Nat. Volatiles & Essent. Oils, 2021; 8(6): 5780-5786

NVEO
Natural Volatiles &
Essential Oils

Hypoglycemic And Hypolipidemic Properties Of Aqueous Extract Of Brassica Oleracea Var Acephala Of Kashmir Valley In STZ Induced Diabetic Rats

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ABSTRACT

Diabetes mellitus has become the widespread disorder globally. The edible leaf of K-29 (Khanyari) is one of the vegetable that is regularly consumed in the Kashmir. Thus it was of interest to assess the hypoglycemic and hypolipidemic impacts of extract of leaves of Khanyari on blood glucose, and lipid profile in STZ induced diabetic rats. Diabetes was induced in male Wistar rats by injecting rats with 50mg/kg of bodyweight of Steptozotocin (STZ). Diabetic rats showed a notable increase in blood glucose level. Oral supplementation of extract of brassica oleracea var acephala (K-29) of Kashmir valley at 200mg/kg body weight led to significant decrease in blood glucose level and on their complete lipid profile.

Keywords: STZ, Brassics oleracea var acephala, Hypoglycemic, hypolipidemic

Introduction:

Modifications in way of life have reduced active work, development of heftiness, quick varieties in ecological complexities increasing the chances for diabetes (1). Worldwide assessment gives insight that in 2017 there were 451 million individuals with diabetes everywhere (2,3). Likewise it is approximated

that practically 49.7% individuals are living with undiscovered diabetes (4,5). Besides, it has been assessed that 374 million individuals experience the ill effects of IGT (weakened glucose resilience) and about 21.3 million females endured with hyper-glycaemia during growth (6,7). In 2017, around 5,000,000 individuals passed on universally due to diabetes in age going from 20-99 years (8,9).

Diabetes is a multifactorial disease, with serious consequences on normal health. Thus, throughout world, an increasing hunt for searching of new targets and treatments for this incurable disorder is going on. Although, many of the plant based available treatments have been developed, but without prior knowledge of their molecular targets. Understanding biochemical and molecular targets of such plants and their products will definitely pave way for the development of novel and effective therapies.

Research suggests that in insulin responsive tissues, the insulin hormone stimulates the uptake and metabolism of glucose through the expression of specific glucose transporters on the surface of the plasma membrane of mammalian cells. These glucose transporters catalyze the facilitated transport of glucose and belong to a family of glucose transport proteins (GLUTs). Among these glucose specific transporters, the GLUT2 is the most abundant isoform in liver and pancreatic β-cells. Due to the down regulation in the expression of this glucose transporter from large intracellular pool on the plasma membrane of specific insulin sensitive tissue representing a major rate limiting step in the metabolism of glucose in diabetes and ultimately leading to postprandial hyperglycemia. So, targeting and modulating the expression of this glucose specific transporters with the help of such anti-diabetic agents can definitely help in improving insulin sensitivity in type 2 diabetic patients and may be helpful in the management of postpradial hyperglycemia.

