

The Relationship Between Nutritional Status and Blood Sugar Level Toward Cognitive Function of Elderly with Diabetes Mellitus

Umi Faridah

Nursing Faculty

University of Muhammadiyah Kudus

Kudus, Central Java, Indonesia

umifaridah@umkudus.ac.id

Indanah

Nursing Faculty

University of Muhammadiyah Kudus

Kudus, Central Java, Indonesia

indanah@umkudus.ac.id

Sulistiyani

Nursing Faculty

University of Muhammadiyah Kudus

Kudus, Central Java, Indonesia

sulistiyani@gmail.com

Abstract Background: Elderly is a person with advanced age who experiences biological, physical, psychological and social changes. This change will affect all aspects of life, including their health. There are several risk factors that encourage cognitive function including age, gender, race, genetics, blood pressure, heart failure, cardiac arrhythmias, lipid and cholesterol levels, thyroid function, obesity, nutrition, alcohol, smoking, trauma and diabetes mellitus. Diabetes is associated with early cognitive function and risk factors for the occurrence of disorders of mild cognitive function, vascular dementia, and Alzheimer's disease (Rahayu, 2011). This study examines the relationship between nutritional status and blood sugar levels toward cognitive function in elderly with DM at Soewondo Hospital of Pati. **Method:** Analytic correlation analysis with Cross Sectional approach method was conducted. The samples were 74 respondents taken using with simple random sampling technique and later tested using Chi-Square and Rank Spearman data analysis. This study showed that there is a relationship between the nutritional status and cognitive function of elderly with diabetes mellitus with p value of 0.000 and there is a relationship between blood sugar levels and cognitive function of elderly with diabetes mellitus with a p value of 0.000. **Conclusion:** There is a correlation between nutritional status and sugar levels with cognitive function in elderly with DM at Soewondo Hospital of Pati.

Keywords: *nutritional status, blood sugar level, cognitive function, elderly*

I. INTRODUCTION

Elderly is a person with advanced age who experiences biological, physical, psychological and social changes. This change will influence all aspects of life, including their health [7].

Elderly is someone who has reached the age of 60 years and above (Republic of Indonesia Law No.13Th. 1998). The elderly population reaches 605 million people in the world. Nearly 400 million of the world's elderly population live in low-income countries. Over the next 25 years, many low-income countries become high-income countries which are followed by an increase in the number of elderly people. In 2025, Indonesia as one of the five low-income countries will

be one of the largest elderly populations in the world, reaching 35 million [21].

In the elderly, there will be a decline in various functions of the body's organs. This decrease in function is caused by a reduction in the number of cells anatomically. In addition, reduced activity, lack of nutrient intake, pollution, and free radicals greatly affect the decline in the functioning of organs in the elderly and can affect cognitive function in the elderly [18].

Cognitive function is part of sublime cortical functions, where knowledge of sublime cognitive functions links human behavior to the nervous system. Cognitive function consists of attention, language, memory, visuospatial and executive functions. Impaired cognitive function occurs when one or more cognitive functions are damaged [6].

The results of Functional Magnetic Resonance Imaging (fMRI) research found that along with aging there is also a process of decline in brain function. This is linked to problems with cognitive function disorders such as Alzheimer's and dementia. In 2005, dementia sufferers in the Asia Pacific region numbered 13.7 million people and it is predicted that it will increase to 64.6 million people by 2020. In Indonesia, according to the Access Economics Pty Limited report the number of people with dementia in 2005 was 606,100 people, predicted in 2020 to be 1,016,800 people and in 2050 to 3,042,000 people; this was supported by research conducted by Milfa Sari which raised the theme of decreasing cognitive function in the elderly in Semarang City showed that 17.6% of the elderly had decreased cognitive function [14].

Diabetes Mellitus is a condition of chronic hyperglycemia accompanied by various metabolic disorders due to hormonal disorders, which can cause various chronic complications in eyes, kidneys, nerves and blood vessels, accompanied by lesions on the basement membrane in examination with electron microscopy. Diabetes mellitus is still a common problem. Even Indonesia is still in the fourth position as the country with the largest population suffering from diabetes after the United States, China, and India [10].

