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# Impact of One Mineral Density among Postmenopausal Women with Gestational DM using Dual Energy X-ray Absorptiometry

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## ABSTRACT

Bone mineral density has been assessed using Dual-Energy X-Ray Absorptiometry. Bone mineral density is measured according to the results of the Dual-Energy X-Ray Absorptiometry examination of the vertebral column and pelvis. Although gestational DM is known to affect bone mineral density, at the present time this particular relationship is not clear, in this study evaluating the effects of gestational diabetes mellitus on bone mineral density among postmenopausal women's. Bone density of controls and patients was measured using a DEXA scan in this study the number of samples were 125, the investigator employed purposive sampling technique for data collection demographic Performa and semi-structure questionnaire was used, and for data analysis inferential statistics used from SPSS software.

***Aim:*** Is to evaluate the impact of bone mineral density among postmenopausal women with gestational DM using X-ray absorptiometry and to determine association between impact of bone mineral density among postmenopausal women with gestational DM using X-ray absorptiometry and demographic variables.

***Materials and Methods:*** This study was conducted in the Outpatient Clinic of Rheumatology, Arihant Multispecialty tertiary care teaching, Belagavi. From February 2026 to April as a part of evaluating the effects of gestational diabetes mellitus on bone mineral density among postmenopausal women's, the number of samples were 125, the investigator employed purposive sampling technique for data collection demographic Performa and semi-structure questionnaire was used, and for data analysis inferential statistics used from SPSS software.

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***Results:*** Graph 1, revealed that majority of the respondents having left leg and knee deformity their mean is 14 (30%) and SD will be 11.4, more or less similar results showing right leg and knee deformity their mean is 12 (26%) and SD will be 8.3, , more or less similar results showing left upper arm and elbow deformity their mean is 10 (24%) and SD will be 6.7, and less similar results showing right upper arm and elbow deformity their mean is 9 (20%) and SD will be 5.4.

***Conclusion:*** At the end of investigation the researcher concluded that based on bone mineral density of the upper extremities and lower extremities with osteoporosis among females majority of the finding are 14 (30%) are having left leg and knee deformity, and based on Type of DM among postmenopausal women's with their mean, mean (%), and SD, revealed that majority of the respondents having Type I (DM) is about 28 (63%) and SD will be 5.4, and 21 (37%) and SD will be 6.7.

**KEYWORDS:**

• Bone Mineral Density • Postmenopausal Women • Gestational Dm • Dual-Energy X-Ray and Absorptiometry

## INTRODUCTION

Little is known about changes in bone mineral density (BMD) during pregnancy. Early model densitometers emitted substantial radiation that was not considered safe for evaluation during pregnancy. With the advent of fan beam densitometers that emit low ionizing radiation, their use at the beginning of the second trimester of pregnancy became possible. Although earlier studies showed little to no effect of vitamin D on maternal bone loss during pregnancy, other authors have suggested that vitamin D status is a modifying factor in bone loss; however, this possibility has not been studied systematically in pregnant women to our knowledge.[1]

Various methods to assess the changes in bone mineral density (BMD) during pregnancy have been studied. The use of standard dual-energy X-ray absorptiometry (DXA) in pregnant women has been limited by the potential harmful effects of radiation during pregnancy. Studies that utilize this method for assessments would obtain measurement in women before pregnancy and then repeat it in the early postpartum period, yet the actual changes during pregnancy could not be assessed. The recent development in quantitative ultrasound methods for assessment of BMD in pregnancy carries the particular advantage of being free from irradiation effects. Ultrasound measurements have been found to correlate well with BMD measurements compared to conventional DXA methods in non-pregnant subjects, and could be used alone for prediction of fracture risks in postmenopausal women. Ultrasound measurements may be performed at different sites, including the tibia, metacarpals and phalanges.[2]

