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ORIGINAL ARTICLE

Body Mass Index Vs Fracture Risk Value Primary Osteoporosis (A Case Study on Women Ages 40-45 Years at Sub-Urban Area)

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Abstract
This study aims to determine the relationship between BMI and fracture risk value primary osteoporosis in women aged 40-45 years in sub-urban areas. And how to optimize social activities in the environment as an effort to reduce the risk of osteoporosis. Body mass index is one of the important risk factors for osteoporosis fractures because the protective effects of subcutaneous fat tissue on bone in elderly women are calculated using FRAX®tool. The WHO in collaboration with the Sheffield's University central of metabolic bone disease has created a calculating device, the WHO risk assessment fracture tool (FRAX®tool). FRAX®tool is an online-based device used to calculate the risk of osteoporosis fractures in major bones, namely proximal humerus, wrist, vertebrae, and femur bone in the next ten years. This research is an analytical study using a cross sectional design, the number of samples is 70 female respondents aged 40–45 years in Kelurahan Melong Asih, Cimahi. The relationship between body mass index and the risk of primary osteoporosis fracture, used the rank spearman correlation test. The results of this study indicate a strong negative correlation between body mass index and the risk value of osteoporosis major, while the relationship between body mass index and risk value for osteoporosis femur fracture was found to be a moderate negative correlation. From the results of the risk of major osteoporosis fracture the lower a person's body mass index, the greater the risk of major primary osteoporosis fracture, whereas the results of the risk of femur fracture are only in obese grade II that is low, while other criteria have the same value, so it cannot be concluded if the lower a person's body mass index, the greater the risk value of the femur fracture.
Keywords : Body Mass Index; Fracture Risk Value; Osteoporosis.

1 INTRODUCTION

Osteoporosis is characterized by reduced bone mass and changes in the microarchitecture of bone tissue leading to bone fragility and increased risk of fracture due to minor trauma (1; 2). Osteoporosis is a silent disease, without any special signs making it difficult to detect it early. Generally, new symptoms appear at the age of over 50 years (1; 2, 3). The occurrence of fractures in the elderly is more difficult to heal so that it can reduce the quality of life of the elderly (4; 5, 6). Research by Mithal et.al (2009) states that the number of osteoporosis cases in Asia is 28.7% in men and

32.3% in women from all bone cases due to metabolic disorders (7). When a woman enters the age of 40 years, it will gradually decrease in bone density. In addition, at the age of 45 to 50 years, women will enter the menopause phase (where the hormone estrogen is lost more and more) so that women are more susceptible to osteoporosis when they are over 45 years old (2; 4; 5).

To identify risk factors for osteoporosis and fractures due to osteoporosis, it can be measured using Bone Mass Density/BMD (to determine bone density), while the FRAX® tool is used to determine the percentage risk of osteoporosis fracture from the age of 40 in the next ten years (4; 6; 8). Risk factors that become indicators in the calculation of the FRAX® tool, namely age, gender, body mass index, history of fracture, history of fracture of the femur from parents, smoking, glucocorticoids, rheumatoid arthritis, secondary osteoporosis, and alcoholic beverages (6). The World Health Organization (WHO) states that a low Body Mass Index (BMI) is a clinical risk factor for osteoporotic fracture (9). This is due to the reduced protective effect of subcutaneous fat tissue on bone density in the elderly (5; 10). Decreased bone density is more common in individuals over 50 years of age with a BMI of less than 17 kg / m^2 (10; 11). Decreased bone density in the elderly can also be caused by a decrease in calcium absorption which is influenced by decreased levels of the hormone estrogen (12; 13; 14).

The risk factor for osteoporosis fracture that will be studied is BMI to determine the fracture risk value calculated using the FRAX® tool method. Apart from BMI, there are other factors, namely: physical activity, vitamin D status, and nutrition (4; 17). The osteoporosis risk factor values calculated using the FRAX®tool were divided into: 1) major osteoporosis risk factors that assess the prediction of fractures in the wrist, proximal humerus, and spine; 2) risk factors for osteoporosis in the neck of the femur which assess the prediction of femoral fracture. This assessment will be used to determine early on the percentage of osteoporotic fractures so that preventive measures can be taken (9; 16).

Based on the description above, the authors examined the BMI and the value of the risk of primary osteoporotic fracture calculated using the FRAX® tool, and measured the correlation. This research was conducted on women aged 40–45 years in Melong Asih Village, Cimahi. Research on the calculation of risk factors for primary osteoporosis fracture has never been done before, especially in the Melong Asih Village Cimahi area. This sub-district is the second largest in South Cimahi after Cibeureum. The total female population in Kelurahan Melong Asih is more than that of Cibeureum with a total of 36,092. Of these, women aged 40–45 are 2,620 (18).

