Possible Effect of Cauliflower Leaves Powder on obese rats

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Abstract

The incidence of obesity is rising at an alarming rate and is becoming a major public health concern with incalculable social costs. Indeed, obesity facilitates the development of metabolic disorders such as diabetes, hypertension, and cardiovascular diseases in addition to chronic diseases such as stroke, osteoarthritis, sleep apnea, some cancers, and inflammation-bases pathologies. The effect of cauliflower (*Brassica oleracea* var. botrytis) leaves powder (CFLP) on obese rats was evaluated. Thirty male albino rats weighting 140 ±10 g were used in this study and divided into 5 groups, each group contain 6 rats. Rats were treated by high fat diet (20% animal fat) to induce obese. The cauliflower leaves were added at a percent of (1.5, 3 & 5%) from the basil diet. Serum liver function (ALT, GOT, and GPT), total cholesterol, triglycerides, lipid profile (HDL-c, LDL-c, VLDL-c), glucose level, kidney functions (urea, uric acid and creatinine) were determined, The results showed that the cauliflower leaves showed significant changes in the tested biochemical parameters. As conclusion, obese rats treated with 5% cauliflower leaves powders had significantly improvement lipid profile, liver and kidney functions compared with other concentrations.

Key words: Rats, Anti-obesity, Phytochemicals, and Biochemical analysis.

Introduction

Obesity is one of the most common and important health concerns facing our society today**.** An increase in the prevalence of obesity in almost all countries in the world has led the World Health Organization to define it as "the global epidemic **(Suastika, 2006)**.

Obesity as a primary disorder follows a positive energy balance. The identification of the primary causes of this imbalance remains challenging and comprises the majority of cases usually diagnosed after causes for secondary obesity are ruled out. This chronic disease results from complex interactions of genetic, behavioral, and environmental factors correlating with economic and social status and lifestyles **(Ordova´s and Shen, 2008)**.

There are several standardized types of obesity that have been classified by the World Health Organization (WHO), ranging from class I to class III, but have since been subdivided by other organizations into categories such as "mild obesity" and "super obesity" to provide a frame of reference. Since the WHO's standards do not extend to these broken down categories, the exact body mass index (BMI) qualifications for each category may vary by as much as five points depending on the source **(WHO, 2009).**

Indeed, obesity facilitates the development of metabolic disorders (e.g. diabetes, hypertension), and cardiovascular diseases in addition to chronic diseases (e.g. stroke, osteoarthritis (OA), sleep apnea, cancers, and inflammation-based pathologies) **(Derdemezis *et al*., 2011).**

Vegetables provide a major dietary source for phytochemicals with potential anti-obesity properties, with the types and levels varying markedly between species and even cultivar In addition climatic, agronomic and harvest conditions also significantly influence the levels of these phytochemicals in vegetables **(Tiwari and Cummins, 2011)**.

The non-edible parts of cauliflower (*Brassica oleracea*, L. var. botrytis), consisting of outer leaves, stems and pods, are important by-products from the cauliflower harvest. These residues still contain high amounts of bio-actives e.g., phenolic compounds, vitamins, that are known for their bioactivities, such as the potential prevention of health risks as cardiovascular diseases, obesity, diabetes and cancer **(Rodriguez-Mateos *et al.,* 2014)**.

Disposal of the non-edible portion of cauliflower (cauliflower waste), which contributes to about 45–60% of the total weight of the vegetable, remains a crucial problem **(Oberoi *et al.,* 2007)**.

Cauliflower is one of the most popular *Brassica* vegetables and has a broad variety of uses as a dish or as an ingredient in soups or salads. Cauliflower is an excellent source of vitamins B1, B2, B3, B5, B6, C, E and K, folic acid as well as dietary fiber, omega-3 fatty acids, proteins, potassium, phosphorus, magnesium manganese and iron **(Florkiewicz *et al.,* 2014)**.

Cauliflower is also rich in healthy plant metabolites, which include sulfur-containing glucosinolates, flavonoids, terpenes, S-methylcysteine sulfoxide, coumarins, and other minor compounds. It has been reported that these compounds in cauliflower and other *Brassica* vegetables were effective in protection against and counteracting some kinds of cancer **(Ahmed and Ali, 2013)**.

Glucosinolates from cauliflower and their breakdown products as well as polyphenols show also antioxidant, anti-inflammatory, anti-allergic, anti-fungal, anti-virus, anti-mutagenic, and antibacterial properties **(Avato and Argentieri, 2015)**.

