

Association between educational level and diabetes knowledge among older adults with type 2 diabetes in Bandung City: a cross-sectional study

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ABSTRACT

Diabetes mellitus (DM) is a major non-communicable disease among older adults and a growing public health problem in Indonesia. Older people often have limited health literacy, which may affect their knowledge and self-management of DM. This study aimed to analyze the relationship between education level and knowledge about DM among the elderly in Bandung City, West Java. A descriptive cross-sectional study was conducted on 150 elderlies with type 2 DM using purposive sampling at primary health care facilities with high DM cases. Data were collected through structured interviews using a demographic questionnaire and a 15-item multiple-choice questionnaire on DM knowledge that had been tested for validity and reliability previously, adapted from an Indonesian diabetes self-management instrument. Knowledge scores were categorized into good and poor. Data were analyzed using the Chi-square test. Most respondents had an elementary or high-school education. The majority of the elderly with higher education levels had good knowledge about DM, while those with lower education levels tended to have poorer knowledge. There was a statistically significant association between education level and elderly knowledge about DM ($p < 0.001$). Education level is significantly associated with DM knowledge among the elderly in Bandung. These findings highlight the need for a tailored continuity of care diabetes program, especially for the elderly with lower educational attainment, in order to improve self-management and glycemic control.

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1. INTRODUCTION

Diabetes mellitus is a growing public health problem in Indonesia, particularly among older adults. The International Diabetes Federation (IDF) estimated that Indonesia is among the countries with the largest number of adults living with diabetes, with a prevalence of around 11% in recent years and more than 19–20 million affected adults [1]. The Indonesian Basic Health Research also shows an increasing trend in DM

prevalence based on blood glucose measurements and physician diagnosis, confirming that DM is a major and growing public health problem in Indonesia [2]. Among older adults, the risk of DM and its complications is even higher due to age-related physiological changes, multiple comorbidities, and limitations in accessing and understanding health information [3]-[5].

Knowledge and health literacy significantly impact diabetes self-management and clinical outcomes. A meta-analysis highlighted that better health literacy correlates with enhanced diabetes knowledge, self-care behaviors, and glycaemic control [6]. In contrast, limited health literacy among low-income populations contributes to inadequate self-care and poor glycaemic control [7], [8]. Older adults with insufficient knowledge and low health literacy face poorer clinical results and complications, influenced by socio-demographic factors [9]. Studies in Southeast and East Asia, particularly in Vietnam and Thailand, reveal that older adults with type 2 diabetes demonstrate moderate diabetes-related knowledge, with lower education levels negatively affecting this knowledge [10], [11]. Additionally, there is a strong linkage between health literacy, self-efficacy, self-care behaviors, and glycaemic control among these populations [12], [13].

However, evidence on the relationship between education level and diabetes knowledge among Indonesian older adults remains limited. A nationally representative analysis (Indonesia Family Life Survey) showed that lower educational levels were associated with a higher prevalence of diabetes [14]. One study in Indonesia reported that diabetes knowledge itself was a significant predictor, but this study highlights education and knowledge as key determinants of self-management [15]. In addition, higher diabetes literacy is positively associated with better self-management among older adults [16].

The relationship between education level and diabetes knowledge shows inconsistency across studies. Hartono and Ediyono [17] found no significant link between education and knowledge of diabetes management among type 2 DM patients in West Kalimantan, while duration of illness was significant. Conversely, a study in Cimahi indicated that diabetes knowledge varied by educational level, age, and gender [18]. Research on pre-elderly populations suggests higher education correlates with better diabetes knowledge and preventive actions [19].

Although the influence of education on diabetes knowledge is well documented, most research in Indonesia has focused on rural populations or relied on broad national surveys. For example, the 2018 Indonesian Basic Health Survey revealed clear urban–rural differences in diabetes-related risk factors, such as physical activity, obesity, and diet, although it did not delve into knowledge or education levels specifically [20]. Other studies, like the analysis of the Indonesian Basic Health Survey, further highlight urban–rural distinctions in prediabetes determinants but still do not assess health literacy or education’s direct impact on diabetes knowledge [21].

With increasing urbanization, cities such as Bandung are experiencing significant changes in their demographic and health profiles. The urban environment introduces unique factors, such as greater access to education, healthcare services, and digital information. That may shape health literacy differently compared to rural areas. Although direct studies on diabetes knowledge among the elderly in Bandung are scarce, regional research (South Jakarta) has demonstrated that structured educational interventions can significantly improve knowledge about type 2 diabetes among older adults [22].

