# *Anti-Diabetic Effects and Lipid profile for Abelmoschus esculentus (Okra) and Corchorus olitorius (Jew's mallow) Caused by Streptozotocin in Rats*

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# Anti-Diabetic Effects and Lipid profile for Abelmoschus esculentus (Okra) and Corchorus olitorius (Jew's mallow) Caused by Streptozotocin in Rats

*Soheir Fawzy Mohamed**

*Abstract*

The present study was directed to use Abelmoschus esculentus (Okra) and Corchorus olitorius (Jew's mallow) as a source of dietary fiber in order to study the biological effect of such materials which were used in the experimental diets for streptozotocin-induced diabetic rats . Rats were made diabetic by injecting streptozotocin into leg muscle at dose of 50 mg/kg body weight. Diabetic rats were (28 rats) divided into 4 groups (7 rats each group) .The first group was negative control group (NC), the second group was diabetic positive control (PC), the third one was 10 % Corchorus olitorius (Jew's mallow) group (COJ), and the fourth was 10 %Abelmoschus esculentus (Okra) group (AEO) .Blood samples were collected weekly for glucose monitoring while blood lipids were measured at the end of the experiment. The study was assigned for 4 weeks. The results revealed that, the treatment with Abelmoschus esculentus (Okra) and Corchorus olitorius (Jew's mallow) showed significantly decreased of serum glucose level of all the experimental groups. Meanwhile, no significant differences were recorded among blood indices of these groups, i.e. serum total cholesterol, total triglycerides, HDL-c, LDL-c, VLDL-c, at zero time. But after induced hyperglycemia, there were noticeable decrease in TC(total cholesterol level) ,TG , and LDL, while increase HDL. Maximum significant significant decreased was seen in rats fed on Abelmoschus esculentus followed by rats fed on Corchorus olitorius

**Recommendation:** The study recommends eating Abelmoschus esculentus (Okra) and Corchorus olitorius (Jew's mallow)or adding to the

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foods that have a positive effect to treat Diabetes mellitus. Because of its high in insoluble DF might significantly reduce diabetes risk.

**Key words:** Diabetic , Lipid profile Abelmoschus esculentus (Okra) , Corchorus olitorius (Jew's mallow) Streptozotocin ,rats

## *Introduction*

Diabetes mellitus is one of the most sombre chronic diseases and widespread, affecting the health of millions of persons worldwide (Sharma et al. ,2018)

Diabetes mellitus is a status described by an elevation of the level of glucose in the blood. It is a heterogeneous metabolic disorder characterised by common feature of chronic hyperglycaemia with disturbance of carbohydrate, fat and protein metabolism (Sharma et al. ,2018)

Diabetes is a chronic disease that occurs either when the body cannot effectively use the insulin it produces or when the pancreas does not produce enough insulin. Hyperglycemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body’s systems, especially the nerves and blood vessels.( Skalli et al .,2019)

Diabetes is the common leading cause of death in the world and can be considered as the major cause of kidney failure, heart attack, blindness and stroke. There are different types of diabetes but all of them are associated with hyperglycemia. Type 1 diabetes is called insulin-dependent diabetes because it occurs due to the problem in the secretion of insulin, the hormone that decreases blood glucose level by increasing its absorption by the body cells. On the other hand, type 2 diabetes is associated with inability of the body to use insulin effectively and it is usually called insulin-resistant diabetes. This form of diabetes is more prevalent and it is associated with the most complicated problem (WHO, 2018).

Diabetes is characterized by hyperglycemia caused by insulin defects secretion, insulin action, or both. It is a group of metabolic diseases and leads to long-term dysfunction, various failures, especially the eyes, kidneys, nerves, heart and blood vessels. (American Diabetes Association , 2013)

The acute life-threatening effects of uncontrolled diabetes are hyperglycemia with ketone acidosis or non-ketone hyperglycemia syndrome. Symptoms of hyperglycemia include marked polyuria, polydipsia, weight loss, sometimes with polyphagia, and blurred vision. It may also be accompanied by poor growth and exposure to some injuries (American Diabetes Association, 2013)

In humans with diabetes mellitus, both in type 1 and type 2, there are a number of different role as well as structural alterations in insulin producing β-cells.( Folli, et al , 2018)

Dietary fiber (DF) comprises highly complex substances that can be defined as any nondigestible carbohydrate and lignin not degraded in the upper gut. Major sources of DF are whole-grain cereals, fruit, vegetables, and legumes, which typically contain diverse types of DF. (Weickert and Pfeiffer 2018)

Many studies clearly indicate that diets high in insoluble cereal DF and whole grains might significantly reduce diabetes risk. (Weickert and Pfeiffer 2018)

(Corchorus olitorius L.) is one of the traditional plants that

have great potential on the medicinal purpose. Tossa jute leaves are

used in domestic preparation for their nutritive values. They are also

employed as a medicine thanks to their diuretic, antipyretic, analgesic, antimicrobial activities, and their interesting content in antitumor (Farah et al., 2006) and phenolic antioxidative compounds (Azuma et al., 1999).

