Correlation Between Hypertension and Cognitive Impairment in Elderly in Jatinom, Klaten

Fery Luvita Sari[1(✉)], Agus Taufiqurrohman[1], and Hasna Dian Farida[2]

[1] Neurology Department Faculty of Medicine, Universitas Islam Indonesia, Yogyakarta, Indonesia
17110406@uii.ac.id

[2] Medical Student Faculty of Medicine, Universitas Islam Indonesia, Yogyakarta, Indonesia

Abstract. Background: The elderly is prone to health problems such as geriatric syndrome, including cognitive impairment. One of the causes of cognitive impairment is vascular disorders such as hypertension. Although hypertension is not a contagious disease, the percentage of incidence in Central Java Province is quite high. Lifestyle is one of the factors that influence the occurrence of hypertension and should be noted that not all hypertensive conditions have symptoms or complaints. Aim: To determine the correlation of hypertension with cognitive impairment in the elderly in Jatinom, Klaten. Methods: Observational analytic with cross sectional design. The study required 35 subjects over 60 years who had hypertension. The study was conducted by home visit by measuring blood pressure and submitting questions and orders according to the Mini Mental State Examination (MMSE). Results: Analysis using the Mann Whitney test obtained p value = 0,000 ($p < 0.05$) for hypertension and the level of education with MMSE score. Hypertension and the level of education can affect cognitive impairment in the elderly (elderly 60–74 years old and old age 75–90 years old). Cognitive impairment was not correlated with age, sex, occupation, family history, diabetes mellitus, stroke, smoking, alcohol consumption, physical activity, and body mass index Conclusion: There was a significant correlation between hypertension and the level of education with cognitive impairment..

Keywords: Hypertension · cognitive impairment · elderly

1 Introduction

In 2018, the estimated population in Indonesia was 265,015,313 people with a percentage of 10.7% of the population aged 60 years and over. The age of more than 60 years, which is commonly called the elderly, is increasing every year because life expectancy has increased [1] In 2020 it is estimated that the elderly population will increase by 11.34% of the Indonesian population [2] Klaten is one of the city in Central Java with an area of 65,556 hectares and has a population in 2016 of 1,163,218 people, as many as 6.4% are over 60 years old with most of them being dominated by women. Jatinom is one of

H. Nurdiyanto et al. (Eds.): ICCvD 2021, AHSR 52, pp. 406–418, 2023.
https://doi.org/10.2991/978-94-6463-048-0_48

the sub-districts as the location for data collection with a population of 54,472 people with 704 more women than men and 8,073 people aged over 60 years [3] Elderly people in high risk of geriatric syndrome disorders such as cognitive disorder which is one of the most common disorders in addition to nutritional disorders, urinary incontinence and depression with a percentage of 38.4% [4] Cognitive impairment can occur due to various factors, including low levels of education, less of physical activity, hypertension, diabetes mellitus [5–7] Central Java has the highest proportion of non-communicable cases, hypertension reported at 64.83%, dominated by adults and mostly women [8] In Klaten Regency the percentage of hypertension is 6.83%[9] Hypertension is part of cerebrovascular diseases due to increased blood pressure, it can cause brain damage. Changes in the structure and function of the brain can cause neuropathological disorders resulting in cognitive impairment, such as decrease in memory and thinking. Previous study stated that the longer a person has hypertension, the lower cognitive function will be [6, 7].

Elderly is the condition of a more than 60 years old according to Undang-Undang number 13 of 1998 and Peraturan Pemerintah Republik Indonesia number 43 of 2004. The World Health Organization (WHO) classifies the level of elderly into: middle age (45–59 years old), elderly (60–74 years old), old age (75–90 years old), and very old (more than 90 years old) [8] The effects of aging can generally seen in someone who enters 40 years old. Several theories regarding aging such as the free radical theory. The free radical theory states that aging process is tissue damage resulting from oxidative metabolism that reacts with cellular components. These components such as proteins, lipids and DNA form molecules that do not function and interfere with other cell functions due to free radicals. Free radicals are composed of unpaired electrons so that when they act they will find their main partner with unsaturated fats and proteins. The binding of these free radicals will change the structure of the cell membrane to be permeable and cause mitochondria and lysosomes to be disrupted. In addition, the work of DNA for chromosomal mutations can be disrupted because free radicals damage cell membranes or chromosomes. Levels of free radicals when the amount exceeds the concentration causes changes in aging process. Getting older will affect physiological conditions that will experience various changes from the function of physical conditions. The characteristic of aging physiological condition is homeostenosis, which means reduced homeostatic reserves in each organ, the body's physiological reserves to deal with homeostasis decrease. To return to homeostasis requires a large physiological reserve [10].