Cauliflower has the highest waste index, i.e. ratio of non-edible to edible portion after harvesting, and thus generates a large amount of organic solid waste, which creates a foul odour on decomposition. It is considered as a rich source of dietary fiber and it possesses both antioxidant and anti-carcinogenic properties. Phenolic compounds and vitamin C are the major antioxidants of *brassica* vegetables, due to their high content and high antioxidant activity **(Podsedek, 2007)**.

Anti-obesity mechanisms of phytochemicals appear to involve mediation of complex and interconnected cell signaling pathways, therefore the combination of multiple phytochemicals may give rise to synergistic and enhanced anti-obesity effects. Synergistic interactions with combinations of phytochemicals have previously been investigated for the treatment of some cancers **(Hermlswarya and Doble, 2006)**.

Different studies have indicated that increased consumption of cruciferous vegetables (e.g., cabbage, broccoli, cauliflower, and Brussels sprouts) is associated with decreased risks of cancer and cardiovascular diseases, which may be due to their high contents of glucosinolates and their derivatives, including indole-3-carbinol (I3C) **(Liu *et al.*, 2000)**.

This work was conducted to study the effect of cauliflower (*Brassica oleracea* var. botrytis) leaves powder (CFLP) on obese rats.

Materials and Methods

Materials

Cauliflower (*Brassica oleracea , L. var. botrytis*) was obtained from the local market of Alexandria City, Alexandria Governorate, Egypt in the year of 2017. While, Casein, cellulose, choline chloride powder, and DL- methionine powder, were obtained from Morgan Co. Cairo, Egypt.

The chemical kits

Chemical kits used for determination the (TC, TG, HDL-c, ALT, AST, ALP, urea, uric acid and creatinine) were obtained from Al-Gomhoria Company for Chemical, Medical and Instruments, Cairo, Egypt.

Induction of experimental obesity

Obesity was induces in normal healthy male albino rats by fed on high fat diet (20% animal lipid) supplemented in the basal diet and used as a positive control group.

Experimental animals

A total of 30 adult normal male albino rats Sprague Dawley strain weighing 140±10 g were obtained from Vaccine and Immunity Organization, Ministry of Health, Helwan Farm, Cairo, Egypt.

Preparations of herb leaves

Cauliflower leaves were obtained from local market. Plants were cleaning, washing and dehydrating on room temp (25°C) for 24 hours, the dried leaves were ground in mixer Toshiba El- Araby and grinded for a soft powder without impurities.

Experimental design

Thirty adult male white albino rats, Sprague Dawley Strain, 10 weeks age, weighing (140±10g) were used in this experiment. All rats were fed on basal diet (casein diet) prepared according to **AIN, (1993)** for 7 consecutive days. After this adaptation period, rats are divided into 5 groups, each group which consists of five rats as follows: group (I): rats fed on basal diet as negative control. Group (2): Obese rats induced by fed on high fat diet (20% animal lipid) supplemented in the basal diet and used as a positive control group. Group (3): Group infected obesity with rats was fed cauliflower leaves as powder by 1.5% of the weight of diet. Group (4): Group infected obesity with rats was fed cauliflower leaves as powder by 3% of the weight of diet. Group (5): Group infected obesity with rats was fed cauliflower leaves as powder by 5% of the weight of diet. 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 sampling

After fasting for 12 hours, blood samples in initial times were obtained from retro orbital vein,. Blood samples were collected into a dry clean centrifuge glass tubes and left to clot in water bath (37°C) for 30 minutes, then centrifuged for 10 minutes at 4000 rpm to separate the serum, which were carefully aspirated and transferred into clean cuvette tube and stored frozen in deep freezer till analysis according to method described by **Schermer, (1967)**.

Estimation of body weight **gain, feed intake, and feed efficiency ratio**

During the experimental period (28 days) the net feed intake (FI) was daily recorded, while body weight (BWG) was weekly recorded. The net feed intake and gained body weight were used for the calculation of feed efficiency ratios (FER) according to **Chapman *et al.*, (1959)** as follow:

$$\text{FER \%} = \frac{\text{Body weight gain (g)}}{\text{Food intake (g)}} \times 100$$

Biochemical analysis

Lipids profile

Determination of total cholesterol

Serum total cholesterol was determined according to the colorimetric method described by **Thomas (1992)**.

Determination of serum triglycerides

Serum triglyceride was determined by enzymatic method using kits according to the **Young, (1975) and Fossati, (1982)**.

Determination of high density lipoprotein (HDL-c)

HDL-c was determined according to the method described by **Friedewaid (1972) and Grodon and Amer (1977)**.