Corchorus olitorius (mentioned as Molkhyia or Jew's Mallow) is an Afro-Arabian annual herb rich in flavonoids. It is considered a source of carotenoids, vitamin C, vitamin E, fatty acids and minerals. It is supposed as a folk remedy for aches and pains, managing diabetes, hypertension (Oboh et al., 2012)

Abelmoschus esculentus was reported as plants used for diabetes . ( Skalli et al .,2019)

The Okra (Abelmoschus esculentus L.) is commonly known as Lady's Finger worldwide. Other names of Okra are as follows: dharos, kacang bendi, qiu kui, okura, okro, quiabos, ochro, quiabo, okoro, gumbo, quimgombo, bamieh, bamya, quingumbo, bamia, bendi, gombo, bhindi, kopi arab, and lai long ma (Jain et al., 2012).

Abelmoschus esculentus (Okra) can be considered as a valuable vegetable due to its beneficial phytochemicals. All the included studies confirmed the anti-diabetic effect of okra on type II diabetic rats. Okra fruit is rich in fibre and other medicinal phytochemicals hence could be a potential source for the development of antidiabetic nutraceutical. Subsequent to our earlier reports on the antidiabetic effects of various parts of exmaradi okra fruit ( Muhammad et al.,2018)

Abelmoschus esculentus (AE), a commonly consumed vegetable, is well-known for its antihyperglycemic effects. ( Huang et al., 2017)

***Martial and Methods***

***Experimental design and diet planning:***

A total number of 28 adults Albino male normal rats, weighing 140-170 g, obtained from Agriculture research institute.

Diets in all experiment groups contain 14% protein, 4% salt mixture, 1% vitamin mixture and 10%fat (Reeves et al., 1993).

Diets used varied in sources of protein and also in % protein, fiber constituent. Prepared diets composition was calculated from the analyses of ingredient.

***Induction of diabetes:***

After two weeks period of adaptation rats injected with streptozotocin to induce hyperglycemic and rats were made diabetic by injecting streptozotocin into leg muscle at dose of 50 mg/kg BW. The animals showing blood glucose level more than 200 mg/dl) were considered diabetic (Szkudelski, 2001)

***Preparation of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ):***

(AEO) and (COJ) were purchased from the local market in Giza, Egypt. Then they washed with clean water. The fresh okra was prepared, where it was stirred and the uncooked plums were removed,

then boiled /10 minutes then cooled with cold water, then sliced into small pieces and air-dried at 45 °C . And it was grounded by an electric blender and was packed in low-density polyethylene bags until it was used for the required analysis.

The fresh (Jew's mallow) COJ leaves were washed and air-dried at 45 °C. And it was grounded by an electric blender and was packed in low-density polyethylene bags until it was used for the required analysis.

***Animal studies***

Rats were fed on basal diet for two weeks as an adaption period. Rats were housed under controlled light (12: 12 light dark),

Temperature were maintained at 25 °C and humidity at 60% respectively with unlimited access to food and water.

Animals were divided randomly into four equal groups, (7 for each group) Groups 1 as negative control (NC) and three diabetic rats groups which injecting streptozotocin into leg muscle at dose of 50 mg/kg BW and reclassified into control positive (+ve) ( G2 ), 10% of Corchorus olitorius (Jew's mallow) ( G3 ) and the last one was 10% of Abelmoschus esculentus (Okra) group (AEO) ( G4 ) . Blood samples were collected weekly for glucose monitoring while blood lipids were measured at the end of the experiment.

During the experimental period (28 days), body weight was recorded every week. Biological evaluations of the different diets were carried out by determination of body weight gain (BWG), Food intake (FI) and feed efficiency ratio (FER) calculated according to Chapman et al., 1959, using the following formulas:

Body weight gain (BWG) (g) = Final weight - Initial weight

Feed efficiency ratio (FER) = Body weight gain ÷ Food intake.

