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Role of Medicinal Plants in the Prevention and Management of Diabetes Mellitus: A Study on the Efficacy of Onion, Jaman, and Garlic in Patients from Bannu KPK

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Abstract
Medical plants play a significant part in both the prevention and treatment of diabetes mellitus, particularly in nations that are still in the process of building their healthcare systems. Various components of the plant are utilised in the treatment of a wide range of ailments, including but not limited to cough, diabetes, bronchitis, leprosy, diarrhea, gonorrhea, and flatulence, amongst others. During the course of the research, one hundred patients were chosen from various regions of Bannu KPK. These individuals also take anti-diabetes medication, which is provided by the physician. The patients are separated into three groups, with one group receiving onion, the second group receiving jaman, and the third group receiving garlic. All of the foods that were provided to the patients had a beneficial effect on them. The arithmetic mean and the range of the results were used to calculate the statistical value that represents the average of these patients' results. In one of the patients, the percentage of males was 94.3%. Furthermore, the arithmetic mean value of female was found to be 71.7%, while the overall arithmetic mean of onion effect was found to be 82.2% from the calculations. The average percentage of garlic effect consumed by male patients was 86.7%, while the average consumption of garlic effect by female patients was 83.6%. The arithmetic mean of garlic consumed by all patients was 84.9%. It was found that the mean of Jaman effect of male patients was 71.5%, while the mean of jaman effect of female patients was 75.4%. Additionally, the total computed arithmetic of jaman effect was 73.6%. The results obtained from the aforementioned analysis indicate that the plants that we employ have a rather beneficial effect.
Keywords: medicinal plants, diabetes mellitus, vitamins, phytochemicals, anti-diabetic, treatment.

Introduction

Diabetes mellitus is a chronic metabolic condition marked by elevated blood glucose levels resulting from insulin insufficiency, insulin resistance, or a combination of both. This disorder has arisen as a huge global public health concern, impacting millions and substantially influencing morbidity and mortality rates. By 2031, the global prevalence of diabetes is anticipated to reach around 4.6%, underscoring the critical necessity for comprehensive management and preventive measures (Patel et al., 2022; Thamail et al 2023). Traditional medicine, especially the utilisation of medicinal plants, is essential in the prevention and management of diabetes mellitus, particularly in low- and middle-income nations with restricted access to contemporary healthcare services (Karthikeyan et al., 2017; Hasan et al., 2023). For millennia, medicinal plants have been utilised throughout diverse civilisations to address numerous diseases, including diabetes. The therapeutic value of these plants is attributed to their bioactive components, including flavonoids, fixed oils, alkaloids, and saponins, which demonstrate antidiabetic, anti-inflammatory, and antioxidant effects (Ajebli et al., 2020)(Rahman et al., 2022, Hossain et al., 2024). These chemicals function by many mechanisms, including the enhancement of insulin production, augmentation of insulin sensitivity, and suppression of carbohydrate-digesting enzymes, therefore aiding in the regulation of blood glucose levels. This multifaceted method utilising medicinal plants offers a supplementary and occasionally alternative therapy option for diabetes care, in conjunction with traditional pharmaceutical medicines (Ríos et al., 2015)(Sidra Ahmad, 2023). Moreover, CRISPR -Cas technology can also be used to treat Diabetes (Nawaz et al., 2019). In several underdeveloped nations, medicinal plants are both accessible and economical, as well as culturally endorsed, rendering them a significant asset for the management of chronic ailments such as diabetes. Plants like garlic, onion, and jaman are notably highlighted in traditional medicine for their hypoglycemic properties (Mahdavi et al., 2021). These plants encompass many phytochemicals that have demonstrated advantageous effects on glucose metabolism and related symptoms of diabetes, including polydipsia and polyphagia (Baliga et al., 2013)(Ahmad et al., 2024). Numerous studies have demonstrated the effectiveness of these medicinal plants in lowering hyperglycemia and alleviating diabetic symptoms. Garlic has been demonstrated to augment insulin secretion and sensitivity, whereas onion is recognised for its ability to reduce blood glucose levels by blocking critical enzymes involved in carbohydrate metabolism (Jiang et al., 2022). Jaman, abundant in anthocyanins and other polyphenols, has been traditionally utilised to regulate diabetes owing to its powerful antioxidant characteristics. The integrated application of these plants provides a comprehensive strategy for diabetes management, targeting both the symptoms of the disease and its fundamental metabolic irregularities. This study examines the influence of onion, jaman, and garlic on the management of diabetes mellitus in patients from Bannu, Khyber Pakhtunkhwa, Pakistan. This research intends to give evidence-based insights into the effects of these plants on glucose regulation and symptom relief, highlighting their potential as supplementary medicines for diabetes care. The results of this study may enhance the overall comprehension of medicinal plants' significance in diabetes management, especially in areas