Osteoporosis is the best-known bone disease characterized by reduced bone mineral density (BMD) and possible changes in bone microarchitecture, leading to an increased risk of fracture. Postmenopausal women with diabetes are more likely to develop osteoporosis than non-diabetic women. A higher prevalence of osteoporotic fractures has been observed in postmenopausal diabetic women despite normal or increased BMD. Existing studies have reported conflicting results regarding bone markers for osteoporotic fractures in postmenopausal women with diabetes. Despite conflicting results, postmenopausal diabetic women are encouraged to use these methods to assess their bone health. Here, we reviewed studies that provided results on bone turnover markers and BMD values in postmenopausal women with diabetes.[3]

Osteoporosis is a disease of the skeleton characterized by decreased bone mass and deterioration of bone tNumber architecture leading to increased bone fragility and susceptibility to fracture. The decrease in bone mass is due to activation of osteoclasts, which enhances bone reabsorption. Postmenopausal osteoporosis is the most common primary type and is characterized by rapid bone loss in recently postmenopausal women. In the Kingdom of Saudi Arabia, a hospital based study showed that 24% of postmenopausal Saudis had osteoporosis (aged 50-60 years).1 Menopause is an established risk factor for osteoporosis. Other risk factors include endocrine disorders such as diabetes mellitus

(DM).[4]

Bone mass peaks in a woman's 20s, with a subsequent plateau until the mid-40s. Menopause marks a transition to accelerated bone loss; however, transient changes in bone mineral density (BMD) may occur before menopause during the "plateau" period for a variety of reasons, including biological processes (pregnancy, lactation),[2] adverse effects of certain diseases or conditions (e.g. hyperparathyroidism, hyperthyroidism, Cushing's syndrome), and use of pharmacologic therapies (e.g. glucocorticoids, antidiabetic medications, antiepileptic drugs, antipsychotic agents, selective serotonin reuptake inhibitors, chronic heparin, gonadotropin-releasing hormone [GnRH] agonists).[5]

## OBJECTIVES

- Evaluate the impact of bone mineral density among postmenopausal women with gestational DM using X-ray absorptiometry.
- To determine association between impact of bone mineral density among postmenopausal women with gestational DM using X-ray absorptiometry and demographic variables.

## HYPOTHESES

**$H_1$:** There will be no significant association between impact of bone mineral density among postmenopausal women with gestational DM using X-ray absorptiometry.

**$H_2$:** There will be significant association between impact of bone mineral density among postmenopausal women with gestational DM using X-ray absorptiometry and demographic variables.

## NEED FOR THE STUDY

Alarmingly, the prevalence of gestational diabetes mellitus (GDM) is also increasing worldwide. GDM, defined as impaired glucose tolerance with onset or first recognition during pregnancy, is a major risk factor for future T2D. Although GDM usually resolves after giving birth, women with GDM have up to a 7-fold increased risk for T2D during the next 5-10 years. Women with a history of GDM may present with pre-diabetes, which means that their blood glucose level may be higher than normal but lower than the diagnostic threshold for T2D. Several healthy lifestyle factors improve bone health, whereas physical inactivity, a nutrient-poor-energy-dense diet and smoking deteriorate bone health. Studies suggest that women at risk for GDM have poorer diet quality and low levels of physical activity, which could affect their bone health.[6]

A major health problem worldwide, osteoporosis affects an estimated 10 million people older than 50 years and puts another 34 million people, regardless of age, at risk of developing the disease. Although OP commonly appears among postmenopausal women, it is rarely diagnosed in premenopausal women, especially during the postpartum period. To date, however, literature addressing OP contains little information about pregnancy- and lactation-associated (PAO). At the same time, evidence that duration of gestation is a risk factor for low bone mineral density (BMD) remains conflicting.[7]

Bone mineral density has been assessed using Dual-Energy X-Ray Absorptiometry. Bone mineral density is measured according to the results of the Dual-Energy X-Ray Absorptiometry examination of the vertebral column and pelvis. Although diabetes mellitus type II (DM) is known to affect bone mineral density, at the present time this particular relationship is not clear.[8]

