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Full Length Research Paper

Visceral fat with its risk factors amongst the Indonesian Javanese elderly

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Direct and indirect risk factors are implied in increased elders' visceral fat level, namely socio-economic, gender, age, workload, physical activities and eating pattern. The aim of study was to get the information on visceral fat level and its risk factors amongst The Indonesian Javanese elderly. A total of 812 elder's (517 women and 295 men) participated in the cross sectional study. Results showed that 12.8% of respondents with high level of visceral fat and 26.7% almost reach high level. Rural and urban areas, educational background, workload when aged 25 and 55 years, and physical activities aged 25 and 55 years had significant correlation with the visceral fat. Body Mass Index (BMI), weight, and height had a significant association with the visceral fat whereas the highest on the BMI (r = 0.896). A decreased visceral fat pattern following reduced weight and height according to sex. Mild physical workload aged 55 years had the opportunity of 2.29 times greater than those who had the heavy workload level at the same age. Nutrition education for elderly should include advice to increase physical activity in order to reduce high level of visceral fat.

Key words: Visceral fat, risk factors, elderly, physical activity, workload.

INTRODUCTION

Indonesia is facing an increased population of elderly from 4.48% in 1971 to 9.77% in 2010 (Sunusi, 2006). Currently, the country is the 5th country with the highest elderly population after China, India, U.S., and Mexico with its 1,000 ethnic and sub-ethnic groups (WHO, 2002). Aging issue in Indonesia is varied according to the area and ethnic groups. The aging proportion in several cities and districts are higher compared to the proportion for the whole country. For example, 8.5% on Yogyakarta City, 10.65% on Gunung Kidul District, 10.01% on Wonogiri District; and 10.13% on Magetan District. Javanese ethnic is the biggest populaton (48.6%) compared to the four biggest populated ethnics in Indonesia, namely Bataknese, Sundanese, Malay and Madurese (Ananta et al., 2005). The increased number of elderly affects their life aspects through physical, biological, psychological, and social changes or the occurrence of degenerative diseases due to aging process. One of the risk factors for degenerative diseases in elderly is obesity.

Obesity is the initial trigger of increased occurrence of coronary heart disease (CHD). Metabolic syndrome has been correlated with visceral fat compared to the gynoid/lower body obesity. The aging process is normally marked by increased fatty mass and progressive concentrated adipose tissue distribution (visceral fat). These changes have important impacts on the risk for various diseases/disorders related to metabolism including insulin resistance, diabetes, and cardiovascular disease, which can be seen in the results from several epidemiological studies. Females are especially susceptible to increased visceral fat level when they achieve menopause period. Factors that play a role in increasing visceral fat level in elderly are socio-economics, gender, age, workload, physical activities, and eating pattern (Chatchalit and Rattana, 2004; Goya et al., 2005; Helena et al., 2001; Maria, 2010; Abdallah et al., 2010). National data on visceral fat level proportion on elderly poeple is virtually absent. Keeping this view in mind, the present study was carried out to get the information on visceral fat level and its risk factors amongst the Indonesian elderly

people.

MATERIALS AND METHODS

Study design and participation

This cross-sectional study comprised 812 elderly (517 females and 295 males). Subjects belonged to the Javanese population andwere inhabits of Surabaya, Semarang and Yogyakarta, representing urban areas; and Wonogiri, Gunung Kidul and Magetan, representing rural areas. The study was implemented between December 2007 and February 2008. The participants were selected randomly from 54 villages/hamlet and 18 sub-districts. This study had been approved by the Ethical Committee of Indonesian MOH Research and Development Body. The inclusion criteria of repondents were male and female aged at least 55 years, living in the communities, came from Javanese ethnic, and had a healthy condition.

Data collection

Primary data were collected through two ways

(1) Structured interview on food consumption history using FFQ (Food Frequency Questionnaire) semi-quantitative tool.
(2) Physical activities in a structured questionnaire.

The respondent food consumption history and physical activities were assessed for the situation when the respondent aged 25 and 55 years old. The objective of collecting recall data in these two periods was aimed to analyze the correlation of energy and fat nutrient intakes, which had bigger calories than protein, and physical activities during young and old period with the visceral fat status during the elderly period.