***Biochemical assay:***

Blood samples were obtained at intervals as mentioned before.

Before blood sampling, rats were fasted for 16 hours. All blood samples were collected by capillary tube from vein pleascus in the eye and centrifuged at 3000 r.p.m. to obtain serum that was stored at -20oC until assayed for the determination of blood glucose, triglyceride, total cholesterol and high density lipoprotein (HDL).

Blood serum sample were analyzed using an enzymically spectrophotometric method as described by Rifai and King (1986).

The absorbance of sample and the standard were measured at 500 nm against the blank using standard solution.

***Lipid profile:***

Total cholesterol, triglycerides (TG), and high density lipoprotein-cholesterol (HDL-c) were determined as described by Thomas (1992), Fossati and Principle (1982) and Albers et al. (1983) respectively. Low density lipoprotein-cholesterol (LDL-c) and Very low density lipoprotein-cholesterol (VLDL-c) were calculated as mentioned by Lee and Nieman (1996). Low density lipoprotein cholesterol can be calculated as follows:

LDL-c = Total cholesterol – (HDL-c + VLDL-c).

VLDL-c = Triglycerides/5

***Chemical Analysis***

Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ) were analyzed chemically for moisture, protein, fiber, ash, total sugars and oil (Fresh weight) contents were determined according to the methods described by (AOAC 2015).

***Statistical analysis:***

Statistical analysis was carried out using one way analysis of variance (ANOVA) test followed by Duncan test through the program of statistical packages for the social science (SPSS) version 16. Results were expressed as mean± SD. The differences among means at p ≤ 0.05 are considered significant (Snedecor and Cochran, 1989).

***Result & discussion***

The chemical composition of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ) illustrated in table (1)

**Table (1): The chemical composition of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ) on dry weight basis**

| | | Moisture | Protein | Ash | Fiber | oil | carbohydrate* |
|---|---|---|---|---|---|---|---|
| | (Jew's mallow) | 87.40<br>±10.01 | 24.96<br>±7.99 | 11.99<br>±2.85 | 7.66<br>±2.10 | 5.95<br>±0.25 | 49.44<br>±12.9 |
| | (Okra) | 91.10<br>±5.10 | 16.60<br>±3.29 | 7.20<br>±0.17 | 8.95<br>±1.55 | 1.23<br>±0.23 | 66.02<br>±3.23 |

Each value is mean ± SD of triplicates

*Carbohydrate was calculated by difference

Data in Table (1) displayed that the Jew's mallow had high contents of protein, ash and oil. So, it had high nutritional value. While, Okra had high contents of fiber, Moisture and Carbohydrate. The chemical composition of Jew's mallow was in harmony with those of Abd El Rahman (2018). Who found that the molokiha leaves powder had high contents of protein and ash which were 24.99, 14.2 respectively. Also, with Morsy *et al.,* (2015). Many studies on the chemical composition of dried Jew's mallow leaves reported that, it contained 22.96 - 35.22% protein, 8.50 – 12.30% crude fiber and 7.18 – 12.00% ash. (Bahlol et al.,2000 , Handoussa et al, (2013) . our result are in agreement with (Van Jaarsveld et al., 2014) who mentioned that the energy and fat content of Jew’s mallow was low and the leaves contained between 2.2 and 10.8 g fiber per 100 g raw edible portion. While, Moisture was 79.6, On the other hand, these results weren't in agreement with those of (Idirs et al., 2009) who mentioned that the proximate and mineral composition of Corchorus olitorius leaves contained 18.38±0.32% ash, 12.54±0.10% crude protein, 11.99±0.50% crude lipid and 19.56±0.18% available carbohydrate. The results of difference in the chemical composition might be due to variation of kinds and seasons.

In this respect , Sami et al., ( 2019 )found a highly variation was observed in chemical composition among different okra pods under his investigation, their results shows high mean moisture contents of 84.67% - 87.65% , M pod has the highest protein content (3.41 g/100 g),the fat content showed a non significantly variation among okra pods, it ranged from 4.34 g/100 g for M pod to 4.52 g/100g for S pod, ash content were significantly among different okra pods, being 10.31 g/100 g (in K pod and 12.20 g/100 g in M pod.

