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Research Article

Glycaemic and Lipidemic Profile of Type-2 Diabetic Adults: An Intervention Study with Capparis Decidua

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Abstract

Introduction: Indian population is moving towards non communicable diseases at an alarming rate, with Type 2 Diabetes mellitus (T2DM) affecting a huge segment of adults, so much so that India has become the Diabetes capital of the world. Along with the various treatment options available, some plant-based options can be explored for their phytochemical properties and nutritional benefits, along with the allopathic treatment options available. One such option that can be tapped is the fruit of Capparis decidua (Kair), which is commonly consumed in various parts of India, especially Rajasthan. It has been traditionally used as an antidiabetic agent but there are very few published research studies regarding its medicinal use, hence it was chosen for the present study.

Objective: The present study evaluated the antihyperglycemic and antihyperlipidemic effects of Capparis decidua powder on adult men and women with Type 2 Diabetes mellitus.

Methodology: The Capparis decidua powder was orally given to adult men and women with T2DM at the dose of 250mg/kg body weight for an intervention period of 90 days. Adult male and female diabetic patients in the age group between 35 to 55 years using purposive sampling technique, who are fulfilling inclusion criteria were selected for the present study.

Results: Changes in Biochemical parameters (Fasting blood glucose, post prandial blood glucose, Hba1c, Total cholesterol, Triglyceride, HDL, LDL and VLDL) were found to be statistically significant at 5% level of significance.

Conclusion: Capparis decidua powder has potent antidiabetic and antihyperlipidemic activities.

Keywords: Glycaemic; Lipidemic Profile; Capparis Decidua

Introduction

Natural medicine originating at plant sources recently gained more attention on a global scale due to their improved tolerance and lesser side effects. WHO estimates over 75% of people worldwide today utilize herbs and other traditional remedies to treat a variety of ailments. In light of traditional use and therapeutic significance of medicinal plants, researchers seemed interested to explore the identification and isolation of the novel active medicinal compounds from natural flora [1]. According to WHO, due to their safety and cost-effectiveness, conventional methods of therapy were used by more than 80% of the world's population [2]. Various phytochemicals, including carbohydrates, tannins, alkaloids, steroids, flavonoids, and terpenes, collected from seeds, fruits, roots, flowers, leaves, and bark, have been used to treat veterinary, agricultural, and human ailments [3-5].

The presence of phytochemicals in therapeutic plants ensured the identification, treatment, and prevention of a number of diseases [6]. The most well-known disease in the world is diabetes mellitus, which affects 200 million people worldwide and an additional 300 million individuals at risk of developing the disease [7]. Insulin-dependent (Type-1) and non-insulin-dependent (Type-2) diabetes mellitus are the two recognised kinds of the disease. Lack of insulin in Type-1 diabetics is linked to practically complete suppression of pancreatic beta-cell activity. But Type-2 diabetes is more prevalent and typically found in obese and inactive individuals. Moreover, diabetes is linked to the body's reduction of antioxidants [8].

Type-2 diabetes is not restricted to the insulin use, and it is well managed by the modification of lifestyle and control of body weight [9]. When physical assessments are insufficient to adequately regulate the metabolic system, oral anti-diabetic medication is typically advised [10]. Traditional herbal medicine and allopathic methods of treatment are equally valued when it comes to the treatment of diabetes. More than 800 medicinal plants have been researched globally to successfully manage diabetes mellitus (anti-diabetic) [11].

A total of 37 European medicinal plants were identified to have anti-diabetic potential, and in in-vivo investigations, eleven of these plants showed a significant anti-hypoglycaemic threshold. Studies have also demonstrated that the hydrophilic components of herbal medicines directly contribute to the blockage of intestinal glucose absorption and enhance transportation in muscle tissues, which in

turn promotes the metabolic process and, ultimately, the release of insulin [12]. Many medicinal plants and herbs contributed to the development of a cutting-edge drug to treat diabetes. As a result, Capparis decidua (C. decidua) was chosen for comparison testing of anti-diabetic activities. Since ancient times, plants have played a crucial role in the repression of food and pathogen-related illnesses that affect ethnic populations [13,14]. They are regarded as a treasure trove of potential medications [15-17].

