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Biological , studies of some herbal and plants formula on the healthy status of obese female Rats

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Abstract: The effects of Portulaca, Thyums, Nigella seeds, Origanum, Linum, Elettaria, Rosmary, Zingiber, Cinnamoum, Oat, Pomegranate Peel and Vitellaria Paradoxa on biological, biochemical and histological parameters of obese rats were studied. Thirty-Five adult female albino rats of Sprague- Dawely, weighting (190±5g) and age (3 months). All rat fed on a basal diet for 15 days then rats fed on high caloric diet (contained 25% fat) for 15 consecutive days to induce obesity and rats divided into 7 groups, one group fed on basal diet as control group, while the left six groups were given daily plants and herbal formula at the level 10% (50% plant and 50% tested herbs) for 28 days. Results showed that body weight gain was markedly lower especially in the group 7, lowered concentrations of total cholesterol, triglycerides, LDL-c, VLDL-c and decreased level of AST and ALT enzymes and a in case of HDL-c concentrations were significant increased. Histopathological examination showed amelioration of histopathological lesions seen in liver of obese rats in control group while rats when received the herbs and plants formula helped to increase the accumulation of fat in the liver. So, from this study, it could be concluded that intake of formula of tested herbs and plants powder at 10 % can be useful for improving the body weight and the other parameters for obese female rats and histopathological examination showed amelioration of histopathological lesions seen in liver of obese rats when received the herbs and plants formula.

Key words: Female obese rats - formula - biochemical parameters – histopathological structure.

Introduction

Obesity is a common and preventable disease of clinical and public health importance. It is often a major risk factor for the development of several non-communicable diseases, significant disability and premature death. There is presently a global epidemic of obesity in all age groups and in both -developed and developing countries. The increasing prevalence of obesity places a large burden on health care use and costs. Weight loss is associated with significant health and economic benefits. Effective weight loss strategies include dietary therapy, physical activity and lifestyle modification. Drug therapy is reserved for obese or overweight patients who have concomitant obesity-related risk factors or diseases. Population-wide prevention programmers have a greater potential of stemming the obesity epidemic and being more cost-effective than clinic-based weight-loss programmers ***(Ofei et al., 2005)***.

Cinnamon (*Cinnamomum verum*) has been used as a spice and as traditional herbal medicine for centuries. The available in vitro and animal in vivo evidence suggests that cinnamon has anti-inflammatory, antimicrobial, antioxidant, antitumor, cardiovascular, cholesterol-lowering, and immunomodulatory effects. In vitro studies have demonstrated that cinnamon may act as an insulin mimetic, to potentiate insulin activity or to stimulate cellular glucose metabolism. Furthermore, animal studies have demonstrated strong hypoglycemic properties. ***(Gruenwald et al., 2010)***.

Cardamom (*Elettaria cardamomum*), a member of the family Zingiberaceae, is well known for its traditional pharmaceutical and food uses. This spice is especially famous for its seed pods with characteristic aroma and taste. Due to the presence of a wide array of bioactive and volatile components with multiple activities, such as antioxidant, antihypertensive, gastroprotective, and antibacterial, this spice has significant potential for the development of value-added novel and processed functional foods and nutraceuticals ***(Farooq et al., 2016)***.

Flaxseed flour has been described as an excellent alpha-linolenic acid source. This study showed the effects of flaxseed flour on body adiposity and bone health in rats fed a flaxseed flour diet composition by dual-energy X-ray absorptiometry, serum hormonal profile, intra-abdominal fat mass, obesity and bone fragility (***Ribeiro et al., 2016).***

Nigella sativa (*N. sativa L*.) is a traditional herbal medicine that has been used for centuries to treat rheumatoid arthritis, diabetes, asthma, and other metabolic disorders. Recently, anti-obesity characteristics of N. sativa have been indicated which belongs to the Ranunculacea family, is an annual herb with many pharmacological properties ***(Nazli et al., 2018).***