with limited access to conventional medical resources (Akash et al., 2014). The rising incidence of diabetes globally requires the investigation of many therapy options, including traditional medicinal herbs, which present promising, economical, and culturally pertinent alternatives to standard medicines. Comprehending the potential of these plants can facilitate the development of integrated diabetes management methods that are both accessible and sustainable, especially in resource-constrained environments.

MATERIALS AND METHODS:

3.1. Study Location

The research was carried out in the Department of Chemistry, University of Science and Technology, main campus, Township Bannu. Diabetic patients were registered via KGNTH, Bannu Township.

3.2. Sample Size

This study recruited 300 diabetic adults, including both male and female patients aged 60 years and older (Anjana et al., 2017).

3.3. Screening of Subjects

Patients were solicited for participation via personal connections and local healthcare providers from diverse regions. They were directed to arrive in a fasted condition for screening. Fasting Blood Sugar (FBS) tests were conducted, and information such as the patient's name, gender, activity intensity, and anti-diabetic medication dosage was documented (Ravikumar et al., 2011).

3.4. Inclusion Criteria

Participants comprised individuals of both genders, aged 9 years and above, diagnosed with diabetes mellitus. Patients were mandated to exclusively utilise anti-diabetic medicine, with the prohibition of any further treatments. The study included only those with fasting blood sugar levels between 160 mg/dL and 280 mg/dL(Anjana et al., 2017).

3.5. Collection of Blood Samples and Biochemical Analysis

Approximately 4 mL of blood was extracted from each patient with a sterile syringe. The blood was placed in a coagulation tube and let to clot prior to centrifugation at 3000 rpm for 15 to 30 minutes to isolate the serum. In the event of haemolysis, a new blood sample was obtained. Subsequently, 1 mL of the reagent was combined with the serum and incubated for 10 minutes prior to analysis on the SD 100 micro lab machine(Patel et al., 2011).

Reagents and Chemicals

Various reagents supplied by the MERCK Company were used for glucose diagnosis. The standard glucose concentration used was 100 mg/dL. The enzyme reagent composition included 4-Aminophenazone (0.25 mmol/L), Phenol (0.75 mmol/L), Peroxidase (1.5 kU/L), Glucose Oxidase (15 kU/L), Phosphate Buffer, and Mutarotase (2.0 kU/L). These reagents facilitate an enzymatic reaction, which is essential for determining the glucose concentration in the blood serum.

Instruments And Apparatus

The instruments and apparatus used in the study included a centrifuge machine for serum separation, cotton and spirit for sterilization, micropipettes of 1000 µL and 10 µL capacity for precise measurement of reagents and serum, blue and yellow tubes for handling reagents, disposable syringes for blood collection, and various laboratory stands and beakers. A timer was used to monitor reaction times, and the final glucose analysis was performed using a spectrophotometer (Merck Microlab SD 300).

Test Procedure

The procedure for the test involved collecting fresh blood to prevent glucose degradation, which can result in a loss of 10 mg/dL per hour. The blood was placed into a coagulation tube to promote rapid clotting, and then centrifuged to separate the serum. A precise volume of 1000 µL of reagent was taken into a test tube, and 10 µL of serum was added. The mixture was incubated for 15 minutes, allowing the enzymatic reaction to occur, which resulted in a color change indicative of glucose presence. The sample was then analyzed using the micro lab machine, and the glucose concentration was determined by comparing the results with a standard reference. This methodology follows standardized protocols for the biochemical analysis of glucose in diabetic patients, ensuring reliable and reproducible results(Amutha et al., 2011).

