

# BREAST DENSITY AMONG THE THREE MAJOR ETHNIC GROUPS OF WOMEN IN MALAYSIA FROM A FULL-FIELD DIGITAL MAMMOGRAPHY SYSTEM

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## ABSTRACT

*We carried out a prospective study of breast density Full-Field Digital mammograms performed on 668 Malaysian women from three ethnic groups at a voluntary screening mammographic centre in Kuala Lumpur, Malaysia. Of these women, 259 were Malays (38.8%), 298 were Chinese (44.6%) and 111 were Indians (16.6%). The Tabár breast density classification (I - V) was used to evaluate breast density. A Stepwise multiple regression analysis was used to test for significant difference in breast density for the three ethnic groups. Data was also analyzed using descriptive statistics. We found that Pattern I was seen in 49.4% Malay, 47.3% Chinese and 40.5% Indian women. Predominantly fatty breasts (Patterns II and III) were seen on the mammograms of 36.3% Malay, 11.1% Chinese and 25.2% Indian women. Dense type IV and V patterns were seen in 20.8% Malay, 29.5% Chinese and 42% Indian women. There was no statistically significant difference ( $p>0.01$ ) in breast density in the three ethnic groups. The breast density reduces with increasing age in all three ethnic groups.*

## ABSTRAK

*Satu kajian mengenai ketumpatan payudara secara prospektif telah dijalankan terhadap 668 mammogram dari system digital mamografi berbidang penuh untuk wanita dari tiga kumpulan etnik utama, di sebuah pusat saringan mamografi sukarela di Kuala Lumpur, Malaysia. Dari jumlah itu, 259 adalah Melayu (38.8%), 298 adalah China (44.6%) dan 111 adalah India (16.6%). Klasifikasi ketumpatan payudara Tabár (I - V) telah diguna untuk menilai ketumpatan payudara. Analisis regrasi telah diguna untuk menguji perbezaan signifikansi ketumpatan payudara untuk ketiga-tiga kumpulan etnik. Data juga telah dianalisa menggunakan statistik deskriptik. Kami dapati Corak I dilihat untuk 49.4% wanita Melayu, 47.3% China dan 40.5% India. Payudara yang rata-rata mengandungi lemak (Corak II dan III) telah dilihat untuk 36.3% wanita Melayu, 11.1% China dan 25.2% India. Manakala payudara yang padat (Corak IV dan V) telah dilihat untuk 20.8% Melayu, 29.5% China dan 42% India. Tidak terdapat perbezaan signifikansi ( $p>0.01$ ) ketumpatan payudara untuk ketiga-tiga kumpulan etnik. Ketumpatan payudara berkurangan dengan peningkatan umur untuk ketiga-tiga kumpulan etnik.*

**Keywords:** Breast density, Ethnic Groups, Digital Mammography

## INTRODUCTION

Increased breast density is a recognized risk factor for breast cancer (Byrne *et al.*, 1995 and Warner *et al.*, 1991). Different classification schemes of breast density have been used clinically. The first was introduced by Wolfe, based on qualitative and quantitative criteria of breast parenchyma to describe four different patterns (Wolfe 1976). Wolfe believes that the amount and volume of connective and epithelial elements within the breast can be related to breast cancer risk and that this is especially valid in women before the age of 60 years (Wolfe *et al.* 1983). Boyd *et al.* (1995) proposed a semi-quantitative score of six categories as an attempt to increase reproducibility of the classification system.

Tabár & Dean (1982) found Wolfe's classification (Wolfe 1976) of little practical value. In 1997, Tabár (Gram *et al.* 1997 and Tot *et al.* 2000) proposed a modification of Wolfe's classification, with five patterns based on histologic-mammographic correlations. Another classification was developed by the American College of Radiology (ACR) under the Breast Imaging Reporting and Data System (BI-RADS), to standardize mammography reports, reduce confusion in the interpretation of breast images, and facilitate the monitoring of results. The ACR's first edition of BI-RADS describes four categories of density patterns (ACR 1993). A later 2003 edition categorized breast density based on quantitative criteria as quartiles of density percentages (ACR 2003).

