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# Appraisal of mean glandular dose (MGD) during mammography examinations

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ABSTRACT

Mammography x-rays uses to demonstrate different lesions among women by using ionizing radiation. This irradiation exposes the patient to slight high radiation amounts. This study conducted in amongst mammography patients in Khartoum, Sudan. The sample magnitude was 100 patients whose different types of diseases. All patients were underwent mammography. The factors were documented in this study were patient's characteristics and radiation exposure related factors. The mean MGD values calculated were 3.6 ± 0.29 ($p<0.05$). Those results were suggestively more than the standard dose determined by international agencies (IAEA, NCRP and ACR).



## 1. Introduction

Exposure to radiation may or may not cause an obvious consequence. Effects can comprise an alteration, which may not be injurious. Injury to tissues, which might not be essentially poisonous to the person; or hurt, which is clinically noticeable in the irradiated tissue. It might appear after many years. The Commission of radiation protection defines the harm to person who obtains a dosage of radiation. It is a relatively multifaceted mixture of the possibility of injury, the sternness of the injury and the period of beginning afterward exposure (Abdallah and Mohammed, 2016). Each of the transmission imaging types uses x-rays, and consequently exposes the patient to ionizing radiation. Ionizing radiation denotes to electromagnetic emissions of adequate power that, once they hit particles in the human tissue such as hydrocarbons, they may damage their structure. They do so by hitting with molecules and producing the elimination of one of their electrons, which reasons the molecule to develop definitely charged and highly responsive. Because majority of the human body construction is water. Literature review: A lot of published data scope for optimization doses in mammography that include MGD, EASK and ESD some of these publish calculate doses by equation method and other publisher may take other method like ionization chamber, phantoms etc. at this moment we will take a glance for these published papers and research related to our study (Abdallah and Mohammed, 2016). The mammography dose detected in routine examination of the breast and the researcher define the MGD at mediolateral and craniocaudal projection and measure the total dose for a whole mammographic examination in the radiology clinic of the university of Sarajevo clinic center, 63 patients included, the doses measured by multiplying conversion factor and also measures entering air kerma in air without back scatter, a MGD was 1.64 mGy for women between 40 and 49 year for mediolateral oblique projection and 1.45 mGy for craniocaudal projection also the study noted remarkable co relation between dose and breast thickness (Kunosic et al., 2010). In Pakistan, some publishers assessed the glandular dose for 100 Pakistani women, the publisher were measured entrance skin dose by used dosimeter, the result multiplied by factors to measure MGD. The range of glandular dose was 2.95 – 3.8 mGy, also the study recorded that the dose different according to the breast thickness. The MGD of female included in study more than reference dose than recommended by ACR (Shahid et al., 2013). The MGD within the normal value for 386 Ethiopian women in more than 1463 mammographic examinations, the age group between fourth and sixth decade years, the result of study recorded that the average of MGD was 2.57 +_ 2.1 mGy (Delli et al., 2012). When we used s factor that allow predicting MGD in more than one x-rays tube construction, the s factor calculated by a monte

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Carlo program, this method used to estimate dose in united kindom and European protocols for breast doses (Dance et al., 2009). Kanlyan reported that MGD in hospital named King Chulalongkorn Memorial, this study also measured entrance skin dose for breast in different projections, Selenia Dimesion used in study, the average of MGD was 1.78 mGy in cranicaudal and 1.86 mGy im mediolateral oblique, the entrance skin exposure dose was 6.79 – 6.83 mGy in angulated cranial projections respectively (Theerakul, 2014). Some publisher from japan used Amulet, Fujifilm solution system, this machine consist of the automatic control system for exposure to ensure optimum image density, the study started by estimate MGD and ESD for breast by used phantom then applied for 200 women in fourth and seventh decade, the result recorded that MGD was 1.61 mGy in average, where the ESD was 6.06 mGy. In Malaysia, a survey conducted from mammographic that used x-rays tube construction in FFDM system, the MGD decreasing with age in direct proportional, also there was no significant in MGD in different target filter combination (Jamal et al., 2013). Mammographic dose evaluated retrospectively by obtain the entrance air kerma and breast thickness in all mammographic models (Bor et al., 2008). The MGD quantity used also as expression for risk almost in cancer cases for that appropriate assessment method of glandular dose and entrance skin dose decreasing mortality ratio (Bosmans and Marshall, 2013).