2 METHODOLOGY

This study is an analytical study using a cross-sectional design, which is a study that aims to find the relationship between the independent variable and the dependent variable by measuring it at one time to determine the relationship between BMI and the calculated risk factor for primary osteoporosis fracture using FRAX®tool (23). The data used in this study are primary data derived from the results of BMI examinations in women aged 40–45 years in Melong Asih Village, Cimahi. The minimum number of respondents needed in this study was 51 respondents, but in practice it was obtained 70 respondents.

The sampling method used by the researcher in this study was consecutive sampling, which included subjects who matched the research criteria at a certain time, so that the required number of subjects was met (23). Correlative test analysis used to assess correlation is the Spearman rank test, because the data were not normally distributed after being tested by Kolmogorov-Smirnov. This test was conducted to determine the correlation between the BMI value and the risk of primary osteoporotic fracture based on the calculation of the FRAX® tool.

3 RESULTS

The results of a study of 70 women aged 40–45 years in Melong Asih Village, Cimahi, showed a relationship between BMI and the value of primary osteoporotic fracture risk.

Overview of BMI in Women aged 40–45 years in Melog Asih Village Cimahi with Primary

Osteoporosis Fracture Risk Value

The results showed that the highest BMI was found in the BMI criteria for obesity, which was 61.43%. For more details, it can be seen in the following table :

Table 1. Distribution of BMI Respondents

BMI Criterias	f	%
Underweight (< 18,5)	0	0
Normal (18,5-22,9)	12	17,14
Overweight (23-24,9)	15	21,43
Obese Grade I (25-30)	**28**	**40,00**
Obese Grade II (>30)	15	21,43
Total	**70**	**100**

When a woman enters the age of 40, there is a slow decrease in bone density. In addition, women at the age of 45 to 50 years, a menopause phase will occur where the hormone estrogen will decrease. This causes women to be more susceptible to osteoporosis at the age of over 45 years. Whereas in general, symptoms of osteoporosis such as lower back pain and neck pain, hunched posture, and a gradual decrease in height only appear at the age of over 50 years (2; 4; 5).

Furthermore, the aging process also occurs at the age of 40 years and over. At that age, fat-free mass (FFM) decreases while fat mass increases. At the age of 40–45 years, a high body mass index is generally found due to the progressive addition of fat mass (5; 14).

Value of the Risk of Primary Osteoporosis Fracture

To find out how the risk value of primary osteoporosis fracture in respondents using FRAX®tool software, the calculation results are based on the risk value for osteoporotic fracture of the femur (%) and the risk value for major osteoporosis fracture (%). This can be seen in the following table:

Table 2. Statistical Value of Primary Osteoporosis Fracture Risk

Statistik Deskriptif	n	Median	min	max	Avr	std. dev
Major Osteoporosis (%)	70	1,40	0,9	2,4	1,42	0,31
Femur Fracture (%)	70	0,10	0	0,2	0,10	0,03

Based on the table above, the average risk of osteoporosis major fracture is 1.14 ± 0.31% or has a mean risk of 1.42 (0.9-2.4) percent risk. The risk value for osteoporosis fracture of the femur averaged 0.1 ± 0.03% or had a mean value of 0.1 (0-0.2) percent risk.

In this study, an assessment of the value of fracture risk in primary osteoporosis in research subjects was carried out by looking at two aspects of fracture risk, namely (1) risk of major osteoporosis fracture and (2) risk of femoral fracture.

Assessment of the risk value is the occurrence of fractures in the major bones, namely: the proximal humerus, wrists, and vertebrae in the study subjects. The result shows that there is a tendency to decrease the risk value of osteoporosis fracture, especially obesity grade I and obesity grade II. This can be seen in the following table:

Table 3. Statistical Value of Major Osteoporosis Fracture Risk Based on BMI

BMI Criteria	Descriptive Statistic of Major Osteoporosis (%)					
	n	Median	Min	Max	AVR	std.dev
Normal (18,5-22,9)	12	1,75	1,1	2,4	1,75	0,46
Overweight (23-24,9)	15	1,50	1,1	2	1,51	0,29
Obese Grade I (25-30)	28	1,40	1	1,6	1,35	0,15
Obese Grade II (>30)	15	1,20	0,9	1,3	1,17	0,10

Based on the average value, it can be seen that the higher the BMI, the lower the risk value for osteoporosis major fracture that is owned in the next ten years. Assessment of the risk value for fracture of the femur in the study subjects also showed a tendency to decrease the risk value for osteoporotic fracture only in grade II obesity.

