House Physical Environment Condition of Type 2 Diabetes Mellitus Patient from Puskesmas Sempaja Geriatric Health Post Unit

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Abstract. The prevalence rate of type 2 diabetes mellitus (T2D) tends to increase in various parts of the world. T2D is characterized by high blood glucose level, and currently among the top diseases affecting millions of people in the world. T2D is a chronic disease that is prone to various complications, one of which is diabetic neuropathy and foot ulcers. T2D is more common in the elderly who primarily stayed home, so access, quality and maintenance to adequate housing are important for diabetic patients in managing diabetes routines and diet. This research is a cross-sectional analytic study. Participants in this study were selected purposively from geriatric health post at Community Health Center in Sempaja, Samarinda, Indonesia. The variables studied were the physical condition of the house based on healthy house questionnaire from the Indonesian Ministry of Health, and the status of diabetes of the patient. The results showed that only 8.6% (n = 5) of T2D patients had unhealthy house while 15.5% (n = 9) of those without T2D had unhealthy house. No association between physical environment conditions between house of T2D patients and those without T2D was found (p = 0.1664). Nonetheless, significant differences were found on the component of the healthy house score: the housing score (p = 0.0243) and sanitation score (p = 0.00730; no significance was found on the behavior score (p = 0.1240).

Keywords: Healthy House · Diabetes · Environmental Health

1 Introduction

Reports has shown that there was a tendency to increase incidence and prevalence of Type 2 Diabetes Mellitus (T2D) in various parts of the world. The International Diabetes Federation (IDF) estimated that in 2021, the number of diabetics patients has reached 536.6 million and it was predicted that in 2045 it would increase to 783.2 million [1]. Meanwhile, Indonesia in 2018, estimated an overall prevalence 1.5% of T2D, and it was as much as 5.83% in people age 55 years and older [2].

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Diabetes mellitus itself is a group of disorders with main characteristic of chronic hyperglycemia: prolonged increase of blood sugar which was caused mainly from a disturbance of insulin secretion or of insulin effect or both, but T2D predominantly is the latter [3]. T2D is the most common form of diabetes mellitus, covering up to 90% of all diabetes mellitus patients, and it is a global health threat with upper middle income countries as its epicenters of high prevalence, such as China, India and Indonesia [4].

T2D is also associated with other diseases, including metabolic syndrome [5] and complications, both macrovascular (cardiovascular diseases) [6] and microvascular [7] Microvascular complication of T2D includes diabetic nephropathy which leads to chronic kidney disease, diabetic retinopathy which affect sight and diabetic neuropathy which can cause diabetic foot ulcer, where peripheral nerve dysfunction making wounds easily infected. Foot ulcers is the most feared complication causing impaired mobility, disability, and morbidity, and quite a challenge for clinician in its management.

Several factor contributing to the pathophysiology of T2D, mostly comes from diet quality and quantity, lifestyle: less physical activity, sedentary living, smoking, stress, sleeping disturbances; genetic predisposition and environment [3, 7] Environment, especially physical environment, is commonly thought to be a minor factor in T2D [8]. Nonetheless, several studies has shown association between T2D and noise pollution [9, 10], residential traffic [11], air pollution [12], and air particulate matter [13] Sanitation might also contribute to the increasing risk of T2D. While infection itself might not the cause of diabetes, it has been shown that several infections were associated with T2D such as hepatitis C virus which might induce insulin resistance [14] and Chlamydia pneumoniae which trigger pancreas β-cell dysfunction and systemic inflammation [15].

Environment not only plays as risk for T2D, but also determine the outcome of T2D. Look AHEAD study [16] has shown that low neighborhood socioeconomic stats was significantly associated with lower outcome of diabetes patients. Moreover, neighborhood environment with diabetes self-care management were shown to have significant effect on diabetes control [17]. Overall, housing insecurities (access to adequate housing, quality of housing, and the ability to maintain housing) was found to be related with diabetes self-care and its prognosis [18]. Thus, it is important for T2D patients to maintain their house in improving their disease prognosis.