Over the past few years, traditional, complementary, and alternative medicines have attracted renewed interest on a global scale [18,19]. Due to their lower cost and side effects, phytomedicines have gained wider acceptance as complementary and alternative therapies despite the lack of scientific data regarding their usefulness [20-22]. 80% of the population in underdeveloped nations trusts phytomedicines for the treatment of various illnesses [23]. Research on the possible bioactivity and nutritional significance of various families of phytochemicals, including carotenoids, flavonoids, glucosinolates, and phytoestrogens, has grown in popularity over the past several decades [24]. According to literature, plants have been utilised as medicines and their molecular structures have served as the basis for many modern drugs [25].

Blood glucose (or blood sugar) levels that are elevated in people with diabetes are chronic metabolic conditions that over time cause substantial harm to the heart, blood vessels, eyes, kidneys, and nerves. The most prevalent type of diabetes is type 2, which often affects adults, and develops when the body stops producing enough insulin or becomes resistant to it. Type 2 diabetes has been much more common during the past three decades in nations of all income levels. Diabetes type 1 is a chronic illness in which the pancreas generates little or no insulin on its own. It was previously referred to as juvenile diabetes or insulin-dependent diabetes.

Diabetes mellitus is a metabolic disorder in which cells are unable to absorb glucose from the blood. Type I insulin-dependent diabetes mellitus is a congenital condition, whereas type II non-insulin-dependent diabetes mellitus is an acquired condition [26].

Prevalence of Diabetes Mellitus

The burden of diabetes is significant and increasing internationally, including in developing economies like India, mainly caused by the increasing incidence of overweight/obesity and bad lifestyles. In India, 77 million people were estimated to have diabetes in 2019, and by 2045, that number is projected to reach over 134 million. About 57% of these people are still undiagnosed. The majority of cases of diabetes, type 2, can result in microvascular and macrovascular problems that can affect many organ systems.

These complications play a significant role in the rise in early morbidity and death among diabetics, which results in a reduction in life expectancy and a significant financial load on the Indian healthcare system. In addition to genetics and family history, the risk factors for diabetes include ethnicity, age, obesity, physical inactivity, eating a poor diet, and behavioural patterns. Diabetes consequences can be avoided or delayed by maintaining stable blood sugar, blood pressure, and blood lipid levels.

Capparis decidua

Edgew.; member of family - The xerophytic, thickly branched plant family Capparaceae climbs. It is mostly found in subtropical and tropical climates, where it thrives primarily in arid and semi-arid terrain (Dhakad., *et al*., 2016). It is frequently known with hundreds of vernacular names; few common are Kari, Delha, Caper, Kair, Karyal, Hanbag, Karil, Kabra, etc.]. Caper plant immature fruits can be eaten and are primarily used as pickles and vegetables. It is one of the key components of the classic and well-liked Rajasthani dish "Panchkuta," which is a concoction of five dried plant species and is specifically made during the traditional "Basoda festival" in Rajasthan, India.

Asthma, body pain, body fracture, cardiac issue, cough, cholera, digestive disorders, dysentery, earache, eczema, intermittent fever, migraine, muscular injury, toothache, typhoid, and rheumatism are just a few of the diseases that are treated with various parts of C. decidua in both codified and non-codified systems of medicine. Various animal and clinical studies have shown the plant's enormous pharmacological potential, which includes antioxidant, anti-diabetic, anti-inflammatory, analgesic, anticancer, hepatoprotective, hypolipidemic, antiatherosclerotic, antihypertensive, anthelmintic, antimicrobial, anti-nociceptive, antirheumatic, and anticonvulsant activities, among others. Each and every traditional medical system, including Ayurveda, Tibb-e-Unani, Greco-Arab, Chinese, etc., recognises the value of this plant in traditional medicine [27,28].

The abundance of secondary metabolites found in plant-based diets has a good impact on human health and helps to prevent disease. In addition to its significance in pharmacology, C. decidua is regarded as a rich source of essential minerals that add to the plant's nutraceutical value. A substantial content of calcium and potassium is present in the plant which is valued both for livestock feed and human food. Flowers and fruits of *C. decidua* are a potential source of prime electrolytic minerals. The plant also contains a sizeable amount of vital minerals, mainly Fe and Zn, which supports its potential application in overcoming the mineral shortfall in the human diet [29].