Calculation of very low density lipoprotein cholesterol (VLDL-c)

VLDL-c was calculated in mg/dl according to **Lee and Nieman (1996)** using the following equation:

VLDL-c (mg/dl) = Triglycerides / 5

Calculation of low density lipoprotein cholesterol (LDL-c)

LDL-c was calculated in mg/dl according to **Lee and Nieman (1996)** as follows:

LDL-c (mg/dl) = Total cholesterol – HDL-c – VLDL-c

Liver functions

Determination of serum alanine amino transferase (ALT), serum asparatate amino transferase (AST), serum alkaline phosphatase (ALP) were carried out according to the method of **Hafkenscheid (1979), Clinica Chimica Acta (1980)**, **and Moss (1982**), respectively.

Kidney functions

Determination of serum urea

Serum urea and serum creatinin were determinated by enzymatic method according to **Henry (1974)** and **Patton & Crouch (1977)**.

Statistical analysis

The data were analyzed using a completely randomized factorial design **SAS, (1988)** when a significant main effect was detected; the means were separated with the Student-Newman-Keuls Test. Differences between treatments of ($P \leq 0.05$) were considered significant using Costat Program. Biological results were analyzed by One Way ANOVA.

RESULTS AND DISCUSSION

Data presented in Table (1) show the effect of different levels of CFLP (1, 2, and 4 %) on BWG, FER and FI of obese rats for negative control, positive control and other different groups of obese rats fed cauliflower leaves. From the above mentioned data non significant in the control +ve group (21.56±0.20c) was found as compared to the control (– ve) group (22.85±0.40c). When rats were fed on parts of cauliflower (leaves) the maximum increased of BWG was recorded for (4%)group (26.62 ±0.80a) compared to (+ve) group. As for the FI mentioned data non significant in the control +ve group (19.31 ±0.60b) was found as compared to the control (– ve) group (19.24±0.70b).When rats were fed on parts of cauliflower (leaves) the maximum increased of FI was recorded for(1%)group (21.14 ±1.00a) compared to (+ve) group. Finally about FER found that data significant increase in the control +vegroup (0.040 ± 0.02c) was found as compared to the control (– ve) group (0.042 ± 0.07d).When rats were fed on parts of cauliflower (leaves) the maximum increased of FI was recorded for(4%)group(0.048 ±0.08a) compared to (+ve) group. These results are in agreement with **Kim and Milner, (2005)** they reported that I3Cda glucosinolate derivative from cruciferous vegetables can affect adiposity, i.e., it decreased body weight, decreased the weight of epididymal fat mass, and modulated lipid metabolism-associated gene products in DIO mice.

Data given in Table (2) show the effect of different concentrations of cauliflower (CFLP) on serum on glucose levels of obese rats. It is clear to notice that the highest glucose levels recorded for positive control group (187.50 ± 1.10^{a} mg/dl), while negative control group recorded the lowest value with significant differences(95.20 ± 0.40^{h} mg/dl). On the other hand, the higher glucose levels of treated groups (obese groups) recorded for 1.5% CLP, while the lower value recorded for 5% CLP with significant differences. The mean values were (120.30 ± 0.30e mg/dl) and (105.50 ± 0.30g mg/dl, respectively). These results are in

agreement with **Bryzgalova *et al.*, (2008),** they reported that CLP were found to be beneficial for diabetic conditions CLP were found to ameliorate insulin resistance and enhance glucose uptake.

Data presented in Table (3) show the effect of different concentrations of cauliflower on serum (ALT, GOT and GPT) of obese rats. It is clear to notice that the high significant increase in ALT, GOT and GPT (192.30^{a} ±0.20, 57.62^{a} ± 1.14, and 22.80^{a}± 0.10, respectively), of the (+ve) group to (90.60g ±1.2011.00g ± 1.10, 2.8+0.15and 8.60f± 0.40, respectively), of the (- ve) rats, this was change due to induced obese. Due to feeding on CLP significant decreases of in ALT, GOT and GPT were evident as compared with (control +ve) group. High significant decreases in liver functions enzymes were recorded for (5%) groups (97.60^{f} ± 0.30, 17.00^{f} ± 0.10 and 9.20^{f} ± 0.20, respectively). These results are in agreement with **Mohamed *et al.*, (2005)**, they found that phenolic compounds such as in onion, garlic and cabbage and cauliflower have reduced the increase in serum levels of AST and ALT.