Diabetes is associated with early cognitive function and risk factors for the occurrence of mild cognitive function disorders, vascular dementia and Alzheimer's disease. Individuals with diabetes are 1.5 times more likely to experience cognitive impairment, and are expected to develop about 1.7 times dementia; the risk of Alzheimer's disease ranges from 1.2 to 2.3 compared to individuals without diabetes. Decreased cognitive function mild symptoms are easy to forget and if severe will cause senility, this is often considered an ordinary problem and is a natural thing that happens to those who are elderly. In addition, the elderly also experience special problems that require attention, among others, are more vulnerable to macrovascular and microvascular complications of DM and the presence of geriatric syndrome. Approximately 10% of elderly people aged 65 years and 50% at the age of more than 85 years will experience cognitive impairment, which will be found mild disorders. This can be caused by lack of nutrient intake so that there is an increase in sugar due to the removal of fat reserves for metabolic processes.

The study conducted by Velayudhan et al (2012) [3] for 4 years for 61 subjects aged over 65 years who had a mild decline in cognitive abilities, 17 of whom suffered from diabetes. These results indicate that in addition to increasing the risk of dementia, diabetes mellitus can also increase the progression of a decrease in mild cognitive abilities to dementia. The high level of glucose in the blood activates inflammatory cytokines through various mechanisms of intra-cellular biochemistry such as an increase in the aldose reductase pathway, activation of Protein Kinase C, and the formation of advanced glycation end products (AGEs) resulting in dysfunction of the vascular endothelium. The high risk of vascular dysfunction in diabetics with high sugar levels is believed to be the cause of the increased risk of dementia.

Epidemiological studies show that the prevalence of diabetes mellitus and impaired blood glucose levels increase with age, settling before finally decreasing. WHO data found that after reaching the age of 30 years, blood glucose levels will rise 1-2 mg% / year when fasting and will increase by 5,6-13 mg% / year at 2 hours after meals. Basic Health Research Results (Riskesdas) in 2007 showed the cause of death at the age of 65 years and over in male diabetes mellitus as much as 4.9% while in women as much as 6.0%. Diabetes mellitus is influenced by nutritional status.

According to conducted research [17] on nutritional status with the incidence of diabetes mellitus in DKI Jakarta showed that underweight nutritional status was 530 respondents, normal nutritional status as many as 2213 respondents, overweight nutritional status as many as 215 respondents and obesity as many as 2744 respondents from total 5702 populations; the number of obese diabetes mellitus patients was 165 respondents while there were 119 people who were not Obesity Diabetes Mellitus. Based on nutritional status with the calculation of the Body Mass Index (BMI), the proportion of the incidence of diabetes mellitus in the obese sample is greater than the sample who are not obese. Samples with obesity nutritional status are at risk of developing Diabetes Mellitus 2.93 times greater than normal nutritional status.

Nutritional status consists of poor nutritional status, normal nutritional status, and more nutritional status. Lack of nutrition and being overweight both increase the risk of diabetes occurring in diabetes. Malnutrition (malnutrition) can damage the pancreas, while obesity (over nutrition) results in impaired insulin work. Intake of nutrients is one of the most important factors in improving the health of the elderly and reducing various risks associated with the aging process and decreasing cognitive function. Some studies suggest that adequate intake of micronutrients will help maintain cognitive function in elderly subjects. The results of the study in Madrid stated that there are several vitamins that are related to cognitive functions, including vitamin B1, folate, riboflavin, and vitamin C, in addition to supplementation of vitamins C and E can provide a protective effect on decreased cognitive function. Vitamin C is an antioxidant that plays a role in counteracting oxidative stress. Research in America states that deficiency of folic acid, vitamin B6 and vitamin B12 can also cause damage to the brain's blood vessels and cause impaired cognitive function. Good cognitive function is needed so that someone can improve quality of life, especially optimization of functional status, restore productivity, creativity, and feeling happy [22].