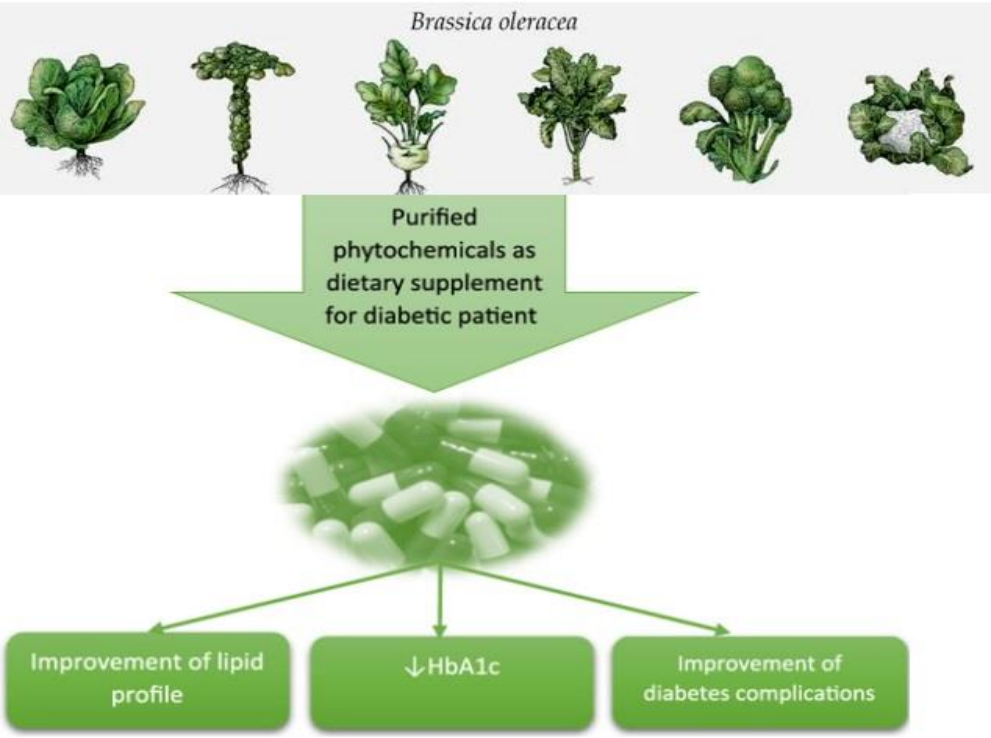

Fig: Properties of phytochemicals

Materials and Methods:

Chemical Materials: Steptozotocin (STZ) and glibenclamide were purchased from sigma. The chemicals used in the present investigation were purchased from sigma. All the kits used were given by spin react, Erba.

Animals: The male albino rats weighing 130–180 g will be purchased from IIIM Jammu, India for the current investigation. The rats will be kept under controlled environment at the Faculty of Veterinary Sciences, SKUAST (K) and given standard chow diet and water during the study. The present study is approved by the institutional animal ethics committee (Registration no:1809/GO/Re-L/15/CPCSEA) at SKAUST Shuhama, Srinagar.

Methods

Preparation of crude extract of Brasicca oleracea var acephala: The fresh samples of Brasicca oleracea vegetables, collected at their edible stages will be thoroughly washed in stream of running distilled water, shade dried and crushed to a fine powder. The powdered samples (500 g) will be then weighed and extracted with double distilled water in Erlenmeyer flasks at room temperature. The maceration will be carried out five times each, in 48 hours with occasional shaking and stirring. The extracts from each vegetable will be pooled, filtered (Whatman filter paper No.1) and concentrated as crude water extracts at 40°C in vacuo and stored at -80°till further investigations.

Experimental Design: In this experiment, 24 albino rats were used and grouped into four classes (6 rats in each class) as follows:

Class 1: Untreated normal rats (injected with citrate buffer)

Class 2: Diabetes-STZ Diabetic Rats

Class 3: Rats treated with Plant extract (200 mg / kg bw)

Class 4: STZ rats treated with glibenclamide (1 mg / kg bw)

Induction of diabetic rats: After grouping the rats into normal (n = 6) and diabetic cases (n =18), the diabetes will be induced in diabetic group by streptozotocin injection (50 mg per kg) which is freshly prepared in 0.1Mcitrate buffer(pH 4.5). Post 48hrs of STZ injection, rats with non-fasting plasma glucose >300 mg per dl will be considered diabetic and randomly divided into three groups. The second group will be left as such to serve as diabetic control group, the third group will orally receive on daily basis 200 mg per Kale extracts for period of 21 days and remaining fourth group will receive standard drug. Oral glucose tolerance test gives an idea of effect on glucose levels at different time intervals in rats fed with starch alone or in combination with plant extract.

Sample preparation:

After 21 days of treatments with extract, rats were deprived for food for 3 hours, and then same are sacrificed. The Blood will be collected by cardiac puncture for complete lipid profile. Liver will be dissected out immediately, then washed with saline and dry with the filter paper. Portions of some liver (100 mg) will be rapidly digested in two ml of 30% KOH and then used for estimation of glycogen.

