



RESEARCH ARTICLE

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Oral Antidiabetic Activity on Dietary Patterns of Urban and Rural Patients

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ABSTRACT

Diabetes mellitus is a metabolic disease with a steadily rising global prevalence; its management is influenced by various factors, including dietary habits and pharmacological therapy. This study aimed to identify the use of oral antidiabetic therapies, dietary patterns, and blood glucose levels among diabetes mellitus patients in urban and rural areas. This cross-sectional observational study involved 60 patients with type 2 diabetes mellitus, evenly distributed between Cirebon City (urban) and Majalengka Regency (Munjul Village). Dietary data were collected using a Food Frequency Questionnaire (FFQ), while data on therapy (metformin, glibenclamide, glimepiride) and blood glucose levels were obtained from medical records. Data analysis employed the Mann-Whitney test to compare differences between the groups. The results revealed significant differences in dietary patterns (mean ranks: 19.97 vs. 41.03; $p < 0.001$) and the types of oral antidiabetic therapy used (mean ranks: 21.42 vs. 39.58; $p < 0.001$) between the two regions; urban patients exhibited more controlled dietary habits and a higher frequency of monotherapy, whereas rural patients tended to use combination therapy. However, no significant difference was found regarding the reduction in blood glucose levels (mean ranks: 31.38 vs. 29.62; $p = 0.695$) between the two groups. The study concludes that despite differences in dietary patterns and therapeutic regimens, glycemic control among diabetic patients in both regions was relatively comparable.

Keywords: Dietary pattern; oral antidiabetic therapy; blood glucose; urban-rural differences.

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INTRODUCTION

Diabetes mellitus is characterized by elevated blood glucose levels resulting from impaired insulin secretion, impaired insulin action, or both. Type 2 diabetes accounts for 90–95% of all diagnosed diabetes cases. Managing type 2 diabetes requires controlling blood glucose levels through lifestyle modifications—particularly dietary changes—and the use of appropriate antidiabetic therapies. Diet plays a crucial role in blood glucose control, as the type and quantity of food consumed influence glucose levels, while oral antidiabetic therapies help achieve glycemic control targets. Beyond individual factors, environmental conditions and the characteristics of urban and rural areas can be associated with differences in dietary patterns and the use of antidiabetic therapies. Therefore, it is important to examine the differences in dietary patterns and oral antidiabetic therapy usage among type 2 diabetes patients in urban and rural areas, as well as their relationship with blood glucose levels.

Diabetes mellitus is characterized by elevated blood glucose levels resulting from impaired insulin secretion, impaired insulin action, or both. Type 2 diabetes accounts for 90–95% of all diagnosed diabetes cases. Managing type 2 diabetes requires controlling blood glucose levels through lifestyle modifications—specifically dietary changes—and the use of appropriate antidiabetic therapy. Diet plays a crucial role in blood glucose control, as the type and quantity of food consumed influence glucose levels, while oral antidiabetic therapies help achieve glycemic control targets. Beyond individual factors, environmental conditions and the characteristics of urban and rural areas can be associated with differences in dietary patterns and the use of antidiabetic therapies. This study is significant for examining differences in dietary patterns and oral antidiabetic therapy usage among type 2 diabetes patients in urban and rural areas, as well as their relationship with blood glucose levels.

The prevalence of diabetes mellitus in West Java stands at 1.74 percent, with an estimated 570,611 people living with the condition. In 2021, the West Java Health Department reported 46,837 people with diabetes mellitus, 17,379 of whom did not receive health care in accordance with government-established standards (3). Meanwhile, according to 2020 data from the Cirebon Regency Health Office, there were 22,345 people with diabetes mellitus (4).

