

Application of the DASH Diet Diet to Blood Sugar Control and Diabetes Complications

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ABSTRACT

Diabetes mellitus (DM) is one of the global health problems with increasing prevalence and complications. Dietary interventions are one of the important pillars in diabetes management, where the Dietary Approaches to Stop Hypertension (DASH) diet is beginning to be recognized as a potential strategy. This quasi-experimental study with a pre-test and post-test control group design aims to evaluate the effect of the application of DASH modified according to local food on glycemic control and risk markers of complications in patients with type 2 diabetes mellitus in Indonesia. A total of 80 participants were divided into intervention and control groups. The intervention group followed the DASH program for 12 weeks with menu arrangements according to local food availability. Variables measured included fasting blood glucose, HbA1c, blood pressure, lipid profile, and glomerular filtration rate (eGFR). The results showed significant improvement in the intervention group, with a decrease in fasting blood glucose (−27 mg/dL), HbA1c (−1.3%), systolic blood pressure (−11.6 mmHg), LDL cholesterol, and an increase in HDL cholesterol and eGFR ($p < 0.05$). These findings confirm that DASH is not only effective as a hypertension control strategy, but also as a nutritional intervention to improve glycemic control and lower the risk of diabetes complications. Although the results are promising, further research with randomized clinical trial designs, larger sample counts, and longer durations is still needed to strengthen the evidence base

INTRODUCTION

Diabetes mellitus is one of the non-communicable diseases that continues to experience significant increases in the world and is a serious threat to public health. The International Diabetes Federation (IDF) reports that by 2024 there will be approximately 589 million adults living with diabetes and this number is expected to increase to 853 million by 2050, with most cases found in lower-middle-income countries including Indonesia (IDF, 2025). In Indonesia alone, the prevalence of diabetes has reached 11.3% in 2024 or around 20.4 million people, placing Indonesia as the country with the fifth highest number of diabetes cases in the world (IDF, 2024). This condition not only increases the burden on health but also has major economic implications, with total health expenditure due to diabetes estimated to reach 6.3 billion US dollars annually (Wahidin et al., 2024).



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Blood sugar control is an important aspect of diabetes management because failure to achieve optimal glycemic control is directly related to the risk of chronic complications such as heart disease, nephropathy, and retinopathy (American Diabetes Association, 2024). One of the strategies that is highly recommended in diabetes control is through dietary modification. The DASH (Dietary Approaches to Stop Hypertension) diet, which was originally developed to control hypertension, is now gaining attention in diabetes management because it emphasizes high consumption of fruits, vegetables, whole grains, nuts, and low-fat dairy products, as well as low in saturated fat, added sugar, and sodium (Lv & Aihemaiti, 2024). Several recent studies have shown that the DASH diet is not only effective in lowering blood pressure, but also plays a role in improving insulin resistance, lipid profile, and HbA1c levels, making it relevant to be applied to diabetics (Belanger et al., 2023; Swami et al., 2025).

However, the problem faced is that there is still a high rate of diabetes complications in Indonesia due to an unhealthy diet. Recent studies show that Indonesians tend to consume foods high in sugar, salt, and saturated fat, which contributes to the high prevalence of prediabetes and diabetes (Liberty et al., 2024). In addition, the existence of nutritional transitions in urban and rural communities further exacerbates cardiometabolic risks related to heart, kidney, and vascular complications (Anyanwu et al., 2022). Therefore, the implementation of a healthier and scientifically evidence-based diet is an urgent need to prevent long-term complications of diabetes.

Previous research has shown that adherence to the DASH diet is associated with a reduced risk of diabetes and improvements in metabolic parameters, but most of that evidence comes from overseas studies. Several meta-analyses state that although DASH has the potential to provide significant benefits, prospective clinical trials of long-duration are still needed to ascertain its impact on the outcomes of major cardiovascular complications (Quan et al., 2024; Bensaoud et al., 2025). This shows the limitations of previous research, especially in the context of developing countries such as Indonesia that have different food consumption and cultural characteristics.

This article offers a novelty by examining the application of the DASH diet adapted to the local context in Indonesia and evaluating not only blood sugar control, but also risk markers of complications such as blood pressure, lipid profile, and kidney function. This approach is expected to be able to make a practical and scientific contribution to the development of diabetes complication prevention strategies in Indonesia (Hu et al., 2025). Thus, this study closes the gap of previous studies while providing added value in the form of evidence-based recommendations that are more applicable in clinical practice and health policy.

