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HOW *Phaseolus vulgaris* L (CHEAKPEA) CAN REDUCE OF BLOOD SUGAR LEVELS IN TYPE 2 DIABETES MELLITUS

Arnia Sactya Marta[1], Isna Hikmawati[1]✉, Nur Isnaini[1], Meida Laely Ramdani[1]

[1]Fakultas Ilmu Kesehatan, Universitas Muhammadiyah Purwokerto, Jl. Letjend Soeparjo Roestam, PO. BOX 229, Purwokerto, Indonesia.
Corresponding author: isnahikmawati@ump.ac.id

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Corresponding author
isnahikmawati@ump.ac.id

Abstrak

Latar belakang: Diabetes selama 10 dekade terakhir terjadi peningkatan dari 4,7% menjadi 8,5% pada penduduk dunia, Diabetes melitus (DM) tipe-2 dapat dikendalikan dengan aktifitas fisik, pola makan, konsumsi buah dan sayur. Tujuan penelitian ini untuk mengetahui efektivitas jus buncis terhadap penurunan gula darah pada penderita DM tipe-2. **Metode:** Penelitian *quasi experiment* ini melibatkan 44 responden yang dikategorikan menjadi 2 kelompok yaitu 22 subjek intervensi dan 22 subjek kontrol. Pengambilan sampel menggunakan purposive sampling dengan kriteria inklusi pada penderita DM yang berusia 53–77 tahun. Instrumen, alat, dan bahan penelitian ini adalah lembar kusioner, jus buncis, dan alat pengukur kadar gula darah. Analisa data menggunakan uji Wilcoxon dengan α=5%. **Hasil:** Sebagian besar subjek tergolong lansia sebanyak 54,55%, jenis kelamin paling banyak yaitu perempuan (65,91%). Sebanyak 5 responden (11,4%) dengan gula darah normal dan 17 responden (38,6%) dengan hiperglikemi. Penurunan kadar gula darah secara signifikan tejadi pada kelompok intervensi yang diberikan jus buncis dengan nilai ρ=0,001, dengan rerata sebesar 94,5 mg/dL. **Kesimpulan:** Jus buncis dapat digunakan untuk menurunkan kadar gula darah pada penderita DM tipe-2.

Abstract

Background: Diabetes during the last 10 decades has increased from 4.7% to 8.5% of the world's population. Type 2 Diabetes Mellitus (DM) can be controlled with physical activity, diet, fruit and vegetable consumption. The purpose of this study was to determine the effectiveness of bean juice on reducing blood sugar in patients with type 2 DM. Method: This quasi-experimental study involved 44 respondents who were categorized into 2 groups, namely 22 intervention subjects and 22 control subjects. Sampling used purposive sampling with inclusion criteria in DM patients aged 53–77 years. The instruments, tools, and materials of this study were questionnaire sheets, bean juice, and blood sugar measuring devices. Data analysis used the Wilcoxon test with α = 5%. Results: Most subjects were elderly as much as 54.55%, the most gender was female (65.91%). A total of 5 respondents (11.4%) with normal blood sugar and 17 respondents (38.6%) with hyperglycemia. A significant decrease in blood sugar levels occurred in the intervention group given bean juice with a value of ρ=0.001, with an average of 94.5 mg/dL. Conclusion: Bean juice can be used to lower blood sugar levels in patients with type 2 diabetes.

INTRODUCTION

Diabetes is a severe chronic disease that affects many people around the world. In 2014, an estimated 422 million people had the disease, increasing from 4.7% to 8.5% of the adult population. Countries with lower rates of diabetes and upper-middle-income countries have experienced the highest rates of increase in diabetes over the past 20 years (1). In 2008, Basic Health reported that 57% of the Indonesian population currently has diabetes. Type 2 diabetes mellitus occurs quite frequently due to several risk factors such as gender, age, and heredity, as well as smoking, physical activity, alcohol consumption, and body mass index. Diabetes mellitus is known as the silent killer because it can damage various organs and cause various complications (2).