The management of diabetes mellitus involves both pharmacological and non-pharmacological therapies. Pharmacological therapy commonly includes oral antidiabetic drugs (OADs), such as metformin, sulfonylureas, and thiazolidinediones, while non-pharmacological management includes dietary regulation and physical activity (5). Oral antidiabetic drugs contribute to glycemic control through different mechanisms, including improving insulin sensitivity, reducing hepatic glucose production, and increasing glucose utilization by peripheral tissues. The selection of an appropriate oral antidiabetic therapy is important for achieving glycemic control and is generally based on the patient's clinical condition, treatment response, and severity of hyperglycemia. Oral antidiabetic therapy may be administered as monotherapy or combination therapy when glycemic targets are not adequately achieved with a single agent (6). Differences in the use of oral antidiabetic therapy may occur between urban and rural settings due to variations in healthcare access, availability of medicines, healthcare-

seeking behavior, socioeconomic conditions, and clinical characteristics of patients. Therefore, examining differences in oral antidiabetic therapy between urban and rural populations is important to understand variations in pharmacological management and their relationship with glycemic control in patients with type 2 diabetes mellitus.

In addition to pharmacological therapy, dietary management is an important component of diabetes mellitus control. A dietary pattern refers to a person's eating habits, which include the types, frequency, quantity, and composition of foods consumed on a regular basis. In patients with diabetes mellitus, an appropriate dietary pattern plays a role in helping to maintain stable blood glucose levels and supporting the achievement of glycemic control(7). An irregular diet or one dominated by foods high in carbohydrates, fat, and calories can contribute to elevated blood glucose levels, whereas consuming foods rich in fiber, vitamins, and minerals can support blood glucose control. Dietary assessment in this study was conducted using the Food Frequency Questionnaire (FFQ), which is used to describe the frequency of consumption of various types of foods over a specific period. The FFQ score was then used to assess dietary quality based on a predetermined scoring system, with higher scores indicating a poorer diet and lower scores indicating a better diet. Thus, the FFQ score provides a quantitative picture of the respondents' dietary quality and allows for a comparison of dietary patterns between patients with type 2 diabetes mellitus in urban and rural areas.(8).

It is important to examine differences in dietary patterns and the use of antidiabetic therapies among people with diabetes mellitus in urban and rural areas, as the environmental characteristics and health care conditions in these two settings may differ. Several previous studies have shown differences in diabetes management between urban and rural areas. Earlier research reported that patients in urban areas tend to achieve better blood glucose control, which may be related to easier access to medications, health information, and medical services(9). Consistent with these findings, Foss et al. (2023) reported that patients in rural areas have lower levels of medication adherence and glycemic target achievement compared to patients in urban areas. These findings suggest that regional characteristics may be associated with variations in diabetes management, although socioeconomic factors, educational levels, access to health care, and the availability of health care personnel were not directly analyzed in this study(10).

Empirical studies comparing dietary patterns, the use of oral antidiabetic therapy, and blood glucose levels in patients with type 2 diabetes mellitus in urban and rural areas remain limited, particularly among populations in the city of Cirebon and Majalengka Regency. Although several studies have addressed diabetes management based on regional characteristics, evidence regarding differences in dietary patterns and the use of oral antidiabetic therapy—as well as their relationship to blood glucose control outcomes in specific urban and rural populations—remains insufficient. This gap highlights the need for a study comparing dietary patterns and the use of oral antidiabetic therapy between patients in urban and rural areas and assessing whether these differences are associated with differences in blood glucose levels. Therefore, this study aims to compare dietary patterns, the use of

oral antidiabetic therapy, and blood glucose levels in patients with type 2 diabetes mellitus in the city of Cirebon (an urban area) and Majalengka Regency (a rural area).

METHOD

This study has been approved by the Health Research Ethics Committee of the Faculty of Pharmacy, YPIB University, under ethics approval number 325/KEPK/EC/IV/2025. This is a non-experimental, cross-sectional study. Data collection will be conducted retrospectively to identify differences in dietary patterns, oral antidiabetic therapy, and blood glucose levels between urban and rural areas. The study is scheduled to take place in February 2025 at healthcare facilities in Cirebon City and Munjul Village, Majalengka Regency. Research instruments include medical records to obtain information on blood glucose levels and oral antidiabetic medication use, while dietary data will be collected using a Food Frequency Questionnaire (FFQ). Purposive sampling will be employed, selecting subjects from a population that meets the inclusion criteria for patients with type 2 diabetes mellitus. Data analysis will be performed using SPSS software version 27. Univariate analysis will be used to describe the frequency distribution of respondent characteristics and research variables, followed by bivariate analysis using the Mann-Whitney U test to compare dietary patterns, oral antidiabetic use, and blood glucose levels between the two regions.