Bioactivity of Capparis Decidua

The presence of a variety of phytochemicals, such as alkaloids (capparisinine, capparisine, stachydrine, and isocodonocarpine), phenolics, flavonoids, sterols, and fatty acids, is what gives the caper plant its amazing bioactivities. The primary disease in the globe is diabetes mellitus, which affects around 347 million individuals and can cause a variety of complications when left untreated [30].

The alpha amylase enzyme, which is linked to the disintegration of starch into its constituent parts, is one of the body's essential enzymes. Amylase suppression causes the digestion of carbohydrates

to take longer, which lowers the amount of glucose that is absorbed. As a result, the increased post-prandial sugar level decreased [31]. Alpha-glycosidase (intestinal) and alpha-amylase (pancreatic), which are used to convert complex saccharides into absorbable monosaccharides, react to generate carbohydrates metabolising enzymes [32].

Antidiabetic activity of capparis decidua

Diabetes can be controlled by reducing postprandial hyperglycemia, which can be accomplished by inhibiting the digestive tract's amylase and glucosidase enzymes, which hydrolyze carbs into glucose [33]. In order to cure diabetes, plants with a sufficient concentration of -amylase and -glucosidase inhibitors can be employed. C. decidua has distinguished itself as a possible antidiabetic option among these plants. The plant's fruit extracts significantly inhibited both enzymes, followed by extracts from the flowers and leaves [34].

Rats that were given an alloxan (80 mg/kg IP)-induced diabetic diet for three weeks displayed considerable hypoglycaemic activity when C. decidua fruit powder (30%) was included in the diet [35,36]. According to findings from a different study, C. decidua's alkaloid fraction has demonstrated promise in the management of diabetes [37]. In another study, the reduction of blood glucose levels in normal and diabetic rats using methanol (300 mg/kg) and pure (30 mg/kg) stem extracts was explored [38].

Antihyperlipidemic activities

The last few decades have shown that cardiac conditions are the leading cause of death worldwide [39]. Due to their ability to reduce lipid levels, plant extracts are employed as cardioprotective phytomaterials [40-43]. In STZ-diabetic rats, the ethanolic extracts of several C. decidua components significantly decreased the level of plasma cholesterol, with the bark and fruit extracts having the greatest impact [44]. Administration of C. decidua flower and fruit extracts significantly reduces heart and liver cholesterol levels [45]. The presence of saponins and tannins in the ethanolic extract, which prevented the absorption of lipids and were therefore utilised as hypo-cholesterolemic agents, could be used to explain the hypolipidemic effect of C. decidua [46]. When tested on diabetic rats, a fraction of C. aphylla stem purified using chromatographic methods decreased total plasma cholesterol, triglycerides, and low-density lipoproteins; nevertheless, high-density lipoproteins increased [47]. Cardiovascular disorders are one of the leading causes of death worldwide, and atherosclerosis causes their development [48]. The increased serum levels of cholesterol and LDL (low-density lipoprotein) cholesterol promote atherosclerosis and other cardiovascular illnesses [49].

According to reports, C. decidua ethanolic extract lowers blood cholesterol levels by increasing neutral steroid excretion through faeces and lowering the reabsorption of cholesterol from internal sources [50]. Because HDL aids in the efflux of cholesterol from the walls of arteries and shifts it back to the liver, a reduction in HDL levels raises the risk of coronary artery disorders [51]. When rabbits are fed an athero diet together with cholesterol, the ratio of HDL cholesterol to total cholesterol decreases noticeably. This ratio returns to normal when these rabbits are fed an ethanolic (50%) extract of the C. decidua flower, demonstrating the plant's potent anti-atherosclerotic properties [52].

Objective

The present study evaluated the antihyperglycemic and antihyperlipidemic effects of Capparis decidua powder on adult men and women with Type-2 diabetes.

Methodology

A private hospital in Jaipur city was selected for the study. Adult male and female diabetic patient in the age group between 35 to 55 years, who are fulfilling inclusion criteria were selected for the study. Informed consent forms were collected from the patient.

