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Literature Review: The Effect of Psyllium Fiber in Type 2 Diabetic Mellitus Patient

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ABSTRACT
The increasing prevalence of type 2 diabetes mellitus has encouraged the search for more natural and sustainable management alternatives, one of which is through nutritional intervention using soluble fiber such as psyllium. This study aims to examine the effects of psyllium on blood glucose control and other metabolic parameters in patients with type 2 diabetes. The method used is a literature study from various relevant field studies, focusing on the results of psyllium consumption for a certain duration. The results of the study showed that psyllium was able to reduce fasting blood glucose levels, HbA1c, and increase insulin sensitivity. In addition, psyllium also contributes to weight loss and improving lipid profiles, such as reducing LDL cholesterol and increasing HDL. Thus, psyllium has great potential to be part of a comprehensive nutritional therapy that is safe and effective in managing type 2 diabetes.

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INTRODUCTION

Type 2 diabetes mellitus is one of the most common chronic metabolic diseases suffered by people in the world in this century. This disorder is characterized by increased blood glucose levels due to insulin resistance and pancreatic beta cell dysfunction. Along with the development of a modern lifestyle that is full of high-calorie, low-fiber foods, and low physical activity, the prevalence of type 2 diabetes has shown a very significant increasing trend in various countries, including Indonesia (Gibb et al., 2020) .

Data from the International Diabetes Federation (IDF) in 2021 stated that more than 537 million adults in the world live with diabetes, and around 90% of them are type 2 diabetes sufferers. In Indonesia, the results of the 2018 Basic Health Research (Riskesdas) showed an increase in the prevalence of diabetes mellitus from 6.9% in 2013 to 10.9% in 2018. This figure is certainly worrying, because it shows that one in ten adults in Indonesia has diabetes, with most cases not being medically diagnosed (Braven Armando, 2022) .

One non-pharmacological approach to managing type 2 diabetes is through improving diet, especially by increasing fiber intake. Dietary fiber has been shown to help lower blood glucose levels, increase insulin sensitivity, and improve lipid profiles. Of the various types of fiber, psyllium —a soluble fiber derived from the seeds of *the Plantago ovata* —is the main focus because of its viscous nature and ability to slow down glucose absorption in the intestine.

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Psyllium works by forming a thick gel in the digestive tract that can slow gastric emptying and slow the rate of glucose digestion, thereby reducing the spike in blood sugar levels after meals. In addition to its glycemic effects, psyllium has also been shown to lower LDL cholesterol levels and increase satiety, which ultimately helps control weight—an important factor in the management of type 2 diabetes. Psyllium is now widely available as a supplement and as a food additive (Muhammad Owais Fazal et al., 2024) .

In theory, dietary fiber is divided into two types, namely soluble and insoluble fiber. Soluble fiber such as psyllium dissolves in water to form a gel that inhibits the absorption of glucose and fat, and slows the rate of food digestion. Insoluble fiber functions more dominantly in facilitating bowel movements. According to the American Diabetes Association, daily fiber consumption of 25-30 grams with a sufficient proportion of soluble fiber can have a positive impact on blood glucose control and metabolic health of diabetics (Marbun et al., 2023) .

psyllium consumption can lower the glycemic index of food, prolong digestion time, and increase the release of gastrointestinal hormones such as GLP-1. This hormone helps increase insulin secretion and inhibits the release of glucose from the liver. In other words, psyllium has the potential for hormonal effects that support glucose management, making it more than just a regular dietary fiber. This synergistic effect between mechanical and hormonal mechanisms makes psyllium interesting for further research (Soviana & Maenasari, 2019) .

However, in society, there is still a phenomenon of low awareness of diabetes sufferers regarding the importance of fiber consumption, especially from natural sources such as psyllium. Many patients still focus on medical treatment without balancing it with optimal dietary improvements. Fiber consumption in daily food, especially in urban communities, is still below daily recommendations. As a result, the effectiveness of treatment is often not optimal, and the risk of complications remains high.

The main problem currently faced is the lack of integration of psyllium as part of the type 2 diabetes management strategy in daily clinical practice. Education about the benefits of psyllium is still limited, both among health workers and patients. In addition, there are doubts about the long-term safety and clinical effectiveness of psyllium in lowering blood glucose levels in people with diabetes, especially if used without the supervision of a doctor or nutritionist.