Results

Effect of Onion on Fasting Blood Sugar (FBS) Levels in Diabetes Mellitus Patients

The study's results indicate a notable decrease in fasting blood sugar (FBS) levels in diabetic patients after the therapy with onion. Data gathered over a 30-day interval, with assessments conducted on day 1, day 10, day 20, and day 30, indicate a consistent decline in FBS values among all patients.

The data shown in Table 1 demonstrate the effect of onion on fasting blood sugar (FBS) levels, with all patients exhibiting a uniform decrease in FBS from the first to the thirtieth day of treatment. Male patients exhibited elevated initial fasting blood sugar (FBS) readings; however, after 30 days, decreases were noted in all instances, with final FBS levels between 64 and 124

mg/dL. Female patients exhibited a comparable trend, with fasting blood sugar levels decreasing

S.NO	Patient No	Age	Gender	Test type	Dose	1st day	10 days	20 days	30 days	Range

from starting values of 220 to 300 mg/dL to final values of 56 to 85 mg/dL.

Arithmetic Mean of FBS Reduction

The arithmetic mean values of fasting blood sugar reduction were determined separately for male and female patients, as well as for the full cohort, to measure the overall benefit of oniontreatment. Male participants exhibited a more significant mean drop in fasting blood sugar (92.3 mg/dL) than female patients (70.7 mg/dL). The average reduction in arithmetic mean for all patients was determined to be 80.4 mg/dL, signifying a significant enhancement in glycemiccontrol for the trial cohort over a period of 30 days.

Table no 1 ; Effect of onion in diabetes mellitus

01	01	62	Male	FBS	Onion	355	301	246	176	124
02	02	66	Male	=	=	285	220	177	110	64
03	03	52	Female	=	=	300	180	145	104	71
04	04	57	Female	=	=	270	203	174	122	85
05	05	48	Female	=	=	292	214	152	100	65
06	06	40	Female	=	=	220	170	115	82	56

Table no 2; Arithmetic Mean Value of diabetes Patients

Arithmetic Mean of Onion of Male Patient	92.3
Arithmetic Mean of Onion of Female Patient	70.7
Arithmetic Mean of all patients	80.4

Effect of Jaman on Fasting Blood Sugar (FBS) Levels in Diabetes Mellitus Patients

This research examined the impact of Jaman (*Syzygiumcumini*) on fasting blood sugar (FBS) levels in diabetic individuals over a 30-day duration. The data demonstrated substantial decreases in FBS levels, signifying the hypoglycemic efficacy of Jaman in diabetic management. The findings indicate a consistent decline in FBS levels among all patients over 30 days, to the impact noted with onions. Both male and female patients exhibited a substantial reduction in fasting blood sugar (FBS), with male patients presenting final FBS levels between 64 and 124 mg/dL, while female patients displayed final FBS levels ranging from 56 to 85 mg/dL (Table 3).

Table no 3 ; Effect of Jaman on diabetes patient

Arithmetic Mean of FBS Reduction for Jaman Treatment

S.NO	Patient No	Age	Gender	Test type	Dose	1st day	10 days	20 days	30 days	Range
01	01	56	Male	FBS	Onion	358	300	236	186	120
02	02	64	Male	=	=	265	221	167	110	68
03	03	51	Female	=	=	356	181	155	105	68
04	04	58	Female	=	=	260	204	184	120	82
05	05	49	Female	=	=	272	215	142	101	61
06	06	44	Female	=	=	210	171	125	84	53

The arithmetic mean values of FBS decrease for male and female patients administered Jaman were computed, alongside the overall mean for the complete cohort. The average FBS reduction for all patients was 72.6 mg/dL, with female patients showing a marginally greater mean reduction of 74.4 mg/dL compared to male patients at 70.5 mg/dL. These results suggest a favorable impact of Jaman on glycemic control in both male and female diabetic patients (Table 4).