According to World Health Organization (WHO) 2024 Diabetes is a metabolic disease characterized by high blood sugar levels that can harm the heart, kidneys, eyes, nerves, and circulatory system if ignored (3). Type 2 diabetes is the most common type of disease and is caused by an unhealthy lifestyle, an unbalanced diet, and a lack of physical activity. Diabetics who manage their diet well can maintain blood sugar levels below 160 mg/dL, while diabetics who do not manage their diet well have average blood sugar levels above 160 mg/dL (4).

Signs and symptoms of diabetes include polyuria, polydipsia, polyphagia, drowsiness or fatigue, drastic weight loss, impaired sexual function, vaginal infections, blurred vision, and tingling (5). Diabetes mellitus must be treated appropriately so that it does not get worse. Therapies that do not use drugs containing chemicals are called nonpharmacological therapies. Herbal components derived from fruits and vegetables are usually used in this therapy because they have compounds that can lower blood sugar. One of them is chickpea juice. Pulses have shown strong antidiabetic qualities, and claims have been made that pulses could be an important component in new antidiabetic therapies (6).

Phaseolus vulgaris L (Chickpeas) is a type of legume that is an annual herbaceous plant. Due to its high protein and vitamin content, chickpeas are one of the legume vegetables that are favored by the general public. Secondary metabolites such as triterpenoids, alkaloids, flavonoids, phenols, and saponins are found in chickpeas. Specifically, it is known that phenolic compounds have many properties, including anti-inflammatory, antiproliferative, antimutagenic, antibacterial, anticarcinogenic, and anti-diabetic properties (7). Chickpeas are high in antioxidant chemicals, protein, carbohydrates, fiber, minerals, and B vitamins. According to the findings of a literature review, preclinical and clinical trial results show the antidiabetic effects of peas. For example, blood glucose levels of diabetic rats can be lowered by 300 mg/kgBB of ethanol extract from peas, with a higher response than metformin (8). Pulses have been used as phytotherapy by some to lower blood sugar levels in patients with diabetes mellitus. Since legumes stimulate insulin secretion, it is expected that legumes can lower blood sugar levels (9). The purpose of this study was to determine the effectiveness of chickpea juice reducing blood sugar levels in patients with type 2 diabetes mellitus.

METHOD

This research is quantitative with a quasi-experiment design. With 2 groups of pretest and posttest. Researchers aim to determine the relationship and decrease in blood sugar levels in the intervention group given chickpea juice.

The population in this study were patients with Type 2 Diabetes Mellitus at the Adrio Husada Clinic and Kembaran 1 Health Center. The sample of this study were some patients who were included in the inclusion criteria, namely patients with Type 2 Diabetes Mellitus at the Adrio Clinic and Kembaran 1 Health Center, diabetes mellitus patients who were willing to become respondents, and patients aged 53 - 73 years. Exclusion criteria such as patients with Diabetes Mellitus with complications and patients who are not willing to become respondents.

The sampling technique used was purposive sampling. Based on the categorical descriptive formula, 22 respondents were obtained which were categorized into two groups: 22 intervention groups and 22 control groups. The intervention group was held at Adrio Husada Clinic Sokaraja Lor, while the control group was conducted at Kembaran 1 Health Center. The instruments used in this study were questionnaires and chickpea juice.

The intervention group consisting of 22 respondents was given 500 ml of chickpea juice placed in a glass cup (with 200 grams of chickpeas which were washed and cut into small pieces and then added with 500 ml of boiled water at room temperature and then pureed using a blender).