Visceral fat in standing position was measured using Omron Body Fat Analyzer HBF 352. This tool is an excellent tool to quickly measure human body fat percentage and body mass. The subject were asked to stand up with both feet slightly apart and place both hands on the monitor by holding the grip electrodes. The subject should hold his/her arms straight out at an angle of 90° to his/her body and do not move during the measurement. Classification of visceral fat was defined from three levels:

(i) Normal (1-9).
(ii) Approaching high (10-14).
(iii) High (>15) (Omron, 2006).

Based on the most commonly reported foods and portion sizes, we constructed a food list with the units of measurement. The food list was converted to a Semi-Quantitative Food Frequency Questionnaire (SFFQ) format following the basic pattern of SFFQ using usual reported portions. The long SFFQ was field-tested, shortened, and developed into the final SFFQ (Table 1). To develop the SFFQ we went through the following steps:

(I) Construction of a food list.
(ii) Definition of portion sizes, and assignment of frequency of consumption.
(iii) Pilot test of long-FFQ and assembling the selected food list into SFFQ.

Adequacy of nutritional intake defined from 80% of The Indonesian Recommended Dietary Intake (RDA) which is suitable for general population nutritional status assessment. Before SFFQ practiced in the field, it has been pretested in the small sample with the quite high validity.

The physical activities (PA) questionnaire assessed daily routine activity at home and or outdoor, leisure time and sport when respondents aged 25 and 55 years. Three items of assesment covered type, duration per week, dan frequency per week. Type of sports were divided into three levels: light, moderate, and heavy (Durnin and Passmore 1955).

Statistical analyses

Means and standard deviations for the independent variables: area where the elderly lives, gender, age, work load in 25 and 55 years old, fat and energy intakes in 25 and 55 years old as well as the economic status with dependent variable, that is, visceral fat level were analyzed using paired t-test. The correlation coefficient between the visceral fat with height, weight and BMI was used to analyze the determinant factors related to visceral fat. All statistical analyses were performed using the SPSS version 13. A p value of 0.05 was considerd as significant difference.

RESULTS

The mean of visceral fat of high and approaching high levels in the urban area were similar with rural area. Female elderly had a slightly higher level of visceral fat compared to male. Younger elderly group (55 to 65 years old) had an average visceral fat level that was almost similar to the 66 to 85 years old group (Table 2). A positive correlation ($p < 0.05$) was observed between high educational level with mean of visceral fat level.

Visceral fat level had significant association with educational background. High level of visceral fat in low educational group was bigger than in high education. This means high education people had lower high level of visceral fat compared to low education people. The physical workload in 25 and 55 years old points of time has a relation with the average visceral fat level.

Elderly with mild physical workload were different from the elderly with high workload. Low activity level lead to a slightly higher level of visceral fat compared to the moderate and high activity levels (Table 2). Significant difference was observed for the mean of energy and fat intakes level with visceral fat level. Adequate energy intake group when aged 25 years old had a slightly higher level visceral fat compared to less energy intake group (Table 3). BMI had the highest correlation with visceral fat (Table 4). It was observed that visceral fat decrease with reducing height and weight. Increasing height and weight will increase high level of visceral fat. However, there was no correlation between height as well as weight with visceral fat according to gender (Table 5). Mild physical workload had 2.29 higher chance to have high level visceral fat compared to the elderly with high level after being controlled by other risk factors (Table 6).

DISCUSSION

Significant positive association was observed between

Table 1. Semi quantitative food frequency questionnaire (SFFQ).

Type of food	Frequency of consumption								House-holdportion (g)
	> 1/day	1 ×/day	3-5×/ week	1-2 ×/ week	2-3 ×/ month	1 ×/month	1-2×/year	Never	
Carbohydrate									
a. Rice	7	6	5	4	3	2	1	0	
b. Biscuits	7	6	5	4	3	2	1	0	
c. Etc	7	6	5	4	3	2	1	0	
Fat	7	6	5	4	3	2	1	0	
a. Meat	7	6	5	4	3	2	1	0	
b. Egg	7	6	5	4	3	2	1	0	
c. Chicken	7	6	5	4	3	2	1	0	
d. Etc	7	6	5	4	3	2	1	0	

Table 2. Mean of visceral fat based on areas, gender, age, education level, type of work, and physical activity level (aged 25 and 55 years old).

