Original Article

The Prevalence of Osteoporosis among Antenatal Clinic Attendees in a Rural Mission Hospital in South-East Nigeria

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ABSTRACT

Introduction: Osteoporosis is a global public health problem characterized by reduction of bone mineral density (BMD). This study aimed to assess the prevalence of osteoporosis among antenatal clinic attendees in a rural Southeastern hospital. **Material and Methods:** This was a cross-sectional study of booking Antenatal Clinic Attendees at Mile 4 Catholic Hospital, Abakaliki, between October 2014 and February 2015. The study participants were selected through systematic random sampling. The BMD of the right calcaneal bone of the participants was measured using the OsteoPro, a Quantitative ultrasound scan. **Results:** A total of 327 eligible women participated in the study. The average age of the participants was 29 ± 4.5 years. The average parity was 2 ± 1.6 childbirths. The mean *T*-score was −1.19 ± 4.9. Osteoporosis and osteopenia were recorded in 119 women (36.4%) and 56 women (17.1%), respectively, whereas 152 (46.5%) were within normal range. History of regular exercise by the respondents is statistically significant on the reduction of osteopenia and osteoporosis ($P \leq 0.05$). The history of ever use of calcium supplementation by the study participants in the index pregnancy did not have any significant effect on the reduction of osteoporosis. **Conclusion:** There is a high prevalence of osteoporosis among pregnant women in Southeast Nigeria. This may be due to the predominant poor adherence and low dose of calcium supplementation among pregnant women in this environment. Therefore, there is an urgent need for sensitization on this public health problem.

KEYWORDS: *Antenatal women, calcaneal bone, osteopenia, osteoporosis, osteoPro, Southeast Nigeria*

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INTRODUCTION

Osteoporosis is a global public health problem. It reduces the bone mineral density (BMD), thereby increasing the tendency of the bone to fracture.[1,2] Although this chronic disease is usually a problem of postmenopausal women, men and women who are 50 years old or more,[3] the pregnant women can also be at risk, thus increasing their risk of fragility fractures.[4] Osteoporosis usually occurs at the femoral necks, lumbar spine, and other sites during the second or third trimester of pregnancy.[5] The loss of BMD increases the possibility of bone fractures, which may seriously affect either the mother or the child. In pregnancy, there is an increased calcium demand, especially by the fetus. Therefore, insufficient dietary calcium leads to increased calcium resorption from the maternal bones to meet the fetal calcium demand. This increased calcium resorption from the maternal bones accompanied by inadequate bone formation causes osteoporosis in pregnancy. However, the physiological adaptation to pregnancy involves a complex hormonal regulation, thereby preventing excessive resorption of calcium by the maternal skeleton.[6] Therefore, calcium supplementation in pregnancy causes an increase in maternal blood calcium which meets the demands of fetal requirement for calcium, thereby reducing resorption of calcium

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from the maternal skeleton. High calcium containing diets such as crabs, crayfish, milk products, meat, fish, vegetables, fortified cereals, and bread, will also help meet the increased calcium demand in pregnancy.

Other causes of osteoporosis in pregnancy comprise failure of calcitrophic hormones and decreased activities of osteoblasts. Calcitrophic hormones and osteoblasts help the maternal skeleton adapt to the stress of pregnancy and delivery.[7,8] Osteoporosis has been found to be more common among Caucasians when compared with Africans and patients with calcium deficiency, protein energy malnutrition, short interpregnancy interval, sedentary lifestyle, and prolonged breast feeding.[8-13] Osteoporosis is usually asymptomatic until it causes fracture. The long-term effect of pregnancy on BMD is still controversial. While Kolle *et al*.[14] revealed an association of low BMD and previous pregnancy in Norwegian premenopausal women, other studies showed nonsignificant association between pregnancy and permanent bone loss.[15,16] A recent systematic review has shown that pregnancy has a protective effect on bone mass if it is followed by lactation.[17]

