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The Effect Of Different Concentrations Of Ammi Visnaga Plant On Biochemical Changes In Hyperglycemic Rats

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Abstract
Ammi visnaga is a plant known for improving blood sugar by containing many bioactive compounds, also containing essential oils that are strong vasodilators, with its extracts being used in pharmaceutical products. **Aim**: establish the research aims regarding the effects of differing concentrations of Ammi visnaga on biochemical changes in hyperglycemic mice. **Materials and Methods:** Thirty-six male Sprague Dawley rats were divided into normal (n=6) and diabetic (n=30). The second group was injected with streptozotocin (at a dose of 75 mg/ kg intraperitoneally), and those with blood glucose concentrations more than 250 mg/dL were classified as diabetic. Rats were divided into six groups, (1) non-diabetic group (n=6) received distilled water (2 mL/ day); (2) diabetic control group (n=6) received distilled water (2 mL/ day); (3) diabetic group (n=6) received basal diet +5% Ammi visnaga; (4) diabetic group (n=6) received basal diet +10% Ammi visnaga; (5) diabetic group (n=6) received basal diet +15% Ammi visnaga.(6) diabetic group (n=6) received a basal diet +20% Ammi visnaga. After 28 days, blood was collected, and serum was extracted to determine glucose, liver enzymes, kidney function, and blood lipids **Results**: At the end of the experiment, the glucose level was significantly reduced ($p<0.05$). The values of all groups were significantly lower in liver enzymes and lipid profile as compared to the control positive. **Conclusion**: The results of the present study showed that Ammi visnaga has the therapeutic potential to control the progression of complete episodes of diabetes by controlling the pre-diabetic status..

KEYWORDS: Ammi visnaga - biochemical changes - hyperglycemic rats.

Introduction

Ammi visnaga L. shows promise for blood sugar control in persons with prediabetes or diabetes. It is a short biennial or annual herb indigenous to Mediterranean area of Asia, North Africa, in addition Europe. It is broadly cultivated by numerous individuals & companies seeking to utilize its active or extracts components in the pharmaceutical industry.

A. visnaga is recognized by various common names in Arabic countries, including Khellah, Khella, Khella baladi, Chellah, Khellakl, Gazar sheitani, Kella, Bizer Al-Khilla, Kammon habashi, Kulla, as well as Swak Al-Nabi. Within Turkey (Miara et al., 2019). AV is an herbaceous yearly or occasionally biennial plant that grows a height of up to 1.3 m & a diameter the green aerial part up to 1.2 m. The root is a cylindrical taproot & has a light brown color. The root is either slightly tortuous or straight, growing in a vertically. The root surface illustrates traces of secondary fibrous rootlets. The main tap root reaches a length of up to fifty centimeters and a maximum diameter of 1.5 centimeter at its widest portion. The stem is greatly branching erect, densely leafy, cylindrical, as well as glabrous. (Nirumand et al ., 2018). The powdered and/or decoction plant was conventionally utilized in the management of moderate anginal, kidney colic, as well as abdominal cramps. It is utilized as a supportive management for moderate occlusion of respiratory tract in spastic bronchitis or asthma, as well as for postoperative management of conditions related to urinary calculi. Plant and the extracts of the plant are widely utilized in the management of psoriasis & vitiligo, and serve as a lithotripter agent. It is usually utilized to dilate bronchial, urinary, in addition blood vessels without influencing blood pressure. It is utilized internally as an emmenagogue to control menstruation, as a diuretic, & for the management of diabetes, vertigo, as well as renal stones. An infusion of aerial portions was additionally utilized to manage headaches (Balandrin et al., 1993). The chemical parts of Ammi visnaga L are well recognized and were published by multiple researchers in different research over the years. Prior research has documented numerous constituents in Ammi visnaga L, such as γ-flavonoids, pyrones, coumarins, as well as essential oils. The quantity & quality of these 2^{ry} metabolites are based on specific plant portion analyzed, & the growing conditions, & the application of any bioregulators. (Tripathi et al ., 2017). Phenolic compounds are regarded as an essential group of 2^{ry} metabolites found in Ammi visnaga L, especially in its aerial portions, as documented by numerous investigators. They mainly belong to the class of flavonoids. They occur in both conjugated and aglycone forms. (Ghoneim et al ., 2016). Additional classes of chemical compounds have been identified in different portions of AV; still, they are regarded as minor compounds and occur in small percent inside the plant. These involve β-sitosterol-glucoside & β-sitosterol, along with palmitoleic, palmitic, stearic, linoleic, petroselinic, arachidic, linolenic, as well as tetracosanoic acids, which have been detected utilizing LC-QTOF mass spectrometry, which stands for high-performance liquid chromatography of quadrupole time-of-flight techniques (Bishr et al ., 2018). The global level of type II diabetes wae risen drastically. Research indicates a huge connection between diabetes, obesity, in addition insulin obstruction, as well as adjustments in the capacity of beta-cells in the pancreas. (Amawi et al ., 2020) The subsequent effects include reduced paces of insulin digestion, such as lipids, glucose, as well as proteins. Diabetes can induce regulatory alterations in the hemostasis of magnesium, phosphorus, as well as calcium, ending in genuine confusions such as neurological problems and cardiovascular sickness. The American Diabetes Association (ADA) defines pre-diabetes as either impaired fasting glucose (5.6–6.9 millimoles per liter) or altered oral glucose tolerance test (two-hour OGTT glucose 7.8–11.0 millimoles per liter). (Ahed et al ., 2020). Various investigations demonstrated that the pre-diabetic state is distinguished through reduced insulin secretion & decreased glucose tolerance. The condition of pre-diabetes has been shown to be associated with the occurrence of cardiovascular occasions such as myocardial anomalies. Consequently, as A resolution has been made in this express regarding the cardiovascular alterations, the findings are ideal in preventing the progression of cardiac diseases. (Khalil et al ., 2020)

