Mammographic Breast Density and Its Associated Findings Among IIUM Kuantan Staff

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Abstract:

Introduction: Mammographic breast density is a strong risk factor for breast cancer. In this study, we investigate the distribution of mammographic density in female staff members from the International Islamic University Malaysia (IIUM) in Kuantan. We also explore the associations between mammographic density and various factors, including age, parity, body mass index (BMI), breastfeeding history, and the usage of hormonal replacement therapy. **Methodology:** A cross-sectional study was conducted, involving 54 female staff volunteers from IIUM Kuantan. All participants underwent digital mammography screening, and their mammographic density was evaluated using the Breast Imaging Reporting and Data System (BI-RADS) classification, which categorizes breast density composition from A to D, from being entirely fatty to extremely dense. The demographic and other relevant data were collected through structured questionnaires and reviewing of medical records. Logistic regression was performed to assess the association between mammographic density and the selected factors. **Result & Discussion:** Most breast density fell into category B (51.9%) and category C (48.1%), with no participants falling under category A or D. Further analysis revealed no statistically significant association between mammographic density with age, parity, BMI, breastfeeding history, or usage of hormonal replacement therapy. **Conclusion:** The relatively even distribution between the mammographic density of B and C categories suggests a balanced representation of breast parenchymal patterns in this population. Although the lack of statistical significance is likely due to the small sample cohort, factors such as age, BMI and breast-feeding history showed weak association with breast density. These findings contribute to the existing knowledge on breast health and may aid in the future development of tailored screening and prevention strategies.

Keywords: breast density, digital mammography, BI-RADS

Introduction:

Mammography is a recommended screening method for early detection of breast cancer. The prognosis improves with earlier diagnosis stages (Sant et al., 2003, Mahmud & Aljunid, 2018) . Mammography also helps to identify high risk women by determining mammographic breast density. Women who have densities of over 75% of their breasts have a four to six times higher risk of developing breast cancer than women of the same age who do not have any densities (Heng et al., 2004). This study describes the prevalence of mammographic breast density according to the BI-RADS among female IIUM staff and determines an association between breast density with age, parity, breastfeeding, BMI and usage of hormonal replacement therapy.

Materials and Methods:

This is a cross-sectional study involving female IIUM Kuantan staff who underwent mammography examination at the Department of Radiology, SASMEC @ IIUM between 1st January 2022 to 31st December 2022. The ethical approval was obtained from the Kulliyyah of Medicine Research Committee (KRC), International Islamic University Malaysia (IIUM), and IIUM Research Ethics Committee (IREC). The recruitment of the participants was done in collaboration with the Department of Family Medicine colleagues who studies about "Breast Awareness and Mammography Uptake Among SASMEC and IIUM Kuantan Staff". The staff who took part in their questionnaires and were keen for mammogram examination were directed to us via a shared database. Participants were then contacted by the co-investigator through phone calls or WhatsApp application. A suitable appointment date and time were given for the mammogram study. Subsequently, all mammograms performed were traced from the Radiology Information System (RIS). A total of 54 mammogram examinations that fulfilled the criteria were retrieved and selected into the study. Exclusion criteria are those who were already diagnosed with breast cancer and currently on mammogram follow-up and those who had previous local surgical procedures which affect the breast parenchyma pattern. Digital mammography examinations were performed using *Siemens Mammomat Inspiration*. Two-view images were acquired in cranial-caudal and medial-lateral oblique. Images were then transferred from the workstation into the Digital Imaging and Communication in Medicine (DICOM) format. Data were also acquired from the radiology information system (RIS) mammography form in addition with the pre-designed self-administrative questionnaire containing family history and personal details including the age, height, weight, parity, breastfeeding and hormonal replacement therapy (HRT) usage. The sociodemographic details and corresponding mammogram findings were assessed and tabulated. Data collection was performed by a single person. Images from the picture archiving communication system (PACS) were assessed and data from the RIS and questionnaire were charted into a Microsoft Excel worksheet for data collection. These data were then transferred from Microsoft Excel to a Statistical Package for the Social Sciences (SPSS) version 26.0; SPSS by IBM in New York for analysis.

The mammographic breast density composition was assessed according to the ACR BI-RADS classification i.e., A: almost entirely fatty, B: scattered areas of fibroglandular density, C: heterogeneously dense, and D: extremely dense. BI-RADS C and D are considered as dense breasts with higher risk of breast cancer. The rest of the findings and associated features were interpreted and final BI-RADS assessment categories were recorded. BI-RADS Category 1 indicates normal mammogram, Category 2 indicates findings that are typically benign and not suspicious for malignancy, Category 3 shows a probably benign lesion that needs short follow-up and Category 4 and 5 are those with suspicious abnormality. The sociodemographic data including the age, weight, height, number of children, family history of breast cancer, breastfeeding history and history of hormone replacement usage of the staff were also recorded. Body mass index (BMI) variable was calculated using the weight and height variables. Descriptive analysis was done to assess the prevalence of breast density according to BI-RADS classification. Multiple logistic regression was used to analyse the association of breast density with age, parity, breastfeeding, BMI, and the usage of hormonal replacement therapy.

