

 <p>ISSN NO. 2320-5407</p>	<p>Journal Homepage: - <a href="http://www.journalijar.com">www.journalijar.com</a></p> <p><b>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)</b></p> <p>Article DOI: 10.21474/IJAR01/3503 DOI URL: <a href="http://dx.doi.org/10.21474/IJAR01/3503">http://dx.doi.org/10.21474/IJAR01/3503</a></p>	 <p>INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR) ISSN 2320-5407 Journal Homepage: <a href="http://www.journalijar.com">http://www.journalijar.com</a> Journal DOI: 10.21474/IJAR01</p>
---	---	--

### RESEARCH ARTICLE

#### EVALUATION OF AGD IN DIGITAL BREAST TOMOSYNTHESIS RELATIVE TO THOSE IN TWO-VIEW-FULL-FIELD DIGITAL MAMMOGRAPHY.

H. S. Niroshani<sup>1\*</sup>, H. D. N. S. Hathurusinghe<sup>2</sup> and R. Tudugala<sup>1</sup>.

1. Department of Radiography & Radiotherapy, Faculty of Allied Health Sciences, Kotelawala Defence University, Sri Lanka
2. Department of Radiology, Nawaloka Hospitals Plc, Sri Lanka.

#### Manuscript Info

##### Manuscript History

Received: 05 January 2017

Final Accepted: 08 February 2017

Published: March 2017

**Keywords:** Digital breast tomosynthesis, Full field digital mammography, Average glandular dose

#### Abstract

Digital Breast Tomosynthesis (DBT) is performing in high resolution limited angle tomography at radiographic dose levels. Advanced system facilitates the DBT along with 2 view Full Field Digital mammography (FFDM). The objectives of this study were to compare the Average Glandular Dose (AGD) of DBT and FFDM and to calculate the percentage of radiation dose reduction when using DBT with compare to FFDM. The study was carried out using data base of DBT system in a private hospital. In the investigation we analyzed dose of 251 patients who underwent mammographic examinations of both FFDM and DBT. All data analyses were done using IBM SPSS statistical software version 20.0. P-value 0.05 was considered as statistically significant. The explanatory variables were age, breast thickness, kVp, mAs, target/filter combination, and AGD values of DBT and FFDM. Mean values for the patient age and compressed breast thickness were 50 years and 49 mm ( $\pm 11.9$ SD) respectively. The majority of the images were acquired using W/Rh target/filter combination and 51% patients came for the diagnostic mammograms and 49% for screening mammograms. A wide kVp range was observed for DBT than FFDM while mAs range was lower in DBT. According to the results total average glandular dose (TAGD) from FFDM and DBT for diagnostic was 4.21mGy ( $\pm 1.46$ SD), for screening 4.04 ( $\pm 1.31$ SD) and there was a statistically significant difference between mean values of TAGD. Mean AGD for Mediolateral Oblique (MLO) view in DBT was 2.05mGy ( $\pm 0.60$ SD), in FFDM 2.73mGy ( $\pm 1.02$ SD). AGD for Craniocaudal (CC) view in DBT was 1.63mGy ( $\pm 0.36$ SD) and for FFDM it was 1.83mGy ( $\pm 0.66$ SD). AGD to the breast from DBT was significantly lower than that for FFDM while range was lower in FFDM than DBT. There was a significant difference between mean values of CC and MLO views in DBT and FFDM ( $P < 0.05$ ). It was evident that AGD from DBT was lower than that for FFDM further AGD was reduced by 55.3% by using DBT with compared to TAGD,

**Corresponding Author:- H. S. Niroshani.**

Address:- Department of Radiography & Radiotherapy, Faculty of Allied Health Sciences, Kotelawala Defence University, Sri Lanka.

using both FFDM and DBT together for same patient and AGD was reduced 19.19% by using DBT with compared to AGD from FFDM.

Copy Right, IJAR, 2017,. All rights reserved.