2 Literature Review

A. Hypertension

Hypertension is a condition of increasing blood pressure more than normal based on the Joint National Committee (JNC) VII, more than 140 mmHg for systolic blood pressure and or diastolic blood pressure of more than 90 mmHg as measured using a sphygmomanometer. Hypertension is classified into normal (systolic $<$ 120mmHg and diastolic $<$ 80 mmHg), prehypertension (systolic 120–139 mmHg or diastolic 80–89 mmHg), grade 1 hypertension (systolic 140–159 mmHg or diastolic 90–99 mmHg), grade 2 hypertension (systolic 160 mmHg or diastolic 100 mmHg). Hypertension in

elderly causes a decrease in the elasticity of the arteries so that the systolic blood pressure is higher and the diastolic blood pressure is lower, which is called isolated systolic hypertension. This condition can be influenced by degenerative process, so that the incidence of hypertension increases especially in the female elderly. Hypertension can caused by genetics, metabolic syndrome and lifestyle such as excessive body weight, lack of activity, stress, smoking habits, alcohol consumption and narcotics consumption. Increasing blood pressure can caused by the presence of renal artery stenosis due to atherosclerotic lesions and obstructive sleep apnea. Factors that can cause hypertension also increase levels of saturated and unsaturated fats, cholesterol levels in the blood. Thus, the body compensates by forming adipose tissue. Excessive production causes dysfunction resulting in increased pressure in the blood vessels. The older a person is, the higher incidence of hypertension[11] Blood pressure influenced by cardiac output and total peripheral resistance as parameters, if there is increasing blood pressure, cardiac output and total peripheral resistance also increase[10, 12] Arterial blood vessels in hypertension are narrowed, stiff and thicken. Arteries elasticity will be decrease resulting in increasing of vascular resistance. Uncontrolled hypertension can cause various complications of cardiovascular disease such as stroke, heart failure, coronary heart disease and can even cause a decrease in cognitive function in the central nervous system. The longer person suffers from hypertension, the lower of cognitive function, especially in the elderly[6, 10] Damage of brain blood vessels is the main target for the effects of hypertension so that structural and functional changes occur and causing neuropathological abnormalities. It can lead to cognitive impairment[13].

B.Cognitive Function

Cognitive functions include memory, attention, language, visuospatial and executive functions that are interconnected, and memory is the most frequently impaired. Memory is the ability to remember information, it is classified into memory based on the duration of storage, namely short-term and long-term memory and based on the type of information stored, namely implicit and explicit memory. Implicit memory is material that is stored by itself without each one being aware of it, such as the ability to ride a bicycle, while explicit memory is material that is consciously stored by each one so that it can be conveyed to others. This explicit memory is often impaired[14, 15] Cognitive impairment generally occurs due to disturbances in the central nervous system related to the degeneration process, problems with reduced oxygen supply to the brain, vitamin deficiencies, genetic and nutritional problems. Factors that influence the occurrence of impaired cognitive function include disorders involving brain structures such as a history of trauma and malignancy, metabolic disorders and infections. If cognitive impairment occurs in old age, the influencing factors can be increasing age, gender, genetics, recent educational history, history of diseases related to brain and environmental problems[16] Cardiovascular disease such as hypertension has risk factors for atherosclerosis which can reduce cognitive function in memory and easily happened in obese patients. Stroke can occur as a risk of atherosclerosis and at risk for impaired cognitive function[17] Cognitive impairment are classified into dementia and non-dementia cognitive disorders or called mild cognitive impairment (MCI)[18] In conducting a cognitive function examination, using the Mini Mental State Examination (MMSE)[15].