Results:

A total of 54 patients participated in the study. The sociodemographic characteristics are presented in the table below (Table 1). The average age of the participants was 46.56 years, with a standard deviation of 5.19. In terms of family history of breast cancer, 77.8% (n=42) reported no family history, while 22.2% (n=12) had a positive family history. Regarding the number of parities, 31.5% (n=17) are nulliparous. Breastfeeding history showed that majority 51.9%

(n=28) did not breastfeed. The participants had an average BMI of 27.0, with a standard deviation of 4.79. In terms of hormonal replacement therapy or birth control pill usage, mostly 55.6% (n=30) reported never using them.

Table 1: Sociodemographic distribution

Sociodemographic		**N**	**Percentage (%)**
Family History of Breast Cancer	No	42	77.8
	Yes	12	22.2
Number of Parity	0	17	31.5
	1	3	5.6
	2	10	18.5
	3	9	16.7
	More than 4	15	27.8
Breastfeeding History	None	28	51.9
	Less than 12 Months	13	24.1
	12 – 24 Months	8	14.8
	24 – 36 Months	5	9.3

The prevalence of breast density according to the BI-RADS classification shows 51.9% (n=28) were classified under Category B, while 48.1% (n=26) fell into Category C. None of the participant has breast density of category A and D. Regarding the final assessment categories according to BI-RADS score (Table 2), majority of patients, 64.8% (n=35), were classified under BI-RADS 2. Additionally, 13.0% (n=7) were classified under BI-RADS 1, while 22.2% (n=12) fell into BI-RADS 3; while no participants were classified under BI-RADS 4 or 5. Table 3 shows a summary of the distribution of BI-RADS classifications within different Breast Density categories. There is no statistically significant association between Breast Density and BI-RADS classifications (p-value = 0.952). This suggests that the distribution of BI-RADS classifications is similar across different Breast Density categories (B and C).

Table 2: Distribution of BI-RADS Category Among Staff Who Underwent Mammography

BI-RADS Category	**N**	**Percentage (%)**
1- Normal	7	13.0
2 - Benign	35	64.8
3- Probably benign	12	22.2
4,5-Suspicious and Malignant	0	0
Total	54	100

Table 3: Breast Density and BI-RADS categories classification

Breast Density	BI-RADS			Total	p-value
	1	2	3		
B	4 (7.4%)	18 (33.3%)	6 (11.1%)	28 (51.9%)	0.952
C	3 (5.6%)	17 (31.5%)	6 (11.1%)	26 (48.1%)	
Total	7 (13%)	35 (64.8%)	12 (22.2%)	54 (100%)	

Descriptive statistics and multiple logistics regression were used to determine the association of breast density with age, parity, breastfeeding, BMI and usage of hormonal replacement therapy. These are shown in Table 4. It revealed that the mean age of the participants in Breast Density Category B was 47.36 years (SD = 5.97), while in Breast Density Category C, it was slightly lower at 45.69 years (SD = 4.15). There is no difference in the distribution of breastfeeding history and parity among participants across different Breast Density categories. A slightly more women with higher mean BMI had denser breast in Category B. A slightly higher number of women with denser breasts were also noted to use of HRT.

Table 4: Association between breast density with demographic data

Demographic		Breast Density, (Mean (SD) / N (%))			
		A	B	C	D
Age		0 (0)	47.36 (5.97)	45.69 (4.15)	0 (0)
Parity	0	0 (0)	9 (16.7)	8 (14.8)	0 (0)
	1	0 (0)	2 (3.7)	1 (1.9)	0 (0)
	2	0 (0)	5 (9.3)	5 (9.3)	0 (0)
	3	0 (0)	6 (11.1)	3(5.6)	0 (0)
	More than 4	0 (0)	6 (11.1)	9 (16.7)	0 (0)
Breastfeeding History	None	0 (0)	17 (31.5)	11 (20.4)	0 (0)
	Less than 12 Months	0 (0)	5 (9.3)	8 (14.8)	0 (0)
	12 – 24 Months	0 (0)	4 (7.4)	4 (7.4)	0 (0)
	24 – 36 Months	0 (0)	2 (3.7)	3 (5.6)	0 (0)
BMI		0 (0)	27.68 (4.54)	26.27 (5.03)	0 (0)
Usage of Hormonal Replacement Therapy / Birth Control Pills	Never	0 (0)	14 (25.9)	16 (29.6)	0 (0)
	Current Use	0 (0)	2 (3.7)	5 (9.3)	0 (0)
	Former Use	0 (0)	12 (22.2)	5 (9.3)	0 (0)

Table 5: Correlation between breast density with demographic data

	B	S.E.	Significant	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Age	-0.077	0.063	0.223	0.926	0.817	1.048
Number of Parity	-0.057	0.223	0.798	0.945	0.610	1.463
Breastfeeding History	0.417	0.363	0.251	1.518	0.745	3.093
BMI	-0.088	0.067	0.193	0.916	0.803	1.045
Usage of Hormonal Replacement Therapy / Birth Control Pills	-0.625	0.351	0.075	0.535	0.269	1.065
Constant	6.123	3.766	0.104	456.231		

