

Association of Nutritional Status with Diabetes Mellitus and Hypertension in the Elderly

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ABSTRACT

Background: Non-communicable disease (NCD) is one of the most common cause of death among any other causes. The prevalence of NCDs has been increasing in developing countries. Based on data from the World Health Organization, several NCDs such as cardiovascular disease, malignancy, respiratory disease and diabetes mellitus (DM) cause 71% of deaths worldwide each year. Based on data from the US National Health and Nutrition Examination Survey (NHANES) and the American Diabetes Association (ADA), the prevalence of DM and hypertension in the elderly is 22-33% and 70%, respectively. **Methodology:** The number of samples in this cross-sectional analytical study were 441 of elderly. The calculation of the number of drop out was 10%. The inclusion criteria in this study were male and female, aged ≥ 60 years and willing to sign the informed consent. The data obtained were tested using the Chi square test. **Results:** 8.4% of research subjects with obesity hold high ad random blood glucose levels, and 14.7% hold a history of DM. A total of 70.3% of obese subjects hold high blood pressure and 42.3% had a history of hypertension. There was a statistically significant relationship between the nutritional status and previous history of hypertension (p -value = 0.013). There was no statistically significant relationship among nutritional status and ad random blood glucose levels, previous history of DM and high blood pressure of the research subjects (p -value = 0.212; 0.196; and 0.168).

Conclusion: There is association between nutritional status of the elderly with an increase of blood pressure but not associated with an increase in blood glucose level.

Keywords: Elderly, Nutritional status, Diabetes mellitus, Hypertension.

1. BACKGROUND

Prevalence of elderly has been increasing from year to year. Globally, life expectancy now has increased from 65 years to 82.8 years for men and 85.3 years for women. Body composition changes along with aging process. Fat redistribution from peripheral and subcutaneous to central fat cause an increase in waist circumference in elderly.¹ Thermic effect in the elderly is 20% less compared to younger age. Physical activity decreases with age. These causes are believed to be the reason of a decrease in total expenditure energy in elderly.² Increased body weight (BW) and the absence of physical activity in the elderly are associated

with the occurrence of various diseases such as hypertension and diabetes mellitus (DM).^{3,4} Research conducted by Gray N, et al. showed that increased

BMI was associated with risk of developing complications of DM.⁴ Research conducted by Amador LF, et al. showed that a high BMI was associated with occurrence of hypertension in elderly. Data from the Framingham study indicates that hypertension and obesity are both risk factors for the development of congestive heart failure, which is one of the leading causes of morbidity and mortality in elderly.⁵ This study was conducted to examine relationship of nutritional status with DM and hypertension in elderly.

2. METHODS

This study is an analytical study with a cross-sectional design. The study was conducted at Tarumanagara University in March – June 2021. Number of samples for this study was 198 people. Sample size was obtained by using the sample size estimation formula to test the hypothesis of 2

independent proportions. Estimated drop out sample size in this study is 10%. The inclusion criteria for selecting research subjects were male and female with age of 60 years and willing to sign the informed-consent form. Data collection of age and gender was carried out through direct interviews with the research subjects. Age of the research subject was confirmed by identity card of the research subject.

Measurements of body weight (BW) and height were carried out to find body mass index data of each research subject. Manual BW scales were used and placed on a flat and hard surface. Scale ball indicator was set right in the middle. During weight measurement, research subjects were asked to dress up with the lightest possible clothes and not using footwear. They were also asked to urinate first and removing all accessories such as glasses, belts, etc. The research subjects stand upright on the scales, in a position as directed by the researcher. The reading of scales was carried out directly by the researcher. Weighing process was repeated (or two times) for each subject. The difference between the two readings were <0.1 kg.

TB measurements were carried out using a microtoise mounted on a flat and hard wall. The research subject stands against the wall under the microtoise. The back of the subject's head, shoulders, buttocks, calves and heels were gently touching the wall. Research subjects hold straight head position. Researchers lowered the microtoise until it touched the top of the research subject's head. Measurements were carried out 2 times. The difference between the two readings were <0.1 cm.