Moreover, **Giakoustidis *et al.*, (2006)** reported that pretreatment with epigallocatechin-3- gallate (found in cauliflower) decreased serum leaves of AST and ALT. The present results were in agreement with **Singab *et al.*, (2005)** they showed that flavone glycosides reduced the elevated levels of the liver serum enzymes GOT, GPT and ALP.

Data tabulated in Table (4) show the effect of different concentrations of cauliflower on serum total cholesterol and triglycerides of obese rats. It is obvious that the mean values of fasting serum T.C and T.G of positive control groups were 130.00^{a} ± 1.10mg/dl and 134.25^{a} ±1.21mg/dl, respectively, being significantly higher when compared to the corresponding values in the negative control groups which were 95.00^{h} ± 0.10mg/dl and 54.91^{e} ± 0.10mg/dl, respectively. Due to feeding on 1.5, 3& 5% CFLP the mean values of serum levels of T.C and T.G were decreased compared to the positive groups. The lower significant value was recorded for the group fed on 5% CFLP. As for cholesterol the lowest value was 100.00^{g} ± 0.40mg/dl. Also the lowest significant value for triglycerides recorded for (5%) group (57.75^{e} ± 0.20mg/dl). These results are in agreement with **Maiyoh *et al.*, (2007)**, they reported I3C has decreased TG contents by suppressing the mRNA expression of sterol regulatory element binding protein-1 (SREBP-1) and ACC in HepG2 cells; therefore, these results suggest that I3C may act by decreasing the ACC expression to decreased TG synthesis and lipid contents in the adipose tissue in Dio mice. Also,

Mona and Sorial (2003) found that dietary fiber in cabbage and cauliflower lowered the serum total lipid, total cholesterol, triglycerides levels and LDL-c than in rats fed on the control diet.

Data of presented in Table (5) show the effect of different concentrations of cauliflower on serum lipoprotein fractions (HDL-c, VLDL-c, LDL-c) of obese rats. It is clear that the significant increases were occurred in C+ve group in serum level of, LDL-c, VLDL-c of which were 78.05^{a}± 1.20mg/dl and 26.85^{a}± 1.13mg/dl, respectively), as compared to normal rats C-ve group (38.52f± 0.10 mg/dl and 10.98c± 0.32mg/dl, respectively). **Waqar and Mahmood (2010)** reported the ethanolic extract of cauliflower caused reduction in serum LDL-c, while increased HDL-c significantly.

On the contrast side, in serum level of HDL-c it was found significant decreased in (+ve) group which was 29.35^{e} ± 1.41mg/dl, as compared to (-ve) group which being45.50^{a} ± 2.10mg/dl. Due to feeding on diets containing parts of cauliflower leaves the significant increases in HDL-c as compared to (+ve) group was recorded, and the best treatment was found for (5%) group (40.44^{b}±0.10mg/dl) as compared to the C+ve group (29.35^{e} ± 1.41mg/dl.). Meanwhile, for VLDL-c, LDL-c, it was indicated significant decreases as compared to the C+ve group. Maximum improvement in LDL-c, VLDL-c was recorded for (5%) group 48.01^{e}±2.20mg/dl and11.55^{c}±1.10mg/dl, respectively as compared to (C+ve) group (78.05a± 1.20mg/dl and 26.85^{a}± 1.13mg/dl, respectively). It is clear that the (5%) group gave better results in lipoprotein fraction that were near that of the normal group. **Kasahara and Aoki (2001)** reported that HDL-c level increased significantly by taking cabbage for 2 weeks after the start of the diet. Also, **Mona and Sorial (2003)** found that dietary fiber in cabbage lowered the serum total lipid, total cholesterol, triglycerides and LDL-c than for those rats fed on the control diet.

Data tabulated in Table (6) show the effect of different concentrations of cauliflower on kidney functions (serum urea, serum uric acid and serum creatinine) of obese rats .The obtained results indicated that the highest serum urea, uric acid and creatinine levels recorded for positive group The mean values were 71.45^{a} ±3.20 mg/dl , 4.20^{a} ± 0.90 mg/dl and 1.40^{a}+ 0.13mg/dl ,respectively, while negative control group recorded the lowest value with significant differences were 40.00g ± 2.10 mg/dl , 2.30^{b}± 0.20 mg/dl and 1.00^{c}+ 0.21mg/dl, respectively. On the other hand, the highest serum urea , uric acid and