### Introduction:-

Mammography is considered to be the most effective method for the early detection of breast cancer<sup>[1]</sup>. Although mammographic process is using low energy x-rays to examine the human breast the use of ionizing radiation implies the risk of inducing fatal breast cancer<sup>[2]</sup>. Minimizing radiation risk is important in general as manifested by the as low as reasonably achievable (ALARA) principle.<sup>[3][4]</sup>

As glandular tissue is radiosensitive organ, the average glandular dose (AGD) to the breast is the most important quantity to estimate the risk of radiation-induced carcinogenesis from mammography. AGD is currently accepted as an estimation of the patient dose in mammography.<sup>[4]</sup>

Digital Breast Tomosynthesis (DBT) is a FDA approved radiological imaging method for breast imaging<sup>[1]</sup>. It performs high resolution limited angle tomography at radiographic dose levels<sup>[5][6]</sup>. DBT allows the detection of a greater number of expansion lesions and a better morphological analysis of masses and architectural distortions<sup>[7]</sup>. Advanced system facilitates the DBT along with two view Full Field Digital mammography (FFDM)<sup>[8][9]</sup>. Therefore the purpose of the study was to compare the Average Glandular Dose (AGD) of DBT and FFDM and to calculate the percentage of radiation dose reduction when using DBT with compare to FFDM.

### Methodology:-

The study was carried out using data base of Digital Breast Tomosynthesis system at a private hospital, Colombo. This was a quantitative, retrospective research project. The study sample was included 251 patients exposure parameters. Data was collected through machine storage in the period of 01.01.2016 to 01.04.2016. KV, mAs, thickness, age, force, view, AGD, ESD, Exposure Index (EI) was recorded for each individual subject in to excel sheet. The data was analyzed by SPSS 20.0 software with  $P < 0.05$  indicating level of significance and using descriptive statistics.

### Results:-

Below table, contain the variable measurements of Full field digital mammography (FFDM/2D imaging) and Digital breast tomosynthesis (DBT/3D imaging).

	Variables	Mean	Standard deviation	Minimum	Maximum	Range
FFDM/2D imaging	Age	50.492	9.720	32.000	87.000	55.000
	HVL	1.083	1.690	0.486	559.000	558.514
	kVp	28.695	5.342	21.000	521.00	283.00
	mAs	171.30	64.71	58.00	415.00	357.00
	Thickness(mm)	309.28	11.999	14.000	93.000	79.000
	Force(lb)	25.180	60.66	238.00	51.900	41.400
	AGD(mGy)	2.2834	0.9675	0.3400	6.5200	6.1800
	ESD(mGy)	8.340	4.811	1.800	30.430	28.630
DBT/3D Imaging	EI(Exposure index)	309.28	60.66	238.00	4449.0	283.00
	Kv	31.927	2.518	27.000	48.000	21.000
	mAs	102.65	18.88	60.60	249.00	188.40
	AGD	1440.5	0.5416	1.1500	9.2100	8.0600
	ESD	5.8203	474.6	814.0	14.8800	13.8000
	EI	31.927	2.0968	1.0800	521.00	3635.0

Total average glandular dose (TAGD) from FFDM and DBT for diagnostic was 4.21mGy ( $\pm 1.46$ SD), for screening 4.04( $\pm 1.31$ SD) and there was a statistically significant difference between mean values of AGD. Mean AGD for

Mediolateral Oblique (MLO) view in DBT was 2.05mGy ( $\pm 0.60$ SD), in FFDM 2.73mGy ( $\pm 1.02$ SD). AGD for Craniocaudal (CC) view in DBT was 1.63mGy ( $\pm 0.36$ SD) and for FFDM it was 1.83mGy ( $\pm 0.66$ SD). AGD to the breast from DBT was significantly lower than that for FFDM while range was lower in FFDM than DBT. There was a significant difference between mean values of CC and MLO views in DBT and FFDM ( $P < 0.05$ ).