As one of Indonesia’s largest and most dynamic cities, Bandung offers a valuable context for exploring these disparities. The city’s diverse socioeconomic landscape and rapid urban development present both opportunities and challenges for diabetes education among the elderly. Moreover, dietary and energy intake patterns differ between urban Bandung and rural areas like Sumedang, where education level is only correlated with vegetable and legume intake in the rural setting. This study suggests that education may influence health behaviors differently across contexts [23]. This study seeks to fill a critical gap in the literature by investigating the correlation between education level and diabetes knowledge among older adults in urban Bandung. The findings may inform urban health policies and targeted interventions, not only for Bandung but also for other rapidly growing Indonesian cities undergoing similar transitions.

2. METHOD

We conducted a descriptive cross-sectional study at six primary health centres in Bandung City. A purposive sample of 150 older adults with physician-diagnosed type 2 DM was recruited. Eligibility required independence in daily living (Barthel Index) and normal/mild cognitive function (MMSE). Data were collected using a structured questionnaire consisting of two parts. The first part recorded sociodemographic characteristics (age, sex, ethnicity, marital status, education level, occupation, and duration of diabetes). The second part assessed diabetes knowledge. The diabetes knowledge section was adapted from the diabetes knowledge test (DKT2) developed and validated by Fitzgerald *et al.* [24] and from an Indonesian diabetes self-management instrument used previously by Kurniawan and Yudianto [25]. The instruments were culturally adapted 15-item diabetes knowledge questionnaires, validated by expert review and pilot testing (Cronbach’s alpha = 0.72). Each correct answer was scored as 1, generating a total score of 0–15. Knowledge

was categorized into 'good' and 'poor' based on pilot distribution. Associations between education level and knowledge were tested using Chi-square analysis ($p < 0.05$).

3. RESULTS AND DISCUSSION

3.1. Results

A study involving 150 older adults with type 2 diabetes mellitus revealed demographic details indicating that most participants were aged 60–74, predominantly female, and of Sunda ethnicity. Approximately half had low educational attainment, with one-fifth having completed higher education. Most were married, while others were widowed or single. Table 1 details the sociodemographic characteristics of respondents.

Table 2 details the respondents' lifestyle and clinical characteristics. Most had never smoked or consumed alcohol, primarily engaged in household chores, and reported walking as their main form of exercise. Less than half maintained a regular diet, but most attended medical check-ups. About two-thirds experienced foot complaints, including numbness, pain, or tingling, and a similar proportion had received diabetes education.

Table 3 illustrates a significant relationship between education level and diabetes knowledge, revealing that respondents with lower education levels tend to score below average in diabetes knowledge. Conversely, those with senior high school and college/university education generally scored above average. The Chi-square test confirmed this association as statistically significant ($p < 0.001$), indicating that higher education correlates with better diabetes knowledge among elderly diabetes patients in Bandung.

Table 1. Sociodemographic characteristics of respondents (n = 150)

Variable	Category	n	%
Age (years)	60–74	133	88.67
	75–90	17	11.33
Sex	Male	48	32.0
	Female	102	68.0
Ethnicity	Sunda	102	68.0
	Javanese	12	8.0
	Other	36	24.0
Education level	Ever attended primary school but did not graduate	5	3.33
	Primary school	43	28.67
	Junior high school	28	18.67
	Senior high school	43	28.67
	College/university	31	20.67
Marital status	Single/never married	5	3.33
	Married	43	56.67
	Widowed	28	40.0

Table 2. Clinical and health behavior characteristics of respondents (n = 150)

Variable	Category	n	%
Smoking history	Never	101	67.3
	Former, but quit	33	22.0
	Currently smoking	16	10.7
Alcohol consumption history	Never	137	91.3
	Former, but quit	10	6.7
	Currently drinking	3	2.0
Routine daily activity	Working	9	6.0
	School	1	0.7
	Household chores	105	70.0
	Other	35	23.3
Type of exercise	Never	11	7.3
	Walking	107	71.3
	Running	3	2.0
	Gymnastics/exercise class	25	16.7
	Cycling	4	2.7
Regular diet	Yes	59	39.3
	No	90	60.0
Regular check-up	Yes	133	88.7
	No	17	11.3
Foot complaints (numbness/pain/tingling)	Yes	102	68.0
	No	48	32.0
History of diabetes education	Yes	97	64.7
	No	53	35.3