All procedures performed in this study were under the ethical standards of the national research committee. This research has been approved by the Health Research Ethics Commission, Muhammadiyah Purwokerto University, with Number: KEPK/UMP/27/VII/2024

RESULTS

Based on the results of research that has been conducted on 44 people with Diabetes Militus which is divided into 2 groups, 22 intervention groups given chickpea juice and 22 control/non-intervention group respondents. Characteristics of intervention group respondents in the elderly category (60-74 years) amounted to 16 respondents (72.7%). Gender in the intervention group is comparable, namely women totaling 11 respondents (50%) and men also totaling 11 respondents (50%). BMI 18.5-25.0 amounted to 11 respondents (50%). Family history was comparable at "Yes" there were 11 respondents (50%) and at "No" there were also 11 respondents (50%). Duration of illness 1 - 5 years amounted to 10 respondents (45.5%). The characteristics of the control group respondents in the middle age category (45 – 59 years) amounted to 14 respondents (63.6%). Gender in the control group amounted to 18 respondents (81.8%). BMI 18.5-25.0 amounted to 12 respondents (54.5%). Family history in "Yes" amounted to

13 respondents (59.1%). Duration of disease 6-10 years amounted to 11 respondents (50%). **(Table 1)**

Tabel 1. Respondent Characteristics

Characteristics	Intervention group		Control group		Total
	n	%	n	%	%
Age (year)					
45-59	6	27.3	14	63.6	(20) 45.45
60-74	16	72.7	8	36.4	(24) 54.55
Gender					
Man	11	50	4	18.2	(15) 34.09
Woman	11	50	18	81.8	(29) 65.91
IMT					
IMT 17,0-18,4	1	4.5	0	0	(1) 2.27
IMT 18,5-25,0	11	50	12	54.5	(23) 52.27
IMT 25,1-27,0	4	18.2	4	18.2	(8) 18.18
IMT > 27.0	6	27.3	6	27.3	(12) 27.27
Family history					
Yes	11	50	13	59.1	(24) 54.55
No	11	50	9	40.9	(20) 45.45
Duration of illness					
<5 year	10	45.5	7	31.8	(17) 38.64
6-10 year	9	40.9	11	50	(20) 45.45
>10 year	3	4.5	4	18.2	(7) 15.9

Based on **Table. 2**, it can be seen that blood sugar in the intervention group before giving chickpea juice which was >199 mg/dL amounted to 17 respondents (38.6%). Blood sugar after being given chickpea juice in the intervention group which was >199 mg/dL amounted to 3 respondents (13.6%). Blood sugar levels in the control group that was >199 mg/dL amounted to 15 respondents (34.1%). Blood sugar after the control group that was >199 mg/dL amounted to 11 respondents (25%). **(Table 2)**

Table 2. Overview of normal blood sugar levels in patients with diabetes mellitus

Group		Blood sugar rate in %		
		<140 mg/dl	140-199 mg/dl	>199 mg/dl
Intervention	Pre	(0) 0	(5) 22.7	(17) 77.3
(n=22)	Post	(6) 27.3	(13) 59.1	(3) 13.6
control	Pre	(3) 13.6	(4) 18.2	(15) 68.2
(n=22)	Post	(1) 4.5	(10) 45.5	(11) 50

Based on **Table. 3**, The average blood sugar level in the intervention group before being given chickpea juice was 266.64 with a minimum ± maximum value of 147 ± 533. After being given chickpea juice, the average blood sugar level dropped to 172.14 with a minimum ± maximum value of 169.50 ± 423. This decrease was significant, as evidenced by the Wilcoxon test which yielded a p=0.001, indicating a significant difference before and after the chickpea juice intervention. On the other hand, in the control group, the average blood sugar level before was 237.09 mg/dL with a minimum ± maximum value of 115 ± 410, while after was 218.86 mg/dL with a minimum ± maximum value of 137 ± 343, which showed an increase. The Wilcoxon test gave a p=0.322, indicating that there was no significant difference between blood sugar levels before and after in the group that did not receive chickpea juice. **(Table 3)**

Table 3. Mean, median, minimum and maximum values in patients with Diabetes Melitus before and after giving chickpea juice in the intervention group and control group