Several previous studies have explored the benefits of psyllium, but the results are still varied. A study by (Mustofa et al., 2023) showed that psyllium supplementation for 8 weeks significantly reduced blood glucose and LDL cholesterol levels. Meanwhile, a study by (Nurzakiah et al., 2021) found that psyllium only reduced postprandial glucose, but had no effect on fasting glucose levels. Another study by Pal (Yunita et al., 2023) confirmed that the dose of psyllium and the duration of intervention affect the results obtained, but there is no standard agreement on the optimal effective dose.

The research gap lies in the lack of systematic reviews that bring together evidence from various studies in a critical and structured manner. Some studies are short-term, involve small samples, or use non-uniform intervention designs. This makes it difficult to draw strong

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and applicable conclusions in clinical practice. Therefore, literature is needed a comprehensive review to bridge this gap and provide a scientific basis for fiber-based diabetes management practices.

Literature This review aims to identify and analyze the effects of psyllium on glycemic control in patients with type 2 diabetes based on published scientific evidence. This review will evaluate the results of related clinical studies, including the effects on fasting glucose levels, HbA1c, and postprandial glucose. Thus, this review is expected to provide a more comprehensive understanding of the role of psyllium in the natural management of diabetes.

The implications of this study lie not only in the development of scientific knowledge, but also in encouraging the use of evidence-based nutritional approaches in clinical practice. Integrating psyllium into the diet of patients with type 2 diabetes is expected to reduce dependence on pharmacological therapy, reduce the risk of long-term complications, and improve the quality of life of patients. Literature This review can also be a reference in compiling a more contextual and applicable diabetes diet guide.

RESEARCH METHODS

This research uses a qualitative approach with *literature methods. review* or literature study as the main basis. *Literature review* was chosen because it was considered appropriate to explore, analyze, and synthesize various previous research findings related to the effects of psyllium fiber on blood glucose control in patients with type 2 diabetes mellitus. Through this approach, researchers can examine in depth how psyllium is used in various intervention designs, the doses given, and the outcome parameters measured in each study (Sugiyono, 2021) .

The data sources in this study consisted of 15 relevant, reputable, and peer *-reviewed national and international scientific journal articles.* The articles reviewed were published between 2000 and 2024, with a primary focus on experimental or quasi-experimental studies examining the effects of psyllium on clinical indicators in patients with type 2 diabetes. The search base ar The article was conducted through several trusted databases such as PubMed, ScienceDirect, Google Scholar, and ResearchGate, using the keywords: " psyllium," "fiber supplement," " type 2 diabetes mellitus," " glycemic control," and "HbA1c."

The journal selection process was carried out systematically by applying certain inclusion and exclusion criteria. Inclusion criteria included articles that were available in English or Indonesian, included intervention methods with psyllium, had subjects with DMT2, and included variables such as fasting glucose, HbA1c, or postprandial glucose. (Rukminingsih, 2020). Meanwhile, exclusion criteria include articles that are opinion articles, narrative reviews without primary data, or animal studies that cannot be directly compared with humans. Articles that meet these criteria are then analyzed to explore similarities, differences, and trends in the results of each study.

In the data analysis stage, researchers used a thematic approach to group the findings based on the focus of the study such as psyllium dose, intervention duration, and changes in blood glucose parameters. Data from each journal were tabulated, compared, and synthesized to identify common patterns, inconsistencies in results, and possible factors

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influencing the effectiveness of psyllium. This approach aims to produce evidence - *based conclusions. conclusion*) which can be the basis for clinical practice or further research in the future.

RESULTS AND DISCUSSION

Reviewed scientific journals, it was found that most studies showed a positive effect of psyllium fiber consumption on glycemic control in patients with type 2 diabetes mellitus. The most consistent effect was shown in reducing postprandial blood glucose levels and HbA1c, although there were variations in results depending on the dose, duration of intervention, and characteristics of the study subjects. Several studies also noted increased insulin sensitivity and improved lipid profiles as additional effects of psyllium supplementation. These findings provide an overview that psyllium has significant potential in supporting non-pharmacological diabetes management through soluble fiber-based dietary interventions.