Table 3. Association between education level and diabetes knowledge among the elderly (n = 150)

Education level	Poor knowledge		Good knowledge		Total (n)	p-value
	n	%	n	%		
Ever attended primary school	4	80.0	1	20.0	5	<0.001
Primary school	30	69.8	13	30.2	43	
Junior high school	18	64.3	10	35.7	28	
Senior high school	16	37.2	27	62.8	43	
College/university	8	25.8	23	74.2	31	
Total	76	50.7	74	49.3	150	

3.2. Discussion

This study revealed a statistically significant correlation between educational attainment and diabetes knowledge among older persons with type 2 diabetes mellitus in Bandung City. Elderly individuals with greater educational levels exhibited superior understanding of diabetes, while those with lesser educational attainment demonstrated inferior knowledge. The Chi-square analysis revealed a significant association ($p < 0.001$), demonstrating that formal education significantly influences diabetes knowledge among older persons.

The discovery aligns with the theoretical premise that education affects an individual's capacity to acquire, analyze, and comprehend essential health information necessary for making informed health decisions [6], [7]. Prior research indicates that individuals with elevated education levels and health literacy possess superior capabilities in interpreting physician directives, comprehending laboratory findings, and executing advised lifestyle modifications, such as dietary adjustments, physical exercise, and adherence to prescription regimens [6]-[10]. In older persons, inadequate health literacy and insufficient knowledge correlate with adverse clinical outcomes and an increased risk of problems [9], [26]. The current results corroborate existing findings, indicating that educational attainment is a crucial factor influencing diabetes awareness in later life.

The findings of this study align with research conducted in other Asian nations. In Vietnam, Nguyen *et al.* [11] found that senior outpatients with type 2 diabetes mellitus had only modest knowledge and practices, with lower educational attainment adversely correlated with diabetes knowledge. Ong-Artborirak *et al.* [27] showed that in Thai communities, health literacy, self-efficacy, and self-care behaviors among older persons with type 2 diabetes mellitus were interconnected and significantly impacted glycemic control. Recent research from Egypt and other contexts reveals that older persons with restricted health literacy and insufficient knowledge are more prone to exhibit inadequate self-care behaviors and inferior outcomes [8], [9], [13]. These findings underscore the significance of tailored educational and health literacy initiatives for elderly individuals with diabetes.

In Indonesia, diabetes among older adults is a significant public health issue due to its rising prevalence and the numerous risk factors encountered by the aged. Numerous studies have investigated knowledge, preventive behaviors, and self-management across various age demographics. Kurniawan and Yudianto [25] indicated that diabetes self-management in adult patients with type 2 diabetes mellitus correlated with education and familial support. Rianto *et al.* [18] discovered that patients' understanding and perception of diabetes mellitus were correlated with their attitudes towards disease management in primary care environments. A study in Semarang revealed that older adults with type 2 diabetes mellitus exhibited diverse levels of knowledge and behavior concerning diabetes, with several individuals still engaging in suboptimal behaviors. Research conducted in a nursing home in Cimahi revealed that older persons' understanding of diabetes mellitus varied according to age, educational attainment, and gender [18]. Research in community contexts has indicated that pre-elderly populations with elevated educational attainment exhibit superior knowledge and preventative behaviors about diabetes mellitus (DM) [19]. Nonetheless, not all research has identified a substantial correlation between educational attainment and diabetes knowledge. Hartono and Ediyono [17], operating in a primary care environment in West Kalimantan, indicated that educational attainment did not significantly correlate with knowledge of the five pillars of diabetes management, although the duration of illness was significantly linked to knowledge. These variations indicate that although education is significant, its influence on knowledge may be moderated by factors such as exposure to health education, disease duration, social milieu, and the structure of primary care facilities.

This study contributes to the existing evidence by concentrating on elderly individuals with diabetes in an urban Indonesian context. The correlation between education level and diabetes awareness suggests that older persons with lower educational attainment may necessitate more comprehensive and customized educational assistance. However, limited formal education does not inherently prevent older persons from comprehending diabetic information. Research in Indonesia has demonstrated that organized and contextually relevant education can enhance knowledge and self-management behaviors, even in individuals with lower educational attainment [24], [25]. Group-based diabetes self-management education (DSME) for

older persons has been shown to improve self-care practices, encompassing food, physical activity, and foot care [24]. Changes in self-care behaviors were recorded during the COVID-19 pandemic, subsequent to focused treatments in primary care [25]. Digital education and counseling have been shown to enhance self-care behaviors and treatment adherence in individuals with type 2 diabetes mellitus [28]. A systematic study determined that educational interventions significantly enhance self-care management in diabetes mellitus, particularly when tailored to patients' literacy levels and socio-cultural contexts [29].