2- AIM OF STUDY: -

current research aims to the influence of various concentrations of Ammi visnaga plant on biochemical alterations in hyperglycemic mice.

3- MATERIALS AND METHODS: -

A- Source of Ammi visnaga **:** Ammi visnaga were purchased from Al-Baha City, KSA, local market, washed, cleaned, blended, & ground into fine powder utilizing an electric grinder. To reduce oxidation, they were stored in dark-stoppered glass bottles until ready to be used. according to (Russo, 2001).

B-Rats: Thirty-six male Sprague Dawley rats (n=36) weighing 150-170 g were obtained from Egypt's Ministry of Health's Animal Unit at Helwan Farm. For two weeks, the rats were housed in individual plastic cages under controlled conditions, with a temperature of 22°C and a 12-hour light/dark cycle at the Faculty of Home Economics, Menoufia University, Egypt. The rats had unrestricted access to food and water. All experiments followed the National Institute of Health's Guiding Principles for Animal Care and Use. Rats were weighed after two weeks of acclimatization and randomly allocated to one of two groups: diabetic (30rats) and normal (6 rats)

C- Induction of Diabetes (T1DM): After two weeks of acclimatization of rats, type 1 diabetes mellitus was induced by intraperitoneal injections of Streptozotocin (STZ) as described previously. The rats were injected with a dose of 75 mg/kg intraperitoneally of Streptozotocin (STZ) (Sigma-Aldrich, St. Louis, MO, USA). Following this, all rats fasted for 8 hr, and then blood samples were taken from the retro-orbital veins to determine blood glucose concentrations. The study included diabetic rats with blood glucose concentrations more than 250 mg/dL. Following the exclusion of rats with blood glucose concentrations below 250 mg/dL and deceased rats, 24 rats were included in the study and subsequently developed diabetes. In addition, diabetic rats

D- Diets:

- Basal diet: The basal diet comprises protein (10%), corn oil (10%), choline chloride (0.2%), cellulose (5%), combination of vitamin (1%), salt combination (4%) (Hegested et al., 1941), & corn starch (to one hundred percent). in accordance with AIN (1993)

E- Experimental Design

The study included all normal (6 rats) and diabetic (30 rats). In addition to the experimental procedure, all rats involved in this investigation were fed the standard diet. The proposed interventions were orally administered once per day. AIN., (1993**)** The weights of the rats were also recorded, and diabetic rats have divided into experimental groups accordingly. The following were the experimental groups:

1- The non-diabetic group (ND-Gr) consisted of six normal rats that received a daily 2 mL of distilled water orally per rat once daily.