Statistical analysis

All the data were expressed as the mean ± SEM and analysis of variance (ANOVA) was used for the statistical analysis using SPSS 11.5 followed by Duncan Multiple Range post hoc test. The values were considered to be significant when $p < 0.05$.

Treatment (dose)	0 days (mg/dL)	7th days (mg/dL)	14th days (mg/dL)	21th day (mg/dL)
Normal control	73.15±4.42	73.80±3.92	73.2±4.70	73.0 ±2.45
Diabetic control	237.80 ±18.80	227.15± 17.12	220.32 ±16.40	216.50± 14.52
Metaformin	246.15±13.06	182.50± 10.57	125.65± 16.85	82.15±15.95
Kale extract(k-29)	248.49 ±12.80	182.65±8.88	148.32±12.02	102.80±9.38

Result:

Blood Glucose Level: In Diabetic rats there was significant increase in blood glucose level and oral supplementation of Brassica oleracea var acephala resulted in decrease in blood glucose level (table 1) when compared to control group and the group treated with standard drug (metaformin).

Table 1: Blood glucose level in various groups, values represents means ±SE

Lipid profile:

Table 2:Complete lipid profile. Values represent means ±SE

Lipid profile					
S.NO	Cholesterol Total(mg/dl)	HDL (mg/dl)	LDL (mg/dl)	VLDL (mg/dl)	Triglycerides (mg/dl)

Normal control	62.30±0.04	35.27±0.032	35.32±0.71	22.17±0.31	84.94±1.30
Diabetic control	169.56±0.04	36.54±0.0	91.05±0.59	25.26±1.17	122.51±2.7
metaformin	81.055±2.3	75.3±2.05	34.7±0.66	17.63±0.29	86.30±0.77
Kale extract(k-29)	76.39±1,6	43.1±5.70	36.1±1.35	21.19±1.15	85.4±0.46

Discussion: As far as developing countries like India is concerned where resource limitation is a common issue, diabetes represents a major challenge. This disease is an endocrinological disorder characterized by uncontrolled hyperglycemia, due to the dysregulation of glucose metabolism. It may be caused mainly due to partial or complete inability of the production or secretion of insulin from pancreatic beta cells or incapability of cellular tissue to respond to serum insulin levels. There has been great demand for plant products as a result of their ready and easy availability, cost-effectiveness, and minimal side effects. From the recent research investigations suggested that there are several plant extracts can act as natural inhibitors of carbohydrate metabolizing enzymes and thus possess an immense potential for the management of postprandial hyperglycemia linked to diabetes.

In this context, a traditional vegetable- Kale (B. oleracea L var. acephala) of Kashmir region has a great potential to act against various degenerative diseases due to high antioxidant nature but the vegetable is highly unexplored. Further, it has been reported to be rich source of secondary metabolites including carotenoids, alkaloids, sterols, phenolic compounds and flavonoid etc and, it is the presence of these bioactive molecules, that may account for most of its bioactive and pharmacological actions. Besides, it is loaded with a high content of bioactive glucosinolates like isothiocynates, thiocynates, nitriles, and epithionitriles. The presence of various polyphenols in Brassica are responsible for its health promoting vegetable (11). Also the anti-diabetic and antioxidant activities was reported in knol khol (12). In addition, the Brassica species also possess some sulforaphane which may be responsible for its anti-hyperglycemic effect (13). It was reported that the serious complication of the diabetes is the hepatic fat accumulation (14) which is due to the insulin deficiency in our body (15). In the present study, the kale extract of Kashmir valley (K-29) decreased the Fasting blood glucose levels when given to diabetic rats and proved the significant results when compared to standard drug. The hypoglycemic effect of k-29 can be well explained by the presence of glucosinolates found in them .The hypolipidemic properties present in K-29 may be due to the presence of saponins, decreasing the blood cholesterol level and accelerating rejection of bile acids and neutral lipids out of our body(16).

Conclusion: Based on our findings in the above study, the Brassica oleracea var acephala (K-29) of Kashmir valley reduced the blood glucose level and diabetic related complications. We suggest that the phytomolecules present in the Brassica olercaea var acephala can be used for the formation of component drug to treat diabetes and its related complications.

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