Group		Intervention N = 22	Control N = 22
Mean±SD	Pre	266.64 ± 83.914	237.09 ± 82.720
	Post	172.14 ± 75.602	218.86 ± 64.451
Minimun	Pre	147	115
	Post	76	137
Maximum	Pre	533	410
	Post	423	343
Difference		94.5 ± 8.31	18.23 ± 18.26
t		-4.075	-0.990
p		0.001	0.322

DISCUSSION

Based on the results of the study, most of the respondents' ages were elderly (60-74 years) as much as 72.7%. The elderly or those over 60 years old are more likely to develop diabetes mellitus because their body's ability to regulate high blood sugar becomes less efficient due to degenerative processes such as decreased secretion or insulin resistance. Common symptoms of elderly diabetes mellitus patients, such as polyuria, polydipsia, and polyphagia, are usually absent; instead, what bothers patients the most is the development of chronic degenerative problems in the blood vessels due to pathophysiological changes caused by aging (10). The results of this study are similar to research looking at HbA1c levels and body mass index in patients with type 2 diabetes, with the highest percentage of patients aged ≥60 years. According to research conducted at Dr. Wahidin Sudirohusodo Hospital Makassar, one of the factors causing diabetes in the general population is increasing age (11).

The results showed that the highest number of respondents were women, with a total of 29 respondents (65.91%). According to findings from the 2013 National Basic Health Research, women's susceptibility to obesity increases their risk of developing diabetes. This is due to women's activity levels which tend to be lower than men's. As a result, their bodies do not burn all the fat, leading to fat accumulation and obesity (12). The study findings also showed that there were more female respondents than males. The results of this study are under research that has been conducted on the study of the relationship between Prolanis and blood sugar control in patients with diabetes mellitus aged 35-65 years at Pakis Surabaya Health Center, which shows that Prolanis participants who suffer from type 2 diabetes mellitus are mostly female with 33 people or around 68.7% (13).

Based on the results of nutritional status research, it can be seen that as many as 23 respondents (52.27%) with normal nutritional status (18.5 - 25.0). Diabetes Mellitus sufferers are more affected by their nutritional conditions in

terms of blood glucose levels. Overnutrition occurs when energy intake and expenditure are not balanced, causing excess energy to be stored as fat. Fat will produce free fatty acids during the metabolic process, which can be used as energy reserves. However, if there is prolonged excess energy, free fatty acids may increase and disrupt glucose homeostasis. Overweight tissue can disrupt metabolism, which means it contributes to the pathogenesis of diabetes mellitus by causing insulin resistance (14). The results of this study are by previous research on Physical Activity, Duration of Disease and Blood Sugar Levels in Patients with Diabetes Mellitus (DM) Type 2 showing the nutritional status of 15 people (62.5%) with normal nutritional status (15).

The results showed that respondents with a family history of the disease were 24 respondents (54.55%). Heredity is one of the factors that contribute to the occurrence of diabetes mellitus. History/heredity: People who have maternal relatives are more likely to develop diabetes mellitus, and those who have paternal and maternal relatives are more likely to develop diabetes. This may be due to a mixture of maternal and paternal genes that carry the characteristics of diabetes mellitus, which accelerates the age at which the condition is diagnosed. The risk of developing diabetes is two to six times higher for those who have one or more family members with the disease, such as parents, siblings, or children, compared to those who do not (16). Family history can reveal information about chromosome carriers that have traits that influence behavior. Decision-making may be more prudent if there is a family history of diabetes mellitus (17). The results of this study are under previous researchers who examined the description of diabetic ulcers in individuals with diabetes mellitus, revealing that the incidence of diabetes mellitus with the consequences of diabetic ulcers is significantly influenced by a family history of the condition. Based on information from medical records, 101 people or 89.9% had diabetic ulcers and a family history of peptic diabetes (18).