RESULTS

The demographic and socioeconomic characteristics of respondents in both study locations are presented in Table 1. Overall, the study involved 60 people with diabetes mellitus, divided equally between the city of Cirebon (urban) and Majalengka Regency (rural), with 30 people each.

Table 1. Characteristics of Urban and Rural Respondents

Subject Characteristics	Variable	Urban		Rural	
		n = 30	%	n = 30	%
Gender	Male	14	46.7	4	13.3
	Women	16	53.3	26	86.7
Age	36-45	12	40	10	33.3
	46-55	11	36.7	5	16.7
	56-65	5	16.7	9	30
	>65	2	6.7	6	20
Education	SD	2	6.7	5	16.7
	SMP	4	13.2	4	13.3
	SMA	18	60	11	36.7
	Diploma	3	10	3	10
	Sarjana	3	10	7	23.3

Based on Table 1, there is a difference in the composition of subjects between the Cirebon City and Majalengka Regency areas. In terms of gender, the group in Cirebon City has a relatively balanced distribution between males (46.7%) and females (53.3%). In contrast, the group in Majalengka Regency is significantly dominated by females (86.7%) compared to males (13.3%).

In terms of age, the majority of subjects in Cirebon City were in the productive category, namely the 36-45 age group (40%) and the 46-55 age group (36.7%). Meanwhile, in Majalengka Regency, the age distribution was more evenly spread, with the highest proportions in the 36-45 (33.3%) and 56-65 (30%) age groups, and a higher percentage of elderly people (>65 years) (20%) compared to the city (6.7%).

Furthermore, educational characteristics also show different patterns. Most respondents in Cirebon City have a secondary education background (high school, 60%), while in Majalengka Regency, the highest proportion is also at the high school level (36.7%), but with a higher percentage of elementary school graduates (16.7%) and university graduates (23.3%) compared to the city. These differences in demographic composition are an important context for further analysis of the main research variables related to dietary patterns, medication use, and blood glucose levels.

The results of the statistical test to compare differences in dietary patterns, oral antidiabetic drug use, and blood glucose levels between the two research locations are presented in Table 2. The Mann-Whitney test was used to measure the significance of the mean differences of the three variables.

Table 2. Differences in Dietary Patterns, Oral Antidiabetic Medication, and Blood Glucose Levels in Urban and Rural Areas

Variable	Cirebon City		Majalengka Regency		Asym Sig (2-tailed)
	n	Mean	n	Mean	
Diet	30	19.97	30	41.03	<0.001
Obat Antidiabetic Drugs	30	21.42	30	39.58	<0.001
Blood Sugar Level	30	31.38	30	29.62	0.695

Based on the results of the Mann-Whitney test in Table 2, it is known that there is a significant difference in the variables of dietary patterns and oral antidiabetic drug use between patients in Cirebon City and Majalengka Regency ($p < 0.001$). The lower mean dietary pattern score in Cirebon City (19.97) compared to Majalengka Regency (41.03) indicates that patients in Cirebon have a better and more controlled dietary pattern, while patients in Majalengka tend to have less regular eating habits.

In addition, there was a significant difference ($p < 0.001$) in the use of oral antidiabetic drugs between patients in Cirebon City and Majalengka Regency. The lower mean value in Cirebon City (21.42) indicates that patients in this region use single therapy more, especially Metformin, while in Majalengka Regency (39.58), the use of combination drugs such as Metformin and Glibenclamide is more common. This difference may indicate variations in the severity of the disease or differences in therapy policies in health facilities in each region.

Meanwhile, for the blood glucose level variable, the test results showed no significant difference between the two regions ($p > 0.695$). The average blood glucose levels were relatively similar, namely (31.38) in Cirebon and (29.62) in Majalengka. This indicates that despite differences in diet and type of therapy, blood glucose control in both patient groups was relatively the same, possibly due to metabolic compensation factors, disease duration, or variations in drug dosage.

