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Habits model of elderly with diabetes mellitus in the coastal area of Madura Indonesia

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Abstract

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BACKGROUND: The development of research on diabetes mellitus (DM) increases every year. The prevalence of DM remains the world's attention and a global issue including in Indonesia.

AIMS: The purpose of this study was how to model daily life patterns in elderly people with diabetes in the coastal area of Madura.

METHODS: This study used an analytical design to model the habits. The study population of the Madura coastal elderly community with DM through cross-sectional design. There was 47 elderly as sample using purposive sampling technique. The instruments used were the Barthel index questionnaire to assess activity daily life (ADF), the Depression Anxiety Stress Scale questionnaire, and the respondent characteristic questionnaire. The results of the study were analyzed using structural equation modeling analysis.

RESULTS: This study shows that there was only the effect of respondent characteristics on ADF and coping mechanisms on psychiatric conditions. Significance test shows that there is an influence of respondent characteristics on ADF with a coefficient of -0.748 and an R-square value of 0.559 in the moderate category. There is an influence of the coping mechanism on the psychological condition with a coefficient of -0.397 and an R-square value of 0.158 in the weak category.

CONCLUSIONS: Model analysis shows that only two significant variable: First, respondent characteristics to ADF and second, coping mechanism to psychiatric conditions, while other variables are not significant. This may be due to the existence of other variables such as diet and others that were not studied.

Introduction

The development of research on diabetes mellitus (DM) increases every year. The highest number of DM studies was in 2015 with 75,206 studies and 90% were cited. This shows that the world's attention to DM is quite large and increasing. In Indonesia, DM has increased more than infectious diseases, in Madura, DM is also increasing, even though the Madurese are known to dislike sweet foods. This may occur because wrong eating habits, lifestyle, and stress levels can affect blood sugar levels in the body [1], [2], [3].

Depression is always found in one out of every four people with type 2 diabetes. Depression also increases the risk of diabetes, hyperglycemia, insulin resistance, and other micro and macrovascular complications. Conversely, a diagnosis of type 2 DM also increases the risk of incidence of depression and may contribute to more severe depression. This linkage reflects a shared etiology consisting of a complex two-way interaction between many variables. It includes autonomic and neurohormonal dysregulation, weight gain, inflammation, and hippocampal structural

changes. Two recent meta-analyses of trials of randomized controlled depression treatment in patients with type 2 DM concluded that psychotherapy and antidepressant drugs, respectively, are quite effective for depression and cognitive behavioral therapy (CBT) has a beneficial effect on glycemic control [4], [5], [6].

Another study states that the comorbidity of depression and DM is risk factors cognitive decline in the elderly in Mexico America. Interventions that reduce the prevalence of depression and DM in Mexican Americans can reduce the number of adults experiencing a cognitive decline [7], [8].

On the other hand, there are currently no strategies to prevent or delay other disorders such as cognitive impairment [9]. The purpose of this study how to model daily life patterns in elderly people with diabetes in the coastal area of Madura. This modeling uses structural equation modeling analysis with smartPLS software. This research is the basis for creating a model for overcoming the impact of DM and improving the quality of life for elderly people with DM. The benefits of this research are to improve the quality of life of people with diabetes, especially the elderly,

and indirectly have an impact on the Indonesian economy.

Methods

This study used an analytical design to model the living habits of the elderly with DM on the coast of Madura, the study population of the Madura coastal elderly community with DM, with 47 elderly DM as sample using purposive sampling technique. There are two exogenous latent variables, two endogenous latent variables, and one endogenous manifest variable. The first exogenous latent variable is the characteristic of the respondent which has four indicators: Gender, occupation, education, and age. The second exogenous latent variable is the coping mechanism which has 3 indicators: primary, secondary, and tertiary. The first endogenous latent variable is activity daily life (ADL) which has nine indicators: Bowel performance, Bladder performance, Grooming performance, Toilet use performance, Mobility performance, Feeding performance, Transfer performance, Stairs performance, and Dressing performance. The second endogenous latent variable is a psychiatric condition that has three indicators, namely: Anxiety, depression, and stress. The endogenous manifest variable is blood sugar levels.

The instruments used were the Barthel index questionnaire to assess ADL, the Depression Anxiety Stress Scale questionnaire, and the respondent characteristic questionnaire. The results of the study were analyzed using structural equation modeling analysis with smart-PLS software.