Mild cognitive impairment is a condition with one or more declines in cognitive function but does not interfere with daily activities, so it is a mild cognitive function disorder. In MCI, symptoms of memory decline, daily activities and cognitive functions are not impaired[18] MCI often occurs in more than 65 years old with prevalence of 10–20%. It can develop into dementia when amyloid and neurofibrillary plaques are deposited in the neocortex and presence of Apolipoprotein E epsilon 4 (ApoE4) as a carrier that converting from MCI to Alzheimer in people with cognitive decline[19] Biological risk factors that influence of MCI include genetics, cardiovascular disease, endocrine disease, neuropsychiatric disease, head injury and free radicals. The presence of ApoE4 as a mediator of amyloid deposition is a genetic factor for MCI. Cardiovascular diseases are common such as hypertension, hypercholesterolemia and stroke. Hypertension occurs because of impaired endothelial circulation and dysfunction. Hypertension grade 2 according to JNC VII shows a higher prevalence of MCI than grade 1. The occurrence of stroke caused by uncontrolled blood pressure so that hypertension complications can also cause cognitive function disorders. The effect of hypercholesterolemia on cognitive decline is still dubious, but several studies state that hypercholesterolemia is a factor in the occurrence of Alzheimer's dementia. Metabolic disease can cause a decrease in blood perfusion to the brain and increasing the incidence of atherosclerosis which results in neurodegenerative changes in the form of decreased cognitive function such as hyperglycaemia and hypoglycaemia conditions. Neuropsychiatric diseases that generally affect cognitive function disorders such as depression, personality disorders and loss of interest. Damage from head injuries is as much risk as Alzheimer's dementia and Parkinson's dementia. As in the theory of aging in the form of free radical theory, chemical changes occur that have an impact on damage to body tissue components such as carbohydrates, fats and proteins that often occur in Alzheimer's dementia[18] There are classifications of MCI, namely amnestic MCI and non-amnestic MCI, divided into singular and plural domains. Amnestic MCI means memory impairment, in the absence of other cognitive dysfunction it means single domain amnestic MCI, while if there are other cognitive dysfunctions, it is included in multiple domain amnestic MCI. Single-domain non-amnestic MCI is a disorder of the domain of a cognitive function other than memory, if more than one domain means it includes multiple domain non-amnestic MCI[18].

Dementia means decrease in one or more cognitive components and disturbances of daily living, including severe cognitive functions. Dementia can occur due to development of MCI. In general, someone with dementia will be indifferent, easily confused and experience decreased activity. Dementia has several classifications namely Alzheimer's dementia, vascular dementia, Lewy bodies dementia, Parkinson's disease dementia, frontotemporal dementia, Huntington's dementia, and mixed dementia. Alzheimer's dementia and vascular dementia are more common than other types of dementia. As many as 24 million global cases of dementia, 60% have Alzheimer's dementia and 20% have vascular dementia[18].

C.Mini Mental State Examination (MMSE).

Examination for cognitive function can use several instruments such as MMSE, Clock Drawing Test (CDT) and Montreal Cognitive Assessment (MoCA). The most common and the easiest examination is MMSE with a specificity of 92.2% and a sensitivity of 78.7%, primarily screening for dementia or Alzheimer's disease which mostly

Table 1. Mini Mental State Examination (Mmse)

Aspect	Instructions	Score
Orientation	Inquire about the time, date month, year, season, and place ward/floor, hospital, district, town, country	10
Registration	Examiner names 3 objects (eq. Apple, table, penny) and asks the patient to repeat (1 point for each correct. Then the patient learns the 3 names repeating until correct)	3
Attention and calculation	Subtract 7 from 100, then repeat from result. Continue 5 times: 100, 93, 86, 79, 65. Alternative spell WORLD backwards DLROW	5
Recall	Ask for the names of the 3 objects learned earlier	3
Language	Name 2 objects (e.g. pen, watch)	2
	Repeat "No ifs, ands, or buts	1
	Give a 3 stage command, score 1 for each stage (eg. Place index finger of right hand on your nose and then on your left ear)	3
	Ask the patient to read and obey a written command on a piece of paper. The written instruction is "close your eyes"	1
	Ask the patient to write a sentence, score 1 if it is sensible and has a subject and a verb	1
Copying	Ask the patient to copy a pair of intersecting pentagons	1

Table 2. MMSE INTERPRETATION

Categories	Score
Mild	21 - 26
Medium	15 - 20
Medium – Severe	10 - 14
Severe	< 9

occurs in people over 65 years old. The MMSE consists of 11 domains with a total score of 30. There are 6 aspects that are assessed in the MMSE examination, namely: orientation, registration, calculation, memory, language, and construction[4] (Table 1).