Variable	Level of visceral fat							
	High		Approaching high		Normal		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Area								
Urban	18.0	± 3.3	11.5	± 1.4	6.3	± 2.2*	10.0	± 4.9*
Rural	18.0	± 3.2	11.5	± 1.3	5.2	± 2.3	7.4	± 4.5
Total	18.0	± 3.2	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9
Gender								
Male	17.6	± 2.8	11.6	± 1.3	5.7	± 2.3	9.2	± 4.8
Female	18.3	± 3.5	11.4	± 1.4	5.7	± 2.3	8.6	± 4.9
Total	18.0	± 3.2	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9
Age group								
55-65 y.o	18.1	± 3.4	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9
65-85 y.o.	17.8	± 3.0	11.5	± 1.3	5.9	± 2.4	9.0	± 4.9
Total	18.0	± 3.2	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9
Education level								
Low	18.4	± 3.7	11.5	± 1.4	5.4	± 2.3*	8.0	± 5.0*
High	17.6	± 2.6	11.5	± 1.3	6.4	± 2.1	10.0	± 4.4
Total	18.0	± 3.2	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9

Table 2. Contd.

Workload (aged 25 y.o)								
Low	18.0	± 3.1	11.5	± 1.3	6.2	± 2.3*	9.7	± 4.8*
High	18.1	± 3.7	11.4	± 1.5	5.1	± 2.2	7.5	± 4.7
Total	18.0	± 3.2	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9
Workload (aged 55 y.o.)								
Mild	18.0	± 3.1	11.5	± 1.3	6.2	± 2.2*	9.6	± 4.8*
Severe	18.1	± 3.7	11.6	± 1.5	5.0	± 2.2	7.0	± 4.6
Total	18.0	± 3.2	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9
Physical activity level aged 25 y.o.								
Mild	17.2	± 2.1	11.6	± 1.3	6.0	± 2.3*	9.3	± 4.7*
Moderate	18.7	± 3.5	11.4	± 1.4	5.9	± 2.3	9.2	± 5.0
Severe	18.5	± 4.2	11.6	± 1.3	5.3	± 2.3	8.0	± 4.8
Total	18.0	± 3.2	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9
Physical activity level aged 55 y.o.								
Mild	17.3	± 2.6	11.6	± 1.4	6.1	± 2.3*	9.4	± 4.6*
Moderate	18.4	± 3.5	11.5	± 1.4	5.8	± 2.3	9.2	± 5.2
Severe	18.4	± 3.5	11.4	± 1.3	5.4	± 2.2	7.9	± 4.6
Total	18.0	± 3.2	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9

* Significance level at $p < 0.05$. SD: Standard deviation.

Table 3. Mean of visceral fat level according to energy and fat intakes (aged 25 and 55 years old).

Variable	Level of visceral fat							
	High		Approaching high		Normal		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Energy intake adequacy (aged 25 y.o)								
Poor (< 80% RDA)	17.8	± 2.8	11.5	± 1.3	5.8	± 2.3	8.8	± 4.8
Adequate (>=80% RDA)	19.0	± 4.7	11.5	± 1.4	5.6	± 2.3	9.0	± 5.1
Total	18.0	± 3.2	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9
Energy intake adequacy (aged 55 y.o)								
Poor (< 80% RDA)	18.0	± 3.1	11.5	± 1.4	5.7	± 2.3	8.9	± 4.9
Adequate (>=80% RDA)	18.0	± 3.6	11.5	± 1.4	5.8	± 2.3	8.6	± 4.9
Total	18.0	± 3.2	11.5	± 1.4	5.7	± 2.3	8.8	± 4.9

Table 3. Contd.

Fat intake (aged 25 y.o.)	26.0	±	21.2	28.7	±	19.7	27.6	± 22,7	27,7	± 21,7
Fat intake (aged 55 y.o.)	28.1	±	21.9	29.3	±	21.6	29.5	± 22,2	29,2	± 21,9

RDA: Recommended dietary allowance. SD: standard deviation.

Table 4. Correlation between BMI, weight, height, fat and energy intakes (aged 25 and 55 years old) with visceral fat.