2- The diabetic control group (DC-Gr) consisted of six diabetic rats that received a daily 2 mL of distilled water orally per rat once daily

3- The diabetic group (DC-Gr), consisting of six rats, received basal diet + 5% Ammi visnaga

4- The diabetic group (DC-Gr), consisting of six rats, received basal diet + 10% Ammi visnaga

5- The diabetic group (DC-Gr), consisting of six rats, received basal diet + 15% Ammi visnaga

6- The diabetic group (DC-Gr), consisting of six rats, received basal diet + 20% Ammi visnaga

F- Biological evaluation:

The biological assessment of the diverse diets has been conducted by calculating the food efficiency ratio (FIR) and body weight gain % (BWG) in accordance with Chapman et al., 1959] utilizing the following formulas:

$$BWG = \frac{\text{Final weight} - \text{initial weight}}{\text{Initial weight}}$$

$$FER = \frac{\text{Gain in body weight (g)}}{\text{Feed intake (g)}}$$

G- Blood sampling: Initially, blood samples have been collected from the retro-orbital vein following a fasting period of twelve hours, while at the end of each experiment, they have been gathered from the hepatic portal vein. Samples of the blood have been gathered into clean, dry centrifuge glass tubes & permitted to clot in a water bath at thirty-seven degrees Celsius for twenty-eight minutes. The serum was subsequently separated by centrifuging the tubes at four thousand revolutions per minute for ten minutes. The serum has been cautiously aspirated & transferred to a clean Eppendorf tube, where it was kept at minus twenty degrees Celsius until analysis. This method was labeled by (Schermer,1967).

H- Biochemical Analysis:

Lipid profile:

- Measurements of serum triglycerides: The serum triglycerides have been measured utilizing enzymatic methods and kits in accordance with (**Young, 1975 and Fossati,1982).**

- - Measurements of serum total cholesterol: Serum total cholesterol has been measured using the colorimetric technique previously explained by **(Thomas,1992).**

Measurements of high-density lipoprotein (HDL-c): high-density lipoprotein has been estimated in accordance with the technique established with **(Fredewaid 1972 & Grodon & Amer, 1977).**

- - Measurements of very low-density lipoprotein cholesterol (VLDL-c): very low-density lipoprotein cholesterol has been measured in milligrams per deciliter in accordance with (**Lee & Nieman,1996).**

Measurements of low-density lipoprotein cholesterol (LDL-c): LDL-c has been measured in milligrams per deciliters in accordance with **(Lee and Nieman ,1996)**

- Determination of atherogenic index (AI): Determination of AI = (LDL-c + very low-density lipoprotein cholesterol) (Kikuchi-Hayakawa et al., 1998).

Liver functions:

- Measurements alanine transaminase: - performed regarding the procedure of **(Clinica Chimica Acta, 1980),**

- Measurements aminotransferase (AST) Measurements of serum AST has been carried out in accordance with the technique of **(Hafkenscheid ,1979).**

- Measurements of serum globulin: Serum globulin has been determined in accordance with the method defined by **(Henry, 1964).**

- Serum albumin (SAlb): Serum albumin has been determined with regard to the technique described by **(Doumas et al., 1971).**

Kidney functions:

- Determination of serum urea: Urea has been determined by enzymatic technique in accordance with (**Patton & Crouch ,1977).**

- Measurements of serum creatinine: Serum creatinine has been measured in accordance with the technique expressed with **(Henry ,1974).**

- Measurements of serum uric a`**: Serum uric a` been measured calorimetrically in accordance with the technique of **(Barham & Trinder ,1972).

- Measurements of blood glucose: Enzymatic measurements of serum glucose have been performed calorimetrically in accordance with the technique of **(Tinder ,1969).**

I- Statistical analysis:

The student-Newman-Keuls test has been utilized to separate the means after a significant main effect has been discovered. The data was examined via an entirely randomized factorial design [SAS, 1988]. Treatment variances (P0 value less than 0.05) have been deemed

significant by the Costat Program. Analyses of biological outcomes were conducted using one-way ANOVA. **(1967, Snedecor and Cochran)**

- **Ethical Approval**

The Science Research Ethics Committee of the Faculty of Home Economics accepted the protocol of the research #15-SREC-06-2025.