Assessing the results of the field construction function in the form of two pentagons, it should be seen that the sampled image must intersect between the two corners. The result of MMSE score is influenced by several things such as education level and age. If someone has less than 4 years of education, the results obtained can be less than 25. In normal people, generally they can complete this test within 8 min, while in people with impaired cognitive function it can take longer to about 15 min. Based on age, increasing

an age may result in lower MMSE score[20, 21] Total score in MMSE are classified into 4 categories, namely mild, medium, medium-severe and severe[15] (Table 2).

3 Method

The type of this research is observational study with cross-sectional research design. The subjects in this study were elderly more than 60 years old, willing and having blood pressure results showing hypertension or having a history of hypertension Elderly people who cannot write, suffer from depression, hearing loss (deaf), visual impairment (blind) and speech disturbance excluded from the research subject. From the sample size formulation, the required number of samples is 35 people.

Independent variable in this study is hypertension in elderly. Hypertension means increasing of blood pressure more than 140/90 mmHg using sphygmomanometer, elderly means people more than 60 years old. Dependent variable in this study is cognitive function in elderly when elderly having cognitive impairment using MMSE score. The other variables that included in this study are smoking, physical activities, body mass index. The instruments needed to conduct this research include stethoscope, sphygmomanometer, scales, Mini Mental State Examination (MMSE) Questionnaire, research approval sheet, research questionnaire related to identity and other data.

This study analyses using statistical software in SPSS. All data results were tested for normality by Saphiro Wilk because the number of data was less than 50. The normality test found that the distribution of data was not normal distribution. So to analysis the relationship between hypertension and other variables with cognitive function, which is a categorical scale with the Mann Whitney test.

4 Result and Discussion

This research was conducted in Jatinom which is located in Klaten Regency, total 35 respondents. Researcher visiting the house of each prospective respondent and it took 1 week. This research has been approved by the ethics committee from Faculty of Medicine, Universitas Islam Indonesia with number 13/Ka.Kom.Et/70/KE/VI/2020.

4.1 Subject Characteristic

Based on the results of the required subject, from 35 elderly respondents according to the inclusion and exclusion criteria, there were 25 female subjects and 10 male subjects. The results explain the characteristics of the subject, the gender, age, occupation, last education, habits including alcohol consumption, smoking and physical activity, family history of illness, past history of illness and body mass index. From the data obtained age categorization in the form of elderly with range of 60–74 years old and old age 75–90 years old. Many elderly in the research location are no longer working and some of them still working as traders or laborers. Many respondents whose educational background is Elementary School. Based on research data related to the habits of the elderly, no one consumes alcohol, 3 elderly are still smoking since they were young.

Most subjects perform daily activities rarely requiring a large energy expenditure per day of less than 150 min. Total 35 elderly with history of hypertension were willing to be respondents, most of them did not have a family history of hypertension. However, there are 3 elderly who have a history of stroke and 1 elderly has a history of type II diabetes mellitus. Based on the results of anthropometric examinations, many people are

Table 3. SUBJECT CHARACTERISTIC

Characteristic	Total	Percentage
Gender Male Female	10 25	28.6 71.4
Age Elderly (60–74 years old) Old age (75–90 years old)	29 6	82.9 17.1
Work Work Unemployment	13 22	37.1 62.9
Educational background Elementary school Junior high school Senior high school College	13 11 9 2	37.1 31.4 25.7 5.7
Alcoholic Yes No	0 35	0 100
Smoking Yes No	3 32	8.6 91.4
Physical activities Mild Moderate Severe	32 3 0	91.4 8.6 0
Hypertension family history Yes No	13 22	37.1 62.9
Past medical history Hypertension Stroke Diabetes mellitus Head injury	35 3 1 0	100 8.57 2.85 0