Also, the results were in agreement with those of Adenipekun and Oyetunji., (2010) who mentioned that the fruit of A. esculentus contained the highest amount of crude protein, crude fibre and dry matter,

These results were in line with those of (Sami et al., 2019) who reported that Okra has high crude protein content, low fat, dietary minerals, fiber and carbohydrates contents. And also agree with Adelakun et al., (2009) who studies the chemical composition and the antioxidative properties of Nigerian Okra Seed (Abelmoschus esculentus Moench) and found that the range means obtained for protein, fat, ash, fiber and sugar contents were 42.14– 38.10, 31.04–17.22, 4.06–3.42, 3.45–3.60 and 8.82–8.65, respectively.

***Biochemical analyses:***

***Glucose level***

Table 2 illustrated the effect of feeding diets supplemented with different levels of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ) on serum levels of glucose,

**Table 2: Glucose level .(mg/dl). in Rats of the different experimental groups during four weeks of study**

| time Treatment | Gluc. Bef. | Gluc. Aft. | week1 | week2 | week3 | week4 |
|---|---|---|---|---|---|---|
| G1(NC) | 98.53 ± 3.30 c | 100.23 ± 1.76 b | 102.00 ± 1.11 b | 102.70 ± 0.96 d | 103.26 ±0 .64 b | 104.86 ± 1.63 b |
| G2(PC) | 111.66 ± 1.52 ab | 289.99 ± 4.7 a | 258.52 ± 4.75 a | 254.65 ± 4.70 a | 252.96 ± 4.59 a | 250.73 ± 4.57a |
| G3(COJ) | 102.66 ± 2.72 bc | 303.00 ± 5.00 a | 218.66 ±1.50 a | 182.84 ± 2.53 b | 127.13 ± 2.15 b | 111.77 ± 2.69b |
| G4 (AEO) | 114.22 ± 9.75 a | 316.00 ± 3.00 a | 221.85 ±1.25 a | 152.85 ±1.72 bc | 132.45 ± 1.80 b | 104.95 ± 1.24 b |

Mean values in each row having different superscript (a, b, c & d) are significantly different at P <0.05

G1:Negative Control (NC) G2: positive Control (PC)

G3: Corchorus olitorius (Jew's mallow) (COJ)

G4: Abelmoschus esculentus (Okra) (AEO)

Table (2) showed blood glucose levels for negative control (NC), positive control (diabetic) group (PC) and both treated groups with either Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ). From table (2) it could be noticed that there was a significant differences among blood glucose level before induction between the four groups . And also, after Streptozotocin induction results showed a significant difference between (NC) and each of (PC) and treated groups (G3, G4) while no significant difference was showed between (PC) , (G3) and (G4) groups. A gradually decrease occurred in blood glucose level from weak1 for (G3) and (G4) groups such decrease was 58.08 % after 3 weeks respectively, while after 4 weeks (the end of the experiment) a marked decrease was shown in glucose level for G3 and G4 groups till reached 63.1 % for G3 and 66.78% for G4. On the other hand positive control group (PC) showed a marked increase in blood glucose level after one week, The great influence of G3 and G4 on serum glucose levels of diabetic rats could be seen after 4 weeks

Our result was agreement with, Adon et al.,(2018) who showed no significant difference in the levels of blood glucose (GLU), between the aqueous extract of the bark of Carapa procera and the roots of Corchorus olitorius treated rats when compared to the control non-treated rats.

In this respect, Huang et al.,( 2017) has conclusively found a reduction in serum glucose level in type 2 diabetic rates after four weeks of treatments with Abelmoschus Esculentus( AE) subfraction. The level of the blood glucose of diabetic rates in their study was 442.83±44.71 mg/dL before the treatment and started to decrease up to 209.33±46.05 mg/dL at the end of their experiment. Majd et al., (2018) confirmed this finding by reporting a significant reduction in blood glucose level in diabetic rats after 30 days since the A. esculentus up to 210 mg/dL compared to the bingeing of the treatment 330 mg/dL

***Serum lipid profiles :***

With regard to Total Cholesterol (mg/dl) in rats fed on the tested diets were illustrated in Table (3).

