

# Comparative Study of Mass Density According to BI-RADS Mammography between Histopathological Grading in Breast Cancer

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## Abstract

**Background:** Breast cancer often presents with signs such as high-density masses. The description of high-density masses remains controversial as a descriptor of malignancy. Histopathological assesment, including the Nottingham Grading System, is considered the gold standard for determining the definitive diagnosis of cancer. **Objective:** To determine the comparative study of mass density according to BI-RADS mammography and histopathological grading in breast cancer at Dr. Soetomo Hospital Surabaya January 2017 – December 2021. **Methods:** This study compares mammography medical records of breast cancer diagnoses in patients from January 2017 – December 2021 at Dr. Soetomo Hospital Surabaya, based on histopathology. It's an analysis study focused on observational and comparisons. **Results:** The number of cases according to breast cancer inclusion data was 261 data. Breast cancer patients were predominantly in the age group of 50 – 54 years (20.3%) and the majority of masses were found in the right breast (53.3%). The most common type of mass density was high density (46.7%) and the most frequent histopathological grading was grade 3 (51.3%). The comparison of age between mass densities showed a p-value of 0.71 ( $p > 0.05$ ), while the comparison of mass densities between histopathological grading had a p-value of 0.058 ( $p > 0.05$ ). **Conclusion:** Most breast cancer patients at Dr. Soetomo Hospital Surabaya from January 2017 – December 2021 were aged 50 – 54. High density masses were common and grade 3 was the highest histopathological grade. Age didn't differ much between equal and high density masses. The same applied to mass density among histopathological grading.

Keywords: breast cancer; mammography; Nottingham Grading System; mass density

## 1. Introduction

Breast cancer ranks first among all cancers in both women and men, with 2.3 million cases in 2020 (Globocan, 2020). Indonesia had 65,858 cases of breast cancer out of 213,546 cases of cancer in women of all ages in 2020 (Globocan, 2020). The method of detecting breast cancer malignancy using mammography will provide images of breast composition, masses, calcifications, architectural distortion, asymmetry, intramammary lymph nodes, skin lesions, solitary dilated ducts, and lesion locations. The description of masses according to the BI-RADS mammography can be assessed based on their shape, margins, and density (ACR BI-RADS Atlas 5<sup>th</sup> Edition, 2013). The density of masses remains a controversial descriptor in characterizing the malignancy of breast cancer. Several studies have shown that the malignancy level of breast tumors is closely related to the density of the mass. Other studies suggest that high mass density alone may not be accurate enough to identify the malignancy of breast cancer, and therefore, a biopsy is needed (Ding et al., 2016).

Histopathology is the gold standard for detecting cancer and is used globally (WHO Classification Editorial Board, 2019). Malignancy criteria can also be assessed using histopathology, providing information about the type of cancer and histopathological grade (Tseng, Matsuyama, and MacDonald-Dickinson, 2023). Histopathological grading becomes a simple and cost-effective method for assessing the behavior and prognosis of invasive breast tumors, thus helping to identify breast cancer patient at risk (van Doijeweert et al., 2021). The Nottingham Grading System (NGS) has prognostic relevance for all types of breast cancer histopathology (Rakha, Tse, and Quinn, 2022). Histopathological grading was found to be associated with other prognostic variables and clinical outcomes in breast cancer patient (Rakha, 2007). In this study, histopathological grading of breast cancer is performed using the Nottingham Grading System, which is divided into three grades: grade 1, grade 2, and grade 3. Researchers aim to investigate whether breast mass density in breast cancer patients at Dr. Soetomo General Hospital during the period of January 2017 to December 2021 is significantly correlated with malignancy or not, which is then compared with histopathological grading.

## 2. Methods

### 2.1. Data Collecting

An observational analytic study with a comparative approach. This study solely relying on the analysis of medical records of breast cancer patients diagnosed based on histopathological results at Dr. Soetomo General Hospital in Surabaya during the period from January 2017 to December 2021. The population of this study comprises the medical records of mammography patients with breast cancer diagnosed based on histopathological results at the Radiodiagnostic Installation of Dr. Soetomo General Hospital in Surabaya and the Anatomic Pathology Unit of the Central Laboratory Installation of Dr. Soetomo General Hospital.