Research result

No	Author and Year	Title	Method	Results and Discussion
1	Gibb et al. (2022)	*Psyllium fiber improves glycemic control proportional to loss of glycemic control*	Experimental clinical trial in 35 groups of patients with varying levels of glucose control (euglycemic to T2DM).	Psyllium reduced fasting blood glucose by 11.6 mg / dL in patients with T2DM and HbA1c by an average of 0.97%. Greater effects were seen in patients with poor glucose control. Optimal efficacy was seen at doses ≥10.2 g/day for ≥8 weeks.
2	Feinglos et al. (2023)	*Psyllium improve glycemic control in patients with type 2 diabetes mellitus*	Controlled clinical trial in 63 patients with T2DM, administration of psyllium 10 g/day for 12 weeks.	HbA1c decreased by 0.89%, fasting glucose decreased by 12.4 mg / dL, and weight loss averaged 1.2 kg. Patients reported increased satiety. The strongest effects were seen in the obese group.
3	Brave (2022)	*Role of psyllium (Plantago) ovata) in the treatment of diabetic dyslipidemia*	Experimental trial on 48 DMT2 patients with dyslipidemia, psyllium intervention 8 g/day for 10 weeks.	Total cholesterol decreased by 9.2%, LDL by 12.8%, and fasting glucose by 9.6 mg / dL. Psyllium is effective as a complementary therapy in diabetic patients with lipid problems.
4	Gholami et al. (2024)	*The effect of psyllium on FBG,*	RCT (Randomized Controlled Trial) in	HbA1c decreased significantly by an average of

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		HbA1c, HOMA-IR, and insulin control	1,492 DMT2 patients with a psyllium dose of 5–15 g/day.	0.83%, FPG decreased by 10.5 mg / dL, and HOMA-IR decreased by 1.12 points. The effects were more pronounced in interventions ≥8 weeks. Demonstrating the reliability of psyllium on insulin resistance and glycemic control.
5	Mao et al. (2021)	*Effects of dietary fiber on glycemic control and insulin sensitivity in patients with T2DM*	A structured randomized clinical trial in 2,152 patients with T2DM who received various types of soluble fiber, including psyllium.	Soluble fiber (including psyllium) lowered HbA1c by 0.74%, fasting glucose by 9.8 mg / dL, and improved insulin sensitivity. Optimal effects were seen in non-obese patients who consumed consistently.
6	Lee et al. (2020)	*Additional effect of dietary fiber in T2DM patients using metformin and sulfonylurea*	An open trial in 20 patients with T2DM taking metformin and a sulfonylurea, plus psyllium 7 g/day.	After 6 weeks, HbA1c decreased by 0.63%, fasting glucose decreased by 14.1 mg / dL. No serious side effects were reported. The combined effect of oral medication and fiber was shown to be synergistic.
7	Sierra et al. (2022)	*Therapeutic effects of psyllium in type 2 diabetes patients*	A randomized clinical trial of 100 patients with T2DM who took psyllium 5.1 g twice daily for 8 weeks.	Postprandial glucose reduction of 16.5 mg / dL and HbA1c of 0.85%. Mild side effects such as bloating. Tolerability is very good, especially in elderly patients.
8	Fazal et al. (2024)	*The postprandial glucose lowering effect of dietary fiber (Psyllium Husk)...*	Controlled intervention trial in 52 T2DM patients, given psyllium 6.8 g before main meals for 30 days.	Postprandial glucose decreased by an average of 18.7 mg / dL, insulin levels also decreased significantly. Psyllium effectively inhibits the postprandial glucose spike when taken before meals.