The results of the preliminary survey conducted on elderly people suffering from DM in RAA Soewondo General Hospital showed that as many as 8 elderly experienced dementia; 5 people experienced mild dementia and 3 people experienced severe dementia, and of 8 elderly who had dementia there were 4 people who had nutrition less and 2 people have excessive nutrition. From the above background the researcher raised the title "Relationship between nutritional status and sugar levels with cognitive function in elderly with DM in RAA SOEWONDO PATI Hospital".

II. METHOD

A. *Research Design*

This study was cross sectional study in the way that this would find the relationship between nutritional status and sugar levels with cognitive function of the elderly with DM in RAA SOEWONDO PATI Hospital.

B. *Population and Samples*

The population of this study was a population of elderly patients with DM in the RAA SOEWONDO PATI Hospital at the same time. From the results of the data collection, the total population was 91 patients in 1 month, the number of samples used in this study were 74 elderly people with DM in RAA SOEWONDO PATI Hospital.

C. *Data Collecting and Analysis*

In this study, the Rank-Spearman test was used to calculate statistical tests. Interpretation of the results of the test. Rank-Spearman was declared significant if the value of $p < 0.005$, and was declared significant if $p > 0.005$.

III. RESULTS ND DISCUSSION

1. Relationship between Nutritional Status and Cognitive Function of elderly Diabetes Mellitus sufferers in RAA Soewondo Hospital Pati.

From the results of the correlation between nutritional status and cognitive function, elderly people with Diabetes Mellitus have a Sig. (2-tailed) value of 0.000 with a correlation coefficient of 0.740. This indicates that H_a is accepted and H_o is rejected which means there is a relationship between nutritional status and cognitive function in elderly with diabetes mellitus in RAA Soewondo Hospital Pati, with strong correlation strength values.

According to Supariasa (2012), that nutritional status is influenced by two factors, namely food consumption and health level; especially the presence of infectious diseases, both of these factors are direct causes, while indirect causes of nutrient content are food ingredients, eating habits, presence or absence of giving programs additional food, health care, as well as the physical and social environment. Food consumption affects a person's nutritional status. Good nutritional status or optimal nutritional status occurs when the body gets enough nutrients that are used efficiently, allowing physical growth, brain development, work ability, and general health at the highest level possible [17]. This is in line with the research conducted by Arisman et al (2009) entitled the relationship of nutritional status with a decline in cognitive function in the elderly at the social health care center. It was found that there was a significant relationship between the nutritional status of the elderly with a decline in cognitive function in the elderly with a p value 0.016 [2].

According to researchers, one of several problems and disorders that often arise or occur in the elderly is a decline in cognitive function. Mild symptoms are easy to forget and if severe will cause senility, often considered a normal problem and is a natural thing that happens to those who are elderly. In fact, the decline in cognitive abilities characterized by many forgetfulness is one of the symptoms of senility.

Cognitive is the ability to recognize and interpret someone's environment in the form of attention, language, memory, and deciding functions, thus the disorders will disrupt daily living activities and social activities. A decrease in cognitive function is usually associated with a decrease in the function of the right hemisphere of the brain that takes place faster than the left. Cognitive deterioration in the elderly usually begins with a setback of memory or memory (forgetfulness) and other thinking powers that actually lead to life.

In general cognitive impairment is a setback of memory and memory that can affect daily activities. Such as a decrease in physical function, characterized by the inability of the elderly to carry out daily activities for example: eating, drinking, bathing, walking, sleeping, sitting, bowel movements, and bladder movement. Physical changes that tend to experience this decline will cause a variety of physical disorders that affect health, which has an impact on several aspects of life that have a large influence on changes in nutrition and quality of life of the elderly [5]. This is in line with the research conducted by Dadang (2017) with the results of data analysis using the Kendall Tau Test. The

results of the p value were 0.001 ($p < 0.005$) identifying the relationship between nutritional status and the incidence of dementia in the study respondents. Meanwhile the correlation value (r) shows the results of 0.463, the magnitude of the correlation value is between the ranges of 0.400-0.599, this result indicates that the closeness level of the relationship is moderate. So it can be concluded that there is a relationship with the moderate closeness between nutritional status and the incidence of dementia in the elderly [6].