4- RESULTS AND DISCUSSION

- **RESULTS**

4.1. Biological results.

Influence of various levels of Ammi visnaga on BWG percent, feed intake (FI), & feed efficiency ratio of diabetic mice.

Table (1) results illustrate the effect of different levels of Ammi visnaga for twenty-eight days on body weight gain, FI, in addition nourish efficiency ratio in diabetic mice. As illustrated the mean value of BWG of control positive (+) was greater in comparison with control negative (-), which were -0.36±0.0026 & 0.076±0.0017, correspondingly. but the value of all groups was greater significantly (p-value below 0.05) when in comparison with control positive, by means 1.44±0.029, 1.68±0.023, 1.61±0.011, and 1.93±0.045g, respectively.

The mean value of **FI** of control (+) was greater in comparison with control (-), which were 6.50±0.050 & 6.90±0.010 g, correspondingly. whereas the values of all groups were greater in comparison with control positive, by mean of 13.20±0.009, 19.50±0.005, 20.00 ±0.017, and 21.00±0.0 g, correspondingly. but the value of all groups was greater in comparison with control positive.

Feed efficiency ratio of control (+) was greater significantly (p-value below 0.05) when in comparison with control (-), which were 0.06±0.0007 and 0.011 ±0.005, correspondingly. but, the values of groups all groups were greater compared to control positive, by mean 00.109±0.0173, 0.086±0.0386; 0.081±0.0132, and 0.011±0.0035 respectively.

Table (1): Influence of various levels of Ammi visnaga on BWG %, FI, & FER of diabetic mice.

Group **Parameter**	**Control (-ve)**	**Control (+ve)**	**5%** Ammi visnaga	**10%** Ammi visnaga	**15%** Ammi visnaga	**20%** Ammi visnaga
BWG(g) Mean±SD	0.076±0.0017	0.36±0.0026	1.441±0.029	1.681±0.023	1.61±0.011	1.931±0.045
Fi(g) Mean±SD	6.90±0.010	6.50+±0.050	13.201±0.009	19.501±0.005	20.001±0.017	21.001±0.009
FER Mean±SD	0.011±0.005	0.06±0.0007	0.1091±0.0173	0.0861±0.0386	0.08±0.0132	0.0111±0.0035

Variances are significant at five percent (P-value below 0.05). Control-Ve: Mice nourished on basal diet.

Control +Ve: Diabetic mice nourished on basal diet.

4.2. Biochemical results

Influence of various levels of Ammi visnaga on serum glucose of diabetic mice.

Information in table (2) illustrated that in control (-) normal mice, serum glucose was 117. 75 ± 2. 72 (milligrams per deciliter), which increased by the rate of 111.88% as the result of diabetic diet feeding. Adding of Ammi visnaga (5 ,10 ,15 and 20 %) to the basal diets leads to a significant decrease in serum glucose 142.20±1.61, 135.00±1.82; 127±1.50, and

125±1.57respectively. The results show no significant difference between 15% Ammi visnaga an 20% Ammi visnaga. The 20% Ammi visnaga the best treatment

Table (2): Influence of various concentrations of Ammi visnaga on serum glucose of diabetic mice.

Group **Parameter**	**Control (-ve)**	**Control (+ve)**	**5%** Ammi visnaga	**10%** Ammi visnaga	**15%** Ammi visnaga	**20%** Ammi visnaga
Glucose (mg/dl) Mean±SD	117.7 ± 2. 7	249. 5 ± 2. 2	142.20±1.61	135.00±1.82	127±1.50	125±1.57
% of change	---	+111.88	-39.07	-49.29	-42.98	-27.85

* Values are expressed as mean ± SD.** Values which don't share the same letter in each column are significantly various at P-value below 0.05.

Serum liver enzymes

Table (3) shows the influence of various concentrations of Ammi visnaga on serum ALT, ALP, AST, as well as AST/ALT ratio on diabetic mice groups. Such as illustrated the mean value of aminotransferase of control (+) was significantly greater (p-value below 0.05) when in comparison with control negative, which were 145.00±4.58 and 42.00±2.05 Units per Liter, correspondingly. Also, the value of all groups was significantly decrease when in comparison with control positive 55.80±1.58, 32.00±1.37, 54.00±1.35, and 42.00±2.57 Units per Liter, correspondingly.

