PRINCIPAL COMPONENT ANALYSIS MODEL TO REDUCE COMPLIANCE FACTORS OF MEDICAL NUTRITION THERAPY IN HYPERTENSION PATIENTS

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ABSTRACT
The prevalence of hypertension is increasing, both at all ages and everywhere, and is one of the contributors to death due to complications. Morbidity and mortality due to hypertension can be prevented by implementing appropriate treatment, one of which is medical nutrition therapy. This research aims to analyze factors associated with compliance with medical nutrition therapy in hypertensive patients using principal component analysis. This study is an observational analytic using a cross sectional design. The research started from August to October 2023. The samples for this study were 100 hypertensive patients in the Kedaton Health Center work area and were taken using a multistage random sampling technique that met the inclusion and exclusion criteria. The independent variables are knowledge, education, income, attitude, motivation, self-efficacy, family support, food availability in the household, psychological conditions, and support from health workers; and the dependent variable is compliance with medical nutrition therapy. Data were analyzed using principal component analysis. The results of the study showed that based on principal component analysis, 3 categories of factors were found that played a role in the compliance of medical nutrition therapy in hypertensive patients, namely factor 1 socioeconomic, efficacy, and psychology (education, knowledge, income, efficacy, psychology), factor 2 personal and nutrition (attitude, motivation, food availability), and factor 3 reinforcing (family support, health worker support).
Keywords: Medical nutrition therapy compliance, Hypertension patients, Principal component analysis.

1. INTRODUCTION

Hypertension is often referred to as a silent killer without any symptoms and complaints. Hypertension is also a disease characterized by an increase in blood pressure higher than normal, namely systolic blood pressure> 140 mmHg and diastolic blood pressure> 90mmHg, hypertension is a chronic disease that cannot be cured but can only be controlled and requires long-term or even lifelong treatment, non-compliance with treatment is a factor that inhibits blood pressure control, so intervention is needed to improve compliance (1).

Hypertension and its complications can be treated and prevented by various efforts, namely by controlling blood pressure by administering non-pharmacologic therapy in the form of lifestyle modification, reducing body weight, limiting sodium intake, modifying a low-fat diet, limiting alcohol, limiting caffeine, relaxation techniques, and stopping smoking habits, while pharmacological therapy in the form of administering drugs with types of anti-hypertension medications including diuretics, beta-blockers, vasodilators, calcium channel blockers

and angiotensin-converting enzyme (ACE) inhibitors (2).

Hypertension diet management of patients has an important role, because hypertension is an independent treatment and is a determinant in the success of hypertension treatment, helping to lower blood pressure and prevent complications. Therefore, it is very necessary for hypertension patients to comply with the diet/medical nutrition therapy that is appropriate to the condition of each individual (3).

Many factors influence patient compliance, for example in implementing a diet that is appropriate for their illness, that were factors of knowledge, education, income, attitude, motivation, self-efficacy, family support, food availability in the household, psychological conditions, and support from health workers , and so on (4).

Of the many factors that play a role or are associated with the compliance of diet in hypertension patients, an analysis will be carried out using principal component analysis to reduce a large number of variables into a small number of factors. The purpose of principal component analysis is to explain variations in a set of observed variables on the basis of several dimensions, from variables that change a lot to variables that are few.

2. METHOD

The study was an analytical study with a cross-sectional design. The study was conducted in the working area of the Kedaton Health Center, Bandar Lampung City, Lampung Province, from August to October 2023. The study population was all hypertension patients in Lampung Province. Based on the results of the sample size calculation, the minimum sample for this study was 100 people with hypertension in the working area of the Kedaton Health Center, using the unpaired categorical comparative analytics sample size formula. The sampling technique used purposive sampling. The inclusion criteria were patients who had suffered from hypertension for at least 3 months and were willing to participate in the study. The exclusion criteria were no cognitive dysfunction.

The independent variables were knowledge, education, income, attitude, motivation, self-efficacy, family support, household food availability, psychological condition, and health worker support; and the dependent variable was compliance with medical nutrition therapy. Knowledge, attitude, motivation, self-efficacy, family support, household food availability, psychological condition, and health worker support were assessed from a validated questionnaire. Education and income were obtained through interviews. Compliance with medical nutrition therapy was assessed by comparing the food intake of hypertensive patients with the nutritional needs of hypertensive patients based on the 24-hour food recall questionnaire. Data collection was carried out by previously trained enumerators. Data were analyzed with a 95% confidence level (p <0.05) using the principal component analysis (PCA) technique. The study was conducted after obtaining a letter of passing the research ethics review from the Medical and Health Research Ethics Committee, Faculty of Medicine, University of Lampung with letter number 2912 / UN26.18 / PP.05.02.00 / 2023 .