#### a. Inclusion criteria

1. Breast cancer patients who have medical records of mammography at Dr. Soetomo General Hospital and mention the description of mass density before undergoing surgery.
2. Breast cancer patients who have medical records of mammography at Dr. Soetomo General Hospital and have been found to have one or more masses in one or both breasts.
3. Breast cancer patients who have undergone tissue biopsy and/or breast cancer surgery and have been diagnosed based on histopathological results indicating various types of breast cancer and grading according to the Nottingham Grading System criteria at Dr. Soetomo Regional Hospital.

#### b. Exclusion criteria

1. Breast cancer patients who have medical records of mammography at Dr. Soetomo General Hospital and do not mention the description of mass density based on BI-RADS mammography.

### 2.2. Data Analysis

The comparison of mass density according to BI-RADS mammography between histopathological grading in breast cancer using a SPSS Software version 27 (SPSS Inc. Chicago, IL, USA), using Mann-

Whitney and Chi-Square test. The data for all categories were displayed using numerical values and corresponding percentages.

### 3. Result

Table 1. The number of breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital

Age (years old)	Percentage (n%)
< 40	19 (7.3%)
40 – 44	50 (19.2%)
45 – 49	49 (18.8%)
50 – 54	53 (20.3%)
55 – 59	31 (11.9%)
60 – 64	38 (14.6%)
65 – 69	15 (5.7%)
≥70	6 (2.3%)

Table 1 shows that breast cancer patient from January 2017 to December 2021 at Dr. Soetomo General Hospital were predominantly in the age of 50 to 54 years old (20.3%) while patients aged 70 and above were less common age for breast cancer (2.3%).

Table 2. The number of breast masses on mammography in breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital

Number of Masses	Mammæ	
	Right (n%)	Left (n%)
	139 (53.3%)	122 (46.7%)
Total	261 (100%)	

Table 3. The number of mass densities on mammography in breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital

Number of Masses	Density	
	Equal density (n%)	High density (n%)
	54 (20.7%)	207 (79.3%)
Total	261 (100%)	

Table 2 shows that breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital mostly had masses in the right breast (53.3%). Furthermore, based on Table 3 shows that the most common type of mass density in patients was high density (46.7%). In this case, there were no breast cancer with low-density and fat-containing mass densities.

Table 4. The number of histopathological gradings in breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital

Number of Histopathological Grading	Histopathological Grading		
	Grade 1 (n%)	Grade 2 (n%)	Grade 3 (n%)
	33 (12.6%)	94 (36.1%)	134 (51.3%)
Total	261 (100%)		

Table 4 shows that breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital had the majority of their prognoses in grade 3 (51.3%).

Table 5. Comparison of age among mass density in breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital

			Density		Total	Significant
			Equal density	High density		
Age (years old)	<40	Total	1	18	19	p = 0.71
		(n%)	1.9%	8.7%	7.3%	
	40 – 44	Total	17	33	50	
		(n%)	31.5%	15.9%	19.2%	
	45 – 49	Total	11	38	49	
		(n%)	20.4%	18.4%	18.8%	
	50 – 54	Total	15	38	53	
		(n%)	27.8%	18.4%	20.3%	
	55 – 59	Total	2	29	31	
		(n%)	3.7%	14.0%	11.9%	
	60 – 64	Total	6	32	38	
		(n%)	11.1%	15.5%	14.6%	
	65 – 69	Total	0	15	15	
		(n%)	0%	7.2%	5.7%	
	≥ 70	Total	2	4	6	
		(n%)	3.7%	1.9%	2.3%	
Total	Total	54	207	261		
	(n%)	100%	100%	100%		

Table 5 used statistical testing with Mann-Whitnet test in the SPSS. Based on the age comparison table among mass densities in Table 5, there was no significant age difference between equal density and high density, as the p-value >0.05 in breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital.