Blood glucose levels were checked using a glucometer Gluco dr® from capillary blood. Blood sample collected from one fingertip (2nd, 3rd or 4th finger) of the subject. Fingertips are cleaned with alcohol before punctured. Fingertip puncturing were performed using a pen-lancet device. Blood pressure (BP) were measured by placing a cuff with a distance of 2-3 fingers above the elbow crease of the research subject's right arm. BP measurements were carried out using a digital sphygmomanometer. All data on age, sex, weight, height, blood glucose level and BP obtained were then analyzed using statistical package for social sciences (SPSS) software version 22. The results of data processing are presented in tabular format.

3. RESULTS

Data collection was carried out in March - April 2021 at Campus II, Tarumanagara University. The number of research subjects was 441 people, consisting of 184 (41.7%) men and 257 (58.3%) women (Table 1). A total of 286 research subjects had nutritional status above normal (overweight – obesity) (Table 2)

Table 1. Characteristics of Research Subjects Based on Gender and Age

| No | Characteristics | N=441 | % |
|-----------|-------------------|-------|--------|
| 1. | Gender | | |
| | Men | 184 | 41,7% |
| | Women | 257 | 58,3% |
| 2. | Age (year) | | |
| | 60-69 | 263 | 59,6 % |
| | 70-79 | 142 | 32,2 % |
| | ≥80 | 36 | 8,2 % |

Table 2. Distribution of Nutritional Status of Research Subjects

| No | Nutritional status | N = 441 | % |
|----|--------------------|---------|--------|
| | Undernutrition | 20 | 4,5 % |
| | Normal | 135 | 30,6 % |
| | Overweight | 91 | 20,6 % |
| | Obese I | 149 | 33,8 % |
| | Obese II | 46 | 10,4 % |

Majority the research subjects' age (59.6%) were in the range of 60-69 years. Research subjects with blood glucose levels of 140 mg/dl, 141-199 mg/dl and 200 mg/dl, respectively, were 313 people (71%), 96 people (21.8%) and 32 people (7.3%) (Table 3).

Table 3. Profile of Ad Random Blood Glucose Level of Research Subjects

| Ad Random Blood Glucose Level (mg/dl) | N = 441 | % |
|---------------------------------------|---------|--------|
| ≤ 140 | 313 | 71 % |
| 141 - 199 | 96 | 21,8 % |
| ≥ 200 | 32 | 7,3 % |

The results of BP measurement showed as many as 300 (68%) of research subjects came with hypertension (Table 4). The research subjects who had a previous history of hypertension were 168 people (38.1%)

Table 4. Blood Pressure Profile of Research Subjects

| No | Characteristics | N= | % |
|--|-----------------|-----|------|
| 441 | | | |
| Systolic Blood Pressure (mmHg) | | | |
| | < 120 | 41 | 9,3 |
| | 120-139 | 108 | 24,5 |
| | 140 – 159 | 158 | 35,8 |
| | >160 | 134 | 30,4 |
| Diastolic Blood Pressure (mmHg) | | | |
| | < 80 | 243 | 55,1 |
| | 80-89 | 80 | 18,1 |
| | 90-99 | 95 | 21,5 |
| | >100 | 23 | 5,2 |

Subjects with obesity and a history of hypertension were 121 people (43.3%). There is relationship between nutritional status and previous history of hypertension (p value = 0.013) (Table 5).

Table 5. Correlation between Nutritional Status and Previous History of Hypertension

| | Previous History of Hypertension | | P value |
|--------|----------------------------------|----------------|---------|
| | Yes | No | |
| Obese | 121 (43,3%) | 165 (57,7%) | 0,013 |
| Normal | 47 (30,3%) | 108 (69,7%) | |

Subjects with obesity and hypertension were 201 people (70.3%). There is no relationship between nutritional status and hypertension experienced by research subjects (p value = 0.168) (Table 6).

Table 6. Correlation between Nutritional Status and Hypertension

| | Hypertension | | P value |
|--------|-----------------|---------------|---------|
| | Yes | No | |
| Obese | 201 (70,3 %) | 85 (29,7%) | 0,168 |
| Normal | 99 (63,9 %) | 56 (36,1%) | |

Subjects with obesity and a previous history of DM were 42 people (14.7%). There is no relationship between nutritional status and previous history of DM (p value = 0.196) (Table 7).