Table 4. Statistical Value of Femoral Osteoporosis Fracture Risk Based on BMI

BMI Criteria	Descriptive Statistic of Major Osteoporosis (%)					
	n	Median	Min	Max	AVR	std.dev
Normal (18,5-22,9)	12	0,10	0,1	0,2	0,12	0,04
Overweight (23-24,9)	15	0,10	0,1	0,1	0,10	0,00
Obese Grade I (25-30)	28	0,10	0	0,2	0,10	0,03
Obese Grade II (>30)	15	0,10	0	0,1	0,07	0,05

Based on the mean value, it appears that grade II obesity body mass index has a low risk of femoral fracture. Meanwhile, the other body mass index criteria have the same value, so it cannot be said that the higher the body mass index, the lower the risk value for osteoporosis fracture of the femur. Obesity is associated with increased subcutaneous fat mass. High fat mass is a predictor of bone mass because it increases mechanical stress through muscles such as stimulation of osteoblast activity or mass gravity action on the skeleton, thereby increasing stimulation of osteogenesis (20; 21).

Relationship between Body Mass Index and Primary Osteoporosis Fracture Risk Value

To determine whether there is a relationship between body mass index and the risk value of primary osteoporotic fracture, the Spearman rank correlation test was used, where previously it was known that the data tended to be not normally distributed based on the Kolmogorov Smirnov test ($p < 0.05$). The following are the test results:

Table 5. Relationship Between Body Mass Index and Primary Osteoporosis Fracture Risk Value

Correlations	p_{value}	Direction	Coefficient
BMI value with risk of fracture major osteoporosis	0,000	Negative	-0,601
BMI value with risk of osteoporotic fracture of the femur	0,000	Negative	-0,442

Based on the results of statistical calculations, the correlation coefficient value is -0.601 with a p value (sig) of 0.000. The results of statistical tests show that the value of p (0.000) <0.05, so it can be seen that there is a significant relationship between body mass index and the risk value of major osteoporosis fractures in women aged 40–45 years in Melong Asih Village, Cimahi.

Furthermore, the calculation results also show the Spearman rank coefficient of -0.442 which indicates the degree of closeness of the relationship between body mass index and the risk value for osteoporosis fracture of the femur where the test results are significant (p = 0.000 <0.05). A negative value on the correlation coefficient indicates that the higher a person's body mass index, the lower the risk value for primary osteoporosis fracture and vice versa. The test results also showed a relationship between body mass index and osteoporotic fracture risk. This is as stated by Handayani, Oktavianus and Trianto where the incidence of osteoporosis mostly occurs in the elderly with a body mass index of 17-18.4 or mild underweight, which is 100% and the least incidence of osteoporosis occurs in the elderly. with a body mass index> 27 or overweight, which is only 20% (5).

Another study conducted by Nashirin (2) proved that body mass index plays a role in increasing the risk value for osteoporotic fracture based on the FRAX® tool calculation even though it is influenced by differences in other risk factors such as age, previous fracture history and a history of femoral fractures in the elderly.

The association of body mass index with the risk of primary osteoporotic fracture is due to a reduced protective effect of subcutaneous fat tissue on bone in elderly women. Women with excess nutritional status or obesity have better calcium absorption status and lower bone resorption post menopause so that Bone Mineral Density (BMD) will increase. Low body mass index is known to be an important risk factor for the occurrence of low BMD (20). Weight loss indicates a decrease in estrogen associated with a decrease in BMD.35 A decrease in estrogen causes an increase in bone resorption so that small changes due to decreased adipose cells play a role in the risk of osteoporosis (22).

4 LIMITATIONS

There is limitations in this study, namely the sample is not representative of an entire population.

5 CONCLUSSION

Most of the women aged 40–45 years in Kelurahan Melong Asih Cimahi have an obesity body mass index grade 1 with a percentage of 40%. This shows that there is a tendency that the older the respondent's age, the higher the risk value for osteoporosis major fracture and osteoporosis fracture of the femur. There is a significant relationship between BMI with the risk value for osteoporosis major fracture and the risk value for osteoporosis fracture of the femur.

To prevent the risk of fracture femur can be done by controlling as early as possible on several factors. Maintaining an ideal body weight is one of the efforts that can be done in this regard. Consuming healthy foods such as vegetables and fruits that contain high calcium is also an effort to prevent the risk of fracture of the femur. high calcium milk can also be consumed to support this.

Running a healthy lifestyle such as not smoking and regular exercise are also efforts to prevent the risk of fracture of the femur. Sports activities carried out in the home environment, such as playing volleyball, walking, and cycling, are activities that can be followed. Besides being healthy and preventing femur fractures, it can also comfort yourself because you can meet and chat with neighbors and friends. Exercising together is usually more motivating than exercising alone.

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