2. Relationship between Blood Sugar Level and Elderly Cognitive Function of Diabetes Mellitus patients in RAA Soewondo Hospital Pati.

From the results of the chi square test showed there are 34 respondents with controlled blood sugar who had a cognitive function probable (moderate cognitive function disorder) while 40 respondents with uncontrolled blood sugar had more moderate (probable) cognitive functions as many as 17 people (53.1%).

The results of the chi square analysis showed a P value of 0.000, which means p value $< \alpha$, so it can be concluded that H_a is accepted and H_o is rejected, which means there is a relationship between blood sugar levels and cognitive function of the elderly in RAA Soewondo Hospital Pati.

High levels of glucose in the blood will activate proinflammatory cytokines through various mechanisms of intracellular biochemistry such as increased aldose reductase pathways, activation of Protein Kinase C, and the formation of advanced glycation end products (AGEs) resulting in dysfunction of the vascular endothelium. The high risk of vascular dysfunction in diabetics is believed to be the cause of the increased risk of dementia. Hyperglycemia causes atherosclerosis of the cerebral arteries which will cause disruption of blood circulation to the brain. This is what causes an increased risk of dementia [15].

This is in line with the research conducted by Velayudhan in 2010 for 4 years on 61 subjects aged over 65 who had a decrease in mild cognitive abilities. The research found 19 people continued to be dementia, 7 of whom had diabetes. These results indicate that in addition to increasing the risk of dementia, diabetes mellitus can also increase the progression of a decrease in mild cognitive abilities to dementia. In line with this, a study conducted by Arvinitakis in 2009. His study conducted in the center of nursing homes in the United States in 824 elderly people suffering from type 2 diabetes mellitus showed a more marked decline in cognitive function in the type 2 DM group especially for cognitive abilities global, episodic, semantic, visuospatial and perceptual memory with a p value of 0.02 [9]. Decreasing in cognitive domain must occur with increasing age. This is caused by changes in anatomy and physiology that will occur. Decreasing ability of memory, decision making, planning and assessment is more visible than intelligence capabilities that tend to be stable. Some respondents in the type 2 DM group had high blood sugar levels. This will accelerate the decline of cognitive function in the DM type 2 group. The condition of hyperglycemia will cause changes in blood flow to the brain which will reduce the performance of the brain cortex. The effect of glucose levels on cognitive function was found in a study

conducted by the Framingham Study, where the relationship between high glucose levels was found to influence cognitive function with a p value of 0.001.

IV. CONCLUSION

There is a relationship between the nutritional status of the elderly with cognitive function in the elderly with diabetes mellitus in RAA Soewondo Pati Hospital as evidenced by the Spearman Rank test with sig = 0,000 and the Correlation Coefficient value is 0.740.

There is a relationship between blood sugar levels and cognitive function in elderly people with diabetes mellitus in RAA Soewondo Hospital Pati proven by Chi square test with a P value 0,000.

ACKNOWLEDGMENT

This research was supported/partially supported by Muhammadiyah University of Kudus. We really thank head of research and publication department of UMKU for assistance with particular technique, methodology and for comments that greatly improved the manuscript.

