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Sonographic Breast Parenchymal Pattern among 500 Nigerian Women in Sokoto, North Western Nigeria

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Abstract

Background: Sonographic breast density refers to the relative component of fibro-glandular tissue and fatty tissue in the breast as demonstrated following ultrasonography. Breast composition changes with age, hormonal status, pregnancy, lactation, and menopause. Breast ultrasound is particularly useful when mammographic density is high.

Aim and Objective: This study is aimed at assessing the pattern of breast parenchyma following routine ultrasonography among 500 Nigerian women in Sokoto, North Western, Nigeria.

Materials and Method: From January 2016 to January 2026, 500 women had breast ultrasonography in private facilities using ultrasound machines Mindray make DP-2200 and DP-10 respectively. All the patients consented to the examinations, and variables mainly age and sex with observed parenchymal pattern were recorded. Patients breasts were scanned in longitudinal and transverse positions with respect to quadrants and positions respectively.

Result: Breast density changes with age due to hormonal activity, glandular involution and fatty replacement. The most common breast parenchymal pattern was the glandular pattern (category 2) and seen among the 26-35 age group.

Keywords: Sonography, Breast, Age, Density, Fibro-Glandular

Introduction

Breast cancer is the second most common cause of cancer death in women, and its well established that early diagnosis reduces deaths from breast cancer [1-3]. Breast density refers to the actual amounts of fat and glandular tissue in the breast, and ranges from entirely fat to nearly all glandular tissues consequently altering mammographic appearance of the breast [1].

Breast composition radiologically constitutes dense breast tissue which reflects both stroma and epithelium, whereas lucent tissues reflects fat. This composition changes with increasing age resulting in decrease in amount of stroma and epithelium with associated increase in the amount of fatty tissues [4-6].

Breast screening in dense breast needs additional imaging, since the sensitivity of mammography reduces with increase in density, and larger and more often node sensitive cancers are associated with denser breast, the ACR (American College of Radiology) now recommends additional screening with ultrasonography(SBU) for increased cancer detection [1, 7-9].

Breast cancers appear hypoechoic while dense tissues are echogenic on ultrasound, this brings out differences in tissue characteristics to improve cancer detection in women with dense breasts [1].

Radiologically, screening ultrasound (both in handheld or automated form) is effective in demonstrating mammographically occult cancer in women with dense tissue, this increasingly detects clinically important, small, invasive, and node-negative cancers as stated in most studies [1, 10-11].

Some studies [12, 13] have classified parenchymal pattern ultrasonographically in to four categories; these are; a: Heterogeneous category, b: Ductal category, c: Mixed category and d: Fibrous category respectively. Additionally, the Breast Imaging Reporting and Data System lexicon of the American College of Radiology(ACR-BIRADS) guidelines of 2003, has classified breast sonographic breast density in to three patterns; Type 1: homogeneously fatty (predominantly fatty) which is the least dense, Type 2: homogenous fibro-glandular (mixed fatty and glandular), and Type 3: heterogeneous (highly dense) [14, 15].

Genetic and environmental factors are believed to affect breast parenchyma tissue structure and there is an association between

breast parenchyma pattern and the risk for breast cancer in any individual female, and it's possible to predict the cancer risk of a healthy woman by imaging modalities such as ultrasound and mammography [12, 16].

Ultrasound of the breast is less cost effective and more sensitive than mammography in examining women with denser breast which are more liable to developing breast cancer, therefore making ultrasound a more frequently used method for the detection of cancers than mammography [12, 13, 17].

Material and Methods

Between January 2016 to January 2026, about 500 Nigerian females with age above 16-years who consented to the examination, were scanned sonographically using 7.5MHz transducer probes of Mindray DP-2200 and Mindray DP-10 respectively.

The patients were scanned in supine, right and left lateral-oblique positions respectively for both breasts starting with the normal breast before the breast with a complaint/ailment. After appropriate patient preparation; explaining the procedure to the patient, obtaining informed consent and appropriate positioning, the breasts were scanned in a synchronous pattern, starting from the inner to outer quadrant for the upper half, and outer to inner quadrant for the lower half for most of the pendulous breasts with some modification for the collapsed or non-pendulous breasts. The images were acquired and interpreted by a radiologist of more than 10-years' experience in the field of radiology.

All examinations were done in private health facilities within Sokoto metropolis after due patients consent and appropriate ethical approval were soughed.

Variables like the age and sex of the patients with the observed parenchymal pattern for each of the subjects were recorded appropriately.