Results

Evaluation of the outer model

Convergent validity

Several references state that a factor loading of 0.50 is considered to have sufficiently strong validation to explain latent constructs [10]. Table 1 is a summary of the loading value of the output. The latent variable of respondent characteristics has only one valid indicator, namely age. The latent variable of coping mechanism is only one invalid indicator, namely secondary (a person's self-defense mechanism consisting of Emotional Focusing Engagement, Emotional Focusing Disengagement, and Problem Focusing). The latent variable of daily life activity has nine indicators, only two indicators are invalid, namely, ADL3 (ability to dress up) and ADL6 (ability to walk). Meanwhile, the latent variable of psychiatric

conditions is only one invalid indicator, namely, anxiety (excessive anxiety/tension).

Table 1: Loading factor value

Variable latent	Indicator	Factor loading
Respondent characteristic	Sex (KR1)	0.171
	age (KR2)	0.935
	Job (KR3)	-0.542
	Education (KR4)	-0.573
Coping mechanism	Primer (MK1)	0.555
	Secondary (MK2)	-0.290
	Tertiary (MK3)	0.746
Activity Daily Life	ADL1	0.889
	ADL2	0.639
	ADL3	0.422
	ADL4	0.841
	ADL5	0.647
	ADL6	0.222
	ADL7	0.749
	ADL8	0.740
	ADL9	0.748
Psychiatric condition	Depression (KJ1)	0.878
	Anxiety (KJ2)	0.247
	Stress (KJ3)	0.910

Discriminant validity

The following is the cross-loading value of each indicator. Table 2 shows that the correlation of the latent variable of the respondent's characteristics with its indicators is greater than the indicators of the other three latent variables. This shows that the latent variable of respondent characteristics predicts indicators in their group better than indicators from other groups and it can be concluded that the latent variable of respondent characteristics has good discriminant validity.

Table 2: Cross loading value

Indicator	Respondent characteristic	Activity daily life	Psychiatric condition	Coping mechanism
ADL1 Bowel performance	-0.711	0.889	0.079	-0.068
ADL2 Bladder performance	-0.637	0.639	0.132	-0.087
ADL3 Grooming performance	-0.262	0.422	0.068	0.112
ADL4 Toilet use performance	-0.613	0.841	0.020	-0.155
ADL5 Feeding performance	-0.325	0.647	-0.160	0.000
ADL6 Mobility performance	-0.199	0.222	-0.173	0.080
ADL7 Transfer performance	-0.364	0.749	-0.197	-0.025
ADL8 Dressing performance	-0.383	0.740	0.030	-0.088
ADL9 Stairs performance	-0.662	0.748	0.227	-0.129
Depression (KJ1)	-0.295	0.044	0.878	-0.323
Anxiety (KJ2)	0.038	-0.059	0.247	-0.004
Stress (KJ3)	-0.308	0.072	0.910	-0.397
Sex (KR1)	0.171	0.000	-0.203	0.082
Age (KR2)	0.935	-0.803	-0.219	0.248
Job (KR3)	-0.542	0.256	0.197	-0.028
Education (KR4)	-0.573	0.230	0.469	-0.223
Primer coping mechanism (MK1)	0.123	0.006	-0.179	0.555
Secondary coping mechanism (MK2)	-0.175	0.049	0.167	-0.290
Tertiary coping mechanism (MK3)	0.141	-0.094	-0.292	0.746

The correlation of the coping mechanism latent variable with its indicators is greater than the indicators of the other three latent variables. This shows that the coping mechanism latent variable predicts the indicators in his group better than the indicators from other groups and it can be concluded that the coping mechanism latent variables have good discriminant validity.

The correlation of the latent variable of daily life activity with its indicators is greater than the indicators of the other three latent variables. This shows that the latent variable of daily life activity predicts indicators in his group better than indicators from other groups and it can be concluded that the latent variable of daily life activity has a good validity discriminant.

The correlation of the psychiatric condition latent variable with its indicators is greater than the indicators of the other three latent variables. This shows that the latent variable of psychiatric conditions predicts indicators in his group better than indicators from other groups and it can be concluded that the latent variables of psychiatric conditions have good discriminant validity. All values AVE of the four latent variables are more than the correlation values between latent variables (Table 3). This shows that all latent variables have good discriminant validity.