Table 5 shows for each one-unit increase in age, the odds of having lower breast density increase by a factor of 0.926 (or 7.4% decrease). However, this effect is not statistically significant. There is no clear evidence of a relationship between the number of children a woman has given birth to and her breast density. The odds of having higher breast density for women with a history of breastfeeding are 1.518 times higher than for women without a breastfeeding history. However, this effect is also not statistically significant. With every one-unit increase in the BMI, the odds of having higher breast density decrease by a factor of 0.916 (or 8.4% decrease). However, this effect is not statistically significant. There is weak evidence (p = 0.075) suggesting a possible association between the Usage of Hormonal Replacement Therapy / Birth Control Pills and breast density. Women who use hormonal replacement therapy or birth control pills have 0.535 times lower odds of having higher breast density compared to those who do not use them. However, this effect is also not statistically significant. Overall, based on the provided results, none of the variables show a significant association with breast density.

Discussion:

Mammographic density has been reported as one of the strongest risk factors for breast carcinoma (McCormack & Dos Santos Silva, 2006; Olsen et al., 2009). Our study showed that the distribution of breast density was relatively evenly split between breast density category B and C, 51.9% (n=28) versus 48.1% (n=26) respectively. This is relatively similar with a local study conducted by Hanis et al. (2022) who found 54.3 % of their cohort fell into non-dense categories (A &B) and 37% fell into dense categories (C & D). A comparison with the study conducted in the United States (Checka et al., 2012) showed that breast density category C was most frequently recorded (46%), followed by category B (37%), category D (9%), and category A (8%). It can also be observed that most of the subjects who fell into category A and D were older than 60 years old and younger than 40 years old respectively. In our study, due to the small cohort there was no subject in category A & D density. This is because our study was only conducted among working personnel of a relatively new medical centre and university in which the age range of our subjects was small ranging only from 40 to 66 years old.

Our study revealed that for each one-unit increase in age, the odds of having higher breast density is also decreased, however it is statistically not significant (p = 0.223). This is in contrast with multiple previous studies which have found a statistically significant trend of inverse relationship between age and mammographic density (Azam et al., 2019; Duffy et al., 2018; Hanis et al., 2022; Shang et al., 2021; Zulfiqar et al., 2011). Mammographic density decreased as the women aged, particularly around the menopausal age (Vourtsis & Berg, 2019). Again, this result may be likely due to small study cohort.

Regarding the number of parities, majority of the subjects in our study were parous (68.5%), similar to previous study conducted by Heng et al. (2004) where 78% of the subjects were parous with the average number of deliveries was 2.9. However, our study showed no clear evidence of a relationship between the parity and breast density. This contradicts with several previous studies which have actually proved inverse association between parity and breast density (Hanis et al., 2022; Heng et al., 2004; Sung et al., 2018; Yaghjyan et al., 2012).

In our study, the odds of having higher breast density for women with a history of breastfeeding are 1.518 times higher than for women without a breastfeeding history. However, this effect is also not statistically significant. Several studies found a similar finding whereby there is no association between breastfeeding duration and breast density (McCormack et al., 2008; Tseng et al., 2007). Other authors, however, report detecting positive association between duration of lactation and breast density (Azam et al., 2019; Santamarin et al., 2012).

The mean BMI of our study cohort is 27.0, with a standard deviation of 4.79 which is considered overweight according to the World Health Organization (WHO) BMI reference. Similarly, the mean BMI of previous studies conducted by Yaghjyan et al. (2012) and Hanis et al. (2022) were also fall into overweight range. Past studies have consistently shown that BMI is inversely associated with breast density (Azam et al., 2019; El-Bastawissi et al., 2000; Hanis et al., 2022; Shang et al., 2021; Shamsi et a., 2021; Yaghjyan et al., 2012). In our study, we found that for every one-unit increase in BMI, the odds of having higher breast density decrease by a factor of 0.916 (or 8.4% decrease). However, this effect is not statistically significant.

Previous studies have shown a positive association between hormonal replacement therapy / birth control pills usage and breast density (Azam et al., 2019; Greendale et al., 2003; Rutter et al., 2001). HRT users were more likely to maintain or have increase breast density (Rutter et al., 2001). Unlike these investigations, we did not observe an association of hormonal replacement therapy/ birth control pills usage with breast density. However, the prevalence of HRT/ birth control pills in our study was low, reducing our power to detect an association.

Conclusion:

Our study showed that the distribution of breast density was relatively evenly split between dense and non-dense breasts. Even though the not statistically significant result is likely due to small sample cohort, some factors such as age, BMI and breast-feeding history have shown some association with breast density as reported in other series. These findings can contribute to existing knowledge on breast related diseases and may aid in the development of tailored screening and prevention strategies. Further research with larger sample sizes and more diverse populations is warranted to validate the results and explore additional factors such as menopausal status, physical activity and dietary lifestyle which may influence mammographic density.

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