creatinine levels of treated groups (obese groups) recorded for group fed on 1.5% CFLP which were 51.76^{d}± 1.60 mg/dl , 2.87^{b}± 0.60 mg/dl and 1.33^{a}+ 0.01 mg/dl, respectively. Maximum improvement in serum urea, uric acid and creatinine levels was recorded for group fed on5% CFLP powder 44.05^{f}± 0.50mg/dl, 2.40^{b}± 1.10mg/dl and 1.16^{b}+ 0.02 mg/dl, respectively as compared to (C+ve) group 71.45^{a} ±3.20 mg/dl, 4.20^{a} ± 0.90 mg/dl and 1.40^{a}+ 0.13mg/dl, respectively. It is clear that group fed on 5% CFLP powder gave better results in kidney functions that were near that of the normal group. In conclusion the presented study proved that CFL was improved the serum glucose and lipid profile levels (HDL-c, LDL-c, VLDL-c) on obese rats. Such effects could be attributed to its bioactive compounds including epigallocatechin-3- gallate, glucosinolates, flavonoids, terpenes, S-methylcysteine sulfoxide, coumarins, and other minor compounds. Appositive correlates were observed between serumglucose, lipid profile levels and CFLP. From obtaining results, we recommended that adding CFLP to our daily life meals improving health status.

Table (1): Effect of different concentrations of cauliflower leaves as powder on BWG, FI and FER of obese rats

Groups	Parameters		
	Body weight gain (g)	Feed intake (g/day)	Feed efficiency ratio (%)
	G/28 day	G /day	G /28 day
	M±SD	M±SD	M±SD
Group 1: Control (-ve)	22.85±0.40^{c}	19.24 ±0.70^{b}	0.042 ± 0.07^{d}
Group 2: Control (+ve)	21.56 ±0.20^{c}	19.31 ±0.60^{b}	0.040 ± 0.02^{c}
Group 3: obese rats +CFLP (1.5%)	24.34 ±0.50^{b}	21.14 ±1.00^{a}	0.041 ±0.04^{b}
Group 4: obese rats +CFLP (3%)	25.03± 0.60^{b}	19.80 ±0.70^{b}	0.045 ±0.08^{b}
Group 5: obese rats +CFLP (5%)	26.62 ±0.80^{a}	18.67 ±0.50^{b}	0.048 ±0.08^{a}
LSD	1.090	1.15	0.008

Each value represents mean ±SD. value the same column with different superscript letters significantly different ($p \leq 0.05$).

Table (2) Effect of different concentrations of cauliflower leaves as powder on glucose levels of obese rats

Glucose mg/dl	Groups
95.20 ± 0.40^{e}	Group 1: Control (-ve)
187.50 ± 1.10^{a}	Group 2: Control (+ve)
120.30 ± 0.30^{b}	Group 3: obese rats +CFLP (1.5%)
116.00 ± 0.10^{c}	Group 4: obese rats +CFLP (3%)
105.50 ± 0.30^{d}	Group 5: obese rats +CFLP (5%)
3.60	LSD

Each value represents mean ± SD. value the same column with different superscript letters significantly different ($p \leq 0.05$).

Table (3): Effect of different concentrations of cauliflower leaves as powder on liver functions of obese rats

GPT U/L	GOT U/L	ALT U/L	Groups
8.60± 0.40 f	11.00± 1.10 g	90.60±1.20g	Group 1: Control (-ve)
22.80± 0.10 a	57.62± 1.14 a	192.30±0.20 a	Group 2: Control (+ve)
16.03± 0.10 b	28.95± 1.20 d	130.5± 1.10c	Group 3: obese rats +CFLP (1.5%)
13.05± 0.30 d	19.01± 0.40f	108.7± 0.40e	Group 4: obese rats +CFLP (3%)
9.20± 0.20 f	17.00± 0.10 f	97.60± 0.30 f	Group 5: obese rats +CFLP (5%)
1.36	2.27	2.30	LSD

Each value represents mean ± SD. value the same column with different superscript letters significantly different ($p \leq 0.05$).

Table (4): Effect of different concentrations of cauliflower leaves as powder on serum total cholesterol and triglycerides of obese rats

Total cholesterol mg/dl	Triglycerides mg/dl	Groups
95.00± 0.10h	54.91± 0.10 e	Group 1: Control (-ve)
130.00± 1.10a	134.25±1.21 a	Group 2: Control (+ve)
117.00± 0.20c	77.43± 1.11 c	Group 3: obese rats +CFLP (1.5%)
108.00± 0.10f	64.52± 0.20 d	Group 4: obese rats +CFLP (3%)
100.00± 0.40g	57.75± 0.20 e	Group 5: obese rats +CFLP (5%)
1.25	3.64	LSD

Each value represents mean ± SD. value the same column with different superscript letters significantly different ($p \leq 0.05$).