Therefore, our study was conducted with the objective to measure house physical environment situation of T2D patients and to compare it with those without T2D.

2 Methods

This is a cross-sectional study to compare house physical environment between T2D and non-T2D patients from Geriatric Health Post Unit at the Puskesmas Sempaja community health center, Samarinda, Indonesia.

Inclusion criteria for the sample was patients who came to the Geriatric Health Post Unit from August 20th until September 3rd, 2022, while those who refuse to participate or unable to have their house observed were excluded. Minimum sample size was estimated at 22 based on 5.83% prevalence rate of T2D among elderly in Indonesia. Data collection was carried out by observing the respondent's house using Healthy House Assessment Form based on Technical Guidelines from the Ministry of Health of the

Republic of Indonesia [19]. Variables measured were patient characteristics, T2D status and healthy house assessment score which evaluates house components, sanitation facilities, and occupant behavior. Patient characteristics included age and sex, while T2D status was obtained from the medical record. Healthy house assessment score can be categorized with cutoff at score less than 1068 was categorized as unhealthy. Data collected was then described using mean, standard deviation and percentage and their characteristics difference and/or association were analyzed using Pearson chi-square and Mann-Whitney test. Association was significant if p-value is less than 0.05. Statistical analysis was conducted using STATA 17.0 SE.

3 Results and Discussion

Fifty-eight patients participated in our study (see Table 1), 20 (34.48%) among them was diagnosed with T2D. Most of the participants were female, 13 (65%) from the T2D group and 21 (55.26%) from non-T2D patients. Median age in the T2D patients was 60.5 (56; 63) years old, while in non-T2D patients reported significantly younger at 55.5 (54; 59) years old ($p = 0.0071$).

Median healthy house assessment score was reported as much as 1117.5 (1058.5; 1155) in T2D patients, while non-T2D was higher at 1145.5 (1068; 1235), although no significant difference was found ($p = 0.1664$). Based in this score, we categorized the results between health and unhealthy house and found that 5 (25%) of T2D patients still live in unhealthy condition. Similarly for non-T2D patients, 9 (23.68%) lived in unhealthy house.

However, if we breakdown the score into each component (see Fig. 1 and Table 1), there was significant difference between housing component average score, which lower for T2D patient (416.95 ± 9.92), while non-T2D had higher (451.13 ± 9.33, $p = 0.0243$). Significant difference was found also in sanitation facilities assessment, which T2D patients reported average score only at 300 ± 6.02 while non-T2D was better at 327.92 ± 6.53 ($p = 0.0073$). Finally, no significant difference ($p = 0.1240$) between behavioral aspect of the occupant was found, as median score for T2D patient was 396 (374; 440) while non-T2D was 374 (308; 396).

This study aimed to assess the physical house measurement difference between T2D and non-T2D patients who attended geriatric health post unit in Sempaja community health center in Samarinda, Indonesia. The prevalence of diabetics among these patients was higher than estimated population prevalence [2, 20] due to the setting, since those with symptoms and/or diagnosis of T2D or other degenerative disease would visit the health post unit which acts as point care provider for these diseases.

Regarding characteristics of the patients, age of T2D patients was reported older than non-T2D patients, showing age as risk factor of T2D; likewise it seems that it is easier to detect T2D in elderly than those of younger age [20] Another characteristics reported in this study was sex: no significant proportion difference found between the two groups of patient, however most of the patients were female, similar with other prevalence study in Indonesia [20], or even in its urban area [21].

There was no significant difference was found between cumulative healthy house assessment score between the two group of patients. Nonetheless, component of the

Table 1. Characteristics of the participants and their house assessment results

	T2D n = 20	Non-T2D n = 38	p-value
Age*	60.5 (56; 63)	55.5 (54; 59)	0.0071
Male	7 (35.0)	17 (44.74)	0.5121
Healthy house score*	1117.5 (1085.5; 1155)	1145.5 (1068; 1235)	0.1664
House score	416.95 ± 9.92	451.13 ± 9.33	0.0243
Sanitation score	300 ± 6.02	327.92 ± 6.53	0.0073
Behavior score*	396 (374; 440)	374 (308; 396)	0.1240
Unhealthy house	5 (25.0)	9 (23.68)	0.911

Categorical variable was described using frequency (percentage) while numerical variable as mean ± standard deviation if the distribution is normal, otherwise is described as median (Q1; Q3). Significance p-value was calculated using Pearson chi-square for categorical variable and independent Student t-test for numerical variable, except those mark by (*) were calculated using Mann-Whitney test.