Oat has been recognized as a healthful and nutritious cereal containing high concentration of soluble fiber and dense nutrients. Irrespective of nutritionally rich cereal, it has physiological benefits like positive effect on reducing hyperglycaemia, hyperinsulinaemia, hypercholesterolemia and several other benefits are discussed in this review. The main part of the physiological effects of oat soluble fiber is effect on the glycaemic, insulin, and cholesterol responses to foods ***(Sajad et al., 2014).***

Oregano is an herb that's commonly used in cooking. Leaves has a long history of medicinal uses. Over the centuries, it has been used to treat a variety of ailments, including snake and spider bites, respiratory troubles, and menstruation problems. Today, it is marketed for the treatment of a long list of health conditions. There are many claims about the uses of oregano oil. But there is little evidence to suggest that it is effective for any condition. For example, oregano leaves is often marketed for the treatment of intestinal parasites and the symptoms that go with it, such as bloating, cramping, constipation, diarrhea and can kill some food-borne germs ***(Sabino et al., 2018)***.

Pomegranate Peel is a functional food of great interest, due to its multiple beneficial effects on human health. This fruit is rich in anthocyanins and ellagitannins, which exert a protective role towards degenerative diseases. from different parts of the fruit, to obtain extracts enriched in selected polyphenols while retaining biological activity. Antioxidative and antiproliferative assays demonstrated that the antioxidant capability is directly related to the phenolic content, whereas the antiproliferative activity is to be mainly attributed to ellagic acid ***(Alessandra et al., 2016)***.

V. paradoxa, commonly known as shea butter tree, belongs to Sapotaceae family and is largely leaves extract, the antibacterial activity of molecules isolated from its root bark have distributed to the semi-arid zone. V. paradoxa are used for the treatment of skin diseases,

rheumatism, typhoid fever and microfilaria (in association with other medicinal plants). Keeping in view the traditional uses and previous work done in vitro on this plant ***(Siméon et al., 2017)***.

Portulaca oleracea L., belonging to the *Portulacaceae* family. It is eaten extensively as a potherb and added in soups and salads, and has been used as a folk medicine in many countries. Diverse compounds have been isolated from *Portulaca oleracea*, such as flavonoids, alkaloids, polysaccharides, fatty acids, terpenoids, sterols, proteins vitamins and minerals ***(Zhou et al., 2015)***.

Rosemary is a fragrant evergreen herb is a member of the mint family Lamiaceae, along with many other herbs, such as oregano, thyme, basil, and lavender. The herb not only tastes good in culinary dishes, such as rosemary chicken and lamb, but it is also a good source of iron, calcium, and vitamin B-6 . used to help alleviate muscle pain, improve memory, boost the immune and circulatory system, and promote hair growth ***(Joseph and Nordqvist;2017).***

Thymol is a naturally occurring phenol monoterpene derivative of cymene and isomer of carvacrol. It is a medicinal plant with several therapeutic properties. This plant, native to Mediterranean regions, is functional possibilities in pharmacy, food, and cosmetic industry. The interest in the formulation of pharmaceuticals, nutraceuticals, and cosmeceuticals based on thymol is evaluate the potential therapeutic uses of this compound for the treatment of disorders affecting the respiratory, nervous, and cardiovascular systems ***(Salehi et al., 2018)***.

Zingiber officinale (*Zingiberaceae*) commonly known as ginger, a well known food spice, has been used traditionally in a wide variety of ailments. The major chemical constituents of ginger rhizome are essential volatile oils and nonvolatile pungent compounds. The volatile oil components mainly consist of various terpenoids. The nonvolatile compounds include the gingerols, shogaols, paradols and zingerone. Among them, the gingerols and shogaols were identified as the major gingerderived bioactive constituents that are found in fresh and dried ginger, respectively ***(Afzal et al., 2001*)**. *Z. officinale* has been shown to reduce plasma lipids in cholesterolfed hyperlipidaemic rabbits and in streptozotocin- induced diabetic rats and was also found to inhibit LDL oxidation in atherosclerotic mice in vivo effects of the ethanolic extract of Z. officinale for its glucose and lipid regulating activities in highfat

dietfed rat model of metabolic syndrome and treatment of obesity***(Bergman et al., 2006).***

Materials And Methods

Portulaca, Thyums, Nigella, Origanum, Linum, Elettaria, Rosmary, Zingiber, Cinnamoum, Oat and Pomegranate Peel were obtained from a local market from Quwiesna, Menoufia governator, Egypt. All chemicals and diagnostic kits were purchased from El-Gomhoria Co., Cairo, Egypt.