## 2. Materials and methods

Patient positioned in the mammography unit using compressing devices Stand board such as with clear and plastic scull in order to immobilize the breast. The projections used in this study were craniocaudal and mediolateral. The patients asked to direct to other side during the procedure to reduce the dosage that would receive into the lens.

In this study, Rh-AL and W-Rh filter x-rays tube used for this study. A sample of 100 patients with different age group ranged from 44-62 years (50.3 + 4.7) ($p > 0.05$). The exposure factors used in this study were in range of the 26-29 KVp (27.8 + 0.74) ($p > 0.05$), mAs (102-120) (109.9 + 4.6). The MGD and ESAK calculated using Dance's equation.

## 3. Results

The study data analyzed using t-test under windows to detect the significance between the breast thickness and dose. The patients' characteristics used in this study were showed in Table 1. Age group of patients was showed in Table 2. The dose from related studies was showed in Table 3. Relation between breast thickness and age, ESAK (mGy) and Breast thickness (cm) and ESD (mGy), Breast Thickness (cm) and ESD (mGy) and Breast Thickness (cm) was shown in Figs. 1-4.

## 4. Conclusion

Radiation Exposure considers one of the responding factors of breast cancer special after multiple exposures in chest area. So recently many scientists had studied those doses in order to quantifying and linking them with cancer.

**Table 1:** General characteristics of the sample

| Characteristics | Value (N = 100) |
|---|---|
| **Age (years)** | |
| Minimum | 43.00 |
| Maximum | 63.00 |
| Mean ± Standard Deviation | 50.2 ± 4.6 |
| **Breast thickness (cm)** | |
| Minimum | 3.90 |
| Maximum | 6.10 |
| Mean ± Standard Deviation | 5.1 ± 0.39 |
| **kVp** | |
| Minimum | 26.00 |
| Maximum | 30.00 |
| Mean ± Standard Deviation | 27.8 ± 4.7 |
| **mAs** | |
| Minimum | 100.00 |
| Maximum | 126.00 |
| Mean ± Standard Deviation | 109.9 ± 4.5 |

**Table 2:** Age group of patients

| Age Group (years) | Percentage (%) (N=100) |
|---|---|
| 40-45 | 22 |
| 46-50 | 42 |
| 51-55 | 17 |
| 56-60 | 16 |
| 60-65 | 3 |