DICUSSION

Univariate Analysis Results

The results for the gender variable show that the proportion of female patients is higher than that of male patients, both in Cirebon City and Majalengka Regency. Several previous studies have also reported differences in the characteristics of type 2 diabetes mellitus based on gender. Hormonal changes in women, particularly after menopause, are known to be associated with an increased risk of type 2 diabetes mellitus. In addition, women are reported to be more active in monitoring their health and utilizing health services (11), (12), (13). However, these biological and behavioral factors were not analyzed in this study; therefore, these findings are used only to describe the demographic characteristics of the respondents and are not intended to explain the causes of the differences in gender proportions.

Furthermore, the age variable showed that the majority of respondents were in the 46–55 age group, both in Cirebon City (40%) and Majalengka Regency (36.7%). This finding is consistent with Wahyuni et al. (2023), who stated that the prevalence of diabetes mellitus tends to increase with age (14). Petermann-Rocha et al. (2018) also reported that individuals over 45 years of age have a higher risk of developing diabetes mellitus (15). The predominance of the 46–55 age group in both regions indicates that type 2 diabetes mellitus in this study is most commonly found among middle-aged individuals. The difference in age distribution between Cirebon City and Majalengka Regency should be considered when interpreting the observed differences in dietary patterns and the use of antidiabetic therapy, as age characteristics may be related to both dietary habits and patients' clinical conditions. However, this study did not specifically analyze age as a factor influencing dietary patterns or the use of antidiabetic therapy. Therefore, the age findings in this study are primarily used to describe the characteristics of the respondents and to provide context for interpreting the comparative results between the two regions (16).

Based on educational level, most patients in Cirebon City had a high school education (60%), whereas in Majalengka Regency, the proportions of patients with a junior high school education (36.7%) and a high school education (36.7%) were relatively balanced. Differences in educational attainment between these two regions may be one characteristic to consider when interpreting the differences in dietary patterns and the use of antidiabetic therapy found in this study. Several previous studies have shown that educational attainment and health education may be associated with understanding and management of diabetes mellitus. Heise et al. (2022) reported that structured education can improve patients' knowledge and reduce disease-related stress (17). Doupis et al. (2019) also demonstrated a

tendency for a relationship between educational level and adherence to oral antidiabetic therapy (18). while Boakye et al. (2018) emphasized the importance of education in supporting health literacy in the management of chronic diseases (19). Based on these findings, the difference in educational levels between Cirebon City and Majalengka Regency could theoretically be related to patients' ability to receive and apply information regarding dietary habits and treatment. However, this study did not measure health literacy, knowledge about diabetes, or adherence to treatment; therefore, this relationship cannot be confirmed as a mechanism explaining the differences between the two regions. Consequently, educational level in this study is viewed as a demographic characteristic and contextual factor that must be taken into account when interpreting the study results.

Bivariate Analysis Results

The Mann-Whitney test results for the dietary pattern variable showed that the average dietary pattern score in Cirebon City (19.97) was significantly lower than that in Majalengka Regency (41.03) and the asym sig value ($p < 0.001$) indicates that there is a significant difference in dietary patterns between patients in Cirebon City and Majalengka Regency. This finding indicates that patients in Cirebon City tend to have more controlled eating habits that are in line with recommendations compared to patients in Majalengka.

This significant difference may be influenced by factors such as higher education levels and better nutritional knowledge in Cirebon, and is supported by the finding that a lower mean reflects relatively better eating behavior, which may be supported by more adequate access to information and health services in urban areas. Conversely, the higher scores in Majalengka Regency indicate less controlled eating patterns, which are strongly suspected to be influenced by limited access to nutritional information, healthy food ingredients, and the influence of stronger traditional consumption habits. These findings are in line with the research by Rani et al., 2022, which revealed differences in food consumption patterns between diabetic subjects in urban and rural areas (20). In addition, Carvalho et al., 2019, emphasized that variations in dietary patterns between regions are greatly influenced by socioeconomic and cultural differences (21). Rural communities generally have a habit of consuming traditional foods that are high in calories and low in fiber, while urban communities have better access to healthy food ingredients and nutrition education. These findings are also in line with the research by Khattab et al., 2010, which reported that the majority of diabetic patients in low-income areas did not follow the meal plans recommended by nutritionists, which resulted in poor glycemic control (22).