The ALT concentrations in the control positive group were significantly raised (p-value below 0.05) than the control negative mice, measuring 40.00±2.65 and 18.00±0.87 U/L, correspondingly. The values of all groups were significantly reduced in comparison with the positive control mice., 22.20±0.81, 15.20±0.73, 17.50±0.46, and 15.30±0.68 U/L, respectively.

Table 3 illustrates that the mean AST/ALT ratio in the (+) control group was significantly elevated (p-value below 0.05) compared to the negative control group, with values of 3.63±0.092 and 2.33±0.061, correspondingly. Also, the values of all groups were significantly lower as in comparison with the control positive group, being 2.51±0.048, 2.11±0.036, 3.08±0.072, & 2.75±0.029, respectively.

Table (3): Influence of various levels of Ammi visnaga on ALT, AST, ALP, in addition AST/ALT ratio on diabetic mice.

Group **Parameter**	**Control (-ve)**	**Control (+ve)**	**5%** Ammi visnaga	**10%** Ammi visnaga	**15%** Ammi visnaga	**20%** Ammi visnaga
AST (U/L) Mean±SD	42.00±2.05	145.00± 4.58	55.801± 1.5	32.001±1. 37	54.001±1 .35	42.001±2.57
ALT (U/L) Mean±SD	18.00±0.87	40.00±2 .65	22.20±0 .81	15.201±0. 73	17.501±0 .46	15.301±0.68
AST/ALT Ratio Mean±SD	2.33±0.061	3.63±0. 092	2.511±0 .048	2.111±0.0 36	3.081±0. 072	2.75±0.029

Kidney Function

Information in table (4) results illustrate Influence of different levels of Ammi visnaga on serum creatinine, uric a` in addition to urea in diabetic groups.

The information indicates that the mean creatinine concentration in the (+) control group was elevated in comparison with that in the negative control group, measuring 1.20±0.044 and 0.70±0.032 milligrams per deciliter, correspondingly. Also, the values of all groups have been lower compared to the (+) control. by means of 0.80±0.045, 0.78±0.0236, 0.68±0.073, and 0.65±0.0366 milligrams per deciliter, correspondingly.

Serum Urea of control (+) was greater compared to control (-), which were 162.00±7.21 & 37.00±2.45 milligrams per deciliter, correspondingly. Also, the values of all groups were lower in comparison with control positive, by a mean of 120.00±2.54, 107.00±2.75, 123.00±2.53, and 107.00±3.00 mg/dl, respectively.

As for Uric a`, the outcomes illustrated that the mean value of control (+) was greater compared to control (-), which were 3.50±0.22 & 2.00±0.11 milligrams per deciliter, correspondingly. Also, the values of all groups were lower in comparison with control positive, by means 1.93±0.03, 1.33±0.04, 1.86±0.05, and 1.60±0.03 milligrams per deciliter, correspondingly.

Table (4): Influence of various levels of Ammi visnaga on serum urea, creatinine in addition uric a` in diabetic groups.

Group **Parameter**	**Control (-ve)**	**Control (+ve)**	**5%** Ammi visnaga	**10%** Ammi visnaga	**15%** Ammi visnaga	**20%** Ammi visnaga
Creatinine (milligram per deciliter) Mean±SD	0.70±0.032	1.201±0.044	0.801±0.045	0.781±0.0236	0.681±0.073	0.651±0.036
Uric a` (milligram per deciliter) Mean±SD	2.001±0.11	3.501±0.22	1.931±0.03	1.331±0.04	1.861±0.05	1.601±0.03
Urea (milligram per deciliter) Mean±SD	2.33+0.061	3.63±0.092	120.001±2.54	107.001±2.75	123.001±2.53	107.001±3.00

lipid profile

Data in table (5) demonstrate the Influence of various concentrations of Ammi visnaga on serum TG, TC, LDLc, VLDLc, HDLc, in addition A.I. ratio in diabetic mice.

As illustrated in this table, the mean value of TC of control (+) was greater compared to control (-), which were 191.00±3.61 & 142.00±2.64 milligrams per deciliter, correspondingly, and the value of all groups were significantly decrease (p-value below 0.05) in comparison with control positive, by means 142.00±3.44, 130.00±4.38, 160.00±2.75, and 132.00±3.41mg/dl, respectively.