Fifty adult males and females with type 2 diabetes mellitus were chosen for the current study using a purposive sampling technique. For a 90-day intervention period, they received Capparis Decidua powder at a dosage of 250 mg/kg/bodyweight along with diet counselling. At the baseline information regarding demographic profile, Anthropometry (Height, Weight, BMI, Waist circumference, Hip Circumference and WHR) and Biochemical levels (Glycaemic and Lipidemic profile) were obtained.

Inclusion criteria

- Patient with T2dm
- Patients aged 35-50 years.
- Patient with fasting blood sugar levels > 126 mg/dl
- Patient on oral hypoglycaemic drugs
- Willing to participate in the study.
- Residents of Jaipur city only

Exclusion criteria

- Patient suffering from complications of diabetes as retinopathy, nephropathy, neuropathy or suffering from other acute illnesses like heart disease etc.
- Pregnant or lactating mother
- Patient on insulin therapy

Biochemical test

The blood sample was collected and analysed at pre and post phase at a laboratory in Jaipur for assessment of all biochemical parameters to find out the effect of treatment. The kair powder was prepared at home (Procurement, Washing and sundried, cleaning and sorting for adulteration, Grinding and weighing, packing, and labelled) for supplementation and analysed for proximate value and microbial contamination. Blood serum was used for the analysis of fasting blood glucose, post prandial glucose, triglycerides, total cholesterol, HDL, and LDL cholesterol at baseline and after 3 months of supplementation. Blood sample was obtained after 12 hours overnight fasting.

Statistical analysis

Data was tabulated and computed. Mean, median and standard deviation was calculated. Difference in the various parameters of intervention was assessed by using 't' test.

Results and Discussion

	Pre	Post	t-value
Weight (Kg)	75.27 ± 14.11	72.2 ± 12.82	0.001*
Height (cm)	165.36 ± 8.74	165.36 ± 8.74	0 NS
BMI (kg/m^2)	27.44 ± 3.83	26.21 ± 2.97	0.001*
WC (cm)	107.86 ± 9.44	106.94 ± 9.05	0.003*
HC (cm)	106.86 ± 7.73	106.42 ± 6.64	0.917NS
WHR (cm)	1.01 ± 0.06	1.00 ± 0.05	0.002*
*Significant, NS-nonsignificant			

Table 1: Mean value of Anthropometric measurement of Kair (Capparis Decidua) powder of diabetic patients aged 35-55 years.

The above table 1 depicts the anthropometric measurement of diabetic patients consuming kair powder for three month and results reported that there was an improvement after intervention. There was a significant reduction in weight, body mass index, waist circumference and waist hip ratio of the respondents. Similarly, the mean difference of all the anthropometric indices except hip circumference (Figure 1-5).