(*continued*)

Table 3. (*continued*)

Characteristic	Total	Percentage
Degree of hypertension Prehypertension Hypertension grade 1 and 2	13 22	37,14 62,86
Body mass index Normal Overweight	7 8	20 22,9
Obesity grade 1 Obesity grade 2 Cognitive function	15 5	42,9 14,3
Normal Mild Moderate	5 15 15	14,28 42,86 42,86
Moderate-severe Severe	0 0	0 0

obesity. The results obtained from the interpretation of the MMSE, 5 people with normal cognitive function, 15 people with mild degrees and 15 people with severe degrees (Table 3).

4.2 Subject Characteristic Based on Cognitive Function

After checking blood pressure, subjects were checked for MMSE. The results of the examination obtained 5 people (14.29%) had normal cognitive function while 30 people (85.71%) experienced a cognitive impairment, either mild or moderate. All male subjects experienced a cognitive impairment, while 5 women with normal cognitive function and 20 experienced a cognitive impairment. In elderly, 5 people in normal cognitive function and 24 people experienced a decrease while all old age subjects experienced a cognitive impairment. As many as 13 people who work has normal cognitive function and the others has cognitive impairment. Twenty-two people who are unemployment, 18 people experience cognitive impairment. All subjects with elementary and junior high school education experienced a cognitive impairment, while 5 people with senior high school education and 1 in college education experienced a cognitive impairment. Three subjects who had a smoking habit experienced a cognitive impairment. Subjects with mild daily activities were 27 people and all those who had moderate activity experienced a cognitive impairment. A total of 11 people with a hypertension family history and 19 people without it experienced a cognitive impairment. Three people who had a history of stroke and 1 with a history of diabetes mellitus experienced a cognitive impairment. All subjects with normal body mass index, 6 overweight people, 13 people with obesity grade 1 and 4 people with obesity grade 2 were found to have cognitive impairment (Table 4).

Table 4. Result Based On Cognitive Function

Characteristic	Normal cognitive function	%	Cognitive impairment	%	p value
Gender Male Female	0 5	0 14,29	10 20	28,57 57,14	0,132
Age Elderly Old age	5 0	14,29 0	24 6	68,57 17,14	0,279
Work Work Unemployment	1 4	2,86 11,43	12 18	34,29 51,42	0,398
Educational Elementary Junior High Senior High College	0 0 4 1	0 0 11,43 2,86	13 11 5 1	37,14 31,42 14,29 2,86	0,000
Alcoholic Yes No	0 5	0 14,29	0 30	0 85,71	1,000
Smoking Yes No	0 5	0 14,29	3 27	8,57 77,14	0,466
Physical activities Mild Moderate Severe	5 0 0	14,29 0 0	27 3 0	77,14 8,57 0	0,466
Family history Yes No	2 3	5,71 8,57	11 19	31,43 54,29	0,888
Past history Hypertension Stroke Diabetes Head injury	5 0 0 0	14,29 0 0 0	30 3 1 0	85,71 100 100 0	0,000
Hypertension Prehypertension Hypertension1,2	2 3	5,71 8,57	11 19	31,43 54,29	0,000
Body mass index Normal *Overweight* Obesity grade 1 Obesity grade 2	0 2 2 1	0 5,71 5,71 2,86	7 6 13 4	20,00 17,14 37,14 11,43	0,421

5 Discussion

After the data is collected, a normality test is carried out to determine the distribution of the data. Because of the data is less than 50, it is using saphiro wilk. The test results of

all variables in this study obtained a p value < 0.05 so that the next test was carried out using the Mann Whitney test.

One of the cerebrovascular diseases is hypertension. Based on the causes, hypertension divided into primary or essential hypertension and secondary or non-essential hypertension. The cause of primary hypertension is unknown or idiopathic but some of them are associated with lifestyle factors and occur in about 90%. Meanwhile, secondary hypertension can caused by kidney problems, metabolic disorders and the use of certain drugs, such as the contraception pill[22].