Table 3: AVE value and correlation

Variable latent	AVE	AVE	Correlation			
			Respondent characteristic	Coping mechanism	Activity Daily Life	Psychiatric condition
Respondent characteristic	0.381	0.617	1	0.253	-0.748	-0.327
Coping mechanism	0.316	0.562	0.253	1	-0.095	-0.397
Activity	0.469	0.685	-0.748	-0.095	1	0.060
Daily Life						
Psychiatric condition	0.553	0.744	-0.327	-0.397	0.060	1

Reliability

Reliability testing is carried out to prove the accuracy, consistency, and accuracy of the instrument in measuring constructs or latent variables. In this study, the reliability test used the composite reliability value and Cronbach's alpha. In general, composite reliability and Cronbach's alpha of more than 0.6 are acceptable [11]. The composite value is reliable and Cronbach's alpha for confirmatory studies is more than 0.7, while for explanatory studies more than 0.6 is still acceptable [12], [13], [14]. The following table is a summary of the composite reliable values and Cronbach's alpha of the latent variables.

Table 4 shows that the composite value is reliable and Cronbach's alpha for the latent variable ADL and psychiatric conditions more than 0.7. These results can be concluded that the latent variables of daily life activity and mental conditions are reliable or the indicators of these variables are consistent in measuring daily life activity and psychological conditions. Meanwhile, the latent variable of respondent characteristics and coping mechanism has a reliable composite value of less than 0.6. This shows that the two latent variables have poor reliability.

Test the significance of the outer model

Table 4: Composite reliable and Cronbach's Alpha value

Variable latent	Composite reliability	Cronbach's Alpha
Respondent Characteristic	0.000	-3829
Coping Mechanism	0.333	0.248
Activity Daily Life	0.879	0.845
Psychiatric condition	0.756	0.568

The PLS-SEM method cannot be tested for the significance of the model, because the data distribution is unknown. Therefore, the significance test uses the resampling bootstrapping method. The following is a summary of the significance test results for both the outer model using $\alpha = 5\%$.

Two significant indicators are not statistically valid on the latent variable of the respondent's characteristics, namely gender and education. There is one significant indicator that is not statistically valid on the latent variable of daily life activity, namely, ADL6 (ability to walk). There is one indicator in the latent variable of the coping mechanism which is statistically significant, namely, the coping mechanism. There is a significant indicator that is not statistically valid on the latent variable of psychiatric conditions, namely, anxiety.

Table 5 shows that the latent variables of respondents' characteristics are formed by 4 indicators, where the results of the outer model test show valid age and job indicators. That is, in this model, age and job are indicators that can build the respondent's characteristic construct. The latent variable of daily life activity is formed by 9 indicators, where the results of the outer model test show that only the transfer performance indicator is invalid. That is, in this model, all indicators except transfer performance are indicators that can build latent constructs of activity daily life.

The latent variable of the coping mechanism is formed by 3 indicators, where the results of the outer model test show that only tertiary indicators are valid. That is, in this model, only tertiary indicators can build latent constructs of coping mechanisms.

The latent variable of the psychological condition is formed by 3 indicators, where the outer model test results show that only the anxiety indicator is invalid. That is, in this model, the construct of mental conditions is built on depression and stress.

Table 5: The result of outer model significance test

Indicator	t-stat	p-value	Interpretation
Sex (KR1)— Respondent characteristic	0.475	0.635	Not valid
Age (KR2)— Respondent characteristic	5.202	0.000	Valid
Education (KR3)— Respondent characteristic	1.723	0.086	Not valid
Job (KR4)— Respondent characteristic	2.485	0.013	Valid
ADL 1 Bowel performance ← Activity Daily Life	3.098	0.002	Valid
ADL 2 Bowel performance ← Activity Daily Life	2.949	0.003	Valid
ADL 3 Grooming performance ← Activity Daily Life	2.071	0.039	Valid
ADL 4 Toilet use performance ← Activity Daily Life	3.126	0.002	Valid
ADL 5 Feeding performance ← Activity Daily Life	2.730	0.007	Valid
ADL 6 Mobility performance ← Activity Daily Life	0.908	0.365	Not valid
ADL 7 Transfer performance ← Activity Daily Life	2.964	0.003	Valid
ADL 8 Dressing performance ← Activity Daily Life	3.158	0.002	Valid
ADL 9 Stairs performance ← Activity Daily Life	2.916	0.004	Valid
Primer (MK1)— Mekanisme Koping	1.367	0.172	Not valid
Secondary (MK2)— coping mechanism	0.563	0.573	Not valid
Tertiary (MK3)— coping mechanism	1.991	0.047	Valid
Depression (KJ1)— Psychiatric condition	2.730	0.007	Valid
Anxiety (KJ2)— Psychiatric condition	0.624	0.533	Not valid
Stress (KJ3)— Psychiatric condition	2.683	0.008	Valid