TG of control (+) was greater compared to control (-), which were 188.00±6.08 & 121.00±3.41 milligrams per deciliter correspondingly, and the values of all groups were lower

in comparison with control positive, by means 161.00±4.49, 150.00±4.78, 141.00±3.41, and 134.00±3.16 mg/dl, respectively.

As for HDL-c, the mean value of control (+) has been decreased in comparison with control negative, which were 68.00±1.73 and 110.00±4.35 milligrams per deciliter, correspondingly, and the values of all groups were greater compared to control positive, by means of 92.60±1.51, 95.30±1.13, 92.80±2.43, and 98.80±3.36 mg/dl,

The same table illustrated that low-density lipoprotein cholesterol of control (+) was greater in comparison with control negative, which were 85.40±2.51 and 7.80±0.26 milligrams per deciliter, correspondingly. Whereas the values of all groups were reduced in comparison with control positive, by a mean of 17.40±0.53, 4.70±0.45, 39.00±2.00, and 6.40± 0.36 milligrams per deciliters, correspondingly.

As for VLDL-c**,** the outcomes illustrated that the mean value of control (+) was greater compared to control (-), which were 37.60±2.42 & 24.20±0.72 milligrams per deciliter, correspondingly. Also, the values of all groups were lower in comparison with control positive, by means 32,00±1.73, 30.00±1.00, 28.20±1.93, and 26.80±0.75mg/dl, respectively.

The same table showed that atherogenic index ratio of control (+) was greater compared to control (-), which were 1.81±0.025 & 0.29±0.017 correspondingly, whereas the values of all groups were lower compared to control positive, by means 0.53±0.026, 0.36±0.045, 0.72±0.057, and 0.34±0.016 correspondingly.

Table (5) Influence of various levels of Ammi visnaga **on serum TG, TC, HDLc, VLDLc, LDLc in addition A.I. ratio in diabetic rats**

Group **Parameter**	**Control (-ve)**	**Control (+ve)**	**5%** Ammi visnaga	**10%** Ammi visnaga	**15%** Ammi visnaga	**20%** Ammi visnaga
TC (mg/dl) Mean±SD	142.00±2.64	191.00±3.61	142.001±3.44	130.001±4.38	160.001±2.57	132.001±3.41
TG (mg/dl) Mean±SD	121.00±3.41	188.001±6.08	161.00±4.49	150.001±4.78	141.001±3.41	134.001±3.16
HDL (mg/dl) Mean±SD	110.001±4.35	68.00±1.73	92.601±1.5	95.30±1.13	92.801±2.43	98.80±3.36
LDL (mc/dl) Mean±SD	7.80±0.26	85.401±2.51	17.401±0.53	4.701±0.45	39.001±2.00	6.401±0.36
VLDL (mg/dl)	24.20±0.72	37.601±2.42	32.001±1.73	30.00±1.00	28.201±1.93	26.801±0.75
Atherogenic index (A.I. Ratio	0.29±0.017	1.81±0.025	0.531±0.026	0.361±0.045	0.721±0.057	0.341±0.016

- **DISCUSSION**

The main objectives of the present study were to explore the efficacy of using Ammi visnagain in treating diabetic cases and the Improvement of vital functions. The present study showed that another herbal treatment, Ammi visnaga, can be used to treat diabetic conditions. We think that it can exert their effects by two mechanisms. The first mechanism is mediated through the antioxidant's effect. The second mechanism is through decreasing lipid levels, such as cholesterol and triglycerides, as reported in other studies **(**Wang et al., 2019). The