According to JNC VII, hypertension is classified into normal, prehypertension, grade 1 hypertension and grade 2. Factors that cannot modified are age, gender, and heredity. Factors that modifiable in the form of lifestyle such as excessive salt consumption, fatty foods, smoking, alcohol, physical activity, obesity and stress. A person with hypertension does not have all symptoms. The symptoms are not specific such as dizziness, headache, palpitations, blurred vision and fatigue[22] The prevalence of hypertension in elderly increases due to decrease elasticity of arterial blood vessels causing endothelial damage so that cerebrovascular blood flow is blocked and increases blood pressure. This condition can cause cognitive impairment. Hypertension, which is a cerebrovascular disease, may play a role in the degenerative process of cognitive impairment with cerebral microvascular changes as well as hypoperfusion, demyelination and ischemic lesions in the white subcortex[23] Cognitive means a process that involves sensory process. Aspects assessed here are orientation or visuospatial, calculations, memory or ability to remember, language, and praxis or construction. Cognitive impairment is common in elderly. Risk factors that can play a role in impaired cognitive function such as gender, age, smoking habits, education level, lack of physical activity, dyslipidemia, hypertension, stroke, coronary heart disease, diabetes mellitus and depression[24] The results of data analysis using Mann Whitney test showed a relationship between hypertension and cognitive function in the elderly, indicated by the value of $p = 0.000$, which means that it is related. These results are the same as the other research[6] Older people will experience structure and function changes of the brain as a target organ for hypertension followed by biochemical changes in the central nervous system so that they are at risk of decreasing cognitive function, especially memory[25] If hypertension can be treated it can prevent complications such as stroke and decline in cognitive function[26] Long history of hypertension also affects the decline in cognitive decline and affect the quality of life[6].

These results also influenced by the last education level of the elderly. The results indicate the p value $= 0.000$ which means there is a relationship. In accordance with previous research, the achievement of high level of education able to prevent cognitive decline in elderly so that the results are normal. There is a theory regarding the synaptic reserve hypothesis which explains that someone with higher education has more brain synapses than people with low education[25, 27].

There is no relation between family history of illness and cognitive function, it is possible that other factors play a role in these conditions such as physical activity, diet, stress, heredity, infectious diseases and other degenerative diseases[7] Smoking habits, alcohol consumption and physical activity from this study have no relation. Physical activity is a structured activity that can improve the cognitive function of the elderly and

the volume of the hippocampus which plays a role in memory[28] Similar with previous research, this study has no correlation between age, gender, diabetes mellitus, stroke, occupation, family history of disease and body mass index with cognitive impairment in the elderly[29–31] Based on data analysis, age is not related to cognitive impairment because there are differences between classifications in the elderly[29, 30]. Less than 75 years old, incidence of cognitive impairment between women and men is the same, so it cannot be concluded that gender has effect on cognitive function disorders. However, at the age of more than 80 years old, many women experience a decline in cognitive function which is influenced by deteriorating socio-economic conditions[29] An elderly easily experiences a cognitive impairment associated with the habit of consuming foods containing excessive carbohydrates and fats[29].

This study has limitation of not further investigating regarding other factors that may be associated with hypertension. As well as the number of subjects that slightly affect the data analysis.

6 Conclusion

Hypertension affects cognitive function in the form of a decline in the elderly. The last education of an elderly affects cognitive function disorders. There is no relationship between age, gender, occupation, family history of similar diseases, diabetes mellitus, stroke, smoking, alcohol consumption, physical activity, body mass index to impaired cognitive function.

Further research is needed to explain factors to prognosis of hypertension that affect cognitive impairment by increasing the number of samples, using other instruments and different research methods such as cohorts. Research is needed related to the type of medication consumed by the elderly with hypertension to determine the effect of treatment on preventing cognitive impairment.