**Table (3): Total Cholesterol (mg/dl) in rats fed on the tested diets**

| Treatments | | | | |
|---|---|---|---|---|
| Time | G1(NC) | G2(PC) | G3(COJ) | G4(AEO) |
| Zero | 75.15 ± 2.50 c | 95.14 ±1.74 a | 80.95 ±1.35 b | 78.81 ± 0.39 b |
| Induced | 118.73 ±1.60 a | 120.78 ±4.29 a | 92.16 ±1.01 b | 88.05 ±4.45 b |
| 4 weeks | 86.59 ±4.86 b | 111.73 ±5.80 a | 76.65 ±1.55 c | 75.48 ±1.90 c |

Mean values in each row having different superscript (a, b, c & d) are significantly different at $P < 0.05$

G1:Negative Control (NC) G2: positive Control (PC)

G3: Corchorus olitorius (Jew's mallow) (COJ)

G4: Abelmoschus esculentus (Okra) (AEO)

Table (3) showed Total cholesterol (TC) in negative control (NC) , positive control (PC) and both treated groups Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ). From these results, it could be noticed that after diabetic induction by Streptozotocin, positive control group (PC) and both treatment groups, showed significant higher increase in TC compared with negative control group at zero time. It is evident that rat fed on G3 & G4 indicated high significant decrease in serum total cholesterol. Feeding on control basal diet no fiber caused a slight decrease on cholesterol level of diabetic rats but the level was still significant higher when compared to those fed on diets contained fiber. G4 caused higher significant decrease on cholesterol level compared to G3

Our results are agreement with, Majd et al.,(2018) who reported that there was a significant decrease in the level of TG and cholesterol in diabetic rats treated by A. esculentus compared to non-treated diabetic rates.

In this respect, Adon et al., (2018) indicated that rats treated with (the aqueous extract of the bark of Carapa procera and the roots of Corchorus olitorius) showed a significant decrease in plasma levels of cholesterol, triglyceride and LDL and a significant increase in HDL levels in the rats treated with both aqueous extracts when compared to the control rats.

Effect of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius(Jew's mallow) (COJ) on triglyceride level (mg/dl) are shown in table (4)

Regarding data illustrated in table (4) mentioned the effect of treatments on diabetic rats with (COJ)(G3) or (AEO) (G4) at zero time., there were a high significant increase of TG in diabetic rats (control + ve group) as compared to healthy group control (– ve) which were (85.34 ±3.10) and (61.31 ±1.79) (mg/dl), respectively. All rats fed on (COJ)(G3) or (AEO) (G4) showed significant decreases in TG as compared to control (+ve) group. It is evident that the best treatment was of groups 4 that given (AEO) recorded 61.00 ±1.00 mg\dl. We could noticed significant difference in triglyceride (TG) of rats in both G3,G4 and those of PC group.

**Table (4): Effect of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ) on triglyceride level (mg/dl) in rats fed on the tested diets**

| | Treatments | | | |
|---|---|---|---|---|
| Time | G1(NC) | G2(PC) | G3(COJ) | G4(AEO) |
| Zero | 61.31 ±1.79 c | 85.34 ±3.10 a | 67.62 ±2.65 b | 68.95 ±1.37 b |
| Induced | 92.38 ±1.23 b | 107.66 ±3.21 a | 76.09 ±4.43 c | 79.00 ±2.00 c |
| 4 weeks | 70.53 ±2.57 b | 85.53 ±3.50 a | 64.36 ±0.70 c | 61.00 ±1.00 c |

Mean values in each row having different superscript (a, b, c & d) are significantly different at $P < 0.05$

G1:Negative Control (NC) G2: positive Control (PC)

G3: Corchorus olitorius (Jew's mallow) (COJ)

G4: Abelmoschus esculentus (Okra) (AEO)

This result is supported by Huang et al, (2017) who concluded that A. esculentus can lower the level of TG and cholesterol in Sprague- Dawley treated by A. esculentus and they suggested that this plant possess an effective ability to improve dyslipidemia in diabetic rats. Furthermore, K.I et al., 2018 confirmed this reduction after inducing A. esculentus treatment.

In this respect, Adon et al., (2018) indicated that rats treated with (the aqueous extract of the bark of Carapa procera and the roots of Corchorus olitorius) showed a significant decrease in plasma levels of cholesterol, triglyceride and LDL and a significant increase in HDL levels in the rats treated with both aqueous extracts when compared to the control rats.

Effect of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ) on serum HDL in rats fed on the tested diets are shown in table (5)

**Table (5): Effect of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ) on serum HDL (mg/dl) in rats fed on the tested diets**

| | Treatments | | | |
|---|---|---|---|---|
| Time | G1(NC) | G2(PC) | G3(COJ) | G4(AEO) |
| Zero | 39.83 ±3.00 a | 38.20 ±2.60 a | 29.97 ±2.14 b | 31.80 ±1.31 b |
| Induced | 29.97 ±2.14 c | 46.29 ±4.35 a | 36.00 ±1.00 b | 36.66 ±2.60 b |
| 4 weeks | 35.60 ±2.52 a | 29.97 ±2.14 b | 38.26 ±.642 a | 37.66 ±2.25 a |

