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Mammographic Breast Pattern in Postmenopausal Women in Ibadan, South-Western Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Authors MOO and OIO conceived and design the study. Authors OSB and ATAS did the literature search and wrote the first draft. Authors AOO and AOA did the statistical analysis. Authors OAM and TSA read and corrected the initial draft. Authors TOS, OOO and GOO read and corrected the final draft.

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ABSTRACT

Introduction: Mammographic density is a strong predictor of breast cancer. Menopause has a significant effect on breast pattern and has been documented to have more important influence on the decline in mammographic densities than age. The aim of this study was to describe the breast parenchymal density patterns in postmenopausal women in Ibadan and correlate these with their socio-demographic and anthropometric characteristics.
Methodology: This is a retrospective cross-sectional study of 196 postmenopausal women who had two screening views done on each breast in the Radiology Department of the University

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College Hospital Ibadan. Data was pulled from completed questionnaire by patient who had mammogram during the period under review. The report of the mammograms were matched with patients' socio-demographic characteristics and entered into R statistical package for analysis.

Results: The mean age of the women was 55.0±6.8 years while their mean age at menopause was 48.4±4.6 years. The combined BI-RADS 1 and 2 breast parenchymal patterns which are associated with low risk of breast cancer, were found in 82.1% of the women. The mean difference in age at first birth between women with BI-RADS 1 and 2 and BI-RADS 3 and 4 was statistically significant P=0.035. Body mass index, family and personal history of breast cancer also showed correlation with breast parenchymal pattern, though not statistically significant.

Conclusion: The low prevalence of dense breast pattern in this study is consistent with previous findings of relatively lower prevalence of breast cancer in African women. The clustering of low mean age at birth of first child, low mean age at menopause and multi-parity, in association with the low mammographic density in majority of the women in this study further corroborates the relatively reduced risk of breast cancer in our studied population.

Keywords: Breast; menopause; mammogram; Bi-rads; density.

1. INTRODUCTION

Menopause is the permanent cessation of menstruation in women [1]. It usually occurs in middle age and is heralded by changes in the vascular, urogenital, skeletal, skin and soft tissue including the breast. Changes in psychological and sexual activities of women are also well known [2]. Menopause has a significant effect on breast pattern and is documented to have more important influence on the decline in mammographic densities than age [3]. Apart from menopause and age, the mammographic breast pattern is also affected by other factors such as, genetics, race or ethnic group, parity and the use of hormones [4,5]. Menopause may be natural, medically or surgically induced. Irrespective of the cause, the overall effect of menopause in the various body systems remains the same, though the extent varies with individuals and race [6].

Mammographic pattern reflects the tissue composition of the breast [7,8]. Radiologically, dense tissue in the breast indicates stroma and epithelium, whereas lucent tissue indicates fat [9]. Changes in the tissue composition of the breast occur with increasing age, with the amounts of stroma and epithelium decreasing and the amount of fat increasing [3]. These changes results in an overall decrease in the mammographic densities with increasing age [10]. Studies in the developed world have shown sharp reduction in the relative densities of the mammographic pattern in middle aged women which also coincides with the age at menopause [11]. In the Canadian National Breast Screening Survey [NBSS], the percentage breast densities and mammographic pattern according to age showed a 20% difference in the glandularity of the breast in women between the ages of 40 to 44 years and 55 to 59 years [1].

In Nigeria, where postmenopausal hormonal therapy is rarely used, it is expected that mammographic patterns in postmenopausal women will be a true reflection of density changes in women in Nigeria, taking into consideration the effect of other confounding variables which include body mass index, parity, age at menarche and age at first birth [12,13]. In the first study of its kind in Nigeria, we describe the mammographic breast density patterns correlated with socio-demographic, anthropometric and reproductive factors in postmenopausal women in South-West Nigeria.

2. MATERIALS AND METHODS

A retrospective cross-sectional study of mammographic evaluation of postmenopausal women who presented for mammography over a 23 month period, January 2009 to December 2010 was carried out in the Department of Radiology, University College Hospital (UCH), Ibadan, South-West Nigeria. The study was approved by the UI/UCH Institutional Review Board. A convenient [non random] sample size of one hundred and ninety six was obtained. Data was obtained from study questionnaire completed by each participant during mammographic screening. This provided data on their socio-demographic characteristics, obstetrics and gynecologic history and other selected risk factors for breast cancer.