Analysis began with descriptive statistics (Mean and SD) for quantitative data and was followed by inferential statistics (chi square test) to determine associations. The results were presented in form of tables. All statistical tests were carried out using chi square tests, with level of significance set at 0.05.

Inclusion Criteria: Subjects that consented to the examination, subjects older than 16 years of age (adults according to World Health Organization), subjects duly referred by a clinician.

Exclusion Criteria: Subjects that never consented to the examination, subjects below the age of 16 years.

Results

The 500 Nigerian females that consented to the study, the age ranged between 16-65 years, with the mean and median ages as 33.8 years and 31.06 years respectively. The most frequent age range been the 26-35-year age group with a modal age of about 27.64 years.

The most common breast parenchymal pattern is the glandular pattern falling within the 26-35-year age group with a total number of 180 patients (36%), while the least number of patients were seen in the 56-65-year age group with a frequency of 45(9%).

Breast density typically changes with age due to hormonal activity, glandular involution, and fatty replacement, this data follows the expected clinical pattern.

There is a strong positive association, as age increases, breast density decreases; from glandular to mixed and finally fatty parenchymal pattern. Thus, the association follows a monotonic trend; younger age has a higher glandular density parenchymal pattern, while the older age group have a higher fatty replacement; thus this is a well-known physiologic and radiologic pattern.

Statistically, age is strongly associated with breast density, the pattern of which shows a direct, ordered progression with a relationship that is structural and not random and making significance testing unnecessary.

Clinically, the younger women (16-35 years) are expected to have dense(glandular) breasts, with a reduced mammographic sensitivity, hence the need for ultrasound examination. The middle aged women (36-45 years) show transitional density while older women (46-65 years) show fatty breasts with an improved mammographic sensitivity when compared to ultrasound examination.

From the tabular representation, the 16-25 years' age group happens to be the peak reproductive group with increased hormonal activity. High estrogen levels stimulate the growth of fibro-glandular tissue; hence the predominantly glandular breasts are expected. Clinically the dense breast tissue make ultrasound more useful than mammography, since denser tissue may obscure small lesions on mammograms.

The 26-35 years' age group having a glandular parenchymal pattern also have increased hormonal activity, with most women either been pregnant or lactating, these further increases the glandular tissues hence making ultrasound better and more effective than mammography due to reduced sensitivity as a result of glandular density.

The mixed fatty and glandular breast parenchyma density pattern group (36-45 years) represents a transition phase in breast composition, where some replacement of glandular tissues with fat starts, with mammography becoming more effective, and this age group carries a moderately increased risk of breast cancer when compared to the fatty breasts.

The 46-55 years' age group and predominantly fatty breast density parenchymal pattern, here the women are in the premenopausal or early menopausal age having a reduced estrogen levels hence leading to involution of the glandular tissue with fat becoming dominant, hence mammography becomes highly sensitive. Clinically fewer false positive results are obtained mammographically, and also lower breast cancer risk than dense glandular breasts.

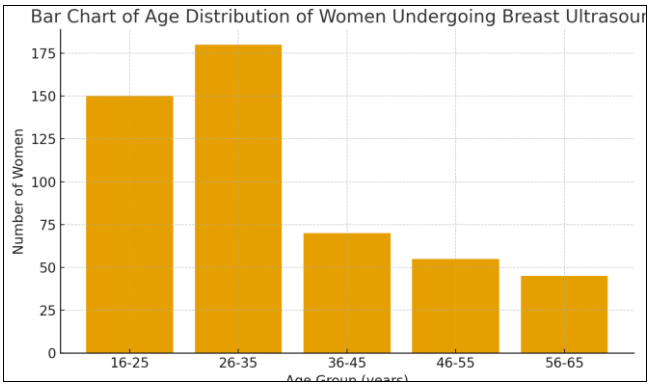
The fatty breast density parenchymal pattern within the age group of 56-65 years, are in the postmenopausal age with breast parenchyma fatty, with marked reduction of glandular elements due to hormonal decline, with mammography optimal and lowest masking effect making cancers easier to detect and also show a very low risk of breast cancer due to marked reduction in breast density.