This study was carried out on thirty-five adult female Sprague Dawley albino rats weighing 155±10 g body weight. The rats were obtained from Laboratory Animal Colony, Helwan, Egypt. Before their use in the experiment, the rats were kept for one week for acclimatization to the laboratory conditions. They were fed on basal diet and provided with water and food ad-libitum.

Preparation of experimental diets and induction of obesity:

Basal diet was prepared according to which provide about 9.5% of its energy from fat (40 g corn oil/kg diet). In order to induce obesity, High Fat Diet (HFD) was used in which at least45% of its energy comes from fat as reported by Young and Kim (2016). Basal diet was modified to contain 40 g corn oil + 200 g ghee/kg diet and the amount of add saturated fat was substituted from the amount of corn starch***(AIN ,1993).***

Experimental procedure:

Rats were divided into seven groups consisting of five rats each. One group was fed on the basal diet and kept as a negative control group, while the other group fed on high fat diet as positive control group. The other groups fed on basal diet with 10% of tested mixtures.

- Group 3: Obese rats fed on basal diet with 10% of this formula contained (50% Pomegranate peel powder + 25% Portulaca oleracea powder + 25% Thymus vulgaris powder).
- Group 4: Obese rats fed on basal diet with 10%of this formula contained (50% Oat powder + 25% Linum (flax) powder + 25% *Nigella sativa* powder).
- Group 5 Obese rats fed on basal diet with 10% of this formula contained (50% Pomegranate peel powder +25% Origanum majorana powder + 25% Elettaria cardamomum pwoder).

- Group 6: Obese rats fed on basal diet with 10% of this formula contained (50% Oat powder +25% Rosemary powder + 25% Zingiber officinale powder).
- Group 7: Obese rats fed on basal diet with 10% of this formula contained (Pomegranate peel + Rosmary + Zingiber + Oat Elettaria + Origanum + Linum + Portulaca + Thymus + Vitellaria + Cnniamomum) as a powder.

During the experiment period, the feed intake and body weight were weighed daily and twice a week, respectively. Body Weight Gain (BWG) and Feed Efficiency Ratio (FER) were calculated at the end of the experimental period according to the following equations:

BWG (g) = final weight (g) - initial weight (g)

FER = weight gain (g)/food intake (g)

Collection of blood samples and organs: At the end of the experimental period, rats were sacrificed following a12 h fast. The rats were lightly anaesthetized by ether and about 7 ml of blood was withdrawn from the hepatic portal vein into dry centrifuge plastic tubes. Blood samples were centrifuged for 20 min at 3000 rpm to separate the serum samples which were kept in tubes at -20°C till biochemical analysis. In addition, livers of the sacrificed rats were removed for histopathological study according to ***(Chapman et al., 1959).***

Biochemical analysis:

Serum total cholesterol was calorimetrically determined according to *(AIN;* and triglyceride was determined calorimetrically according to ***(Dikeman et al2006).*** High Density Lipoprotein cholesterol (HDL-c) was determined calorimetrically according to ***(Kikuchi et al; 1998*)*.*** Low Density Lipoprotein cholesterol (LDL-c) and Very Low-Density Lipoprotein cholesterol (VLDL-c) were calculated mathematically according to*(**Lee and Nieman ,1996**).*

LDL-c = TC-[HDL-c + (TG/5)] VLDL-c = Triglycerides/5.