Table 7. Correlation between Nutritional Status and Diabetes History

| | Diabetes History | | P value |
|--------|------------------|----------------|---------|
| | Ye | No | |
| Obese | 42 (14,7%) | 244 (85,3%) | 0,196 |
| Normal | 16 (10,3%) | 139 (89,7%) | |

Table 8. Relationship between Nutritional Status and DM Status Based on ad Random Blood Glucose Level

| | Diabetes Mellitus | | P value |
|--------|-------------------|-------------|---------|
| | Yes | No | |
| Obese | 24 (8,4%) | 262 (91,6%) | 0,212 |
| Normal | 8 (5,2%) | 147 (94,8%) | |

Subjects with obesity and DM were 24 people (8.4%). There is no relationship between nutritional status and DM experienced by the research subjects (p value = 0.212) (Table 8).

4. DISCUSSION

This study was conducted to examine relationship between nutritional status with DM and hypertension in elderly. More research subjects of 60-69 years (263 people, 59.6%) were involved in this study. The study results are in agreement with previous research conducted by Nuhidayati, et al, Putra, et al and Reswan et al. which conducted with majority of the research subject's age were less than 70 years old.^{6,7,8} The research subjects involved more female (257 people, 58.3%) compared to men (184 people, 41.7%). This is in agreement with research conducted by Putra, et al. Different results were found in the research of Reswan, et al. Gender was associated with blood glucose levels and there is a change in the percentage of body fat composition. The body fat composition of elderly women is higher than that of elderly men.^{7,8} A total of 64.8% of research subjects had overweight and obesity nutritional status. These results are not in agreement with research conducted by Nugroho, et al. Research by Nugroho, et al. showed that prevalence of obesity in the elderly was 10.8%. The research of Krishnamoorthy, et al. showed that elderly with malnutrition condition were higher than obese condition.^{9,10} This difference in

results was associated with the use of body mass index (BMI) which was used as an indicator to determine nutritional status of the research subject. The use of this indicator has disadvantage related to individuals with high muscle mass.¹¹ The use of BMI cannot distinguish whether the increase in body weight is caused by an increase in muscle mass or fat mass.^{12,13}

Majority of the elderly (313 people, 73%) had normal ad random blood glucose levels. This condition was different from the research conducted by Putra, et al. Research conducted by Putra, et al. showed an increase of blood glucose level in elderly (blood glucose level: 100 – 199 mg/dl).⁷ Research conducted by Reswan, et al. showed number of the elderly with diabetes and normal blood glucose level respectively were 4 people (14.81%) and 23 people (85.19%). This increment is associated with impaired glucose metabolism in the elderly.⁸ Most of the research subjects had a systolic blood pressure of 140-159 mm Hg. High systolic blood pressure was in accordance with the research conducted by Nyayu, namely 96% of the research subjects had moderate degree of hypertension. Hypertension is associated with the occurrence of structural and functional changes in the vascular system due to the aging process. Some of the causes of hypertension in the elderly include a decrease in the elasticity of the aortic wall, thickening and stiffness of the heart valves and a decrease of heart's pumping ability. The heart's pumping ability decreases by as much as 1% each year after the age of 20. This will cause a decrease in heart contraction and volume.

The results of this research indicate a relationship between the nutritional status of the elderly with a previous history of hypertension (p value = 0.013). These results were in accordance with research conducted by Langingi et al, Sulam, et al, and Susan, et al.^{14,15,16} However, there was no relationship between nutritional status and hypertension that was being experienced by the research subjects. This is associated with many factors that can affect blood pressure. These various factors were not analyzed in this study. In addition, there was no relationship between nutritional status with a history of diabetes (p value = 0.196) and current diabetes (p value = 0.212) in the research subjects. Different results were found in a research conducted by Harsari, et al. Research by Harsari et al. showed that nutritional status was associated with the incidence of diabetes (p value = 0.04)¹⁷. Research conducted by Medhi, et al. showed a relationship between BMI and the incidence of DM. This study also showed that an

increase in BMI was associated with 8 times greater risk of diabetes.¹⁸ These conditions were caused by many factors that were not analyzed in this study.

5. CONCLUSION

Most of the subjects of this research were women (58.3%). The age of the most research subjects is 60-69 years (59.6%). A total of 20.6% of research subjects were overweight (20,6%) and obese (44,2%). A total of 71% of research subjects had a blood glucose level 140 mg/dl. About 35.8% of the research subjects had a systolic blood pressure of 140-159 mm Hg. The results showed that there was a relationship between nutritional status and previous history of hypertension. However, there was no relationship between nutritional status and the incidence of hypertension, history of DM and the incidence of DM in research subjects.

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