#### Relationship of average glandular dose with breast thickness for FFDM and DBT

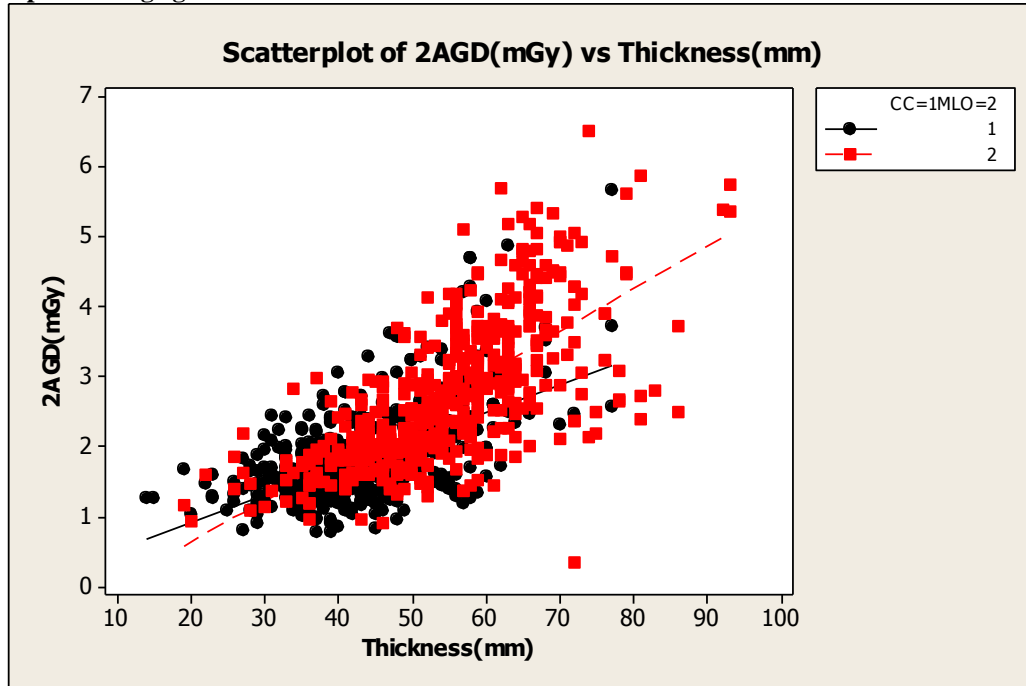


Figure 1:- AGD Vs Breast thickness in FFDM(2D imaging).

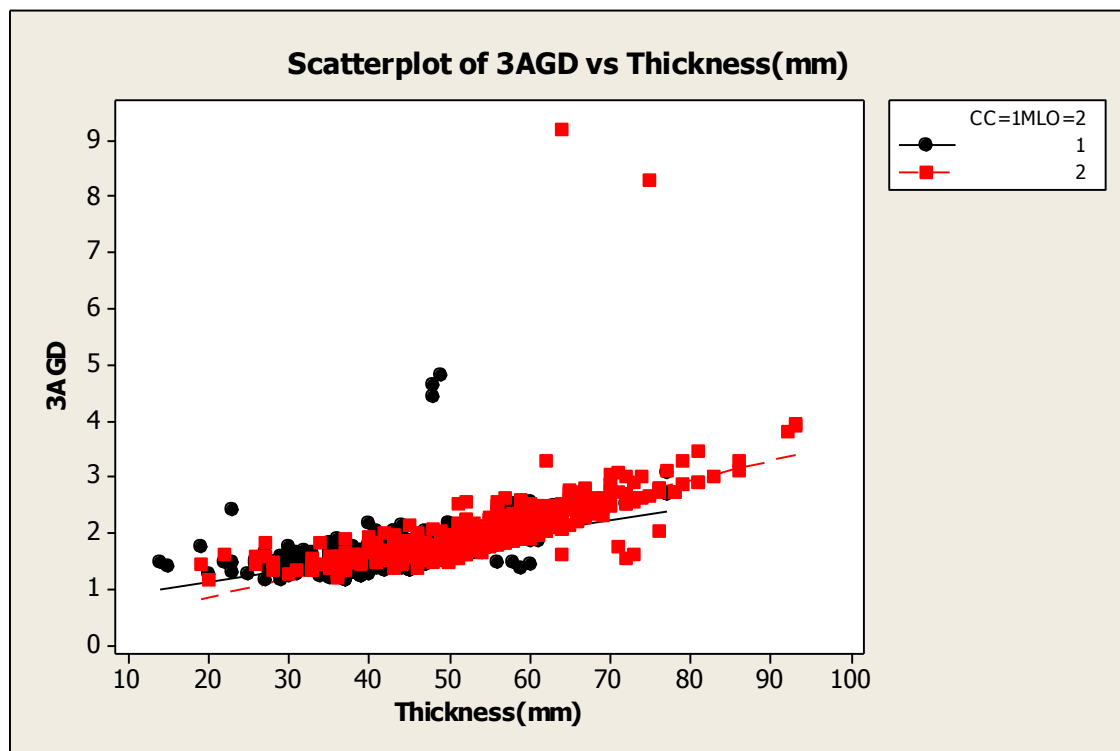


Figure 2:- AGD Vs Breast thickness in DBT(3D Imaging)

The above graphs show positive linear regression between AGD and thickness for DBT and FFDM in both views