Ethnic differences in breast density are recognized. Asian women are reported to be more likely to have dense breasts compared to white women (El-Bastawissi *et al.* 1001), even after adjustments are made for Body Mass Index (BMI) and age (del Carmen *et al.* 2007). If this observation is true, and with the knowledge that increased breast density is a risk factor for breast cancer, then one would expect a high incidence of breast carcinoma in an Asian country such as Malaysia (Zulfiqar *et al.* 2011). However, this does not appear to be the case as the incidence rate is much higher in Western women compared to Malaysian women of Asian ethnic origin. Malaysian women are of varied Asian ethnicities, and Chinese women in Malaysia have a higher incidence of breast cancer compared to Malay and Indian women (Lehman *et al.* 2005). As such, it would be of interest to compare breast density in these three ethnic groups, to see whether differences in their breast density can partially explain the difference in breast cancer incidence.

The primary objective of this study is to examine and document the differences in breast density, if any, among women from the three major ethnic groups in Malaysia. The secondary objective is to study the effect of age on breast density in these three ethnic groups which comprise Malay, Chinese and Indian women.

## MATERIAS AND METHODS

### *Subjects*

This project was a prospective study on Full-Field Digital Mammograms (FFDM) performed at a voluntary screening mammographic centre in Kuala Lumpur, Malaysia with the approval of the Centre's administration. As the subjects' identities were not revealed, their informed consent and ethical committee approval were deemed unnecessary.

The study was conducted from April 2012 to August 2013. Screening Full-Field Digital (FFD) mammograms performed on 668 women were reviewed on the Barco 5 megapixel monitor. These women were from the three major ethnic groups in Malaysia, namely Malay, and Indian. Table 1 shows distribution of number of subjects of the study. Women from other ethnic groups and those who have had breast surgery for any reason were excluded.

Table 1. Ethnic distribution of Study Subjects

Ethnic Group	Number of Women (%)	Age (Years)	
		(Min, Max)	Average $\pm$ SD
Malay	259(38.8)	(35,73)	46.9 $\pm$ 5.3
Chinese	298(44.6)	(34,80)	51.9 $\pm$ 8.4
Indian	111(16.6)	(37,55)	46.9 $\pm$ 5.4
Total	668(100.0)	(34,80)	50.6 $\pm$ 8.4

SD: Standard Deviation: *Assessment of Breast Density*

Standard two-view (Cranial-Caudal and Medial-Lateral Oblique) images performed on one FFDM system were reviewed on the monitor. The breast density from these images were evaluated and classified using the Tabár breast density classification by a single experienced radiologist with more than 20 years' experience in breast imaging.

The Tabár scale (Tabar et al. 2005) classifies mammograms into five patterns (I to V) based on histologic–mammographic correlation as follows:

- a) Pattern I is characterized by relatively equal proportions of fibrous tissue, radiolucent adipose tissue, and nodular and linear densities, and is the most common pattern seen in premenopausal women
- b) Patterns II and III are fatty breasts with radiolucent adipose tissue predominantly present, and are most commonly seen in postmenopausal women
- c) Patterns IV and V are dense breasts due to the presence of adenosis and fibrosis respectively.

The women were divided into four age groups to test the influence of age on breast density in the study subjects. These age groups were <40, 41-50, 51-60 and >60 years (Table 2). There were 64 women in the <40 years age group (6.68%), and they were excluded from the analysis because of the small numbers of patterns I, II and III and IV and V in each ethnic group.