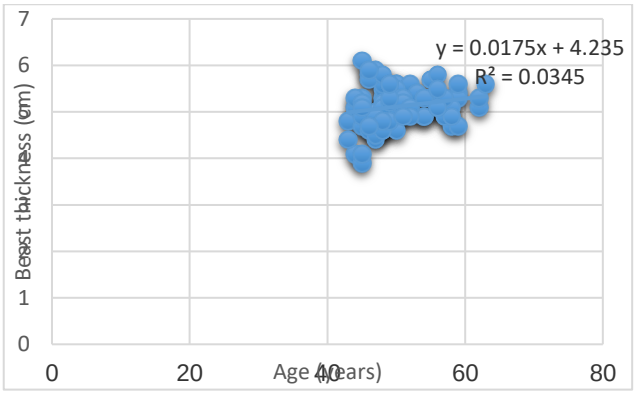


**Fig. 1:** Relation between breast thickness and age

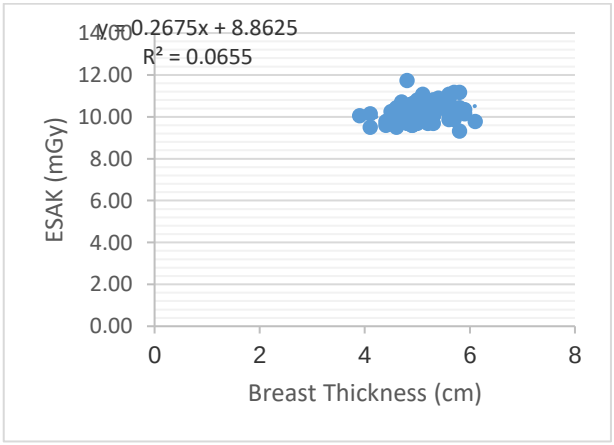


**Fig. 2:** Relation between ESAK (mGy) and Breast thickness (cm)

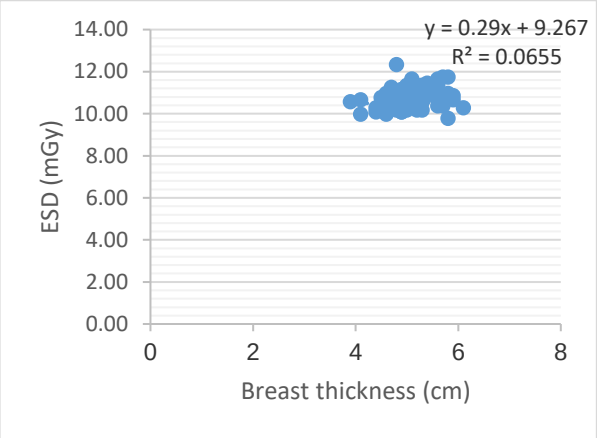


**Fig. 3:** Relation between ESD (mGy) and Breast Thickness (cm)

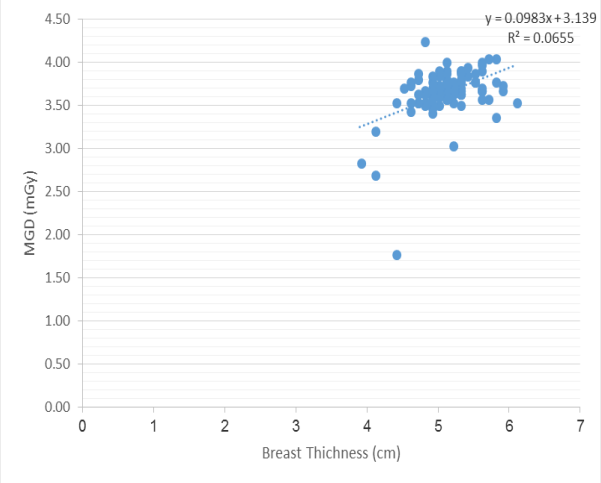


**Fig. 4:** Relation between ESD (mGy) and Breast Thickness (cm)

**Table 3:** The dose from related studies

| Study | MGD (mGy) |
|---|---|
| Bor et al. (2008) | 1.76 |
| Shahid et al. (2013) | 3.6 |
| Kunosic et al. (2010) | 1.4 |
| Ciraj-Bjelac et al. (2010) | 2.8 |
| Wambani et al. (2011) | 2.5 |
| Behrouzkia et al. (2012) | 1.18 |
| Khair et al. (2012) | 1.5 |
| Jamal et al. 2013 | 3.3 |
| Dellie et al. (2012) | 1.77 |
| Abdallah and Mohammed (2016) | 1.5 |

All the patients' and radiation exposure data recorded and used for dose calculation. The measured dose was slight high compared with international standards. Therefore, comparing these results with some similar studies, which used the same target combination such as Shahid et al. (2013) and Jamal et al. (2013). In some studies, static exposure factors formula was used with the variable breast thickness which compensated by tube current. Many scientists took in their studies the patients dosage in static kVp versus variable and they get low radiation dose with a less poorly in image quality. In this study, we discovered that using of W-Rh target combination could give high MGD and ESAK dose and give the patient unnecessary dose.

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