Variable	Visceral fat
BMI	r = 0.896 p = 0.001*
Weight	r = 0.874 p = 0.001*
Height	r = 0.118 p = 0,001*
Fat intake (aged 25 y.o.)	r = 0.034 p = 0.339
Fat intake (aged 55 y.o.)	r = 0.060 p = 0.085
Energy intake (aged 25 y.o.)	r = 0.090 p = 0.792
Energy intake (aged 55 y.o.)	r = 0.220 p = 0.523

*Significance level at $p < 0.05$.

areas with visceral fat level due to fat intake, cholesterol level, and physical activity level differences. The urban elderly had higher fat and cholesterol intakes during young and old age and lower fiber intake compared to the rural elderly. Gender plays a role in determining the proportion of visceral fat level. The prevalence of high visceral fat level was found more in male elderly compared to female elderly. This finding was in line with the theory from Mitchell et al. (2003) which stated that male had more visceral fat compared to female. Females who have

Table 5. Mean of visceral fat according to group of height, weight and gender .

Anthropometric indicator	Visceral fat	
	Male	Female
Height (cm)		
< 150	7.52 ± 4.13	8.50 ± 4.88
150.1- 160	9.20 ± 4.77	8.85 ± 4.84
160.1– 175	9.58 ± 5.02	9.29 ± 5.59
Weight (kg)		
30 – 40	2.27 ± 1.62	2.67 ± 1.62
40.1 – 50	5.04 ± 2.28	5.53 ± 2.01
50.1 – 60	8.28 ± 2.60	8.40 ± 2.41
> 60	13.83 ± 3.89	14.26 ± 4.52

Table 6. Multiple regression analyses of mean visceral fat based on urban, male, and high education.

Independent variable	B	S. E.	P Wald	OR	95.0% C. I. OR
Urban	0.6398	0.1673	0.0001	1.8961	1.3660 - 2.6320
Male	0.4986	0.1712	0.0036	1.6465	1.1772 - 2.3028
High education	0.6556	0.1615	0.0000	1.9264	1.4036 - 2.6439
Workload aged 55 y.o.	0.8306	0.2097	0.0001	2.2947	1.5214 - 3.4610

experienced menopause tend to have increased visceral fat due to reduced physical activities reducing amount of energy expenditure and less estrogen hormone (Lovejoy, 2008). However, females keep more fat in abdominal subcutaneous area, while males aged more than 60 years old tend to keep fat in visceral part. The excess of fat in male tends to accumulate in the upper abdomen. In female, the favoured sites for the accumulation of fat are the buttocks, hips and thighs (Bose,1995).

Early and older elderly groups did not have different level of visceral fat because physical activities and fat intake differences were not big. Visceral fat will increase until 60 years old and it keeps decreasing with reduced physical activities. Visceral fat mass can be lowered by routine and regular exercise (Krishna, 2010). The proportion of high and approaching high level visceral fat on high education group were higher than the lower education group. The result of this study was against that of the study on Spanish elderly which revealed that there was correlation between educational background and central obesity prevalence (Enrique et al., 2006). The result of study was supported by Mexico study which revealed that visceral fat level was affected by daily physical activities (Ono et al., 2002). Work status reflected ability to buy nutritious food such as fruit, vegetables, and low fat milk which were more expensive than less nutritious food. The findings of this study showed that energy and fat intakes had no significant association with visceral fat. It was not in line with the results of Hispanic obese elderly eating pattern study (Hai et al., 2003). Weight correlated with visceral fat because weight may be one of the components to determine body fat level. Therefore, increasing weight will increase visceral fat concentration (MOH, 2003). The strongest correlation was found in BMI indicator and weight towards visceral fat. This finding contradicts the study of body fat percentage and BMI variations on Spanish elderly (Lusine et al., 2003) and study done in 97 elderly male (Santana et al, 2001). Secondly, the study stated that body composition changes with age, with increases in fat mass and visceral fat. However, the study was in line with the two studies abroad. The first study was on the adiposity assessment for assessing abnormality in English (Goya et al., 2005) and the second study stated that BMI and waist circumference play a role in assessing visceral fat in male and female elderly (Janssen et al., 2002).

Conclusion

Urban and rural areas, educational background, physical workload when aged 25 and 55 years, and physical activities aged 25 and 55 years were the risk factors to get high level of visceral fat with physical workload as the main determinant.

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