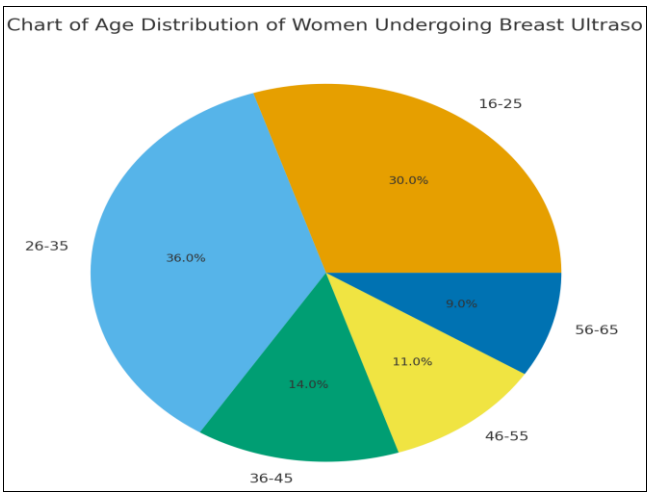
Table 1: Age Distribution with Breast Density Pattern

S. No	Age Group (Years)	Frequency (n)	Breast Density Pattern
1	16-25	150	Predominantly Glandular
2	26-35	180	Glandular
3	36-45	70	Mixed (Equal amount of glandular and fatty breast tissues)
4	46-55	55	Predominantly Fatty
5	56-65	45	Fatty
Total		500	

From the table above, the most frequent age category was the 26-35-year age category having type 2 parenchymal

pattern which is glandular, the least was the fatty breast parenchyma seen in the 56-65-year age category.





Discussion

Breast composition radiologically constitutes dense breast tissue which reflects both stroma and epithelium, whereas lucent tissues reflects fat. This composition changes with increasing age resulting in decrease in amount of stroma and epithelium with associated increase in the amount of fatty tissues [4-6]. Following breast ultrasound among the recruited subjects, each breast also composed of stroma with epithelium, which was more/denser in the younger age group and reduced significantly with increase in age and replaced by fat, thereby agreeing with these literatures.

Breast screening in dense breast needs additional imaging, since the sensitivity of mammography reduces with increase in density, and larger and more often node sensitive cancers are associated with denser breast, the ACR (American College of Radiology) now recommends additional screening with ultrasonography(SBU) for increased cancer detection [1, 7-9]. In this study we observed that the younger age category predominated and had ultrasonography for screening and possible diagnosis in line with directives of ACR.

High resolution ultrasound has a better fibrous-glandular tissue differentiation and often the modality of choice for assessment of dense breast as seen in younger females below the age of 40 years [14, 18], similar fact was employed in this study as more of the study population had dense breast and were referred for and examined ultrasonographically.

The Breast Imaging Reporting and Data System lexicon of the American College of Radiology(ACR-BIRADS) guidelines of 2003, has classified breast sonographic breast density in to three patterns; Type 1: homogeneously fatty (predominantly fatty) which is the least dense, Type 2: homogenous fibro-glandular (mixed fatty and glandular), and Type 3: heterogeneous (highly dense) [14, 15]. In the current study, parenchymal density was classified as either; 1: Predominantly glandular, 2: Glandular, 3: Mixed, 4: Predominantly fatty, and 5: Fatty. The Type 1(Predominantly glandular) and Type 2(Glandular) categories of parenchymal breast density predominated in this study.

There is a strong positive association, as age increases, breast density decreases; from glandular to mixed and finally fatty parenchymal pattern. Thus, the association follows a monotonic trend; younger age has a higher glandular density parenchymal pattern, while the older age group have a higher fatty replacement; thus this is a well-known physiologic and radiologic pattern. This pattern has been observed and reported by many researchers in the literature.

There is a strong and predictable association between age and breast density among the study population, and the association is deterministic and follows the physiological pattern of breast involution with age, which is a finding that has been observed by many studies and researchers.

In some countries like China, ultrasound of the breast is more frequently used than mammography in the detection of breast cancer [12, 13], from this study, similar finding has also been observed among women especially those within the younger age category where the sensitivity of mammography is minimal.

Supplemental ultrasound scan remains the most widely available screening option rather than mammography, unfortunately, handheld ultrasound examination is operator dependent and also time consuming [19]. In this study, handheld ultrasound examination was carried out, though by an experienced radiologist, we hope to incorporate the automated breast ultrasound in subsequent studies to reduce the issue of operator dependence.

Conclusion

There is a strong and predictable association between age and breast density among the study population. Younger age groups (16-35 years) demonstrated predominantly glandular breast density, while middle aged women (36-45 years) showed mixed density. Older age groups (46-55 years) exhibited predominantly fatty breast density. The association is deterministic and follows the physiological pattern of breast involution with age. Because each age category corresponded to a single breast density class, inferential statistics such as chi-square test were not applicable.

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