Furthermore, the results of the analysis of the variable of oral antidiabetic drug use showed an average score of 21.42 in Cirebon and 39.58 in Majalengka with an asym sig ($p < 0.001$), indicating a significant difference in the use of oral antidiabetic drugs. The difference in drug use patterns in the two regions is because the research data describes the types of drugs used by patients.

Based on the observation results, patients in Cirebon City more often used single therapy such as Metformin, while patients in Majalengka Regency more often used a combination of drugs, such as Metformin and Glibenclamide. This could be due to several factors, including differences in the severity

of the disease, the duration of diabetes, and variations in treatment policies at health facilities in each region.

According to PERKENI, 2021 pharmacological therapy for diabetes mellitus begins with the use of Metformin as the first line of treatment, because it is highly effective in lowering fasting blood glucose levels and has a low risk of hypoglycemia. However, if the patient's blood glucose levels are not controlled with single therapy, the doctor will add other antidiabetic drugs such as sulfonylureas (e.g., Glibenclamide), DPP-4 inhibitors, or other combinations to improve glycemic control. The use of these two combinations is known to reduce HbA1c by approximately 0.8-1.5% and reduce the likelihood of hypoglycemia compared to increasing the dose of each drug separately (23). With this complementary mechanism, combination pharmacological therapy becomes more effective or maximizes control of glucose levels and prevents long-term complications in patients with diabetes mellitus. Additionally, David Flood's research shows that differences in place of residence (rural-urban) influence diabetes treatment patterns. Patients in urban areas are more likely to receive therapy according to clinical guidelines and have better access to medications, while patients in rural areas tend to present with more severe disease conditions, thus requiring more medication combinations to achieve glycemic control (24)

Meanwhile, regarding the blood glucose level variable, the results of the Mann-Whitney test showed a mean rank of 31.38 for patients in Cirebon City and 29.62 for patients in Majalengka Regency, with an asymptotic significance value of 0.695 ($p > 0.05$). These results indicate that there was no statistically significant difference in blood glucose levels between the two regions. This finding suggests that the differences in dietary patterns and the use of oral antidiabetic therapy observed between the two regions were not accompanied by significant differences in blood glucose levels. The similarity in blood glucose levels may be related to various clinical factors not analyzed in this study, such as the duration of diabetes mellitus, medication dosage and duration of use, individual response to therapy, and other metabolic factors. Since these factors were not measured in this study, these mechanisms cannot be confirmed as an explanation for the results obtained.

The findings of this study are consistent with those of Williams et al. (2022), who stated that blood glucose control is multifactorial and is not determined solely by the type of treatment regimen used (25). Thus, the results of this study support the view that differences in treatment regimens do not always result in significant differences in blood glucose levels when other factors also play a role in glycemic control. Ahmad and Islahudin (2014) also reported that the duration of diabetes and therapy adjustments may be associated with changes in blood glucose levels (26). while Roy et al. (2016) emphasized the role of metabolic factors and disease duration in long-term glucose control (27). However, this study did not measure disease duration, dosage, or duration of therapy, nor did it assess these metabolic factors; therefore, the results of previous studies were used as context for interpreting the findings, not as evidence that these factors caused the absence of differences in blood glucose levels in this study.

CONCLUSIONS AND RECOMMENDATIONS

This study found significant differences in dietary-pattern scores and oral antidiabetic medication patterns between diabetes mellitus patients in Cirebon City and Majalengka Regency. However, no statistically significant difference in blood glucose levels was observed between the two groups. These findings suggest that diabetes management patterns may vary across urban and rural settings, although the reasons for these differences cannot be determined from the cross-sectional design. Future studies should incorporate diabetes duration, HbA1c, medication adherence, socioeconomic status, physical activity, and healthcare access to better explain urban-rural differences in diabetes management.

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