Mean values in each row having different superscript (a, b, c & d) are significantly different at $P < 0.05$

G1:Negative Control (NC) G2: positive Control (PC)

G3: Corchorus olitorius (Jew's mallow) (COJ)

G4: Abelmoschus esculentus (Okra) (AEO)

The obtained results in table (5) revealed a significant decrease in serum HDL-c in rats fed on diabetic diet control (+ve group) . All rats of diabetic, and fed on Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ) showed a significant increase in HDL-c from zero time till 4 weeks as compared to control (+ve) positive group

In this respect, Huang et al., ( 2017) found that HDL was decreased by nearly half in the diabetic group, but was elevated with Abelmoschus esculentus (AE) treatment and especially with FR, which increased the level in a dose-dependent manner. The ratio of HDL/LDL revealed that all of the AE subfractions were beneficial for the distribution of lipoproteins

Also, agree with Olusanya and Ifeoluwa (2018) who found that in alloxan-induced diabetic rats TC, TG, LDL, and VLDL levels were increased and HDL level was decreased significantly ($p < 0.05$) when compared with normal control rats. In diabetic rats group, administration of ethanolic leaf extract of Corchorus olitorius at 800 mg/kg body weight dose particularly, showed significant ($p < 0.05$) reduction in elevated TC, TG, LDL and VLDL levels while at doses 200 and 400 mg/kg body weight of the extract no significant ($p > 0.05$) difference was observed when compared to diabetic rats group. Also, a significantly ($p < 0.05$) increased level of HDL was observed in diabetic rats treated with the plant extract at doses 400 mg/kg body weight and 800 mg/kg body weight and glibenclamide compared to diabetic control rats.

In this respect, Adon et al., (2018) indicated that rats treated with (the aqueous extract of the bark of Carapa procera and the roots of Corchorus olitorius) showed a significant decrease in plasma levels of cholesterol, triglyceride and LDL and a significant increase in HDL levels in the rats treated with both aqueous extracts when compared to the control rats.

Effect of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ)on serum LDL of rats fed on the tested diets (mg/dl) are shown in table (6)

**Table (6): Effect of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ)on serum LDL (mg/dl) in rats fed on the tested diets**

| | Treatments | | | |
|---|---|---|---|---|
| Time | G1(NC) | G2(PC) | G3(COJ) | G4(AEO) |
| Zero | 23.05 ±5.18 b | 39.87 ±1.68 a | 35.35 ±1.04 a | 35.31 ±2.44 a |
| Induced | 70.29 ±3.32 a | 52.96 ±1.69 b | 39.69 ±1.94 c | 36.83 ±2.58 c |
| 4 weeks | 36.89 ±2.90 b | 64.65 ±3.38 a | 26.78 ±1.74 c | 24.34 ±2.22 c |

Mean values in each row having different superscript (a, b, c & d) are significantly different at P <0.05

G1:Negative Control (NC) G2: positive Control (PC)

G3: Corchorus olitorius (Jew's mallow) (COJ)

G4: Abelmoschus esculentus (Okra) (AEO)

The data detected in Table (6) represent the effect of (COJ) and (AEO) supplementation on serum LDL in rats after 4 weeks. From the result it could be noticed that feeding rats on basal diet (PC) for 4 weeks, resulting in significant increase in LDL-c as compared to normal healthy rats (NC) at zero time. Meanwhile, Co-administration of (COJ) and (AEO) for the same period led to significant decrease in LDL level after 4 weeks. On the other hand LDL at NC control showed a little bit of increase in LDL after 4 weeks.

These results are in agreement with that's obtained by Olusanya and Ifeoluwa (2018) who found that in alloxan-induced diabetic rats TC, TG, LDL, and VLDL levels were increased and HDL level was decreased significantly ($p < 0.05$) when compared with normal control rats. In diabetic rats group, administration of ethanolic leaf extract of Corchorus olitorius at 800 mg/kg body weight dose particularly, showed significant ($p < 0.05$) reduction in elevated TC, TG, LDL and VLDL levels while at doses 200 and 400 mg/kg body weight of the extract no significant ($p > 0.05$) difference was observed when compared to diabetic rats group.

In this respect, Adon et al, (2018) indicated that rats treated with (the aqueous extract of the bark of Carapa procera and the roots of Corchorus olitorius) showed a significant decrease in plasma levels of cholesterol, triglyceride and LDL and a significant increase in HDL levels in the rats treated with both aqueous extracts when compared to the control rats.