References

1. KEMENKES. Analisis Lansia Di Indonesia. Jakarta Selatan. 2017.
2. Budi, T., Shofia, A., & Rohmah, N. Gangguan Gerak dan Fungsi Kognitif pada Wanita Lanjut Usia, 4, 41–57. 2010
3. Badan Pusat Statistik. Klaten dalam Angka. (Seksi Integrasi Pengolahan dan Diseminasi Statistik, Ed.). Klaten: Badan Pusat Statistik Kabupaten Klaten. 2017.
4. Kementerian Kesehatan Republik Indonesia. Juknis Instrumen Pengkajian Paripurna Pasien Geriatri. Jakarta: Kementerian Kesehatan RI. 2017.
5. Muzamil, M. S., & Martini, R. D. Artikel Penelitian Hubungan Antara Tingkat Aktivitas Fisik dengan Fungsi Kognitif pada Usila di Kelurahan Jati Kecamatan Padang Timur, 3(2), 202–205. Retrieved from http://jurnal.fk.unand.ac.id. 2014.
6. Pandean, Gloria., Surachmanto, E.Hubungan hipertensi dengan fungsi kognitif di Poliklinik SMF Ilmu Penyakit Dalam RSUP Prof. Dr. R. D. Kandou Manado, 4. 2016.
7. Rasyid, I. Al, Syafrita, Y., & Sastri, S. Artikel Penelitian Hubungan Faktor Risiko dengan Fungsi Kognitif pada Lanjut Usia Kecamatan Padang Panjang Timur Kota Padang Panjang, 6(1), 49–54. Retrieved from http://jurnal.fk.unand.ac.id. 2017.

8. Badan Pusat Statistik. Statistik Penduduk Lanjut Usia 2019. (R. Susilo, D., Harahap, I., Siang, Ed.). Jakarta: Badan Pusat Statistik. 2019.
9. Dinas Kesehatan Provinsi Jawa Tengah. Profil Kesehatan Provinsi Jawa Tengah Tahun 2017. Semarang: Dinas Kesehatan Provinsi Jawa Tengah. 2017.
10. Setiati, S., Alwi, I., Sudoyo, A.W., Simadibarata, M., Setiyohadi, B., Syam, A. Buku Ajar Ilmu Penyakit Dalam Jilid III (VI). Jakarta Pusat: Interna Publishing. 2014.
11. Price, Sylvia; Wilson, L. Patofisiologi Konsep Klinis Proses-Proses Penyakit (6th ed.). Jakarta: EGC. 2015.
12. Setyanda, Y. O. G., Sulastri, D., & Lestari, Y. Hubungan Merokok dengan Kejadian Hipertensi pada Laki-Laki Usia 35–65 Tahun di Kota Padang. Jurnal Kesehatan Andalas, 4(2), 434–440. https://doi.org/10.25077/jka.v4i2.268. 2015.
13. Iadecola, C., Yaffe, K., Biller, J., Bratzke, L. C., Faraci, F. M., Gorelick, P. B., Saczynski, J. S. Impact of Hypertension on Cognitive Function, 1–28. https://doi.org/10.1161/HYP.0000000000000053. 2016.
14. Marwick, K.; Birrell, S. Psychiatry. Singapore: Elsevier. 2015.
15. PERDOSSI. Panduan Praktik Klinik Diagnosis dan Penatalaksanaan Demensia. Jakarta Pusat: Perhimpunan Dokter Spesialis Saraf Indonesia. 2015.
16. Muryati, Heni., Bhakti, Dwi., Dwiningtyas, M. Gambaran Fungsi Kognitif pada Lansia di UPT Panti Werdha Mojopahit Kabupaten Mojokerto. Metabolisme, 2(2), 1–6. Retrieved from journal.stikespemkabjombang.ac.id. 2013.
17. Agustia, S., Sabrian, F., & Woferst, R. Hubungan Gaya Hidup dengan Fungsi Kognitif pada Lansia. Jom Psik, 1(2), 1–8. 2014.
18. Aninditha, T., Wiratman, W. (Ed.). Buku Ajar Neurologi Departemen Neurologi Fakultas Kedokteran Universitas Indonesia (1st ed.). Jakarta: Departemen Neurologi FK UI. 2017.
19. Eshkoor, S. A., Hamid, T. A., Mun, C. Y., & Ng, C. K. Mild Cognitive Impairment and Its Management in Older People. Clinical Interventions in Aging, 10, 687–693. https://doi.org/10.2147/CIA.S73922. 2015
20. Creavin;, S. T., Wisniewski, S., Ah, N., Cm, T., Hampton, T., Rayment, D. Cullum, S. Mini-Mental State Examination (MMSE) for The Detection of Dementia in Clinically Unevaluated People Aged 65 and Over in Community and Primary Care Populations (Review), (1). https://doi.org/10.1002/14651858.CD011145. pub2. www.cochranelibrary.com. 2016.
21. Hadi, I., & Rosyanti, L. Mild Cognitive Impairment (MCI) pada Aspek Kognitif dan Tingkat Kemandirian Lansia dengan Mini-Mental State Examination (MMSE) Sebagai bagian dari penilaian Penuaan , diperkirakan prevalensi gangguan kognitif tanpa demensia sekitar 22 % dengan usia 71, 11(1). 2019.
22. Kemenkes RI. Pedoman Teknis Penemuan dan Tatalaksana Hipertensi (Revisi 201). Jakarta: Kementerian Kesehatan Republik Indonesia Direktorat Pengendalian Penyakit Tidak Menular Subdit Pengendalian Penyakit Jantung dan Pembuluh Darah. 2014.
23. Hou, Q., Guan, Y., Yu, W., Liu, X., Wu, L., Xiao, M., & Lü, Y. Associations Between Obesity and Cognitive Impairment in The Chinese Elderly: An Observational Study. Clinical Interventions in Aging, 14, 367–373. https://doi.org/10.2147/CIA.S192050. 2019
24. Soiza, R. L., Donaldson, A. I. C., & Myint, P. K. Risk Factors for Cognitive Impairment in Older People with Diabetes: A Community-Based Study. Therapeutic Advances in Vaccines, 9(6), 259–261. https://doi.org/10.1177/2042018819836640. 2018
25. Harry Sundariyati, I. G. A., Ratep, N., & Westa, W. Gambaran Faktor-Faktor yang Mempengaruhi Status Kognitif Pada Lansia di Wilayah Kerja Puskesmas Kubu II, Januari-Februari 2014. E-Jurnal Medika Udayana; Vol 4 No 1 (2015):E-Jurnal Medika Udayana. Retrieved from https://ojs.unud.ac.id/index.php/eum/article/view/12634. 2015.
26. Tadic, M., Cuspidi, C., & Hering, D. Hypertension and cognitive dysfunction in elderly: Blood pressure management for this global burden. BMC Cardiovascular Disorders, 16(1), 1–9. https://doi.org/10.1186/s12872-016-0386-0. 2016.