Self-care management in older persons with diabetes mellitus is further complicated by functional limits, various comorbidities, and environmental influences. Research in remote regions indicates that elderly individuals may encounter supplementary obstacles to self-care, such as restricted access to healthcare facilities, elevated transportation expenses, and diminished opportunities for organized instruction [30]. Studies conducted in Iran and Europe indicate a substantial correlation between functional capacity, medication adherence, self-care behaviors, and glycemic control in older persons with type 2 diabetes mellitus. Gupta *et al.* [30] identified that in rural India, patients and healthcare professionals regarded economic limitations, distance to medical facilities, and a deficient health staff as significant obstacles to effective self-care. Research from Bangladesh and Canada demonstrates that socioeconomic position significantly mediates the relationship between health literacy, self-care, and glycaemic management [31], [32]. These data indicate that education-focused treatments should be supplemented with comprehensive initiatives that tackle structural and socioeconomic obstacles, particularly for low-income elderly individuals. In Indonesia, one study demonstrates that structured education significantly improves both knowledge and self-care behaviors, emphasizing that educational format and support matter [33].

Familial support is a vital element for elderly individuals managing chronic illnesses. Research in Indonesia has demonstrated that the knowledge and engagement of family members correlate with patients' self-management and quality of life [34]. A recent comprehensive review determined that familial participation can enhance adherence to diabetic self-management methods, encompassing nutrition, physical exercise, and medication compliance [35]. Qualitative research from China and other contexts has demonstrated that family dynamics, psychological factors, and self-perceived load substantially affect loneliness and self-care experiences in older persons with type 2 diabetes mellitus [36], [37]. These findings highlight the need to incorporate a family-centered approach into diabetes education programs for older individuals.

The combined findings of this study and prior studies indicate multiple implications for nursing practice and primary health care. Older persons with little education should be prioritized for diabetes education. Educational materials must employ accessible language, visual aids, and culturally pertinent examples to address literacy and sensory constraints. Secondly, DSME ought to be included in current chronic illness programs for older persons within primary care environments, utilizing group-based and interactive approaches that have demonstrated efficacy [29], [38]. Third, family members and caregivers ought to engage actively in educational activities to provide support for everyday self-care at home [35]. Four, based on our research about the evaluation program in Indonesia, older adults need intervention to enhance their knowledge, such as continuity of care [39], [40]. Future research should utilize longitudinal designs to investigate how education level and customized continuity of care programs affect changes in knowledge, self-care behaviors, and glycemic control over time, while also examining the mediating roles of socioeconomic position, family support, and health literacy.

4. CONCLUSION

This study showed a significant association between education level and diabetes knowledge among the elderly in Bandung City. Older adults with higher educational attainment were more likely to have good knowledge about diabetes and its management, whereas those with lower education tended to have poorer knowledge. These findings underline the importance of providing structured and simple diabetes education tailored to the needs of the elderly with low education, involving family members and primary health care providers. Strengthening health education programs for older adults is expected, which is continuity of care of the elderly with diabetes, to improve diabetes self-management and contribute to better glycemic control and prevention of future complications.

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AUTHOR CONTRIBUTIONS STATEMENT

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C : **C**onceptualization

M : **M**ethodology

So : **S**oftware

Va : **V**alidation

Fo : **F**ormal analysis

I : **I**nterpretation

R : **R**esources

D : **D**ata Curation

O : **O**riginal Draft

E : **E**diting

Vi : **V**isualization

Su : **S**upervision

P : **P**roject administration

Fu : **F**unding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

ETHICAL APPROVAL

Ethical approval was obtained from Universitas Padjadjaran's Health Research Ethics Committee (approval number: 1172/UN6.Kep/EC/2024), and informed consent was secured from all participants. All procedures complied with the principles of the Declaration of Helsinki. Potential participants received verbal and written information about the study objectives, procedures, potential risks and benefits, and their rights as research participants. Written informed consent was obtained from all respondents before data collection. Confidentiality and anonymity were ensured by using code numbers instead of personal identifiers, and all data were stored securely and used only for research purposes.

DATA AVAILABILITY

Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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