Based on the results of the study, as many as 20 respondents (45.45%) have suffered from diabetes mellitus for 6-10 years. Experiencing a chronic disease over a long period can affect a person's level of experience and skill in managing treatment. The chronic nature of the condition can be the cause of a decrease in the patient's quality of life, which can affect the therapy and treatment they receive (19). The results of this study are in line with research on the length of time suffering from diabetes mellitus conducted at the internal medicine polyclinic of RSUP Prof. Dr. Wahidin Sudiro Husodo.The results showed that 43 respondents (53.1%) had suffered from the disease for five to ten years. This shows that respondents have long suffered from diabetes mellitus, both hereditary and acquired diseases. This condition occurs because respondents have not been able to manage their diabetes optimally at home and still depend on treatment from health workers to prevent the disease (20).

Based on the results of the study, it is known that in the intervention group, before being given chickpea juice, there were 17 respondents (38.6%) with blood sugar levels >199 mg/dL. After being given chickpea juice, it decreased to 3 people (13.6%). In the control group, before the intervention, there were 15 respondents (34.1%) with blood sugar levels >199 mg/dL, and afterward, the number dropped to 11 respondents (25%). The condition of hyperglycemia known as type 2 diabetes mellitus is caused by cell insensitivity to insulin. Insulin levels can be within the normal range or slightly lower. Type II diabetes mellitus is considered non-insulin dependent diabetes mellitus as the pancreatic beta cells continue to produce insulin (21). Heredity, physical activity, diet, energy production, metabolism and hormones all have an impact on the disease. Fat metabolism is controlled by diet, hormones and nerve impulses and depends on energy requirements. Ketones, which are an alternative fuel source for the brain and other organs, are formed when fatty acids are partially oxidized. In addition to being a dynamic tissue with multiple uses, fat tissue serves as a storage site for energy reserves (22).

Based on the results of research on 22 respondents in the intervention group, it can be seen that the average value before consuming chickpea juice is 266.64 ± 83.914 mg/dL. The average after being given chickpea juice for 1 week with a drinking frequency of 1 time a day 30 minutes before meals and good consumption before 12 hours is 172.14 ± 75.602 mg/dL, there is a decrease in blood sugar levels in respondents with a difference of 94.5 ± 8.31 mg/dL. This is because the blood sugar levels in respondents are too high. The results of this study conducted for 1 week found that there was a decrease in blood sugar in patients with Diabetes Mellitus at Prolanis Klinik Adrio Husada Sokaraja. Research shows that β-sitosterol and stigmasterol are present in chickpeas. In addition to their ability to increase insulin production, both substances-pectin and gum-contained water-soluble fiber. Data from 100 grams of chickpea extract shows that it contains 7.81% carbohydrates, 0.28% fat, 1.77% protein, 2.07% crude fiber, and 0.32% ash. Chickpeas contain nutrients that are beneficial to the human body. The water content reaches 89 grams (23). Drinking fruit, vegetable juice, or certain plant parts that have therapeutic properties is known as juice therapy. The process of crushing, squeezing, or filtering fruits, vegetables, or plant parts to extract their juice can be done using a machine. The legume known as chickpea (phaseolus vulgaris) has medical benefits beyond being eaten as a vegetable, mainly due to its ability to lower blood sugar in diabetics (24). Limitations in this study, researchers cannot control external factors such as diet, lifestyle, and routine drug consumption provided by the clinic during Prolanis activities. Data in the control group used secondary data, blood sugar data before using data in June and blood sugar after using data in July.

CONCLUSION

Giving *Phaseolus vulgaris L* juice is proven effective in reducing blood sugar levels in elderly people with diabetes mellitus. The results showed that the group that received the chickpea juice intervention experienced a significant decrease in blood sugar levels compared to the control group. Because of its high protein and vitamin content, chickpeas are one of the legume vegetables that are favored by the general public. Secondary metabolites such as triterpenoids, alkaloids, flavonoids, phenols, and saponins are found in chickpeas. Specifically, it is known that phenolic compounds have several properties, including anti-inflammatory, antiproliferative, antimutagenic, antibacterial, anticarcino-genic, and anti-diabetic properties. It is expected that

chickpea juice is integrated into a healthy diet for elderly people with type 2 diabetes mellitus.

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