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No	Author and Year	Title	Method	Results and Discussion
9	Zakiyah et al. (2023)	*Carbohydrate, fiber, and vitamin D intake with blood glucose levels...*	Analytical observation on 40 inpatients with DMT2 with intake and blood glucose measurements.	Fiber intake >20 g/day was negatively correlated with blood glucose (r = -0.64). Psyllium as the dominant soluble fiber in the diet showed a stabilizing effect on glucose levels in patients.
10	The Last Supper (2024)	*The relationship between carbohydrate consumption, energy, fiber...*	Observational cross-sectional study of 75 DMT2 patients at a community health center.	Fiber consumption ≥25 g/day was associated with a decrease in fasting blood glucose of 12.1 mg / dL. Psyllium was cited as the primary source of fiber used by patients.
11	Soviana & Maenasari (2020)	*Fiber Intake, Glycemic Load and Blood Glucose Levels...*	Field test on 60 patients with 24-hour recall and blood glucose measurements.	There is a negative relationship (r = -0.58) between fiber consumption and blood glucose. Psyllium is considered superior to fruits/vegetables because its viscosity slows down glucose absorption.
12	Marbun et al. (2023)	*The Effect of Giving High Fiber Food Bars...*	Experiment on 30 DMT2 patients who were given a food bar with psyllium 5 g/day for 14 days.	Fasting blood glucose decreased by an average of 14.7 mg / dL. Subjects also reported feeling fuller for longer and decreased daily carbohydrate consumption.
13	Abutair et al. (2020)	*Soluble fiber from psyllium improve glycemic response...*	RCT in 120 patients with T2DM, psyllium was given 3 x 5 g per day for 12 weeks.	HbA1c decreased by 1.02%, blood glucose decreased by 18.9 mg / dL, weight decreased by 2.6 kg. Waist circumference and body mass index also decreased significantly.
14	Bajorek & Morello (2020)	*Effects of dietary fiber and low glycemic diet index...*	Clinical trial on 84 T2DM patients with low GI diet and	HbA1c decreased by 0.71%, fasting glucose decreased by 10.3 mg / dL. The combination of a low

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No	Author and Year	Title	Method	Results and Discussion
			psyllium for 10 weeks.	glycemic index diet and psyllium provided an additive effect in lowering blood glucose levels compared to a standard diet.
15	Chettri & Chandran (2020)	*Role of Dietary Fibers in Reducing the Risk of Type 2 Diabetes*	Field research involving 3 patients with type 2 diabetes.	This study is a field study involving a number of patients at high risk of type 2 diabetes. They were given an intervention in the form of consuming soluble fiber (especially psyllium) for several weeks. The results showed a decrease in fasting blood glucose levels, increased insulin sensitivity, and a decrease in body mass index (BMI). Data were obtained through clinical measurements before and after the intervention.

Discussion

Type 2 diabetes mellitus is one of the most common chronic metabolic diseases worldwide, characterized by insulin resistance and impaired blood glucose regulation. Management of this disease relies not only on pharmacological therapy, but also on non-pharmacological approaches such as lifestyle and dietary modification. One of the nutritional strategies that has received attention is the use of dietary fiber, especially water-soluble fiber such as psyllium. Psyllium, which is derived from the seed coat *of Plantago ovata,* has the ability to form a thick gel in the intestine, slowing glucose absorption, and improving glycemic control. As interest in complementary and alternative medicine increases, several studies have been conducted to assess the effectiveness of psyllium in managing blood sugar levels in patients with type 2 diabetes.

Effect of Psyllium on Blood Glucose Control in Type 2 Diabetes Patients

Psyllium is known to play a significant role in controlling blood glucose levels due to its high soluble fiber content. This fiber works by forming a thick gel layer in the digestive tract that can slow down the digestion and absorption of carbohydrates. With a slower glucose absorption process, blood sugar levels do not immediately spike drastically after eating, but increase gradually. This is very beneficial for people with type 2 diabetes who often experience postprandial glucose spikes. Several studies have also suggested that the high

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viscosity effect of psyllium helps slow the rate of gastric emptying, which results in a decreased insulin response and more stable glucose control.

Field studies have shown that regular psyllium supplementation, especially when taken before meals, can significantly reduce HbA1c levels over a period of 8 to 12 weeks. In addition, fasting blood glucose levels also decreased, indicating an improvement in basal glycemic control. This effectiveness is more pronounced when psyllium is consumed in measured doses, namely between 5-10 grams per day, which can be mixed with water or food. The appropriate dose and consistent use are very important in determining the success of this additional therapy. Interestingly, the effects of psyllium are not only limited to individuals with hyperglycemia, but can also provide preventive benefits for those who are pre -diabetic or at high risk for metabolic disorders.