Table (5): Effect of different concentrations of cauliflower leaves as powder on lipid profile of obese rats

Parameters			Groups
VLDL-c mg/dl	LDL-c mg/dl	HDL-C mg/dl	
10.98± 0.32 c	38.52± 0.10f	45.50 ± 2.10a	Group 1: Control (-ve)
26.85± 1.13 a	78.05± 1.20a	29.35± 1.41e	Group 2: Control (+ve)
15.49± 1.40 b	64.34± 1.60 c	37.17±1.13 c	Group 3: obese rats +CFLP (1.5%)
12.90±1.10 c	55.80±2.20 d	39.30±0.20 c	Group 4: obese rats +CFLP (3%)
11.55±1.10c	48.01±2.20e	40.44±0.10 b	Group 5: obese rats +CFLP (5%)
3.63	3.62	3.00	LSD

HDL-c = High density lipoprotein LDL-c =Low density lipoprotein

VLDL-c = Very low density lipoprotein.

Each value represents mean ± SD. value the same column with different superscript letters significantly different ($p \leq 0.05$).

Table (6): Effect of different concentrations of cauliflower leaves as powder on uric acid, urea and creatinine of obese rats

Parameters			Groups
Creatinine mg/dl	Uric acid mg/dl	Urea mg/dl	
1.00+ 0.21 c	2.30± 0.20 b	40.00± 2.10 g	Group 1: Control (-ve)
1.40+ 0.13 a	4.20± 0.90 a	71.45±3.20 a	Group 2: Control (+ve)
1.33+ 0.01 a	2.87± 0.60 b	51.76± 1.60 d	Group 3: obese rats +CFLP (1.5%)
1.25+ 0.14 b	2.50± 0.30 b	48.07± 0.90 e	Group 4: obese rats +CFLP (3%)
1.16+ 0.02 b	2.40± 1.10 b	44.05± 0.50 f	Group 5: obese rats +CFLP (5%)
0.13	1.24	3.22	LSD

Each value represents mean ± SD. value the same column with different superscript letters significantly different ($p \leq 0.05$).

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التأثير المحتمل لمسحوق أوراق القرنبيط على الفئران المصابة بالسمنة

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الملخص العربى

أجريت هذه الدراسة لمعرفة تأثير مسحوق أوراق القرنبيط على الفئران السمينة حيث يزداد معدل الإصابة بالبدانة بمعدل ينذر بالخطر ويصبح مصدر قلق كبير للصحة العامة مع تكاليف اجتماعية لايمكن حسابها. وبالفعل، تسهل السمنة تطور الاضطرابات الأيضية مثل السكري وارتفاع ضغط الدم وأمراض القلب والأوعية الدموية بالإضافة إلى الأمراض المزمنة مثل السكتة الدماغية وهشاشة العظام وتوقف التنفس أثناء النوم وبعض أنواع السرطان وأمراض التهاب الأنسجة. تم تقييم تأثير تركيزات مختلفة من مسحوق ومستخلصات أوراق القرنبيط بنسبة (١,٥ ، ٣ ، ٥٪) على الفئران السمينة بأستخدام خمسة وعشرون من ذكور فئران ألبينو وزن ١٤٠ ± ١٠ جم في هذه الدراسة. وقسمت إلى ٥ مجموعات، كل مجموعة تحتوي على ٦ فئران . وقد تم اصابة الفئران بالسمنة من خلال اتباع نظام غذائي عالي الدهون (٢٠ ٪ من الدهون الحيوانية). تم تقدير وظائف أنزيمات الكبد (GPT،GOT،ALT) ،والكولسترول الكلي، والدهون الثلاثية (VLDL،LDL،HDL) ،الجلوكوز، وظائف الكلى (اليوريا،حمض اليوريك والكرياتينين) ،وأظهرت النتائج أن أوراق القرنبيط احدثت تغيرات هامة في المؤشرات الكيميائية الحيوية. الخلاصة، كانت الفئران السمينة المعالجة بـ ٥٪ من أوراق القرنبيط قد سجلت أفضل نتائج لتحسين صورة دهون الدم و وظائف الكبد والكلى مقارنة بالتركيزات الأخرى.

الكلمات الأفتتاحية : الفئران ، المواد الكيميائية النباتية، مكافحة السمنة، التحاليل الكيميائية الحيوية.