Inner model evaluation

Testing of the inner model is done by looking at the results of the significance test of the effect of exogenous latent variables on endogenous latent

variables or endogenous latent variables on other endogenous latent variables. The significance test in PLS-SEM uses the resampling bootstraping method because of the unknown data distribution. The results of the model significance test are shown in Table 6 as follows.

Table 6: Significance test of inner model and p-value

Relationship	t-stat	p-value	Interpretation
Activity Daily Life → blood glucose level	0.103	0.918	Not Significant correlation
Respondent characteristic → Activity Daily Life	2.712	0.007	Significant correlation
Psychiatric condition → blood glucose level	1.187	0.236	Not Significant correlation
Coping mechanism → Psychiatric condition	2.239	0.026	Significant correlation

Table 6 shows that there is only the effect of Respondent Characteristics on ADL and Coping Mechanisms on Psychiatric Conditions. Significance test results in Table 6. It shows that there is an influence of respondent characteristics on ADL with a coefficient of -0.748 and an R-square value of 0.559 in the moderate category [14]. This shows that the variability of the latent variable of ADL can be explained by the variability of the respondent's characteristics of 55.9%, and the remaining 44.1% is explained by other variables outside the characteristics of the respondent.

Significance test results in Table 6. It shows that there is an influence of the coping mechanism on the psychological condition with a coefficient of -0.397 and an R-square value of 0.158 in the weak category [14]. This shows that the variability of the latent

variable of psychiatric conditions can be explained by the variability of the coping mechanism of 15.8%, the remaining 84.2% is explained by other variables outside the coping mechanism.

The following is a summary of the size of the indirect, direct, and total influence of exogenous latent variables to endogenous latent variables or from endogenous latent variables to other endogenous latent variables as shown in Table 7.

Table 7: Direct, indirect, and total correlation

Variable latent	Activity daily life	psychiatric Condition	Blood glucose level
Respondent characteristic	-0.748		-0.012
Coping mechanism		-0.397	-0.073
Activity Daily Life			0.016
Psychiatric condition			0.185

Figure 1 below shows the model and the coefficient value of the relationship between indicators and their constructs and between latent variables and other variables.

The R-square value is a measure of the goodness-fit of a model. According to Chin (1998), the R-square values of 0.67, 0.33, and 0.19 indicate that the model is strong, moderate, and weak, respectively [13]. Meanwhile, according to Hair *et al.* (2009), the R-square value is 0.75, 0.50, and 0.25 indicate the strong, moderate, and weak models, respectively [14]. The following Table 8 shows the R-square value.