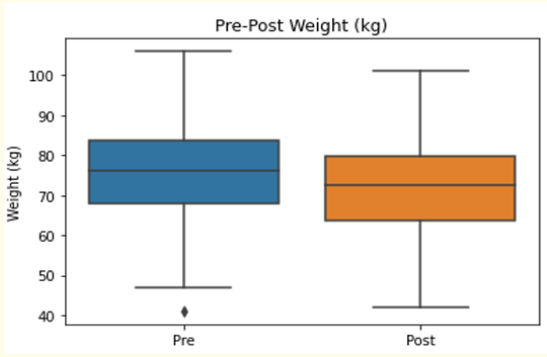

Figure 1

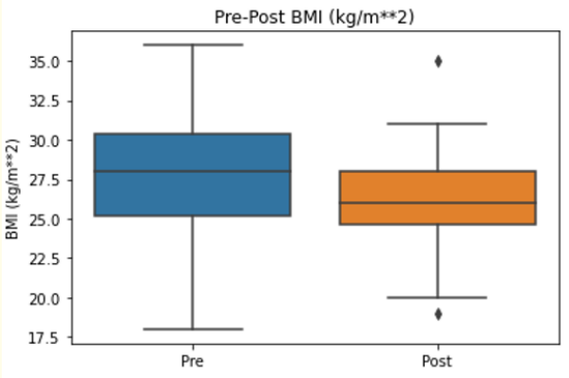

Figure 2

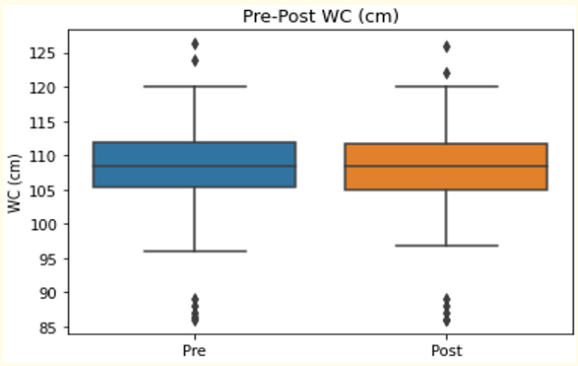

Figure 3

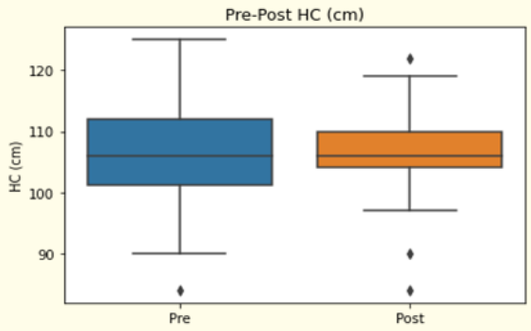

Figure 4

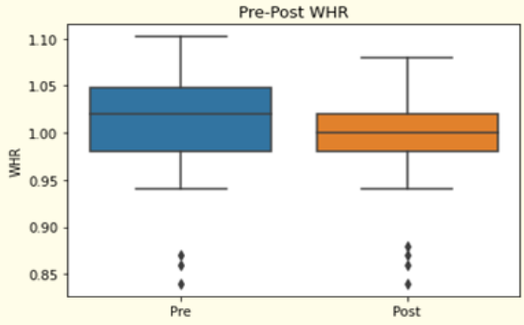

Figure 5

Biochemical estimation

The table 2 and figures 6-11 represent biochemical estimation of Glycaemic profile of diabetic patients aged 35-55 years and results revealed that a significant reduction was noticed among parameters consisting of fasting blood glucose levels, post prandial, HbA1C, total cholesterol, LDL, HDL and VLDL after three months of intervention of diabetic patients consuming Kair powder. There mean differences were observed statistically significant among the parameters except high density lipo-proteins. The figures are following.

Discussions

The results of the current study revealed that after supplementation with Capparis decidua, significant reduction were observed

Variables	Pre	Post	t-value
FBG	182.38 ± 82.52	108.06 ± 12	0.001*
PPG	245.9 ± 91.69	158.08 ± 17.64	0.001*
HbA1C (%)	9.86 ± 2.35	7.69 ± 1.53	0.001*
Total Cholesterol	235.05 ± 45.77	184 ± 29.24	0.001*
Triglyceride	244.65 ± 77.36	180.08 ± 49.06	0.001*
HDL	37.39 ± 6.88	40.13 ± 3.61	0.01NS
LDL	153.19 ± 35.46	128.67 ± 25.41	0.001
VLDL	45.91 ± 14.25	40.73 ± 10.67	0.001*
*Significant, NS-nonsignificant			

Table 2: Mean biochemical estimation of Capparis decidua(Kair) powder of diabetic patients aged 35-55 years.