Table 2. Age distribution of the study subjects for each ethnic group

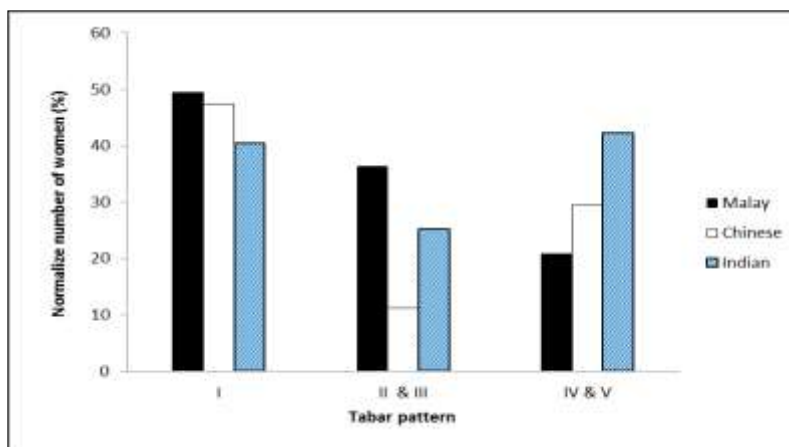
Age range (Years)	No of Women		
	Malay	Chinese	Indian
<40	29	27	8
41-50	116	110	26
51-60	78	112	25
>60	36	49	52
Total	259 (38.8)	298 (44.6)	111 (16.6)

## STATISTICAL ANALYSIS

For statistical analysis, Pattern 1 was considered separately, while patterns II and III were collectively grouped as fatty breasts, and patterns IV and V were grouped together as dense breasts. We used a stepwise multiple regression for an ordered response (breast density) to test for a relationship of ethnicity with breast density. Statistical analysis was performed using the SPSS 17.0 statistical package (Chicago, Illinois, USA). All p values < 0.01 were considered statistically significant. Data were also analyzed using descriptive statistics.

## RESULTS

Our results showed that 49.4% of Malay, 47.3% of Chinese and 40.5% of Indian women in the study subjects had density pattern I on their mammogram images. Patterns II and III (predominantly fatty breasts) were seen in the mammograms of 36.3% Malay, 11.1% Chinese and 25.2% Indian women. Dense patterns IV and V mammograms were seen in 20.8% Malay, 29.5% Chinese and 42% Indian women. Overall, dense breasts were most commonly shown in Indian women. There was however, no significant difference in these normalized percentages (Figure 1). Figure I also shows that overall predominantly fatty breasts (Patterns II & III) were most commonly observed in the mammograms of Malay women, and were less common in the mammograms of Chinese and Indian women.



**Figure 1.** Breast density for each ethnic group with normalized number of women

Table 3 shows the numerical data on breast density according to age for the three ethnic groups. As the numbers were small in the <40 years age group, they were excluded from the histograms in Figure 2. All three ethnic groups showed lower proportions of dense mammograms with increasing age (Fig 2).

Overall, 49.7% of dense breast (Patterns IV and V) were in the 41-50 age group. Fatty breasts are least commonly seen on the mammograms of Chinese women for all age groups, when compared to the other two ethnic groups. In the age groups 41-50 and 51-60 years, fatty breasts were seen most commonly in Malay women. However for women aged >60 years, the proportion of Malay women with predominantly fatty breasts is the same as for Indian women.

There was no statistically significant difference ( $p > 0.01$ ) in breast density in the three ethnic groups based on Paired Stepwise Regression analysis.

Table 3. Breast Density with age

Ethnic Group	Number of Women											
	<40 years			41-50 years			51-60 years			>60 years		
	I	II & III	IV & V	I	II & III	IV & V	I	II & III	IV & V	I	II & III	IV & V
Malay	22	4	10	61	39	29	34	28	11	11	23	4
Chinese	14	2	9	43	6	53	59	10	34	25	15	12
Indian	3	2	3	17	7	17	14	6	13	11	13	14
Total	39	8	22	121	52	99	107	44	58	47	51	20

Pattern I: Normal (approximately equal amounts of fat & glandular tissues); Patterns II and III: Fatty breasts; and Patterns IV and V: Dense breasts