The film- screen system was used with the Senographe DMR$^+$ Mammographic Unit to acquire two basic views, the cranio-caudal and the medio- lateral oblique of both breasts.

The mammographic breast pattern was categorized by the interpreting radiologists MO and AAS using the ACR- BIRADS lexicon which were converted to alphabetical values as follows: BIRADS 1: Entirely fatty(less than 25% fibroglandular tissue, Fig. 1), BIRADS 2- Scattered fibroglandular (25-50% fibroglandular tissue, Fig. 2), BIRADS 3- Heterogeneous fibroglandular (50-75% fibroglandular tissue, Fig. 3), BIRADS 4- Extremely dense (> 75% fibroglandular tissue, Fig. 4) [14]. The mammographic results were matched with patients' data and entered into R statistical package (www.r- projec.org) for analysis. The distribution of age, age at first birth, age at menopause and BMI were compared with the BI-RADS breast pattern groups as well as the final BI-RADS groups. Chi-square statistical test was then applied to assess the difference in proportion between these groups and the categorical variables. The p-value was set at 0.05. The final BI-RADS category groups were also stratified against the BI-RADS breast parenchymal pattern groups.

Fig. 2. A mediolateral oblique view of the left breast showing the scattered fibroglandular breast pattern, Bi-RADS category 2

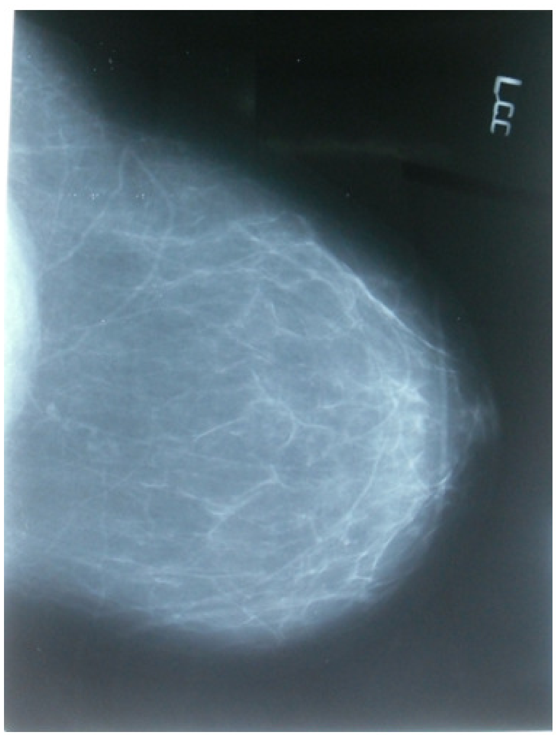

Fig. 1. A craniocaudal view of the left breast showing the homogenous fatty replaced breast pattern, Bi-RADS category 1

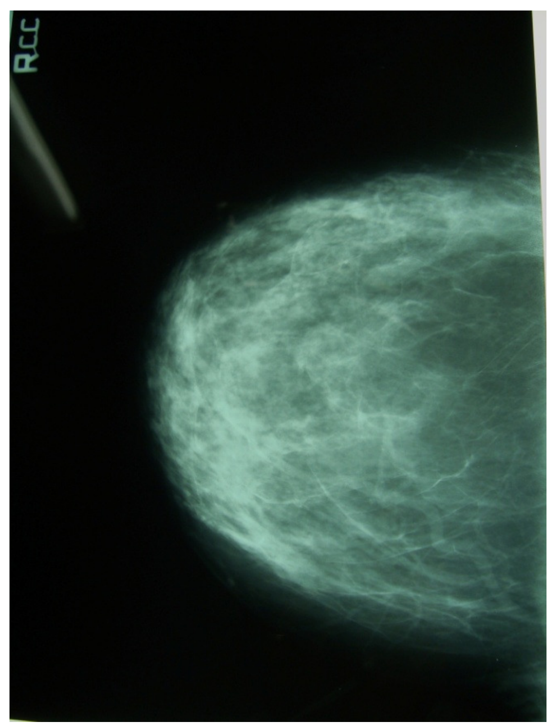

Fig. 3. A craniocaudal view of the right breast showing the heterogeneously dense breast pattern, Bi-RADS category 3