## REVIEW OF LITERATURE

A cross-sectional study of 351 healthy Finnish women aged 20–76 years was done to establish reference values of bone mineral density (BMD) using dual-energy X-ray absorptiometry (DEXA). The effects of age and of several physical and lifestyle factors on BMD of the lumbar spine and proximal femur (femoral neck, trochanter, and Ward's triangle area) were investigated. Altogether 58 women were excluded from the final analysis due to significant spinal osteoarthritis or other diseases or drugs known to influence calcium or bone metabolism. The precision of the method was 0.9, 1.2, 2.7, and 2.4% in the lumbar, femoral neck, Ward's triangle and trochanter area, respectively. Lumbar BMD was increased by 30% ($P$<0.001) in 15 patients with osteoarthritis (21% of women 50 years or older), but it was apparently unaffected in 5 cases with aortic calcification. Except for the trochanter area, BMD diminished along with age, and this was significant after the menopause.[9]

This cross-sectional study assessed the association between T2DM and OP in postmenopausal Saudi women residing in the Qassim region, Kingdom of Saudi Arabia. The study population consisted of 250 postmenopausal women, including 150 women diagnosed with T2DM (diabetes group; group I) with a mean age ± S.D of 58.47 ± 6.07 and 100 controls without diabetes with a mean age ± S.D of 57.13 ± 6.77, named group II. Female patients with diabetes were recruited from King Fahd Specialist Hospital (KFSH), Diabetic and Endocrinology Centre, and Buraidah Central Hospital in Buraidah City, Qassim region, Kingdom of Saudi Arabia (KSA). Before enrolment, participants provided informed consent after being thoroughly briefed on this study's primary objectives and the procedures for sample collection. Participants were selected through a randomization process, ensuring that the inclusion criteria were met. To control for potential confounding variables, the participants were matched based on age, duration of menopause, and BMI.[10]

Studies were considered eligible for the meta-analysis if they evaluated the association between T2 DM and BMD, they were of a cross-sectional, cohort or case–control design, they included healthy subjects without DM as controls, they reported gender-stratified statistics on both individuals with and without T2 DM, BMD was measured by dual energy X-ray absorptiometry (DXA) and BMD measurements were expressed as an absolute value in g/cm2. In the cases that more than one article presented data from the same study population, the study with more complete reporting of data was selected.[11]

## MATERIALS AND METHODS

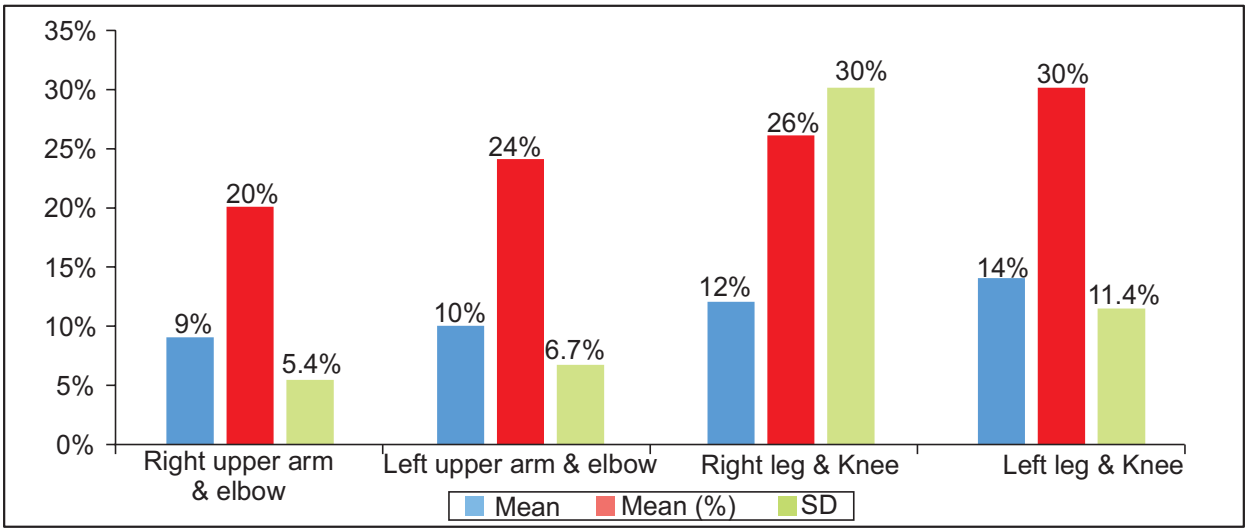
This study was conducted in the Outpatient Clinic of Rheumatology, Arihant Multispecialty tertiary care teaching, Belagavi. From February 2026 to April as a part of evaluating the effects of gestational diabetes mellitus on bone mineral density among postmenopausal women's, the number of samples were 125, the investigator employed purposive sampling technique for data collection demographic Performa and semi-structure questionnaire was used, and for data analysis inferential statistics used from SPSS software.