The activity of Aspartate Aminotransferases (AST) and Alanine Aminotransferases (ALT) enzymes were assigned by the method of ***(Yound ,1975).*** Urea was determinated according to the enzymatic method of ***(Proctor and Crouch, 2013)***. Creatinine was determinated according to kinetic method of ***(Henry, 1974).*** The intensity of this red color formed is proportional to the billirubin concentration in the sample ***(Schultz, 2008).***

Histopathological study:

Livers of the scarified rats were dissected, removed, washed with normal saline and put in 10% formalin solution. The fixed specimens were then trimmed, washed and dehydrated in ascending grades of

alcohol. The tissue specimens were cleared in xylene, embedded in paraffin, sectioned at 4-6 microns thickness, stained with Hematoxylen and Eosin (H and E) and then studied under an electronic microscope according to ***(Bancroft et al;1996).***

Statistical analysis:

Results are expressed as mean values with their standard deviation of the mean. Statistical differences between groups were evaluated using one-way ANOVA followed by Duncan post hoc test using SPSS version 11.0 for Windows (SPSS, Chicago, IL, USA). Differences were considered significant at ($p<0.05$) according to ***(SAS ,2002).***

Results

1- Effect of different mixtures from some plants and herbs on feed intake (FI), body weight gain (BWG) and feed efficiency ratio (FER) of obese rats.

From table (4) it could be noticed that feed intake was higher in the groups which fed on mixture 6 than the other tested mixtures. This mixture was significantly higher than negative control and there is no significant change when compared to normal diet. Body weight gain was markedly higher in the positive control group. There is no significant changes between G4 and negative control group . The lowest one in body weight gain was the group (7) which fed on mixture (5). For feed efficiency ratio (FER) was significantly lowered in the group (7) and the highest one was positive control group . There is no significant between groups 2 and 4 also, between groups 3 and 5 .

Table (1): Effect of different mixtures from some plants and herbs on feed intake (FI), body weight gain (BWG) and feed efficiency ratio (FER) of obese rats.

Animal groups / Parameters	G1 positive control	G2 Negative control	G3 Mixture (1)	G4 Mixture (2)	G5 Mixture (3)	G6 Mixture (4)	G7 Mixture (5)
Feed intake g/day	$13.9^{a}\pm0.18$	$12.58^{b}\pm0.38$	$12.4^{b}\pm1.35$	$11.2^{c}\pm0.03$	$12.73^{b}\pm1.01$	$13.08^{a}\pm0.75$	$10.2^{c}\pm0.03$
BWG g/28days	$65.27^{a}\pm6.01$	$40.20^{c}\pm0.56$	$50.12^{b}\pm1.46$	$40.28^{c}\pm2.19$	$50.17^{b}\pm4.42$	$48.58^{b}\pm2.32$	$26.28^{d}\pm2.19$
FER	$0.16^{a}\pm0.01$	$0.12^{d}\pm0.01$	$0.14^{b}\pm0.06$	$0.12^{d}\pm0.12$	$0.14^{b}\pm0.06$	$0.13^{c}\pm0.01$	$0.09^{e}\pm0.12$

Values are mean±SD. Values in the same column sharing the same superscript letters are not statistically significantly different at ($p<0.05$)

2- Effect of different mixtures from some plants and herbs on lipid profile of obese rats.

Administration of the mixture (5) caused significant decreases in serum levels of total cholesterol, triglycerides, LDL-c and VLDL-c compared to both control group (Table 2). Mixture (4) was the low effect as compared to the other mixtures. Serum HDL-c levels increased with adding different mixtures when compared to positive control group and the highest one was mixture (5).

Table (2): Effect of different mixtures from some plants and herbs on lipid profile of obese rats.

Serum lipids	G1 Positive control	G2 Negative control	G3 Mixture (1)	G4 Mixture (2)	G5 Mixture (3)	G6 Mixture (4)	G7 Mixture (5)
Total cholesterol	198.43^{a}±5.09	155.93^{d}±7.31	175.47^{c}±10.13	155.57^{d}±13.21	172.36^{c}±8.12	188.03^{b}±6.05	105.43^{e}±6.31
Triglycerides	186.48^{a}±0.13	113.96^{d}±0.56	161.4^{c}±3.01	119.36^{d}±1.02	166.68^{c}±2.63	176.8^{b}10.03±	97.96^{e}±7.56
HDL-cholesterol	33.90^{e}±4.12	45.94^{b}±6.66	43.89^{c}±4.04	46.90^{b}±5.97	43.92^{c}±6.09	40.47^{d}±8.15	48.94^{a}±4.55
LDL-cholesterol	127.24^{a}±1.17	87.2^{d}±0.91	99.3^{c}±0.74	84.8^{d}±0.24	95.1^{c}±0.91	112.2^{b}±4.34	36.9^{e}±0.91
VLDL-cholesterol	37.29^{a}±5.12	22.79^{c}±0.91	32.28^{b}±8.04	23.87^{c}±0.24	33.34^{b}±0.91	35.36^{a}±4.34	19.59^{d}±0.91