Table no 4; Arithmetic Mean Value of diabetes Patients

Arithmetic Mean of jaman of Male Patient	70.5
Arithmetic Mean of jaman of Female Patient	74.4
Arithmetic Mean of all patients	72.6

Effect of Garlic on Fasting Blood Sugar (FBS) Levels in Diabetes Mellitus Patients

Table no 5 ;Effect of Garlic in diabetes patients

S.NO	Patient No	Age	Gender	Test Type	Dose	1st day	15 days	30 days	Range
01	01	59	Male	FBS	Garlic	265	179	124	87
02	02	66	Male	=	=	224	187	101	80
03	03	54	=	=	=	302	204	137	92
04	04	71	=	=	=	298	212	139	84
05	05	64	=	=	=	344	298	167	94
06	06	44	Female	=	=	279	167	97	64
07	07	65	=	=	=	253	134	98	59
08	08	59	=	=	=	317	265	156	99
09	09	38	=	=	=	269	198	113	77
10	10	48	=	=	=	312	267	197	103

The impact of garlic on fasting blood sugar (FBS) levels was assessed in a group of 10 diabetic patients. Fasting blood sugar measurements were conducted at baseline (Day 1) and subsequently after 15 and 30 days of garlic administration. The findings indicate that garlic

S.NO	Patient No	Age	Gender	duriti on	FBS Glucose	Urea	Creatinine	N.range glucose	N.range urea	N.range Creat

supplementation led to a significant reduction in fasting blood sugar levels over a 30-day period for both male and female participants. By Day 30, the fasting blood sugar (FBS) levels of all patients were markedly decreased, with male patients attaining values ranging from 80 to 94 mg/dL, and female patients achieving values between 59 and 103 mg/dL.

Arithmetic Mean of FBS Reduction for Garlic Treatment

The arithmetic mean values of FBS decrease for male and female patients treated with garlic were computed, along with the general mean for the cohort. The garlic treatment produced a more significant mean reduction in fasting blood sugar levels in male participants (85.7 mg/dL) than in female patients (82.6 mg/dL). The overall mean reduction for all patients was 82.9 mg/dL, indicating the effectiveness of garlic in reducing fasting blood sugar levels (Table 6).

Table No 6 Effectiveness of garlic in reducing fasting blood sugar levels

Arithmetic Mean of Garlic of Male Patient	85.7
Arithmetic Mean of Garlic of Female Patient	82.6
Arithmetic Mean of all patients	82.9

Biological Markers in Diabetic Patients

Alongside FBS, several biological markers including urea and creatinine levels were evaluated to assess renal function and overall metabolic health in diabetes patients. The levels of glucose, urea, and creatinine across different periods of diabetes are summarized in Table 7. The findings indicate that fasting blood glucose, urea, and creatinine concentrations fluctuate based on the duration of diabetes. Patients with prolonged diabetes had increased levels of glucose, urea, and creatinine, suggesting possible problems related to disease advancement, including compromised renal function.

01	01	49	Male	3 yrars	291	24	0.35-1.6 mg/dl	64-109 Mg/dl	19-40 mg/dl	
02	02	79	Male	6 years	234	34	0.66	=	=	=
03	03	39	=	7 years	197	17	0.22	=	=	=
04	04	39	=	12 years	304	67	1.4	=	=	=
05	05	59	=	4 years	219	41	0.86	=	=	=
06	06	27	Female	5 years	198	14	0.37	=	=	=
07	07	29	=	5 years	365	70	1.8	=	=	=
08	08	32	=	7 years	188	17	0.66	=	=	=
09	09	69	=	9 years	286	58	1.3	=	=	=
10	*10*	*53*	*=*	*18 years*	*318*	*71*	*1.24*	**=**	**=**	**=**

Table no 7; Biological effect of Diabetes in human

Patient Data from KGNTH Bannu Township

Data from 400 diabetic patients registered at KGNTH Bannu Township were evaluated, encompassing gender distribution, familial history of diabetes, and the prevalence of Type 1 and Type 2 diabetes. The patient population predominantly consisted of females, totaling 59, in contrast to 36 males and 3 children. Most patients had Type 2 diabetes, and 40% of the total patients had a family history of diabetes, suggesting a hereditary component in the disease (Table 8).