Effect of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ)on serumVLDL of rats fed on the tested diets (mg/dl) are shown in table (7)

The data detected in Table (7) represent the effect of (COJ) and (AEO) supplementation on serum VLDL in rats after 4 weeks. From the result it could be noticed that feeding rats on basal diet(PC) for 4 weeks, resulting in significant increase in VLDL-c as compared to normal healthy rats (NC) at zero time. Meanwhile, Co-administration of (COJ) and (AEO) for the same period led to significant decrease in VLDL level after 4 weeks. On the other hand VLDL at NC control showed a little bit of increase in VLDL after 4 weeks.

**Table (7): Effect of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ) on serumVLDL (mg/dl) in rats fed on the tested diets**

| | Treatments | | | |
|---|---|---|---|---|
| Time | G1(NC) | G2(PC) | G3(COJ) | G4(AEO) |
| Zero | 12.26 ±.35 c | 17.06 ±0.621 a | 13.52 ±0.53 b | 13.79 ±0.27 b |
| Induced | 18.47 ±0.24 b | 21.53 ±0.64 a | 15.21 ±0.88 c | 15.80 ±0.40 c |
| 4 weeks | 14.10 ±0.51 b | 17.10 ±0.70 a | 12.87 ±0.14 c | 12.20 ±0.20 c |

Mean values in each row having different superscript (a, b, c & d) are significantly different at P <0.05

G1:Negative Control (NC) G2: positive Control (PC)

G3: Corchorus olitorius (Jew's mallow) (COJ)

G4: Abelmoschus esculentus (Okra) (AEO)

These results are in agreement with those obtained by Olusanya and Ifeoluwa (2018) who found that in alloxan-induced diabetic rats TC, TG, LDL, and VLDL levels were increased and HDL level was decreased significantly ($p < 0.05$) when compared with normal control rats. In diabetic rats group, administration of ethanolic leaf extract of Corchorus olitorius at 800 mg/kg body weight dose particularly, showed significant ($p < 0.05$) reduction in elevated TC, TG, LDL and VLDL levels while at doses 200 and 400 mg/kg body weight of the extract no significant ($p > 0.05$) difference was observed when compared to diabetic rats group.

In this respect, Adon et al, (2018) indicated that rats treated with (the aqueous extract of the bark of Carapa procera and the roots of Corchorus olitorius) showed a significant decrease in plasma levels of cholesterol, triglyceride and LDL and a significant increase in HDL levels in the rats treated with both aqueous extracts when compared to the control rats.

***Biological assay :***

Effect of Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ) on weight gain after 4 weeks are shown in table (8).

The initial and final body weights of the experimental rats are illustrated in table (8). Data showed a significant different among all groups. The initial body weights for all the groups at zero time ranged from 139.5 ± 6.5 to 185 ± 5.4. Regarding the final body weight it ranged between 184.25 ± 6.7 in (NC) group to 186.5 ± 0.86 in PC group. It is important to mention that weight gain showed the lowest value in (PC) group (24.25 ± 1.57) .Result showed that amount of Feed intake was highest in Okra (G4) followed by G1, G3 and then G2.

With regard to Feed efficiency ratio (Body weight gain ÷ Food intake) the highest value was reported for G3 followed by G4. Feeding diabetic rats on the basal diet (G2) caused minimum increase in Feed efficiency. These results were in line with those of Abd El-Rahman et al , (2018) who showed the effect of feeding lead poisoning rats on 5%, 10 and 15% of molokhia leaves powder in feeding and growth parameters as feed intake (FI), body weight gain (BWG) and feed efficiency ratio (FER). Their results indicated that the positive control group had the lowest values of these parameters compared to other groups.

**Table 8: Initial , final weight and weight gain in basal diet control , diabetic control Abelmoschus esculentus (Okra) (AEO) and Corchorus olitorius (Jew's mallow) (COJ)**

| | Initial weight | Final weight | Body weight gain | Week weight gain | Food intake | Daily Food intake | Feed efficiency ratio |
|---|---|---|---|---|---|---|---|
| G1(NC) | 139.5 ± 6.5 d | 184.25 ± 6.7 c | 44.75 ± 0.2 b | 11.1875 ± 0.05 b | 467.25 ± 6.5 b | 16.68 0.232 b | 0.09 ± 0.00 c |
| G2(PC) | 162.25 ± 2.43 c | 186.5 ± 0.86 c | 24.25 ± 1.57c | 6.0625 ± 0.39 c | 407.25 ±6.52 c | 14.54 0.232 c | 0.05 ± 0.00 d |
| G3(COJ) | 172.5 ± 2.87 b | 247.25 ± 2.62b | 74.75 ± 0.25 a | 18.6875 ± 0.06 a | 460.75 ± 6.67b | 16.45 0.238 b | 0.16 ± 0.00 a |
| G4(AEO) | 185 ± 5.4 a | 259.75 ± 6.65 a | 74.75 ± 1.25 a | 18.6875 ± 0.31 a | 491.47 ± 6.65 a | 17.55 0.237 a | 0.15 ± 0.00 b |