Values are mean±SD. Values in the same column sharing the same superscript letters are not statistically significantly different at ($p<0.05$)

3- Effect of different mixtures from some plants and herbs on liver functions of obese rats.

Data in table (3) revealed that positive control group had the highest value of liver functions (ALT and AST) whereas the negative control recorded the lowest levels which were in normal levels. The best mixture were 2 and 3 which nearly to the negative control group. There is no significant among G3, 4 and 5 for AST while there is no significant among 3, 4, 5 and 6 for ALT.

Table (3): Effect of different mixtures from some plants and herbs on liver functions of obese rats.

Parameters	G1 Positive control	G2 Negative control	G3 Mixture (1)	G4 Mixture (2)	G5 Mixture (3)	G6 Mixture (4)	G7 Mixture (5)
AST(U/L)	65.1^{a}±4.56	32.5^{e}±4.21	40.2^{d}±6.11	35.1^{d}±7.50	37.7^{d}±5.15	45.1^{c}±3.56	49.8^{b}±4.07
ALT(U/L)	59.7^{a}±6.52	37.4^{d}±4.5	43.9^{c}±5.41	44.4^{c}±7.01	40.7^{c}±8.25	42.7^{c}±3.52	48.8^{b}±5.91

Values are mean±SD. Values in the same column sharing the same superscript letters are not statistically significantly different at ($p<0.05$)

4- Effect of different mixtures from some plants and herbs on kidney functions of obese rats.

From Table (4) it could be noticed that administration different mixtures of plants and herbs had different effective on kidney functions. For creatinine, group (7) was significantly higher the other groups. There is no significant between positive control group and group (3) and also the same statically result among groups 4, 5, 6 and the negative control group.

It is clear that there is no significant changes between groups 3, 4, 5, 6 and both control groups while group 7 was significant with the other groups which being the highest one in billrubin concentration.

Data in the same table showed the effect of different mixtures from herbs and plants on urea levels. There is no significant changes between groups 3 and positive control group whereas there were significant changes between group 7 and the others group which was the highest value for urea.

Table (4): Effect of different mixtures from some plants and herbs on kidney functions of obese rats.

Parameters	G1 Positive control	G2 Negative control	G3 Mixture (1)	G4 Mixture (2)	G5 Mixture (3)	G6 Mixture (4)	G7 Mixture (5)
Creatinine mg/100ml	0.57^{b}±0.011	0.46^{c}±0.212	0.52^{b}±0.071	0.40^{c}±0.042	0.41^{c}±0.213	0.43^{c}±0.141	1.67^{a}±0.421
Billrubin mg/100ml	0.35^{b}±0.005	0.35^{b}±0.221	0.39^{b}±0.08	0.36^{b}±0.211	0.35^{b}±0.151	0.36^{b}±0.021	0.55^{a}±0.11
Urea Nitrogen mg/100ml	32.15^{b}±5.03	28.98^{c}±3.881	32.76^{b}±4.35	26.45^{c}±3.22	25.2^{c}±2.105	26.18^{c}±1.221	51.21^{a}±1.71

Values are mean±SD. Values in the same column sharing the same superscript letters are not statistically significantly different at ($p<0.05$)

Histopathological examination of liver:

Sections in the liver tissue showed preserved lobular architecture. The portal tracts consisted of hepatic artery, portal vein and bile ducts. The central veins showed mild dilatation with accumulation of R.B.Cs(photo 1),. The hepatocytes in photo (2) were normal in arrangement and cytology. (H & E., stain, × 400). However, examined sections from group 3 showed intermuscular oedema, congestion of myocardial blood vessels (photo. 3). Some sections from group 4 revealed congestion of myocardial blood vessels (photo. 4), whereas, other sections from group 5, 6 and 7 showed no histopathological changes (photo. 5, 6 and 7).