#### Relationship of average glandular dose with age for FFDM and DBT

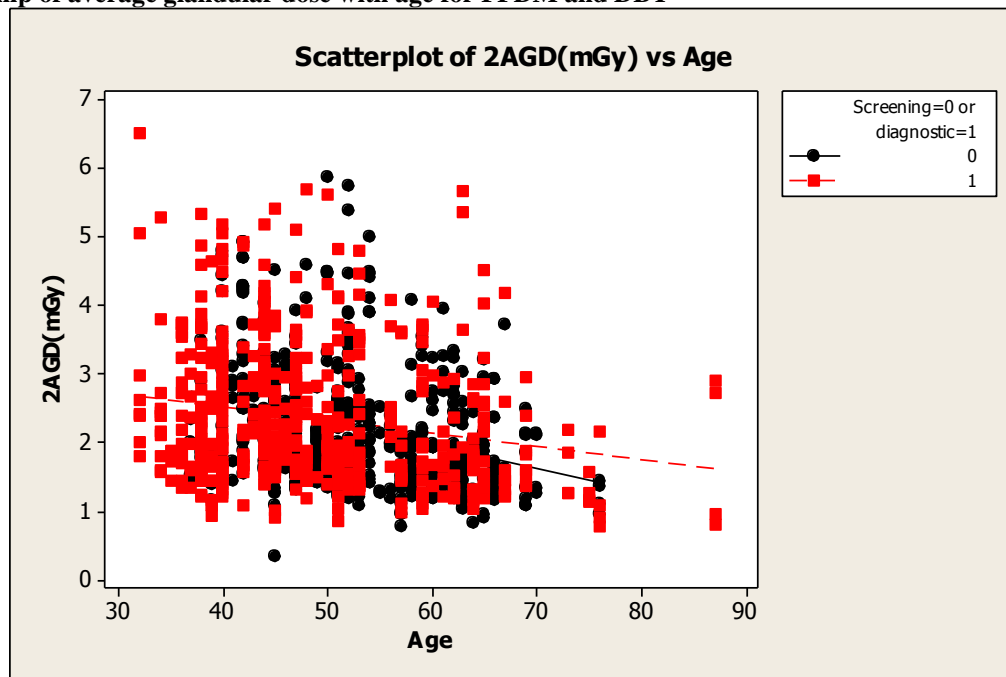


Figure 3:- AGD Vs age in FFDM (2D imaging).