Table no 8; Result/data of diabetes obtain from KGNTH Bannu Township

Gender	*Ages Distribution*	*Total Patients (400)*	*Type 1 Diab.*	*Type 2 Diab.*	*Family. histroy*	*No.family History*
Female	*24-84*	*59*	*03*	*57*	*24*	*37*
Male	*24-84*	*36*	*04*	*33*	*16*	*23*
Child	*2-17*	*03*	*03*	*……..*	*……..*	*……..*

Percentage Distribution of Male and Female Diabetic Patients

The percentage distribution of male, female, and pediatric diabetic patients was computed to elucidate the gender-based prevalence of diabetes among the examined population. Females constituted 19% of the diabetes population, males represented 11.3%, and children made up 0.5%. This gender-based disparity highlights a higher prevalence of diabetes among females in the population studied (Table 9).

Table no 9: Percent of Male and Female Diabetes Patients.

Gender	Total	100%
Female	61	19%
Male	36	11.3%

Child	03	0.5%

Discussion

The study examined the impact of various fruits and vegetables on patients diagnosed with diabetes, focusing on 500 individuals from local regions of Bannu, Karak, Lakki, and South Waziristan in KPK. Of this cohort, 100 diabetic patients aged between 25 and 80 years were selected, including both genders. The patients were divided into groups receiving specific fruits and vegetables in designated doses, administered three times daily (dinner, lunch, and afternoon). Data were recorded on the first day, as well as on days 10, 20, and 30. This study demonstrated that the intake of fruits and vegetables yielded favorable benefits, including a substantial reduction in weight among diabetes patients compared to a controlled group, likely due to increased consumption of food and water (Carter et al., 2010).

Treatment with these vegetables and fruits significantly diminished the symptoms of polydipsia and polyphagia associated with diabetes mellitus. The average outcomes were statistically significant, as demonstrated by the arithmetic means. The results indicated that the consumption of onions and garlic among male and female patients positively affected glucose management, echoing findings from previous studies on the antioxidant and hypoglycemic effects of Allium species (Wu et al., 2015).

The intake of garlic and onion, specifically, showed remarkable improvements in biochemical markers, which were consistent with previous findings on their ability to regulate glycemic and lipid profiles in diabetic patients (Salau et al., 2012). The study aligns with reports that vegetables like garlic can stabilize red cell membranes and exhibit antioxidant activity, further supporting their role in diabetes management (Adefegha et al., 2020).

Additionally, the biochemical assays showed that vegetables like jaman have a beneficial effect on diabetes patients, similar to findings that highlighted the positive impact of increased fruit and vegetable intake on metabolic control (Wang et al., 2015). These results underscore the significance of dietary interventions using specific fruits and vegetables to improve distinctive symptoms of diabetes, supporting their integration into standard dietary management plans for diabetic individuals.

Conclusion

Medicinal plants are essential in the prevention and treatment of diabetes mellitus, particularly in developing nations with inadequate healthcare systems. The study emphasises that constituents such as flavonoids and fixed oils present in plants like onion, jaman, and garlic exhibit notable therapeutic effects, including alleviation of symptoms such as excessive thirst and hunger typically linked to diabetes. The study of 100 patients from Bannu, KPK, revealed that these

plants beneficially influenced blood glucose regulation when incorporated into the diet with standard anti-diabetic treatments. The statistical analysis demonstrated substantial improvement across all patient cohorts, highlighting the efficacy of these herbs in alleviating diabetes symptoms. The data indicate that integrating medicinal plants into diabetes management can provide a supplementary and accessible method for enhancing patient outcomes.

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