METHODOLOGY

This study used a quasi-experimental design with a pre-test and post-test control group approach, which allowed researchers to compare the effectiveness of the application of the DASH diet to glycemic control and markers of diabetes complications. This design was chosen because it is appropriate to test nutritional interventions in a clinical context without having to ignore the ethics of standard therapy administration in the control group (Sedgwick, 2020). Quasi-experimental research has also been widely used in the study of dietary interventions in patients with chronic diseases including diabetes, as it is flexible in adapting to field conditions (Craig et al., 2021).

The population in this study is people with type 2 diabetes mellitus who are treated at a disease clinic in one of the referral hospitals in Indonesia. Inclusion criteria include

patients aged 30–65 years with a diagnosis of diabetes for at least 1 year, have an HbA1c level of > 6.5%, and are willing to participate in a 12-week dietary intervention program. The exclusion criteria are patients with severe complications such as advanced kidney failure or congestive heart disease that may interfere with dietary adherence. Sample selection was carried out using a purposive sampling technique that considers the suitability of the subject's characteristics to the research objectives (Etikan & Bala, 2021).

The interventions provided were in the form of a modified DASH diet according to the local Indonesian context, with an emphasis on high consumption of vegetables, fruits, whole cereals, nuts, fish, and the reduction of salt and saturated fat. The diet menu is prepared by nutritionists by taking into account individual calorie needs, macronutrient composition, and the availability of local foods to suit the people's eating culture (Hu et al., 2025). The intervention group received intensive nutrition counseling through weekly counseling sessions and a menu booklet, while the control group underwent standard nutrition counseling according to national clinical guidelines.

The main variables included fasting blood glucose levels, HbA1c, blood pressure, lipid profile (HDL, LDL, triglycerides), and kidney function (estimated glomerular filtration rate/eGFR and urine albumin-creatinine ratio). This parameter was chosen because it represents glycemic control and the risk of diabetes complications both microvascular and macrovascular (American Diabetes Association, 2024). Data were collected at baseline and after 12 weeks of intervention. The measurement instruments are hospital-standard laboratory autoanalyzers, calibrated sphygmomanometers, and validated dietary compliance questionnaires (Lv & Aihemaiti, 2024).

Data analysis was carried out with a paired t-test to compare changes in the group, as well as an independent t-test or ANCOVA to compare differences between groups with the control of confounding factors such as age, gender, and use of antidiabetic drugs. Statistical analysis was performed using the latest version of SPSS software with a significance level of $p < 0.05$. The use of this statistical method is in line with clinical nutrition intervention research recommendations that emphasize the internal validity of research results (Swami et al., 2025).

This research has received approval from the Health Research Ethics Committee and all participants signed informed consent before participating in the program. The ethical aspect is strictly considered considering that research involves human subjects, so that all procedures follow the principles of the Declaration of Helsinki and the ethical regulations of health research in Indonesia (Craig et al., 2021).

RESULTS AND DISCUSSION

The 12-week DASH diet intervention showed significant improvement in almost all clinical parameters compared to the control group. Baseline analysis showed no significant difference between the intervention and control groups, so the changes that occurred could be attributed to the application of diet.

Parameter	Intervention (n=40)	Control (n=40)	p-value
Fasting Blood Glucose (mg/dL)	162.3 ± 18.1 → 134.7 ± 15.3	160.9 ± 17.5 → 156.8 ± 16.9	<0.01
HbA1c (%)	8.4 ± 0.9 → 7.1 ± 0.8	8.3 ± 0.8 → 8.0 ± 0.9	<0.01

Systolic Blood Pressure (mmHg)	141.2 ± 12.5 → 129.6 ± 10.2	140.8 ± 11.8 → 139.2 ± 12.0	<0.05
LDL Cholesterol (mg/dL)	142.5 ± 19.4 → 128.3 ± 18.1	143.1 ± 20.0 → 141.0 ± 19.7	<0.05
HDL Cholesterol (mg/dL)	42.1 ± 6.2 → 47.3 ± 6.8	41.8 ± 6.5 → 42.0 ± 6.4	<0.05
eGFR (mL/min/1.73 m ²)	78,4 ± 7,5 → 82,1 ± 6,9	77,9 ± 7,4 → 78,2 ± 7,6	<0.05

Table 2 Changes in Clinical Parameters Before and After DASH Intervention

Discussion

The results of this study show that the application of the DASH diet is able to significantly reduce fasting blood HbA1c and glucose levels within 12 weeks. The 1.3% reduction in HbA1c achieved by the intervention group is clinically important, as various evidence states that a reduction in HbA1c levels of at least 1% can reduce the risk of microvascular complications by up to 37% in people with diabetes (American Diabetes Association, 2024). These findings are in line with research by Swami et al. (2025) which showed that DASH modification contributes to improved insulin resistance as well as glycemic control. The underlying mechanisms include high intake of soluble fiber from whole vegetables and cereals, low glycemic index from main foods, and high consumption of magnesium and potassium which support glucose homeostasis (Lv & Aihemaiti, 2024). In addition, polyphenol-rich fruits and vegetables in DASH play a role in reducing oxidative stress which is an important factor in insulin resistance (Hu et al., 2025).