Mean values in each row having different superscript (a, b, c & d) are significantly different at $P < 0.05$

G1:Negative Control (NC) G2: positive Control (PC)

G3: Corchorus olitorius (Jew's mallow) (COJ)

G4: Abelmoschus esculentus (Okra) (AEO)

In this respect, Adon et al, (2018) indicated that rats treated with (the aqueous extract of the bark of Carapa procera and the roots of Corchorus olitorius) show no significant difference on their average body weight when compared to the control rats ($p > 0.05$).

***Conclusion :***

Diabetes mellitus ( DM) is a metabolic disease that can be prevented through lifestyle modification, diet control, and control of overweight and obesity. Education of the populace is still key to the control of this emerging epidemic. Novel drugs are being developed, yet no cure is available in sight for the disease, despite new insight into the pathophysiology of the disease. Management should be tailored to improve the quality of life of individuals with this disease.

The results confirm that Okra and Jew's mallow has the potential to be an excellent choice for managing glucose level on type II diabetic patients.

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# التأثيرات المضادة لمرض السكر وليبيدات الدم ل (البامية) و (الملوخية) الناجم عن الاستربتوزوتوسين في الفئران

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## الملخص

تهدف الدراسة الحالية إلى استخدام (البامية) و(الملوخية) كمصدر للألياف الغذائية من أجل دراسة التأثير البيولوجي لمثل هذه المواد التي استخدمت في النظم الغذائية التجريبية لداء السكر الناجم عن الأستربتوزوتوسين المسبب لمرض السكر في الفئران. تم إجراء إصابة الفئران بالسكر عن طريق حقن الأستربتوزوتوسين في عضلة الساق بجرعة ٥٠ مجم / كجم من وزن الجسم. تم تقسيم الفئران (٢٨ فأر) إلى ٤ مجموعات (٧ فأر لكل مجموعة) المجموعة الأولى كمجموعة ظابطة سالبة (NC) ، المجموعة الثانية كمجموعة ظابطة موجبة لمرض السكر (PC) ، والثالثة كانت ١٠٪ مجموعة الملوخية . والرابعة كانت ١٠٪ مجموعة البامية. تم جمع عينات من الدم أسبوعيًا لمراقبة الجلوكوز بينما تم قياس نسبة الدهون في الدم في نهاية التجربة. تم تعيين الدراسة لمدة ٤ أسابيع. أظهرت النتائج أن العلاج باستخدام (البامية) و (الملوخية ) أظهر انخفاضًا كبيرًا في مستوى الجلوكوز في السيرم لدى جميع المجموعات التجريبية. وفي الوقت نفسه ، لم تسجل فروق ذات دلالة إحصائية بين مؤشرات الدم لهذه المجموعات ، أي الكوليسترول الكلي في الدم ، الدهون الثلاثية الكلية ، HDL-c، LDL-c، VLDL-c ، في وقت بداية التجربة. ولكن بعد الاصابة بمرض السكر ، كان هناك انخفاض ملحوظ في مستوى الكوليسترول ، TG، و LDL. بينما حدث ارتفاع HDL .لوحظ انخفاض كبير ملحوظ في الفئران التي تغذت على(البامية) ، تليها فئران تتغذى على (الملوخية )

**التوصيات** : توصي الدراسة بتناول (البامية) و (الملوخية) أو إضافتهما إلي الأطعمة لما لها من تأثير إيجابي لعلاج مرض السكر في الفئران . بسبب ارتفاعهما في كمية الألياف الغذائية الغير قابلة للذوبان والتي تقلل بشكل كبير من خطر الإصابة بمرض السكر.

**الكلمات الدالة:** مرض السكر ، ليبيدات الدم ، البامية ، الملوخية، الستربتوزوتوسين ، جلوكوز الدم ،الكوليسترول ، الجلسريدات الثلاثية ، الألياف الغذائية- الفئران

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