## RESULTS

**Table 1:** Bone mineral density of the upper extremities and lower extremities with osteoporosis among females N= 74

| Place of deformities | Frequency (f) | Percentage (%) | Mean | Mean (%) | SD | Chi Square |
|---|---|---|---|---|---|---|
| Right upper arm & elbow | 18 | 24 | 9 | 20 | 5.4 | |
| Left upper arm & elbow | 15 | 20 | 10 | 24 | 6.7 | $X^2$= 10.06 |
| Right leg & knee | 19 | 26 | 12 | 26 | 8.3 | DF= 9 |
| Left leg & knee | 22 | 30 | 14 | 30 | 11.4 | P value- 0.58* |
| **Total** | **74** | **100** | **34** | **100%** | **31.8** | |

*p value > 0.05 level of significance




**Graph 1:** Place of deformities with their mean, mean %, and standard deviation

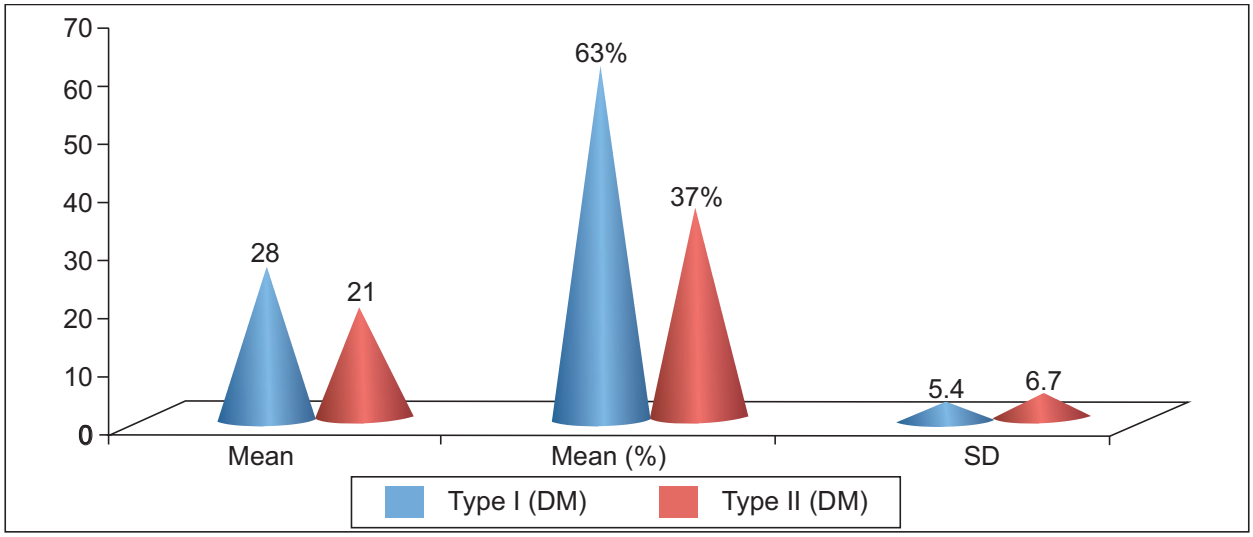
Graph 1, revealed that majority of the respondents having left leg and knee deformity their mean is 14 (30%) and SD will be 11.4, more or less similar results showing right leg and knee deformity their mean is 12 (26%) and SD will be 8.3, more or less similar results showing left upper arm and elbow deformity their mean is 10 (24%) and SD will be 6.7, and less similar results showing right upper arm and elbow deformity their mean is 9 (20%) and SD will be 5.4.