In addition to having an effect on glycemic control, this study also found a significant decrease in systolic blood pressure by 11.6 mmHg in the intervention group. This indicates the dual benefits of the DASH diet, which is to control glucose while reducing the risk of hypertension, which is often a major comorbid in diabetic patients. These results are consistent with the meta-analysis of Isnaini et al. (2025) who reported an average decrease in blood pressure of 8–10 mmHg in individuals with high adherence to DASH. This improvement has major implications in the prevention of cardiovascular complications, given that heart disease is the leading cause of mortality in diabetes (Belanger et al., 2023).

Improvement in lipid profiles in the form of lowering LDL cholesterol and increasing HDL also strengthens the evidence of DASH's effectiveness against cardiometabolic risk. The study of Bensaaud et al. (2025) confirms that adherence to the DASH pattern correlates with a better lipid profile, especially in lowering atherogenicity. This lipid repair mechanism is associated with low saturated fat consumption and high intake of polyunsaturated fats from nuts and fish, as well as phytosterol content from vegetables and fruits that suppress cholesterol absorption. Thus, DASH not only works on blood sugar control but also improves vascular risk factors overall.

An equally important finding was an increase in eGFR in the intervention group, which demonstrated the potential of DASH in slowing the progression of diabetic nephropathy. The study of Hu et al. (2025) also confirms that a diet rich in fruits and vegetables with low sodium is able to reduce albuminuria while maintaining kidney function in diabetic patients. The clinical implications of these results are particularly relevant in Indonesia, considering that diabetic nephropathy is one of the complications with a high cost burden and has a major impact on patients' quality of life.

When compared to previous studies, these results expand the scope of DASH benefits in the context of type 2 diabetes. A meta-analysis of Quan et al. (2024) reported that high adherence to DASH can lower the risk of diabetes by up to 20%. However, most previous studies have focused only on the prevention of diabetes or its effects on blood pressure. The study adds new evidence by highlighting the impact of DASH on diabetes complications, such as kidney function and lipid profiles, which have not been widely studied, particularly in Indonesia. Thus, these results enrich the global literature while making a significant local contribution.

Practically, the results of this study show that DASH can be adapted to local Indonesian food ingredients without reducing its effectiveness. This is important considering that the consumption patterns of the Indonesian people are still dominated by foods high in sugar, salt, and saturated fat (Liberty et al., 2024). With a culturally and resource-based approach, DASH can be used as an applicable nutrition intervention at both the community level and primary health services. In terms of policy, the implementation of DASH can also help reduce the economic burden due to diabetes complications which are expected to increase in the coming decade (Wahidin et al., 2024).

However, this study has limitations. The duration of the intervention was relatively short so it was not possible to measure the long-term impact on major clinical events such as myocardial infarction or terminal kidney failure. The limited sample size is also an obstacle in generalizing the findings to a wider population. In addition, dietary adherence measured through self-reports can lead to bias. Therefore, follow-up studies with randomized designs, longer durations, and more objective compliance monitoring methods are urgently needed to strengthen this evidence

CONCLUSION

This study shows that the application of a modified DASH diet in accordance with the local food context of Indonesia has a significant impact on blood glucose control and prevention of diabetes complications. After the 12-week intervention, the group that followed DASH experienced significant reductions in fasting blood glucose levels and HbA1c, as well as improvements in blood pressure, lipid profile, and kidney function compared to the control group. These results reinforce the evidence that DASH is not only effective as a hypertension control strategy, but also relevant as a comprehensive nutritional intervention in patients with type 2 diabetes mellitus. The findings of this study also confirm that the application of DASH in Indonesia makes it possible to adapt to local foodstuffs, thereby increasing the sustainability potential of dietary adherence. Clinically, DASH can help lower the risk of microvascular and macrovascular complications, which have been the leading causes of morbidity and mortality in people with diabetes. On the other hand, the socio-economic benefits obtained from reducing the burden of complications can contribute to the efficiency of health care costs at the national level. Although the results of this study are significant, there are limitations in the form of limited sample sizes, relatively short duration of interventions, and potentially biased dietary adherence assessment methods. Therefore, follow-up research with a randomized clinical trial design, larger population, and long-term monitoring are needed to confirm these results. With a stronger evidence base, DASH diets can be recommended as an integral part of diabetes management programs in Indonesia, both at the community level and primary health services.

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