3. Results

The influence of education, income, knowledge, attitude, motivation, self-efficacy, family support, household food availability, psychological conditions and health worker support on non-compliance with medical nutrition therapy for hypertension

patients will be tested using PCA so that factor naming can be obtained for all these variables. The results of factor analysis using the principal component analysis (PCA) method, based on the results of the PCA analysis test, it was found that the KMO value was 0.662 (greater than 0.5) so that the factor analysis technique could be continued and the Bartlett's test of sphericity value was 0.000 (p <0.05) then the factor analysis in this study could be continued because it met the first requirement.

Table 1. Results of Initial Factor Analysis Using the Principal Component Analysis (PCA) Method

Variables	KMO	Bartlett's test	Anti-image matrix
	0.662	0,000	
Income			0.770
Education			0.662
Knowledge			0.716
Attitude			0.597
Motivation			0.777
Self-efficacy			0.725
Psychological conditions			0.617
Household food availability			0.599
Family support			0.694
Health worker support			0.679

The MSA value for each variable can be seen based on the anti image matrix value. Based on the results of the PCA analysis, all variables have an MSA value >0.5 so that the second requirement for this PCA analysis is met and the analysis can be continued. The communalities column shows how much the formed factor can explain the variance of a variable. The communalities value for all these variables is the same, namely 1,000, which means that each variable can explain 100% of the variance of the formed factor, thus indicating the close relationship between the relevant variable and the formed factor.

To determine the number of factors formed can be based on the eigenvalue value. If there is a total eigenvalue whose value is less than 1, the factor is stated to be unable to explain the variable well, so it is not included in the formation of the variable. The results of the analysis show that the eigenvalue value shows that the number of variants obtained in the output results is all three (3) variants, meaning that the possible factors formed are three (3) groups. Of the three variables, it can explain the variance of eight items by 60.08%. This figure is quite large because it is proven to be able to explain more than 50% of the variance of the variable.

Table 2. Final Factor Analysis Results Using the Principal Component Analysis (PCA) Method

Variables	Communalities	Initial eigenvalue	Eigenvalues
Income	1,000	2,689	2,689
Education	1,000	1,875	1,875
Knowledge	1,000	1,292	1,292
Attitude	1,000	0.874	
Motivation	1,000	0.768	
Self-efficacy	1,000	0.616	
Psychological conditions	1,000	0.581	
Household food availability	1,000	0.519	
Family support	1,000	0.463	
Health worker support	1,000	0.322	

The number of factors can also be determined from the scree plot. The scree plot is like a broken line. The point where the scree begins to occur, indicates the number of factors, precisely when the scree begins to flatten, indicated by the initial eigen value that is > 1. The results of the analysis in this study show that the initial eigen value > 1 is component number 1 to 3.
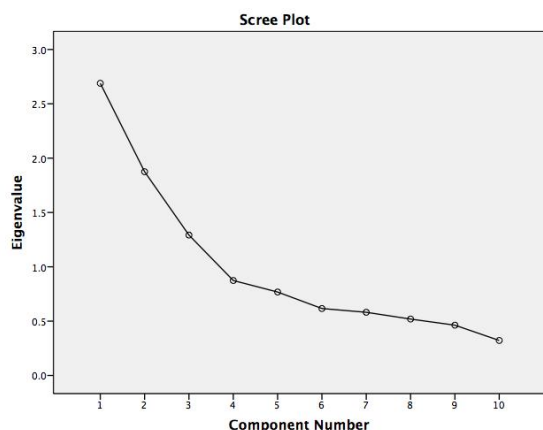
Figure 1. PCA Test Scree Plot

The results of the analysis then show the component matrix of factors that influence non-compliance with medical nutrition therapy in hypertension patients. The matrix component shows the correlation value between a variable and the factors formed.