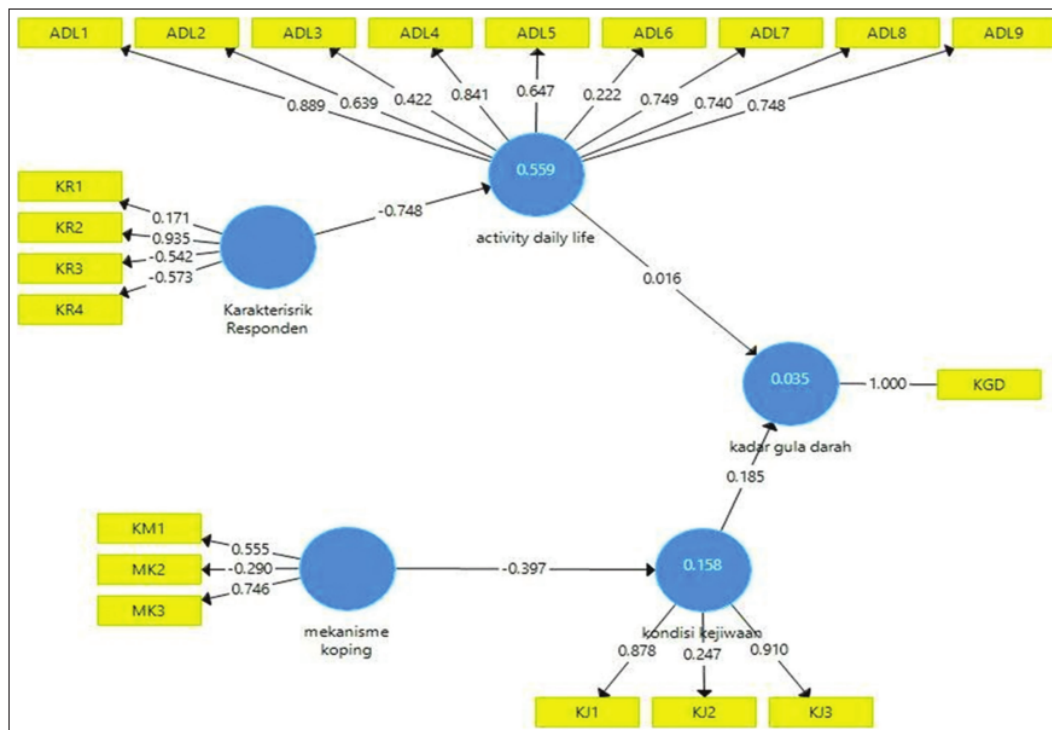


Figure 1: The model with coefficient value

Table 8: R-square value in the full model

Variable	R-square	Interpretation
Activity daily life	0.559	Model moderate
Blood glucose level	0.035	Model weak
Psychiatric conditions	0.158	Model weak

Significance test results show that there is an influence of respondent characteristics on ADL with a coefficient of -0.748 and an R-square value of 0.559 in the moderate category. This suggests that the latent variable of Daily Life Activity variability can be explained by the characteristics of respondents at 55.9% , the remaining 44.1% is explained by other outside variables. There is an influence of the coping mechanism on the psychological condition with a coefficient of -0.397 and an R-square value of 0.158 in the weak category. This shows that the latent variable of psychiatric conditions can be explained by coping mechanism of 15.8% , the remaining 84.2% is explained by other variables outside the coping mechanism.

Discussion

The model analysis shows that daily activities of the elderly do not have a significant effect on blood sugar levels, because the daily activities of the elderly are low intensity, such as drinking, eating, walking, and toileting. A study shows when matched for total period, moderate-intensity endurance-type exercise shows a more effective strategy to manage daily blood glucose homeostasis than repeated bouts of ADL. Nevertheless, the introduction of repeated bouts of ADL during prolonged sedentary behavior forms a valuable strategy to manage postprandial glucose handling in patients with type 2 diabetes [15]. Not only can it control blood sugar levels, but also may be able to control the blood pressure of DM patients [16].

The model analysis shows that respondent characteristic have a significant effect to ADL. It similar with the research that daily activities may be influenced by the characteristics of a person, such as gender, occupation, and age. How do usually older adults spend their day? In ancient times before the internet, there are three activity categories usually older adults spend their day: obligatory activities (personal self-maintenance and IADLs), leisure (reading, television viewing, or other activities), or resting [17]. At the time internet coming familiar, elderly adapting, and a study shows male elders seem to perceive more usefulness due to higher levels of ease of use than woman. This ease of use is also better explained by the level of enjoyment for males [18]. Finally, now internet is found to influence five dimensions of elderly consumers' well-being: enjoyment, personal growth, mastery, autonomy, and social connectedness [19].

The model analysis shows that there is no relationship between psychological conditions and blood sugar levels. Contradicted with the previous research has shown that psychological conditions such as stress can affect blood sugar levels [20], and vice versa, blood sugar levels affect psychological conditions [21]. This may be because there are other variable that affect blood glucose levels, such as diet. Well known that diet management was a primary intervention for diabetes, present research also support dietary therapy was effective to improve blood glucose profile [22].

The model analysis shows that coping mechanism has a significant effect on psychiatric condition, this is consistent with other studies reported, Maladaptive coping strategies of venting and self-blame, behavioral disengagement, were significantly associated with higher perceived stress scores and the new addition of an exercise coping mechanism significantly associated with the lower perceived stress scores. Use of prescribed medications was not significantly associated with perceived stress levels [23].

Conclusion

Model analysis shows that only two significant variable: First, respondent characteristics to ADL and second, coping mechanism to psychiatric conditions, while other variables are not significant. This may be due to the existence of other variables such as diet and others that were not studied.

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