**Table 2:** Type of DM among postmenopausal women's with their mean, mean (%), and SD N= 54

| Gestational DM | Frequency (f) | Percentage(%) | Mean | Mean (%) | SD | Chi Square |
|---|---|---|---|---|---|---|
| Type I (DM) | 31 | 57 | 28 | 63 | 5.4 | $X^2$= 9.4 |
| Type II (DM) | 23 | 43 | 21 | 37 | 6.7 | DF= 1 |
| Total | 54 | 100% | 38 | 100% | 12.1 | P value- 0.61* |

*p value > 0.05 level of significance

Graph 2, revealed that majority of the respondents having Type I (DM) is about 28 (63%) and SD will be 5.4, and 21 (37%) and SD will be 6.7.

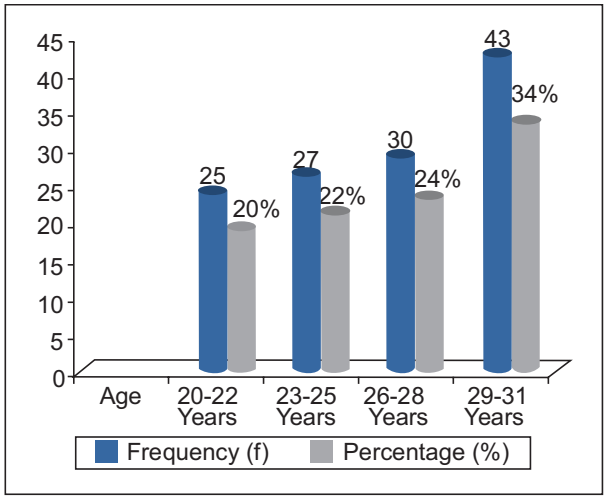



**Graph 2:** Type of DM among postmenopausal women's

Graph 2, revealed that majority of the respondents having Type I (DM) their mean is 28 (63%) and SD will be 5.4, and less similar score of the respondents having Type-II (DM) 21 (37%) and SD will be 6.7.

**Table 3:** Distribution of respondents accordingly age N=125

| Demographic Variables | Frequency (f) | Percentage (%) | Chi-Square |
|---|---|---|---|
| **Age** | | | |
| 20-22 Years | 25 | 20 | |
| 23-25 Years | 27 | 22 | $X^2$= 7.24 |
| 26-28 Years | 30 | 24 | DF= 9 |
| 29-31 Years | 43 | 34 | P Value- 0.39 |
| **Total** | **100** | **100%** | |



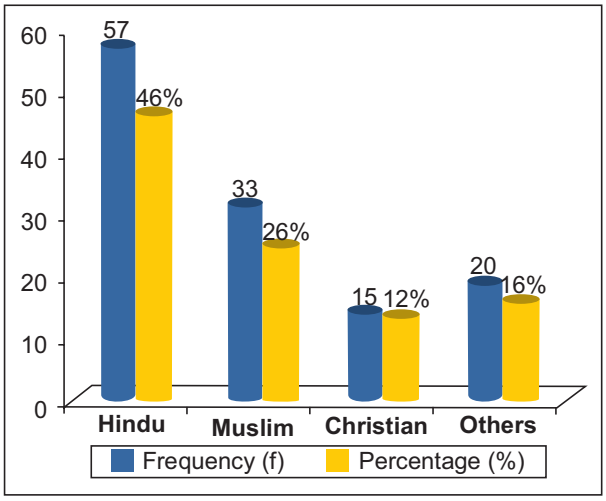

**Graph 3:** Age distribution

Graph 3, revealed that majority of the respondents 43 (34%) belonged to 29-31 years,

30 (24%) of the respondents belonged to 26-28 years, 27 (22%) of the respondents belonged to 23-25 years, and 25 (20%) of the respondents belonged to 20-22 years.