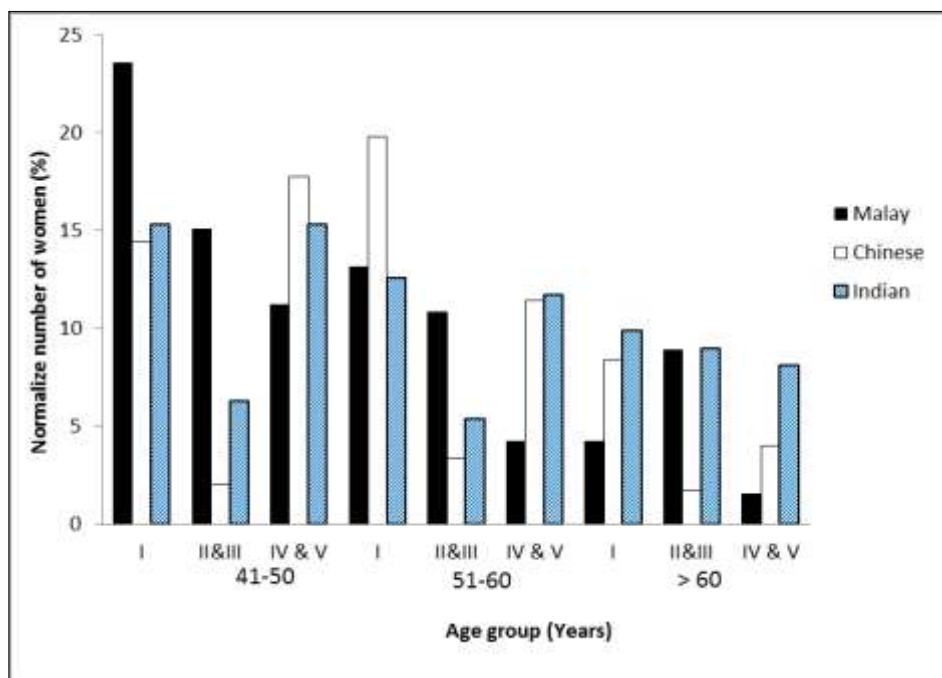


Figure 2. Distribution by age groups of breast density in the three ethnic groups.

## DISCUSSION

Increased breast density is believed to be one of the strongest known risk factors for breast cancer, over and above the known risk factors of age of first birth, age at menopause and family history of breast cancer (Wolfe *et al.* 1983). It has been estimated that women with the highest breast density may have a four- to six-fold increased risk of breast cancer compared to women who have less dense breast tissue Boyd *et al.* (1995). Dense breasts make mammography less sensitive in breast cancer detection, potentially leading to lower rates of detection and higher stage at presentation (Lehman *et al.* 2005).

Malaysia has a multiracial population, comprising three major Asian ethnicities, namely Malay, Chinese and Indians. The Malaysian Yearbook of Statistics reports that Malays make up 62%, Chinese 27% and Indians 9% of the total Malaysian population (YBS 2006). Breast cancer is the most common cancer of

women in all three ethnic groups. Chinese, Indian and Malay women are reported to have age-standardized incidences (ASR) respectively of 59.9, 54.2 and 34.9 per 100,000, with Chinese women consistently showing a higher incidence of breast cancer compared to Indian and Malay women (Lehman *et al.* 2005). It is not known whether there are differences in breast density amongst the three ethnicities that may provide some explanation into the racial differences in breast cancer incidence in our local women. Reports of differences in breast density by ethnicity have implied that genetic and environmental factors may in part determine breast density (Tice 2009).

The mammographic image provides an excellent overview of the relative proportions of the different tissues within the compressed breast. But it has limited resolution as it is a summation image of all the thousands of terminal ductal lobular units (TDLU) and their supporting connective tissue. The mammographic-histologic qualitative basis of the Tabár density classification allows the radiologist to appreciate and better understand the mammogram appearance based on the relative proportions of four building blocks. These four building blocks are nodular densities of the TDLUs, linear densities of fibrous strands, blood vessels and milk ducts, and homogenous densities of fibrous tissue and radiolucent adipose tissue (Tot *et al.* 2000). This was the reason that Tabar's classification of breast density on mammogram was used to classify breast density in this study.

### ***Breast Density Amongst Ethnic Groups***

We found that the majority (47.9%) of the mammograms on our study subjects showed Pattern I, seen predominantly in the age groups below 60 years. This agrees with the reported finding that it is the most common pattern amongst pre-menopausal women (Tabar *et al.* 2005). Patterns II and III, considered to reflect the fatty involution occurring with age in pattern I breasts (Tabár & Dean (1982) were found in 23.5% of the study subjects. These two patterns are not associated with increased risk of developing breast cancer, and facilitate the mammographic detection of cancers.