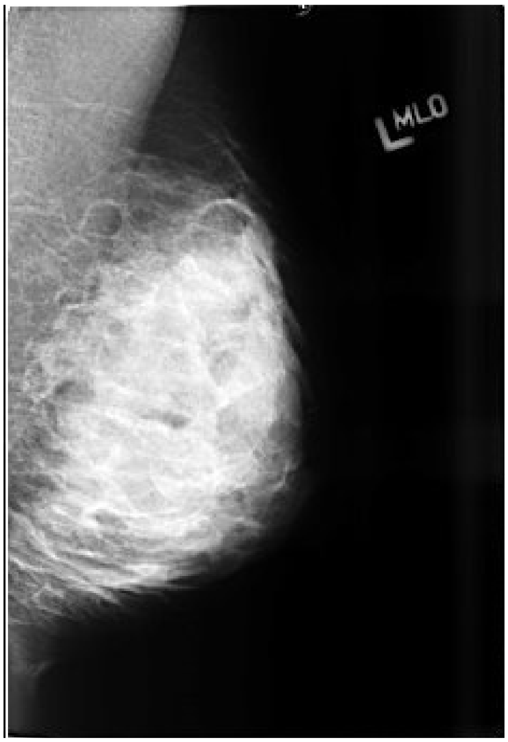

Fig. 4. A mediolateral obligue view of the left breast showing the homogenously dense pattern, Bi-RADS category 4

3. RESULTS

One hundred and ninety six women were studied between January 2009 and December 2010 at the University College Hospital, Ibadan. The mean age of the women studied was 55.0±6.8 years, while their median age was 54.0 years. Their age range was between 38 and 76 years (Table 1). Most of the women (81.6%) were 50 years and above, with only 18.4% below 50 years of age. Fatty replaced breast pattern (BI-RADS 1) was predominant (46.4%), followed by the scattered fibroglandular pattern BI-RADS 2 (35.7%). The heterogeneously dense breast pattern BI-RADS 3 was found in 16.3% and the extremely dense pattern BI-RADS 4 was the least 1.5%. There was no correlation between age and breast density pattern, p=0.66. The predominant breast parenchymal pattern in postmenopausal women below 50 years and those 50 years and above, was BI-RADS 1 and 2, 83.3%% and 81.9%% respectively. BI-RADS 3 and 4 were seen in 16.7% of women below 50 years and 18.1% of those 50 years and above. Extremely dense breast pattern was however found in approximately 2% of women 50 years and above. Fig. 5, shows the variation of breast pattern with age among the postmenopausal women.

The mean age at menopause for all women was 48.4±4.6 years, while the mean age for women with BI-RADS 1&2 and 3&4 breast parenchymal pattern were 48.3+4.7 and 48.9+4.3 respectively. This difference was not statistically significant. Most of the women (95.4%) were parous while only 4.6% were nulliparous. Majority of the parous women (81.1%) had their first child before the age of 30 years. The mean age of the women at birth of their first child was 26.1±5.5 years with a range of 16 to 50 years. Women with BI-RADS 1 and 2 tend to have their first child below the mean age of 26 years. There was statistically significant difference between the breast pattern of women who had their first child below and those with first birth above the mean age of 26 years, P=0.035 (Table 1).

Body mass index was estimated in 162 of the women, out of which 84.6% were either overweight or obese while 15.4% were underweight or with normal weight. There was no statistically significant association between BMI of the respondents and their mammographic breast pattern, P= 0.29 (Table 1). The box plot (Fig. 6), shows the graphic presentation of BMI in the two groups.

A greater percentage, 35.7% (5/14) of the women with family history of breast cancer had the BIRADS 3 and 4 breast pattern when compared to 16.7% of women without positive family history of breast cancer, but this relationship was not statistically significant(p=0.15) (Table 1). Women with personal history of breast cancer also showed a higher percentage (22.2%) of BI-RADS 3 & 4 breast pattern compared to 17.9% in those without personal history of breast cancer. This also was not statistically significant P=0.09 (Table 1).

Final BI-RADS 1 (Normal) and 2 (Benign) categories were the predominant (65.8%) categories found in this study (Fig. 7). Table 2 shows the association of the breast parenchymal pattern with final BI-RADS categories. There were no statistically significant associations between the final BI-RADS categories (1-6) and the mammographic breast patterns. BIRADS 1 and 2 breast patterns remained predominant in all the groups.