Thus, psyllium has also been reported to improve insulin sensitivity, which is the body's ability to respond more effectively to insulin. This is especially important in cases of type 2 diabetes, where insulin resistance is the root cause of metabolic problems. In addition, psyllium consumption also improves the glycemic index of foods consumed together, making them more "glucose-friendly". This means that when psyllium is combined with high-carbohydrate foods, such as rice or bread, the usual spikes in blood sugar can be suppressed. With these benefits, psyllium can be one of the simple yet effective dietary interventions that support holistic metabolic control for patients with type 2 diabetes, especially when combined with proper diet and physical activity.

Potential of Psyllium as a Nutritional Therapy Support for Type 2 Diabetes

In addition to its function as a blood glucose controller, psyllium also makes a significant contribution to other metabolic parameters closely related to the management of type 2 diabetes, such as weight control and blood lipid profile. The soluble fiber content in psyllium has a strong satiating effect, because when mixed with water, it forms a gel that slows down gastric emptying. This makes a person feel full longer and ultimately reduces the desire to overeat. Thus, daily calorie intake can be suppressed naturally without feeling excessively hungry, which is very helpful in the process of weight control in diabetic patients.

Weight loss has a significant impact on insulin sensitivity and blood sugar stability, making psyllium part of a long-term strategy in diabetes management. Several studies have shown that patients who regularly consume psyllium for several weeks to months experience significant weight loss compared to control groups. This effect comes not only from increased satiety, but also from overall decreased appetite and stable blood sugar levels that prevent sudden hunger due to hypoglycemia.

In addition to its weight-loss benefits, psyllium also shows positive effects on lipid profiles, particularly in lowering LDL (low-density lipoprotein) cholesterol levels, often referred to as bad cholesterol. Soluble fiber works by binding bile acids in the intestines and helping them to be excreted through the stool, so the body has to use more cholesterol to re-produce the lost bile acids. This process naturally reduces blood cholesterol levels. Several studies have also noted an increase in HDL (high-density lipoprotein) cholesterol, or good cholesterol, after consuming psyllium over a period of time. This is especially important considering that diabetic patients are at high risk for cardiovascular disease.

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cardiometabolic benefits make psyllium an important element in the nutritional therapy of patients with type 2 diabetes. Compared to pharmacological interventions, psyllium is relatively safe, does not cause serious side effects, and is easily found in the form of supplements or daily food mixtures. Integrating psyllium into the daily diet does not require major changes, simply adding it to water, juice, or foods such as oatmeal and smoothies. Regular consumption in recommended doses can provide significant long-term benefits, both in controlling blood sugar and in maintaining heart health.

In conclusion, psyllium is a promising nutritional option to support the holistic management of type 2 diabetes. Its effects are not only limited to blood glucose, but also on body weight and lipid profile, making it a multifunctional fiber supplement. With its broad benefits, high safety, and easy availability, psyllium is worth considering as part of a sustainable dietary intervention for people with diabetes. However, its use must still be accompanied by appropriate education and consultation with health workers to ensure the appropriate dose and duration of consumption in the context of the patient's individual needs.

CONCLUSION

Based on various research results, psyllium has been shown to have a significant positive impact in helping to manage type 2 diabetes mellitus. The water-soluble fiber content in psyllium can slow down the absorption of carbohydrates, thereby helping to lower fasting and postprandial blood glucose levels, as well as gradually lowering HbA1c levels. In addition, psyllium can also increase insulin sensitivity and lower the glycemic index of food, which ultimately supports the stability of the metabolism of diabetic patients. These effects are even stronger if psyllium is consumed before main meals with appropriate and consistent doses.MIn addition to its role in regulating blood sugar, psyllium also provides additional benefits in losing weight and improving lipid profiles, such as lowering LDL cholesterol levels and increasing HDL. The satiety effect caused by psyllium fiber also helps reduce calorie intake and prevent overeating, which is very important in weight control. With its safe, easy-to-consume, and multifunctional nature, psyllium deserves to be part of a comprehensive nutritional strategy for people with type 2 diabetes. However, the integration of psyllium into the diet should still be under the supervision of a health professional to ensure maximum benefits and avoid unwanted side effects.

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