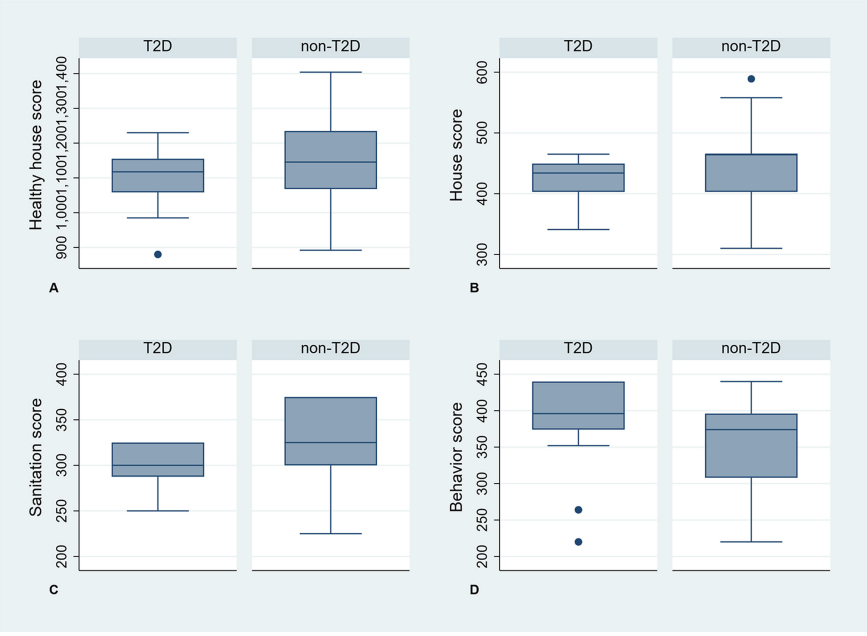

Fig. 1. Boxplot showing distribution of (A) Healthy house score (B) Housing score (C) Sanitation score and (D) Behavior score between T2D and non-T2D patients.

assessment score, namely the housing score and sanitation score were found to be significantly different among groups, while no difference in their behavior. This result was in line with several studies [16, 22] which stated that neighborhood situation was associated with T2D. However, we should not only consider housing and sanitation situation as a risk for T2D, but we also have to consider whether this condition might affect the management of T2D. Mosley-Johnson, et al. [18], stated that housing insecurities had an influence on the management of T2D such as process of care and also self-care behavior of T2D patient, while Smalls, et al. [17], found that neighborhood factors also played in glycemic control. Even in the environment with resource-poor setting was acknowledged as one of risk factor on prolonged diabetic foot, one of the complications of T2D [23]. Therefore, it is advised to improve the sanitation situation, especially those who already suffer this kind of complication [24].

Eventually, this study is the first of its kind to use the healthy house assessment score onto T2D status. Studies which explore physical environment factor on T2D are somewhat limited, as behavioral lifestyle [8] is considered to have more effect on this disease. Furthermore, tools in assessing physical environment in diabetic patients is also limited and might not measure many aspects regarding T2D patients, both as a risk factor or a risk in the prognosis of the outcome of T2D: a better housing assessment tools is needed. This study also focused on patients in urban area, where most of the patients came from upper-middle income district. Future studies should consider more coverage to establish the impact of physical environment on T2D.

4 Conclusion

This study showed that there was no significant difference found for healthy house assessment score between T2D and non-T2D patients ($p = 0.1664$). Nonetheless, significant differences were found on the component of the healthy house score, namely for the housing score ($p = 0.0243$) and sanitation score ($p = 0.00730$, while no significance was found on the behavior score ($p = 0.1240$).

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