REFERENCES

- [1] Agustina, L 2007. Hubungan skor mini nutritional assessment (mna) dengan albumin serum pasien usia lanjut di bangsal geriatri rumah sakit dr kariadi semarang, diakses pada tanggal 7 September 2017, <<http://eprints.undip.ac.id/26103/>>.
- [2] Arisman, Apolzan. 2009. Gizi Dalam Daur Kehidupan. Jakarta: Buku Kedokteran EGC.
- [3] Akmal, Agustiana H.F. 2012. Perbedaan Asupan Energi, Protein, Aktivitas fisik dan Status Gizi Antara Lansia Yang Mengikuti dan Tidak Mengikuti Senam Bugar Lansia. [skripsi]. Universitas Diponegoro;Semarang.
- [4] Arikunto, Suharsimi. 2010. Prosedur Penelitian Suatu Pendekatan Praktik. Edisi Revisi 2010. Yogyakarta: Rineka Cipta.
- [5] Boedhi, D dan Beare. 2017. Buku Ajar Geriatri, Ilmu Kesehatan Usia Lanjut, Jakarta. Fakultas Kedokteran. UniversitasIndonesia.
- [6] Darmojo, B. 2010. Buku ajar geriatri (ilmu kesehatan lanjut usia). FK UI : Jakarta.
- [7] DiMaria-Ghalili,RoseAnnPhD,RN.2009.How to try this themini nutritional assessment, diakses pada tanggal 6 September 2017, <<http://journals.lww.com/ajnonline>>
- [8] FAO/WHO/UNU. 2012. Human Energy Requirement. Report of a Joint FAO/WHO/UNU Expert Consultation, 2011. FAO Food and Nutrition Technical Report Series. Rome.
- [9] Fatimah, M.S., Puruhita, N. 2010. Gizi pada lansia. Dalam: Martono H, Pranaka K. Buku ajar Boedhi-Darmojo: geriatri (ilmu kesehatan usia lanjut). Jakarta
- [10]Hidayatulloh, Agus; Nurhasanah, Ani; Irawan, Ery; Firdaus, Faizal; Isnaini, Fitriatul; Anggraeni, Novi; Fadhilah, Nurul; Adhi, Riefyan; Nurcahya, Santosa Aji.; Sari, Syafira Rembulan, Rahayu. 2011. Hubungan Faktor Resiko Obesitas dengan Rasio Lingkar Pinggang Pinggul Mahasiswa FKM UI. Laporan Tim Riset Asosiasi Keluarga Gizi. Universitas Indonesia.Jakarta.
- [11]Notoatmodjo, 2010. Metodologi Penelitian Kesehatan. Jakarta: Rineka cipta.
- [12]Notoatmodjo, 2012. Promosi kesehatan dan ilmu perilaku. Jakarta: Rineka cipta
- [13]Roselly, Nimas Ayu Arce P, Maulana. 2008. Faktor-Faktor yang Berhubungan dengan Obesitas Berdasarkan Persen Lemak Tubuh pada Pria (40 – 55 Tahun) di Kantor Direktorat Jenderal Zeni TNI-AD Tahun 2008. Skripsi. Fakultas Kesehatan Masyarakat, Universitas Indonesia. Depok: 22, 24-25.
- [14]Gibson, Rosalin, S. 2008. Principle of nutritional assesment second edition. Oxford. University Press. NewYork.
- [15]Iviana, Nova. 2008. Analisis Hubungan Gaya Hidup Dan Pola Makan Dengan Kadar Lipid Darah Dan Tekanan Darah Pada Penderita Jantung Koroner. Skripsi. Program Studi Gizi Masyarakat dan Sumber daya Keluarga Fakultas Pertanian Institut Pertanian Bogor.Bogor
- [16]Sumiyati, N. 2007. Hubungan Antara Tingkat Konsumsi Energi Dan protein Dengan Status Gizi Pada Lansia Di Pantiwreda Pucang Gading Semarang. [skripsi]. Semarang: Ilmu Kesehatan Masyarakat. Universitas Negeri Semarang
- [17]Sunarti & Maryani, Elvia, vasconcellos, et.al. 2013. Rasio Lingkar Pinggang dan Pinggul dengan Penyakit Jantung Koroner di RSUD Kabupaten Sukoharjo. Buletin Penelitian Sistem Kesehatan.
- [18]Suhardjo. 2008. Perencanaan Pangan dan Gizi.Jakarta. Bumi Aksara
- Touthy, T. A. & Jett, K. F. 2010. Gerontological nursing & healthy aging. 3rd
- [19]Wulandari, R., 2010. Risiko Malnutrisi Berdasarkan Mini Nutritional Assessment Terkait dengan Kadar Hemoglobin Pasien Lansia, diakses pada tanggal 7 September 2011, <<http://eprints.undip.ac.id/24891/>>.
- [20]WHO. Global Report On Diabetes. France: World Health Organization; 2016.
- [21]Paul C, Ribeiro O, Santos Pedro, 2010. Cognitive Impairment in old People Living in the Community.Archives of Gerontology and Geriatrics; 51:121-124.