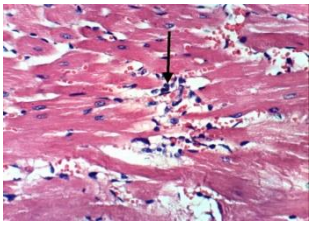

Photo (1): Liver of rat from group 1

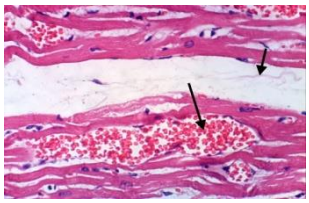

Photo (2): Liver of rat from group 2

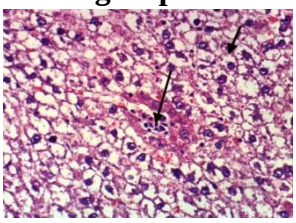

Photo (3): Liver of rat from group 3

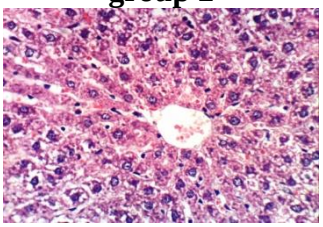

Photo (4): Liver of rat from group 4

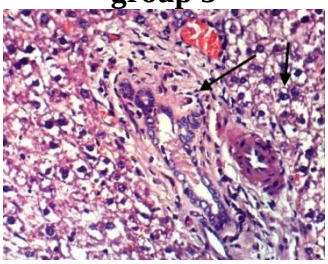

Photo (5): Liver of rat from group 5

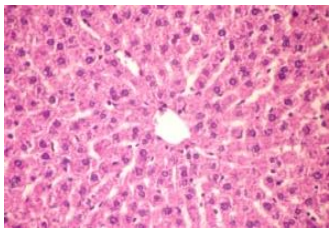

Photo (6): Liver of rat from group 6

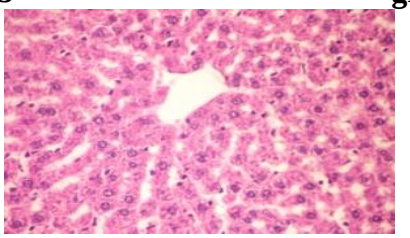

Photo (7): Liver of rat from group 7

Discussion

Several studies have showed that each of the active components isolated from C. cassia named 2-methoxycinnamaldehyde (2-MCA) decreases the expression of vascular cell adhesion molecule-1 (VCAM-activated endothelial cells, suggesting that ischemia/reperfusion (I/R) injury is ameliorated due to the induction of hemeoxygenase- (HO-) .A recent study reported the potential effects of two compounds, cinnamic aldehyde and cinnamic acid, isolated from C. cassia against myocardial ischemia, indicating that cinnamon also has the potential to be used to treat cardiovascular diseases ***(Hwa et al., 2012).***

The administration of cinnamon to mice positively affected the lipid profile, whereby the high density lipoprotein (HDL) cholesterol levels decreased, and plasma triglycerides were reduced Another study by found a reduction in the total cholesterol, triglycerides, and low-density lipoproteins in rats administered Cinnamomum cassia powder (15%) for 35 days. Additionally, cinnamon oils reduced the cholesterol levels in broiler chickens . reported that the administration of cinnamon at 1, 3, and 6 g doses per day caused a reduction in serum glucose,triglyceride, total cholesterol, and LDL cholesterol levels in humans ***(Rahman et al.,2013) .***

Metabolic syndrome is a cluster of cardio-metabolic conditions that include obesity, insulin resistance, atherogenic dyslipidemia, and high blood pressure (BP) and is a major contributor to the development of diabetes .A RCT done on 60 patients with metabolic syndrome showed that NS oil (5 mL/day) used in combination with atorvastatin and metformin could decrease fasting blood sugar (FBS), LDL, and TC significantly after six weeks of use, but had no significant effect on body mass index (BMI) or waist circumference (WC) ***(Kim et al.,2015).***