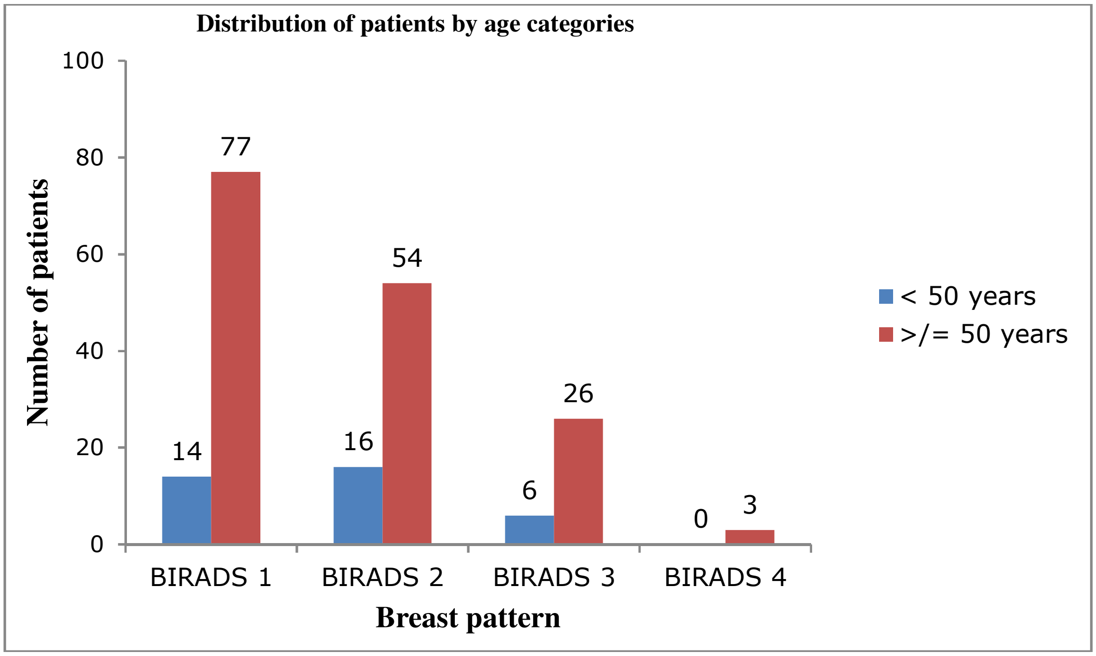

Fig. 5. Distribution of breast parenchymal pattern by age in postmenopausal women in Ibadan
Key: BIRADS 1- Fatty replaced; BIRADS 2- Scattered fibroglandular; BIRADS 3- Heterogeneous; BIRADS 4 - Extremely dense