influences of utilizing AV in decreasing weight have been apparent in significantly reducing the levels of BMI. BMI is a good marker of health since it defines obesity, overweight, in addition normal weight. **(**Amawi et al., 2020). The influence of the aqueous extract of AV on blood glucose concentrations has been examined in fasting normal & STZ-induced diabetic mice following both repeated and single oral administration. The aqueous extract of Ammi visnaga (AV) at a dosage of twenty milligrams per kilogram significantly decreased blood glucose levels in normal mice six hours following a single oral administration (P-value below 0.005) & 9 days following repeated oral administration (P-value below 0.05). This hypoglycemic influence is more noticed in STZ diabetic mice (P-value below 0.001) **(Ahed et al.,2020)**. in aqueous extract of AV illustrated a significant hypoglycemic influence in both STZ-induced diabetic & normal mice. In addition, a decoction derived from the fruits of AV had the ability to reduction blood glucose concentrations by fifty-one percent in normoglycemic mice, in comparison with an oral hypoglycemic agent. (Khalil **et al. 2020)**. The anti-inflammatory properties of AV have been examined, indicating that its content based on a reduction in mRNA expression & the secretion of interleukin-1β, TNF-α, in addition IFNγ. additionally, Ammi visnaga decreased LPS-induced MCP-1 and IL-6 mRNA levels, indicating that its anti-inflammatory effects can result from the suppression of transcription factors including 1 NF-κB and AP-. moreover, Ammi visnaga had a neuroprotective influence by inhibiting kainic a`-induced pathogenesis in brain, with these neuroprotective influences related to its anti-inflammatory properties. **(Amawi et al. 2019)**. The antioxidant action of essential oils extracted from the umbels of AV demonstrated very weak activity. AV extract and its active principals exert are recognized for their relaxing effects on smooth muscles. Samidin & khellol glycoside have been shown to elicit a (+) inotropic influence on the heart, whereas visnadin at a level of 60 micrograms per milliliter elevated coronary blood flow in the isolated guinea pig heart. In contrast, samidin, dihydrosamidin, khellin, as well as visnadin were reported to efficiently normalize electrocardiogram of ischemic myocardia in a dog. Khella extracts or active principles seem to enhance blood supply to coronary smooth muscles. (**Katulanda et al. 2023**)**.**

5. Conclusion

Ammi visnaga has been traditionally used for its medicinal properties, making it an intriguing candidate for managing diabetes. Understanding its impact on biochemical changes in hyperglycemic rats could reveal potential therapeutic benefits and mechanisms. This research may lead to new treatment options for diabetes management. Also, the study highlights the potential of Ammi visnaga in mitigating biochemical changes in hyperglycemic rats, suggesting its therapeutic value in managing diabetes-related complications.

REFERENCES

1. Ahed J Alkhatib. Prediabetes can be Reversed Using Low Dose Tadalafil: Non- Classical Treatment of Diabetes as A New Medical Hypothesis. Archives of Diabetes & Obesity. 2020;2(5).
2. AIN (1993): American Institute of nutrition purified diet for Laboratory Rodent, Final Report. J. Nutrition, 123: 1939- 1951 and O. Compactum Benth. Journal. Essential Oil Res. 8 (6): 657-664.
3. Amawi KF, Alkhatib AJ. Urtica Pilulifera in Treating Pre-diabetic Rat Model to Control the Blood Glucose, Lipids and Oxidative Stress. Medical archives (Sarajevo, Bosnia and Herzegovina). 2020;74(3):168–171.
4. Amawi KF, Alkhatib AJ. Urtica Pilulifera in Treating Pre-diabetic Rat Model to Control the Blood Glucose, Lipids and Oxidative Stress. Medical archives (Sarajevo, Bosnia and Herzegovina). 2020;74(3):168–171.
5. Amawi KF, Al-Mazari IS, Alsarhan A, et al. Diabetes upregulates the expression of HSP90 and downregulates HSP70 in the liver of diabetic rats. Comp Clin Pathol. 2019;28:473–478.