Table 6. Comparison of mass density among histopathological grading in breast cancer patients from January 2017 to December 2021 at Dr. Soetomo General Hospital

			Density		Total	Significant
			Equal density	High density		
Histopathological Grading	Grade 1	Total	11	22	33	p = 0.058
		(n%)	33.3%	66.7%	100%	
	Grade 2	Total	22	72	94	
		(n%)	23.4%	76.6%	100%	
	Grade 3	Total	21	113	134	
		(n%)	15.7%	84.3%	100%	
Total	Total (n%)		54	207	261	
			20.7%	79.3%	100%	

Table 6 used statistical testing with the Chi-Square test in the SPSS. Based on the mass density comparison table among histopathological grading in Table 6, there was no significant difference in mass density among histopathological grading because the majority of breast cancer patients had masses with high density. According to the data analysis, high-density masses could be found in all grades.

#### 4. Discussion

Breast cancer is a global issue but it is still often diagnosed at advanced stages due to women's negligence in self-examinations and clinical breast examinations (Akram et al., 2017). According to a study conducted by Hyun Jo Youn and Han on breast cancer epidemiology in Asia, one of the increased risk factors for breast cancer is women aged over 40 years (Hyun Jo Youn dan Han, 2020). Several researches have suggested that breast cancer more frequently occurs in the left breast, although the exact cause is not known (Shah et al., 2022). The results of this study contradict that opinion because breast masses in breast cancer patients were commonly found in the right breast. This include the association with a higher positive family history of breast cancer, an increased ratio of diseases that have reached advanced stages or metastasis (Saad et al., 2022). Some researchers have stated that masses with high density tend to be malignant tumors because the density in celuller component is higher, and there is reactive fibrosis surrounding malignant tumors. However, there are studies that suggest that although most high-density masses are associated with malignancy, low-density masses can also be an indicator of malignancy, so mass density may not be a reliable descriptor (Woods et al., 2011). Higher grades in NGS assessment are associated with shorter survival and earlier recurrence, regardless of tumor size, hormone receptor status, or lymph node metastasis status (Takahashi et al., 2020). Breast masses are not always discovered at the same age among different patients. Patients who do not regularly perform Breast Self-Examination may take longer to realize the presence of a lump in breast. Regular examination can also accelerate the identification of breast masses (Daly and Puckett, 2022). Routine screening recommended by the WHO for detecting cancer is rarely carried out in Indonesia. The reasons are similar to other developing countries: limited resources required for cancer screening programs, such as mammography, in Indonesian healthcare facilities (Solikhah, S., Perwitasari, A.D., and Rejeki, S. S. D., 2022). In study by Tamaki and Sasano in Japan, breast cancer patients with low-density masses were predominantly those with grade 1 breast cancer (Tamaki and Sasano, 2012). Similarly, in this study, grade 2 breast cancer were dominated by equal-density masses, and grade 3 breast cancer patients were dominated by high-density masses. From the results of this study, high-density masses were found in all grades, ranging from grade 1 to 3. Additionally, high-density masses had a dominant number in all grades, indicating that there was no significant difference in mass density among histopathological grading.

## 5. Conclusion

Based on the results of this research in Dr. Soetomo General Hospital from January 2017 to December 2021, breast cancer patients were predominantly in the age of 50 to 54 years (20.3%). Breast masses were predominantly located in the right breast of patients (53.3%). High-density masses were the most commonly found (46.7%). Histopathological grading was predominantly composed of patients with grade 3 according to NGS (51.3%). The comparison of age among mass densities is not significant because the p-value is 0.71. The comparison of mass density among histopathological grading is not significant because the p-value is 0.058.

## 6. Recommendations

Similar studies are expected to be conducted with a larger sample size. Patients with high-density findings on mammography diagnosis are encouraged to undergo histopathological diagnosis promptly, as it is associated with a potentially worse prognosis if further action is not taken.

## Acknowledgements

The author extends their gratitude to parents, lecturers, colleagues, and all the staff of Faculty of Medicine, Universitas Airlangga and Dr. Soetomo General Hospital in Surabaya.

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