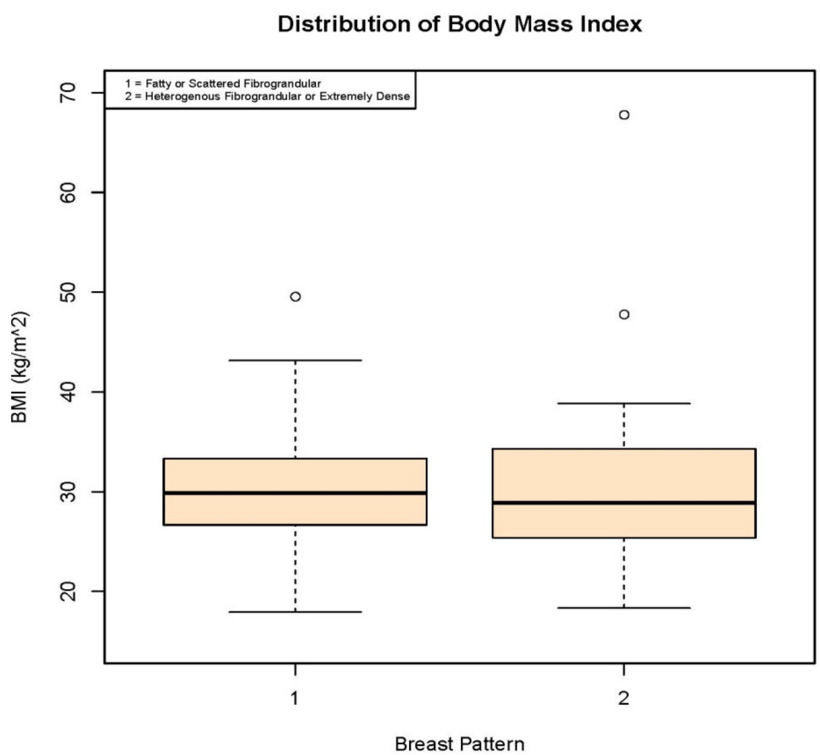

Fig. 6. Distribution of Body Mass Index [BMI] with breast pattern in the women
Key: 1 - BI-RADS 1 & 2; 2 - BI-RADS 3 & 4

Table 1. Association between mammographic breast density pattern (in BI-RADS categories) and selected socio-demographic and clinical variables

Variables	Breast pattern		Total	Chi-square value	P-value
	1 and 2	3 and 4			
N*	**161**	**35**	**196**		
Age N (%)					
< 50 years	30 (18.6%)	6 (17.1%)	36 (18.4%)		
≥ 50 years	131 (81.4%)	29 (82.9%)	160 (81.6%)	0.001	0.97
Age at menopause N (%)					
≤ 48.44	80 (49.7%)	15 (42.9%)	95 (48.5%)		
> 48.44	79 (49.3%)	20 (57.1%)	99 (50.5%)		
Missing	2 (1.0%)	0 (0%)	2 (1.0%)	0.375	0.54
Age at 1st child birth					
Mean ± SD	25.74±5.5	27.84±4.9	26.12±5.5		
[min, max]	[16, 50]	[21, 44]	[16,50]	-2.16	0.035
Age at first child birth N (%)					
≤ 30 years	133 (82.6%)	26 (74.3%)	159 (81.1)		
> 30 years	19 (11.8%)	6 (17.1%)	25 (12.8)		
Missing	9 (5.6%)	3 (8.6%)	12 (6.1%)	0.428	0.513
Parity					
Para 0 or 1	7 (4.3%)	2 (5.7%)	9 (4.6%)		
Para 2 or>	154 (95.7%)	33 (94.3%)	187 (95.4%)	0.009	0.924
BMI (kg/m^2)*					
< 24.9	18 (11.2%)	7 (23.3%)	25 (15.4%)		
≥ 25	114 (70.8%)	23 (76.7%)	137 (84.6%)	1.097	0.295
Family Hx. of breast Ca					
No	150 (93.2%)	30 (85.7%)	180 (91.8%)		
Yes	9 (5.6%)	5 (14.3%)	14 (7.2%)		
Missing	2 (1.0%)	0	2 (1.0%)	2.029	0.1543
Previous Hx of breast Ca					
No	151 (93.8%)	33 (94.3%)	184 (93.9%)		
Yes	7 (4.3%)	2 (5.7%)	9 (4.6%)		
Missing	3 (1.5%)	0	3 (1.5%)	0.014	0.9068

*N – Frequency, *34 values were missing in the calculation of BMI, Hx – history, Ca – Cancer*

Table 2. Association between BI-RADS breast parenchymal pattern and final BI-RADS category

Final BI-RADS	BI-RADS breast pattren		Total	P-value
	1 & 2	3 & 4		
0	17 (8.7%)	2 (1.0%)	19 (9.7%)	
1-2	109 (55.6%)	20 (10.2%)	129 (65.8%)	
3-4	28 (14.3%)	11 (5.6%)	39 (19.9%)	0.25
5-6	4 (2.0%)	1 (0.5%)	5 (2.5%)	
Missing	3 (1.5%)	1 (0.5%)	4 (2.0%)	