6. Balandrin M.F., Kinghorn A.D., Farnsworth N.R. Human Medicinal Agents from Plants. Volume 534. American Chemical Society; Washington, DC, USA: 1993. Plant-Derived Natural Products in Drug Discovery and Development; pp. 2–12.
7. Barham, D. and Trinder, P. (1972): Determination of uric acid. Analyst, 97: 142.
8. Bishr M., El-Degwy M., Abdel Hady M., Amin M., Salama O. Supercritical fluid extraction of γ-Pyrones from Ammi visnaga L. fruits. Future J. Pharm. Sci. 2018;4:57–62.
9. Chapman, D.G.; Castilla, R. and Champbell, J. A. (1959): Evaluation of protein in food. A method for the determination of protein efficiency ratio. Can. J. Biochem. Phsiol, 3 7: 679-686.
10. Clinica Chimica Aeta (1980): 105, 147-172. (Chemical kits). Crespy V, Williamson G: A review of the health effects of green tea catechins in in vivo animal models. Journal. Nutr 2004, 134:34315-34405
11. Doumas, B.T.; Waston, W.R. and Biggs, H.G. (1971): Measurement of serum albumin with bromocresol green. Clin. Chem. Acta., 31:87.
12. Fossati, P. (1982): Principle. Clin.Chem., (Chemical Kits). Determination of Serum Uric acid. Journal.of Clin. Chem., 28:2077.
13. Friedwaid, W.T. (1972): Determination of HDL. Clin. Chem., 18: 499. (Chemical Kits).
14. Ghoneim K., Al-Daly A., Khadrawy F., Amer M., Mahmoud M.A. Efficacy of the toothpick weed Ammi visnaga L. (Apiaceae) fruit extracts on transaminase activity in certain tissues of Schistocerca gregaria (Forskal)(Orthoptera: Acrididae) Int. J. Entomol. Res. 2016;1:19–28.
15. Grodon, T. and Amer, M. (1977): Determination of HDL. Clin. Chem. 18: 707. (Chemical Kits).
16. Hafkenscheid, J.C. (1979): Determination of GOT. Clin. Chem., 25:155.
17. Hegsted, D.; Millls, R. and Perkins, E. (1941): Salt mixture, J. Biol. Chem., 138:459.
18. Henry, R.J. (1964): Method of Protein Determination in Plasma. Clin. Chem. 20: 1362 - 1363.
19. Katulanda GW, Katulanda P, Dematapitiya C, et al. Plasma glucose in screening for diabetes and pre-diabetes: how much is too much? Analysis of fasting plasma glucose and oral glucose tolerance test in Sri Lankans. BMC Endocrine Disorders. 2023;19:11.
20. Khalil N, Bishr M, Desouky S, et al. Ammi Visnaga L., a Potential Medicinal Plant: A Review. Molecules. 2020;25:301.
21. Kikuchi-Hayakawa; Onodera, N.; Matsubara, S.; Yasudo, E.; Chonan, O.; Takahashi, R. and Ishikawa, F. (1998).
22. Lee, R. and Nieman, D. (1996): Nutrition Assessment. 2nd Ed., Mosby, Missouri, USA.
23. Miara M., Bendif H., Rebbas K., Rabah B., Hammou M., Maggi F. Medicinal plants and their traditional uses in the highland region of Bordj Bou Arreridj (Northeast Algeria) J. Herb. Med. 2019;16:100262. doi: 10.1016/j.hermed.2019.100262.
24. Nirumand M.C., Hajialyani M., Rahimi R., Farzaei M.H., Zingue S., Nabavi S.M., Bishayee A. Dietary Plants for the Prevention and Management of Kidney Stones: Preclinical and Clinical Evidence and Molecular Mechanisms. Int. J. Mol. Sci. 2018;19:765. doi: 10.3390/ijms19030765
25. Patton, C.J. and Crouch, S.R. (1977): Enzymatic determination of urea. Journal, of Anal. Chem., 49: 464-469.
26. Russo, A.; Izzo, A.A.; Cardile, V.; Borrelli, F. and Vanella, A. (2001): Indian medicinal plants as antiradicals and DNA cleavage protectors. Phytomedicine, 8(2): 125-32.
27. Schermer, S. (1967): The Blood Morphology of Laboratory Animal. Longmans Printed in Great Britain, Green and Co. Ltd, p. 350.
28. Snedecor, G. W. and Cochran, W. G. (1967): "Statistical Methods". 6th Ed. Iowa State University Press. Ames. Lowa. USA.
29. Thomas, L. (1992): Labor and Diagnose, 4 th Ed., (Chemical Kits).
30. Tinder, P. (1969): Determination of triglycerides. Ann. Clin. Biochem., 6: 24 - 27.
31. Tripathi Y., Pandey A. Bioprospecting of Phytodiversity for New Therapeutic Products:Trends, Potential and Challenges. Org. Med. Chem. 2017;2:1–7.

32. Wang Lianzi, Tao Li, Liu Jiaqing, et al. Association between glycosylated hemoglobin A1c and bone biochemical markers in type 2 diabetic postmenopausal women: a cross-sectional study. BMC Endocrine Disorders. 2019;9:31.
33. Young, D.S. (1975): Determination of GOT. Clin. Chem., 22 (5): 1—21.