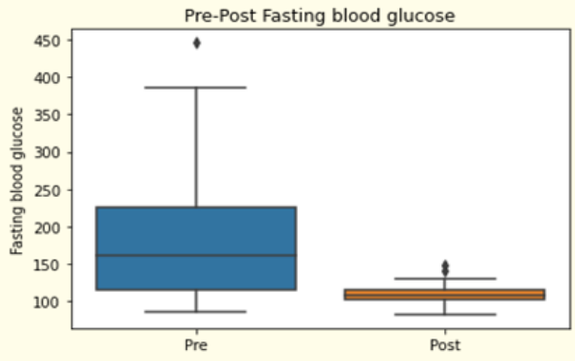

Figure 6

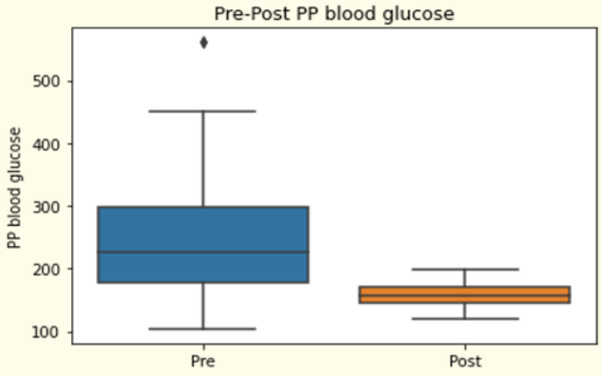

Figure 7

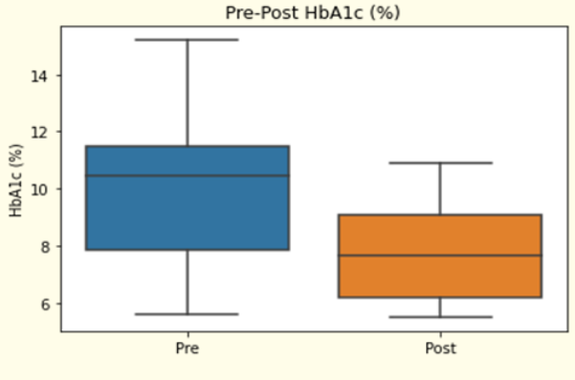

Figure 8

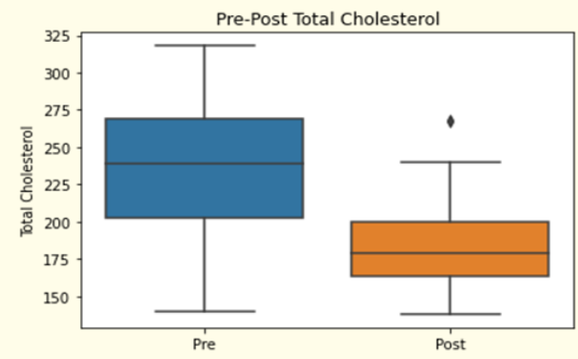

Figure 9

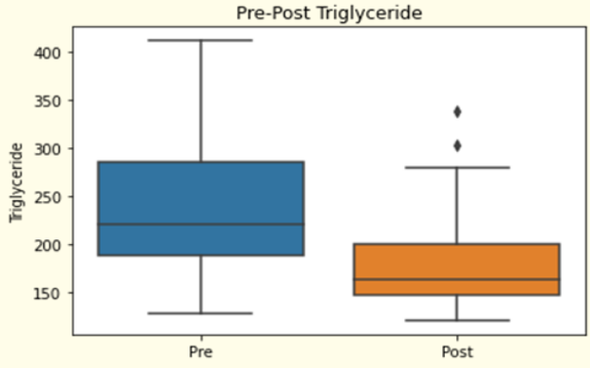

Figure 10

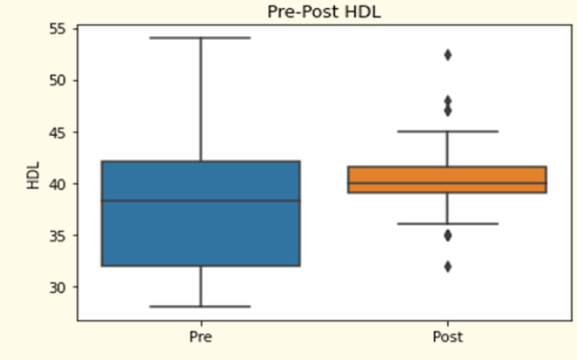

Figure 11

in glycaemic profile (<0.001) comprising fasting blood sugar, post prandial blood sugar and Hba1c, and lipidemic profile (<0.001) following total cholesterol , low density lipoprotein cholesterol, triglyceride ,very low density lipoprotein cholesterol and anthropometric indices (<0.001) including weight, body mass index, waist circumference and waist to hip ratio of respondents. Therefore, the study concluded that after three months supplementation with Capparis decidua powder results reported improved levels in the anthropometric indices, lipidemic profile and overall condition.

A study was observed on rats by [44] and stated that there was noticeable reduction in plasma cholesterol levels after consuming ethanolic extract of capparis decidua and significant impact was

noticed by bark and fruit extract of it. In another study by Yadav., *et al*., 1997 reported that after consuming diet having capparis decidua had significant hypoglycaemic activity in rats. So that capparis decidua have strong antidiabetic effect on diabetic patients.

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