**Table 4:** Distribution of respondents accordingly religion N=125

| Demographic Variables | Frequency (f) | Percentage (%) | Chi-Square |
|---|---|---|---|
| **Religion** | | | |
| Hindu | 57 | 46 | |
| Muslim | 33 | 26 | $X^2$= 10.05 |
| Christian | 15 | 12 | DF= 9 |
| Others | 20 | 16 | P value- 0.34 |
| **Total** | **125** | **100%** | |




**Graph 4:** Religion distribution

Graph 4, revealed that majority of the respondents 57 (46%) belonged to Hindu religion, 33 (26%) of the respondents belonged to Muslims, 20 (16%) of the respondents belonged to others, and 15 (12%) of the respondents belonged to Christians.

## DISCUSSION

In the present study was conducted in the Outpatient Clinic of Rheumatology, Arihant Multispecialty tertiary care teaching, Belagavi. From February 2026 to April as a part of evaluating the effects of gestational diabetes mellitus on bone mineral density among postmenopausal women's, the number of samples were 125, the investigator employed purposive sampling technique for data collection demographic Performa and semi-structure questionnaire was used, and for data analysis inferential statistics used from SPSS software. Graph 1, revealed that majority of the respondents having left leg and knee deformity their mean is 14 (30%) and SD will be 11.4, more or less similar results showing right leg and knee deformity their mean is 12 (26%) and SD will be 8.3, , more or less similar results showing left upper arm and elbow deformity their mean is 10 (24%) and SD will be 6.7, and less similar results showing right upper arm and elbow deformity their mean is 9 (20%) and SD will be 5.4. Graph 2, revealed that majority of the respondents having Type I (DM) is about 28 (63%) and SD will be 5.4, and 21 (37%) and SD will be 6.7. Graph 3, revealed that majority of the respondents 43 (34%) belonged to 29-31 years, 30 (24%) of the respondents belonged to 26-28 years, 27 (22%) of the respondents belonged to 23-25 years, and 25 (20%) of the respondents belonged to 20-22 years. Graph 4, revealed that majority of the respondents 57 (46%) belonged to Hindu religion, 33 (26%) of the respondents belonged to Muslims, 20 (16%) of the respondents belonged to others, and 15 (12%) of the respondents belonged to Christians.

In the similar study Postmenopausal women from the National Health and Nutrition Examination Survey (NHANES) between 2007 and 2010, between 2013 and 2014, and between 2017 and 2018 were retrospectively included in this cross-sectional study. The logistic regression model was used to explore the relationship between GDM and osteoporosis, and a weighted linear regression model was applied to investigate the association between GDM and total femoral BMD, femoral neck BMD, and total TBS. Subgroup analysis of the association between GDM and osteoporosis was performed according to age, body mass index (BMI), and DM (yes or no). Result findings show that the 6732 women included, 253 women (3.76%) had GDM. No significant differences in total femoral BMD, femoral neck BMD, and total TBS were observed between postmenopausal women with and without a history of GDM. However, a history of GDM was associated with a higher risk of osteoporosis in postmenopausal women [odds ratio (OR): 11.18, 95% confidence intervals (CI): 3.64 to 34.27, $P < 0.001$]. There was no significant difference between a history of GDM and osteoporosis in postmenopausal women whom BMI is normal and overweight women. However, there was an association between a history of GDM and osteoporosis in postmenopausal obese women (OR: 26.57,

95% CI 10.23 to 68.98, $P<0.001$). Researcher concluded that a history of GDM was associated with a higher risk of osteoporosis in postmenopausal women, particularly in postmenopausal obese women.

## CONCLUSION

At the end of investigation the researcher concluded that based on bone mineral density of the upper extremities and lower extremities with osteoporosis among females majority of the finding are 14 (30%) are having left leg and knee deformity, and based on Type of DM among postmenopausal women's with their mean, mean (%), and SD, revealed that majority of the respondents having Type I (DM) is about 28 (63%) and SD will be 5.4, and 21 (37%) and SD will be 6.7.

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