27. Muela, H. C. S., Costa-Hong, V. A., Yassuda, M. S., Moraes, N. C., Memória, C. M., Machado, M. F., … Bortolotto, L. A. Hypertension Severity is Associated with Impaired Cognitive Performance. Journal of the American Heart Association, 6(1), 1–11. https://doi.org/10.1161/JAHA.116.004579. 2017.
28. Alviana, F. Komponen Latihan Fisik Terhadap Resiko Jatuh pada Lansia. Jurnal Publikasi Kebidanan Akbid Ylpp Purwokerto, 10(1). Retrieved from http://ojs.akbidylpp.ac.id/Index.Php/%0APrada/Article/View/504. 2019.
29. Horie, N. C., Serrao, V. T., Simon, S. S., Gascon, M. R. P., Dos Santos, A. X., Zambone, M. A., Cercato, C. Cognitive effects of intentional weight loss in elderly obese individuals with mild cognitive impairment. Journal of Clinical Endocrinology and Metabolism, 101(3), 1104–1112. https://doi.org/10.1210/jc.2015-2315. 2016
30. Qin, H. Y., Zhao, X. D., Zhu, B. G., & Hu, C. P. Demographic Factors and Cognitive Function Assessments Associated with Mild Cognitive Impairment Progression for the Elderly. BioMed Research International, 2020. https://doi.org/10.1155/2020/3054373. 2020.
31. Wang, J., Xiao, L. D., Wang, K., Luo, Y., & Li, X. Gender differences in cognitive impairment among rural elderly in China. International Journal of Environmental Research and Public Health, 17(10). https://doi.org/10.3390/ijerph17103724. 2020.