats**

| Parameters<br>Groups | TC (mg/dl)<br>Mean±SD | TG (mg/dl)<br>Mean±SD | HDL (mg/dl)<br>Mean±SD | LDL (mg/dl)<br>Mean±SD | VLDL (mg/dl)<br>Mean±SD |
|---|---|---|---|---|---|
| Control –ve | 100.5±5.2*** | 67.0±2.15*** | 49.2±1.7** | 37.9±1.9*** | 13.4±1.2*** |
| Control +ve | 164.0±3.2 | 108.4±8.7 | 30.7±2.1 | 111.6±4.7 | 21.7±1.2 |
| 2.5% Portulaca powder | 157.7±8.2 | 105.7±2.8 | 34.8±1.8 | 101.8±7.2 | 21.1±2.3 |
| 5 % Portulaca powder | 148.5±3.6 | 95.9±2.6 | 38.4±3.2* | 90.9±3.5* | 19.17±1.6 |
| 2.5% Flax powder | 137.2±3.1* | 85.2±1.4* | 41.7±2.4** | 78.4±1.8** | 17.0±1.6* |
| 5% Flax powder | 143.8±2.9 | 89.9±1.8* | 40.8±1.4** | 85.1±3.2* | 17.9±1.6* |
| 2.5% mixture of Portulaca and Flax | 137.9±4.5* | 86.6±1.9* | 40.8±1.2** | 79.7±3.4** | 17.4±1.3* |
| 5% mixture of Portulaca and Flax | 125.3±1.8** | 79.7±3.2** | 44.2±1.5** | 65.2±2.9** | 15.9±1.2** |

** P<0.05, ** P<0.01, and *** P<0.001*

VLDL recorded non-significant in groups which supplement diet with 2.5% & 5% Portulaca powder. Whereas groups fed on 2.5% & 5% Flax powder and 2.5% mixture of Portulaca and Flax recorded significant decreasing at ($P<0.05$). But group fed on 5% mixture of Portulaca and Flax recorded high significant decreasing at ($P<0.01$). The obtained results are in agreement with [44] who showed that treatment with flaxseed accompanied high cholesterol diet induced hypercholesterolemia rats, lowered serum LDL-C, VLDL-C, phospholipid, endothelin-1 and homocysteine concentration in addition to increasing HDL-C. These results suggest that, flaxseed may be effective in controlling cholesterolemic status & improving dyslipidemia and has the potential in reducing cardiovascular complications due to hypercholesterolemia. Data agree with those of [45], they reported that in two months therapy by Flaxseeds decreased LDL-cholesterol 6.2% and increased HDL-cholesterol 7.7%.).

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# التأثير المحتمل لبذور (الرجلة - الكتان) لتقليل السمنة في حيوانات التجارب

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## الملخص العربى

السمنة مرض مزمن ومعقد، حيث تزيد من الدهون غير الطبيعية في الجسم، مما يضر بالصحة ويؤدي إلى مضاعفات طبية طويلة الأمد ويقلل من العمر الافتراضي. تم تقسيم الفئران البيضاء إلى مجموعتين رئيسيتين لدراسة التأثير المحتمل لبذور بورتولاكا وبذور الكتان على الفئران التي تعاني من السمنة ، المجموعة الأولى (5 فئران) تم إطعامها كمجموعة تحكم عادية على نظام غذائي أساسي وهو النظام الغذائي القياسي. تم تغذية المجموعة الرئيسية الثانية (35 فأرًا) بنظام غذائي عالي الدهون. تم تصنيفها إلى 7 مجموعات فرعية متساوية على النحو التالي: 2) كمجموعة ضابطة موجبة تم تغذيتها بالنظام الغذائي القياسي ، وتم تغذية المجموعة (3 ، 4) على العلف القياسي ومسحوق بذور الرجلة بجرعة 2.5٪ و 5 ٪، على التوالى. تم تغذية المجموعة (5 ، 6) على علف معياري ومسحوق بذور الكتان بجرعة 2.5٪ و 5٪ على التوالي. تم تغذية المجموعة (7 ، 8) بمزيج من الرجلة وبذور الكتان بالإضافة إلى العليقة القياسية بجرعة 2.5٪ و 5٪ على التوالي. أشارت النتائج إلى انخفاض معنوي في مستويات LDLc و VLDLc وأنزيمات الكبد (ALT و AST) وحمض البوليك واليوريا والكرياتينين و TSH مقارنة بمجموعة التحكم الإيجابية. من ناحية أخرى ، أدت المعاملات إلى زيادة ملحوظة في قيم T3 و T4 مقارنة بمجموعة التحكم الموجبة. في الختام ، يمكن أن تحسن الرجلة وبذور الكتان الدهون وهرمونات الغدة الدرقية. الهدف الرئيسي لهذه الدراسة هو إيجاد أفضل الطرق لعلاج السمنة.

الكلمات المفتاحية: بذور الرجلة، بذور الكتان، وزن الجسم، وظائف الكبد، وظائف الكلى، دهون الدم، هرمونات الغدة الدرقية.