In this study, fatty breasts were most commonly seen amongst Malay women, and least commonly in Chinese women. The dense Patterns IV and V were seen in 30.5% of our study subjects, with Indian women showing the highest proportion (42%) of dense breasts. This latter finding was unexpected, but may partly explain the higher breast cancer incidence in the Indian ethnic group compared to the Malays. However the number of Indian women in the study, at 111, was the smallest of the three ethnic groups.

### ***Age and breast density***

The likelihood of seeing mammographically dense breasts decreases with age. Screening mammograms taken at regular intervals have documented the transition from predominantly fibro-glandular tissue seen in Tabár's Pattern I in pre-menopausal women to predominantly fat (Patterns II and III) in older women (Gram *et al.* 1997 and Tot *et al.* 2000). In this study, this pattern change with age is most evident amongst Malay women compared to the other two ethnic groups. Table 3 and Fig 2 show that there is a decline in the numbers and proportions of women with mammographic pattern I with increasing age.

The majority of women (almost 50%) with Patterns IV and V in our study were in the 41-50 years age group. As expected, these dense patterns became least common in women over the age of 60. In this latter group of older women, the highest proportion of dense patterns were most commonly seen in the Indian ethnic group, and least commonly seen in Malay women.

### ***Breast Density and Cancer in Malaysian Women***

Female breast cancer incidence in Malaysia is highest in the Chinese, followed by the Indian and Malay ethnicities. Breast cancer accounts for 33.6%, 30.3% and 31.2% of all cancers in Malay, Chinese and Indian women respectively. Chinese women in Malaysia are estimated to have a one in 14 chance of developing breast cancer, compared to the Indian woman with a one in 15, and Malay women with a one in 24 chance of developing the malignancy (MOH 2008).

Wolfe *et al.* (1983) and Tabar & Dean (1982) found that breast cancer risk is lowest in fatty breasts, categorized as N1 in Wolfe's classification, and Patterns II and III in Tabar's classification. This preliminary report shows that Malay women had the highest overall proportion of fatty breasts. This appears to concur with the reported finding ((MOH 2008) that the lowest breast cancer incidence in Malaysian women is in the Malay ethnic group. Chinese women show the highest incidence of breast cancer amongst the three ethnicities and they showed the least proportion of fatty breasts for all age groups in this study.

The highest proportion of dense breasts was unexpectedly shown to occur in the Indian ethnic group. Breast cancer incidence in Indian women in Malaysia is intermediate between Chinese and Malay women. It is also interesting to note that despite the racial differences in breast density and breast cancer incidence, there is also racial discrepancy in the 5-year survival rates in the three major ethnic groups, recorded at 46%, 57% and 63% in breast cancer patients of Malay, Indian and Chinese women respectively (Taib *et al.* 2007). Clearly, Malay women with breast cancer have the worst survival prognosis. This probably does not have any relationship to breast density pattern, being perhaps more connected to cultural differences in the acceptance of mammographic screening and modern treatment of breast cancer.

### ***Implications of Study Findings***

The findings may have an implication in the planning of breast cancer screening services in the country. In predominantly Malay areas, mammography screening may suffice, while in predominantly Chinese and Indian areas, supplementary breast ultrasound or breast tomosynthesis may need to be provided to overcome the mammographic difficulties of detecting cancers in dense breasts.

### ***Limitations of the Study***

This preliminary report is based on the findings in 668 women, and we await the analysis on a larger group at the end of this on-going project targeting 3000 women. Indian women make up the smallest number of subjects in this study. This may be unavoidable, as the Indian ethnicity makes up only 9% of the Malaysian population compared to the larger percentages of Chinese and Malays (YBS 2006).

## **CONCLUSION**

We found that Pattern I was seen in 49.4% Malay, 47.3% Chinese and 40.5% Indian women. Predominantly fatty breasts (Patterns II and III) were seen on the mammograms of 36.3% Malay, 11.1% Chinese and 25.2% Indian women. Dense type IV and V patterns were seen in 20.8% Malay, 29.5% Chinese and 42% Indian women. There was no statistically significant difference ( $p > 0.01$ ) in breast density in the three ethnic groups. The breast density reduces with increasing age in all three ethnic groups.

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