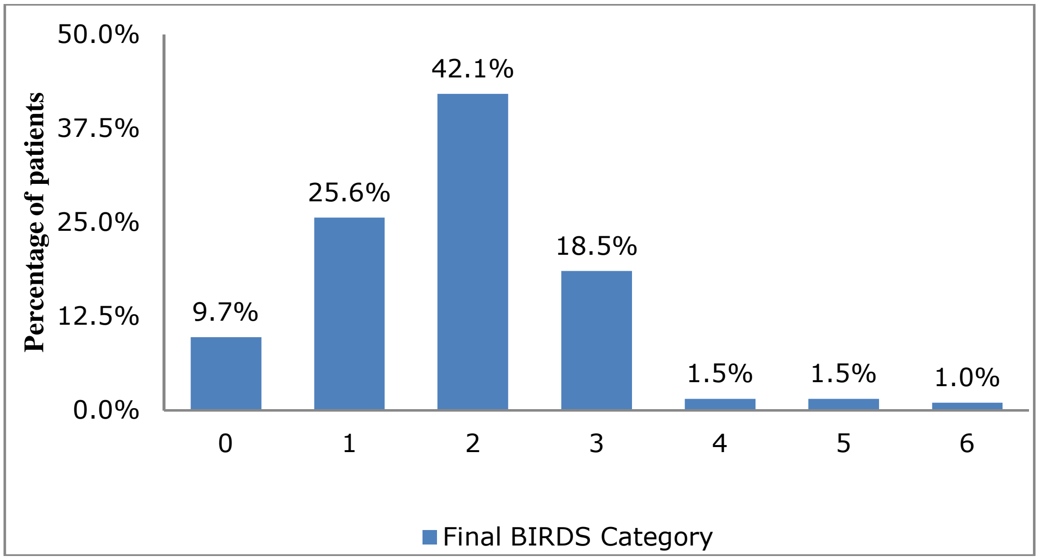

Fig. 7. Distribution of final BI-RADS categories in the study population

Key 0 = Incomplete; 1= Normal; 2= Benign; 3= Probably Benign; 4= Suspicious finding 5= Suggestive of Malignancy; 6= Biopsy cancer

4. DISCUSSION

Mammographic breast pattern is well documented by different authors as an independent risk factor for breast cancer [15,16]. Breast parenchymal pattern on a mammogram is modulated by several factors including non-hereditary and hereditary factors. The non-hereditary factors include demographic, anthropometric, age at menopause, and other gynecological history. These factors individually and in concert affect the mammographic breast density thereby influencing breast cancer risk1. The relatively low prevalence of the extremely dense breast pattern in this study is consistent with previous reports of relatively lower risk of breast cancer in African postmenopausal women [17].

A high prevalence (82%) of BI-RADS 1 and 2 breast density pattern, which is associated with lower risk of breast cancer, is reported in this study. This finding is in consonance with the finding of a related study from the same centre by Obajimi et al. [18] in South West, Nigeria. According to Obajimi et al. [18], whose study was not limited to post-menopausal women, 80% of the women in the menopausal age group had BI-RADS 1 and 2 breast density pattern. Several studies [19,20] abound on racial differences and variations in mammographic densities. Del Carmen et al. [19] had earlier supported that black women have the lowest mean breast density 2.43, followed by Latina patients with 2.65, compared with 2.69 among Caucasian women even after adjusting for age, mammography reader and body mass index. They reported an independent racial effect on breast density. This however contradicts previous reports that compared mammographic density in African-American and White women and found that, in women 65 years of age or younger, African Americans were more likely than Whites to have mammograms that were “dense” (BI-RADS scores of 3 and 4) versus “fatty” (BI-RADS scores of 1 and 2).20 In the study by Chen et al. [21], African Americans had a similar percent mammographic density as Whites in both age groups below and above 65 years.

Only 18% of the women in our study population had the dense breast pattern (BI-RADS 3 and 4), This is lower than the prevalence in the Caucasian women of the same age group in a study by Stomper et al. [22] where 33% had BI-RADS 3 and 4 breast pattern and may explain why African postmenopausal women have a lower risk of breast cancer compared to their Caucasian counterparts.

Age is an important determinant of breast parenchymal density as well as breast cancer risk[1]. Even though there was no significant correlation between breast pattern and age in this study, the decline in the prevalence of

Mammographically dense breast in the population with age is presumably based among other things on the concept of breast tissue aging [1,23]. This concept is closely associated with exposure (and duration), of breast tissues to hormones (endogenous and exogenous hormones), and the effect of hormones on the kinetics of breast cells, rather than just the chronological age alone [1,23].