Based on the results of the principal component analysis, 3 categories of factors were obtained that influence compliance with medical nutrition therapy for hypertension patients, namely factor 1 socioeconomic, efficacy, and psychology (education, knowledge, income, efficacy, psychology), factor 2 personal and nutrition (attitude, motivation, household food availability), and factor 3 reinforcing (family support, support from health workers).
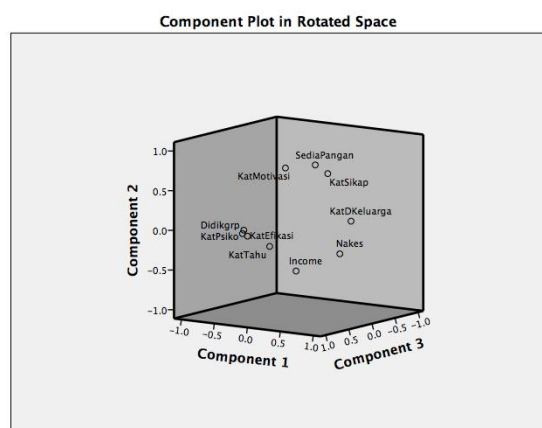

Figure 2. PCA Test Components

4. DISCUSSION

Low medication compliance can result in increased complications and risk of hospitalization. Hypertension will have an impact on the quality of human resources and a significant increase in health costs, therefore all parties, both society and government, should participate in efforts to overcome hypertension, especially in prevention efforts (5).

In the health service strategy for hypertension patients, the role of general practitioners is very important as the spearhead in primary health care. The role of patients and families in the management of hypertension is also very important, because hypertension is a chronic disease that will be treated for life. Therefore, education is needed for patients and their families to provide an understanding of the course of the disease, prevention, complications, and management of hypertension. This will greatly help increase family participation in efforts to improve management outcomes (6).

Patient compliance in taking medication and medical nutrition therapy plays a very important role in the success of treatment to maintain blood pressure within the normal range (7).

The results of the study showed that factors that influence compliance with medical nutrition therapy for hypertension patients consist of 3 factors, that were socioeconomic factors, efficacy and psychology (education, knowledge, income, psychology); personal and nutritional factors (attitude, motivation, food availability); and reinforcing factors (family support, health worker support) .

Socioeconomic factors play an important role in influencing dietary compliance in hypertensive patients. Patients with low income or lower

educational status often face obstacles in accessing accurate health information and balanced nutrition, and have limitations in purchasing healthy foods that can support hypertension management (8).

Patients with higher socioeconomic status tend to have more access to health services, nutritional information, and the ability to purchase healthier foods. In addition, occupational and social factors also play a role; patients who work long hours or have stressful living conditions may have a harder time maintaining a healthy diet. Therefore, socioeconomic status may influence patients' motivation, knowledge, and ability to follow recommended diets, which in turn impacts their blood pressure control (9).

Personal and nutritional factors greatly influence the dietary compliance of hypertensive patients. Personal factors, such as individual knowledge about hypertension and its adverse effects on health, can increase awareness and motivation to follow the recommended diet. Patients who have a good understanding of the importance of a healthy diet, as well as a desire to maintain quality of life, tend to be more compliant in following a diet. Psychological factors such as eating habits, taste preferences, and stress levels also play a role in dietary compliance (10).

Nutritional factors are directly related to the type of food consumed. The right diet for hypertensive patients should be low in sodium, rich in potassium, and high in fiber, and pay attention to nutritional balance to regulate blood pressure. Ignorance of the right nutritional composition or difficulty in implementing a healthy diet can be an obstacle for patients to comply with the recommended diet. Therefore, understanding and implementing good nutrition, along

with personal factors such as motivation and habits, greatly influence the success of managing hypertension through diet (11,12).

Family and medical personnel support are reinforcing factors that greatly influence the compliance of hypertensive patients' diet. Family support, both emotional and practical, can increase patient motivation to follow a healthy diet. Families who understand the importance of a proper diet can help patients plan and prepare food that suits their health needs, as well as provide moral encouragement so that patients remain consistent with their diet (13).

Support from health workers, such as doctors or nutritionists, is also crucial in providing clear and accurate information about the diet that patients should follow. Health workers who are actively involved in monitoring patient progress and providing appropriate guidance can help patients feel more confident and motivated to maintain adherence to the recommended diet. With strong support from family and medical personnel, patients are more likely to successfully manage their hypertension through good and sustainable diet management (14).

5. CONCLUSION

Many factors influence compliance with medical nutrition therapy in hypertensive patients. From the 10 factors studied, it can be reduced to 3 groups of factors, and this is in accordance with existing theories, especially behavioral theories. It is expected that periodic e-education can be carried out for hypertensive patients and their families in an effort to improve medical nutrition therapy so as to prevent complications.

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