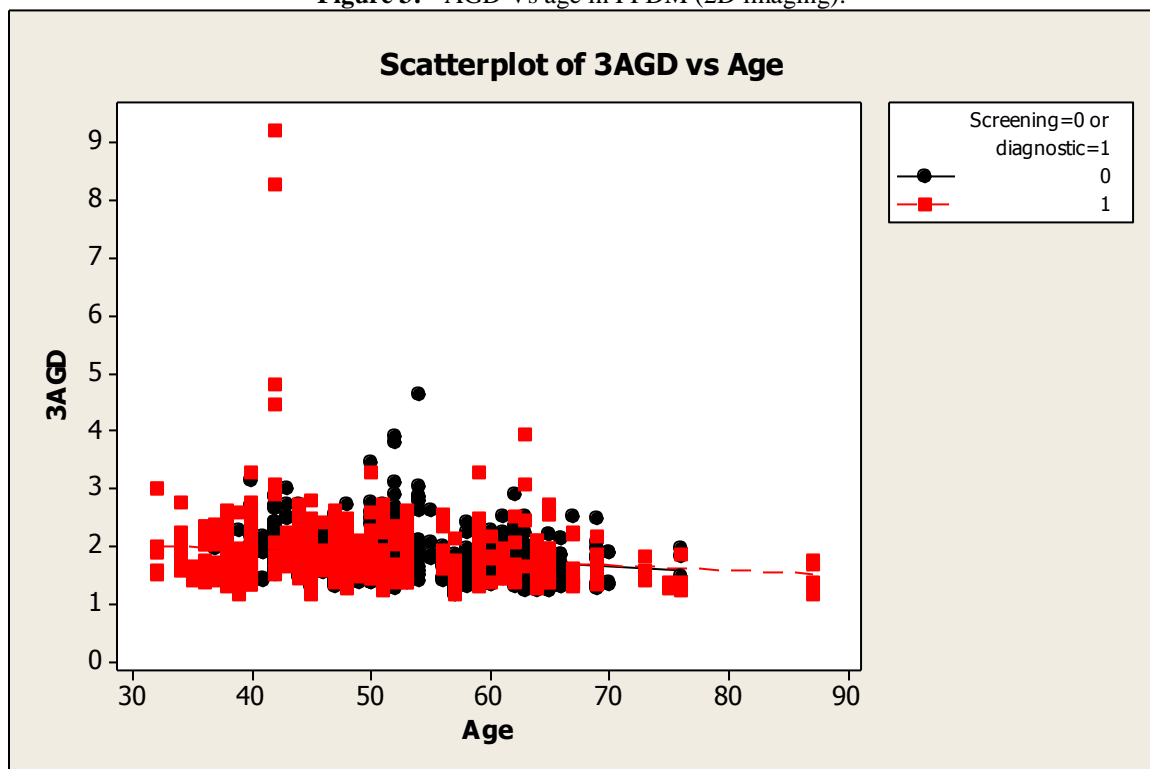


Figure 4:- AGD Vs age in DBT (3D Imaging).

The above graphs show negative linear regression between AGD and age for both DBT and FFDM in both views.

### Discussion:-

Ionizing radiation such as x-rays widely used in radiological examination. Hence there should be a special concern on radiosensitive organs which are exposed to direct x-ray beam. In mammography average glandular dose should be kept minimum due to high radiosensitivity of mammary glands. Chevalier M et al states that TAGD was 3.8mGy and it slightly lower than TAGD from current study. Further mean age and thickness from both study were similar.<sup>[9]</sup> In both study AGD from CC view was lower than MLO due to thickness of the CC view lower than MLO.

Total average glandular dose (TAGD) from FFDM and DBT for diagnostic was significantly higher than that for screening owing to dose is directly proportional to mAs and screening category has much lower mAs value than diagnostic<sup>[1]</sup>. And it was ensure that negative linear regression between AGD and age for both DBT and FFDM of screening and diagnostic categories due to the fatty tissue of the breasts may become more prominent than the glandular tissue as women ages.

According to the results mean average glandular dose to the breast from DBT was significantly lower than that for FFDM. It was evident that AGD from DBT was lower than that for FFDM. Which is similar to the study of Svahn TM et al but controversial to the study of Olgar T et al<sup>[3]</sup>. Further AGD was reduced by 55.3% by using DBT with compared to TAGD, using both FFDM and DBT together for same patient and AGD was reduced 19.19% by using DBT with compared to AGD from FFDM.

### Conclusion:-

The dose values delivered in breast DBT(3D imaging) were lower than in FFDM ( 2D imaging) mode. Hence DBT (3D imaging) has superior AGD reduction to that of FFDM(2D imaging) in the diagnostic and screening settings. DBT (3D imaging) only can use for screening programme in order to minimize the AGD.

### Reference:-

1. Sarah M. Friedewald, MD<sup>1</sup>; Elizabeth A. Rafferty, MD<sup>2</sup>; Stephen L. Rose, MD. “Breast Cancer Screening Using Tomosynthesis in Combination With Digital Mammography”
2. Mammography(radiography of the breast)  
<https://rpop.iaea.org/...Radiology/...Mammography/mammography-technique.htm>
3. T. Olgar, T. Kahn, D. Gosch. “ Average Glandular Dose in Digital Mammography and Breast Tomosynthesis”
4. Kanlayanee Theerakul. “Patient Dose Measurement in Digital Mammography at King Chulalongkorn Memorial Hospital”.
5. Mark A. Helvie, M.D. “Digital Mammography Imaging: Breast Tomosynthesis and Advanced Applications”
6. Shetty, M.K. “Breast cancer Screening and Diagnosis: A Synopsis”.
7. Brian M. Haas, MD Vivek Kalra, MD Jaime Geisel, MD Madhavi Raghu, MD Melissa Durand, MD Liane E. Philpotts, MD. “Comparison of Tomosynthesis Plus Digital Mammography and Digital Mammography Alone for Breast Cancer Screening”
8. Svahn TM, Houssami N, Sechopoulos I, Mattsson S . “Review of radiation dose estimates in digital breast tomosynthesis relative to those in two-view full-field digital mammography”.
9. Chevalier M , Morán P, Ten JJ, Fernández Soto JM, Cepeda T, Vañó E., “Patient dose in digital mammography”.