In this study, the mean age at menopause of 48.4±4.6 years is similar to the mean age at menopause of 48.0±5.9 years in 1189 Nigerian women, in a study by Olaolorun et al. [24] from the same region of Nigeria and also similar to that found among African-American women in the diasporas (49 years) [6]. Age at menopause however showed no significant correlation on breast pattern of the women in this study. Conversely, the mean age at menopause of Caucasian women is reported to be 51 years [5], which is significantly higher than in Africans and in African-American women. It is highly probable that the higher percentage of BI-RADS 1 and 2 in this study population can be partly attributable to the earlier mean age at menopause of the studied population since menopause is documented to have more effect on mammographic pattern than age [1].

Breast development is a continuous process which is cyclical during child bearing age and punctuates at menopause. This process is altered by pregnancy, parturition and breast feeding with corresponding effect on the breast density pattern [4,25]. In this study, there was a statistically significant difference in mammographic densities between women with mean age at first birth less than 26 years compared to those with mean age at first child birth greater than 26 years. The mean age at first birth in the study population is comparably lower than studies in Caucasian women where most women deliver their first child after the age of 30 years [4]. Several studies [4,25] have documented positive correlation between age at the birth of first child and mammographic breast pattern. Caucasian women who had their first child before the age of 30 years in these studies [4,25] were reported to have lower mammographic breast density pattern with corresponding low incidence of breast cancer. The observed pattern in our study is also in agreement with the relatively lower incidence of breast cancer in our population.

Multiparity is known also to correlate positively with low breast density pattern [25]. Majority of the women in this study (95.4%) are parous and have predominantly the BI-RADS 1 and 2 breast pattern. However no significant association of parity with breast density pattern was found, unlike the study on mammographic breast pattern in Nigerian women by Obajimi et al. [18] involving a 498 women, where nulliparity showed significant positive correlation with breast density pattern. The statistical difference obtained in the later study may be partly attributable to the broader age categories, hence the varied parity as well as the much larger sample size of the women studied. Multiparity, together with other socio-demographic features has contributed to the greater percentage of BI-RADS 1 and 2 seen in this study group.

Obesity has also been identified as an independent risk factor for breast cancer in the literature [26,27]. Most (84.6%) of the women in this study were either overweight or obese with a mean BMI of 30.0 kg/m^2. The mean BMI in women with BIRADS 1 and 2 (30.2 kg/m^2) was higher than that of women with BIRADS 3 and 4 (29.3 kg/m^2). This finding though not statistically significant (P=0.48) appears to be at variance with some earlier reports that obesity is a risk factor for breast cancer. However our finding of a greater percentage of women with BI-RADS 1 and 2 (58.2%) showing BMI ≥25 kg/m^2 compared to BI-RADS 3 and 4 (11.7%) is in agreement with most other published studies in developed countries, where BMI is documented to have inverse relationship with breast density pattern [19]. This finding is also consistent with findings in women of African descent in the Diaspora [19,26].

Women with family (14.2%) and personal (7.6%) history of breast cancer in this study showed positive correlation with breast pattern though not statistically significant, P=0.15 and 0.9 respectively. Studies in Caucasians have shown that family history of breast cancer is a stronger risk factor than personal history of the disease [26,27], emphasizing the importance of family history of breast cancer in mammographic screening data. Ding et al. [27] reported studies of a large population of mono and dizygotic twins showing a detailed relationship with genetic factors accounting for up to 60% of breast cancer risk. This study similar to previous studies [28,29] shows that the extremely dense breast pattern predominates in women with family history of breast cancer.

The limitation experienced in this study included lack of a digital radiography with or without computer aided detection to reduce the subjectivity in radiologists' report of mammographic densities; another limitation is the small sample size of this study which may not be a true reflection of the study population. There was no data on confounding factors such as contraceptive history and postmenopausal hormone use; as such these could not be adjusted for in the analysis. As a follow-up to this study we intend to investigate the correlation between mammographic density and levels of sex hormones in Nigerian women.

5. CONCLUSION

The low prevalence of dense mammographic breast pattern in those studied is consistent with previous reports of lower prevalence of dense breast pattern and breast cancer among African postmenopausal women. This study has shown that multiparity, early age at menopause and birth of first child are associated with low breast density pattern which are prevalent in our studied population. These factors individually or in concert may be responsible for the low breast cancer prevalence in postmenopausal women of African descent. Future study with a larger sample size is suggested to further clarify the statistical significance of these associations.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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