The present study focuses on the nutritional, functional and anti-infective properties of pomegranate (Punica granatum L.) peel and peel extract and on their applications as food additives, functional food ingredients or biologically active components in nutraceutical preparations. Due to their well-known ethnomedical relevance and chemical features, the biomolecules available in PoP and PoPx have been proposed, for instance, as substitutes of synthetic food additives, as nutraceuticals and chemopreventive agents. However, because of their

astringency and anti-nutritional properties, the pomgrant peel is not yet considered as ingredients of choice in food systems. Indeed, considering the prospects related to both their health promoting activity and chemical features, the nutritional and nutraceutical potential of seems to be still underestimated. The present review meticulously covers the wide range of actual and possible applications (food preservatives, stabilizers, supplements, prebiotics and quality enhancers) of components in various food products. Given the overall properties of, further investigations in toxicological and sensory aspects of should be encouraged to fully exploit the health promoting and technical/economic potential of these waste materials as food supplements ***(Saeed et al., 2015)***.

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دراسات بيولوجية وكيميائية وتكنولوجية لبعض التوليفات العشبيه والنباتية على الحالة الصحية لاناث الفئران المصابة بالسمنة

شريف صبري رجب[1]، نهاد رشاد الطحان[2]، دعاء السيد عبدالرحمن المقدم
استاذ التغذيه وعلوم الاطعمه-وعميد كليه الاقتصاد المنزلى جامعه المنوفيه[1]، استاذ التغذيه وعلوم الاطعمه-كليه الاقتصاد المنزلى جامعه المنوفيه[2]

المستخلص العربى

تأثير بذور الرجلة ، الزعتر ، بذور الحبة ، البردقوش ، بذور الكتان ، الهيل ، الروزمارى، زنجبيل ، القرفة ، الشوفان ، قشر الرمان و بذور الشيا على الحالة البيولوجية والكيميائية الهستوبا ثولوجى للفئران البدناء تمت التجربة على 35 من الفئران البالغة الإناث البينو من الاسبرجس الدولى، الترجيح (190 ± 5 جرام) والعمر (3 أشهر). كل الفئران تتغذي علي الغذاءالاساسى لمده 15 يوما ثم تتغذي الفئران علي نظام غذائي عالي السعرات الحرارية (الواردة 25 ٪ من الدهون) لمده 15 يوما متتالية للحث علي السمنة والجرذان مقسمه إلى 7 مجموعات ، واحده تغذي مجموعه علي النظام الغذائي الاساسى كمجموعه ضابطة ، في حين تم اضافة الاعشاب والنباتات علي مستوي 10 ٪ (50 ٪ النبات و 50 ٪ اختبار الأعشاب) لمده 28 يوما. وأظهرت النتائج ان زيادة وزن الجسم كان اقل بشكل ملحوظ وخاصه في المجموعة 7، خفضت تركيزات الكولسترول الكلي، الدهون الثلاثية، LDL-c, VLDL-c وانخفاض مستوي الانزيمات AST و ALT و في حاله تركيزات HDL-c وكانت زيادة كبيره . واظهر الفحص التشريحى تحسن الحالة المرضية التي شوهدت في كبد الفئران البدناء في مجموعه الضابطة بينما الفئران التى تغذت على الأعشاب والنباتات ساعدت علي زيادة تراكم الدهون في الكبد. لذلك ، من هذه الدراسة ، يمكن ان يستنتج ان تناول هذه الأعشاب ومسحوق النباتات في تركيز 10 ٪ يمكن ان تكون مفيده لتحسين وزن الجسم وغيرها من فئران الإناث البدناء والفحص التشريحى وأظهرت تحسن الحالة المرضية التي شوهدت في الكبد من الفئران البدناء عندما تلقت الأعشاب والنباتات الصيغة.

الكلمات الرئيسية:

الإناث البدناء الفئران- الاعشاب والنباتات - الاختبارات البيوكيميائية - الهستوباثولجى.