Nigeria is still riddled with the problem of high total fertility rate, low contraceptive prevalence, poverty, ignorance, poor health-seeking behavior, and malnutrition.[18] Most of these risk factors may increase the risk of osteoporosis in this environment. Previous studies have reported low calcium intake in pregnancy, especially in Sub-Saharan Africa and Asia.[19-21] This was mainly due to poor dietary habit and seasonal variation of the meals in these countries. Based on Medline search, the prevalence of osteoporosis among pregnant women has not been done before in Sub-Saharan Africa. It was because of these reasons that this study on the prevalence of osteoporosis among antenatal clinic attendees in a rural mission hospital in Southeast Nigeria, was embarked upon. This study aimed to assess the prevalence of osteoporosis among antenatal clinic attendees in a rural Southeastern hospital.

Materials and Methods

This was a cross-sectional study of booking antenatal clinic attendees that was carried out at Mile 4 Catholic Hospital, Abakaliki, Ebonyi State, between October 2014 and February 2015. The study participants were selected through systematic random sampling.[22] Thereafter, each booking antenatal woman with odd serial number in the attendance register was selected. A structured interviewer-administered questionnaire was used to collate information on the sociodemographic characteristics, parity distribution, and calcium supplementation of the eligible participants. Before the administration of the questionnaire at the study center, it was pretested on twenty booking antenatal clinic attendees at St. Vincent Hospital, Ndubia-Ikwo, Ebonyi State, another rural mission hospital owned by the Roman Catholic Church. For the purpose of this study, adherence to calcium supplementation in pregnancy occurs when the pregnant woman takes at least a tablet of calcium lactate (300 mg) daily from the first trimester of the pregnancy. Ever use of calcium supplementation in the index pregnancy occurs when the pregnant woman takes calcium lactate from the first trimester of the pregnancy but may or may not be compliant with the drug.

The BMD of the right calcaneal bone of the participants was measured using the OsteoPro. OsteoPro is an ultrasound bone mineral densitometer produced by B.M. Tech. Worldwide Co., limited, Falkensteiner StraBe 4, D-61462 Konigstein, Germany. This study used the manufacturer's African reference database for BMD already installed in OsteoPro software. The cutoff values for categorizing patients as having low bone mass (osteopenia) or osteoporosis in this study used the WHO criteria,[23] in which osteoporosis was defined as a *T*-score of <2.5 standard deviation (SD). Osteopenia was also determined when the *T*-score was between –1 and –2.5 SD. The OsteoPro software also provided a *Z*-score of BMD, which is obtained by comparison to reference mean matched for sex, age, and weight. The OsteoPro had a provision for input of the biodata of the clients. The biodata comprised of name of the client, date of birth, sex, region of origin (Africa, America, Asia, Europe, or Middle-East), and side of the calcaneal bone (either right or left) to be tested. Once the input of the biodata was made and the client was tested, the OsteoPro automatically gave the *T*-score and *Z*-score and depicted whether the result was normal, osteopenia or osteoporosis. The inclusion criteria comprised the consenting booking antenatal women with odd serial numbers in the attendance register. However, the booking pregnant women with even serial numbers in the attendance register, those already booked, and those of them who, despite adequate counseling, refused to participate in the study, were excluded from the study. There were only one and three respondents who were taking tobacco and alcohol in the index pregnancy, respectively, and so they were excluded from this study.

The minimum sample size for the study was calculated based on the formula for estimating sample size for cross-sectional studies described by Daniel.[24] With 29.6% osteoporosis prevalence among Jordanian women,[25] the minimum sample size was 320. Data were analyzed using Epi Info Statistical software (CDC, Atlanta, Georgia, version 3.5.4). Analysis of Variance

and Student's *t*-test were used for the analysis of the continuous variables whereas Pearson Chi-squared test was used for analysis of the discrete variables. $P \leq 0.05$ was considered statistically significant. Ethical clearance for the study was obtained from the Ethics Committee of the Federal Teaching Hospital, Abakaliki. Informed written consent was obtained from the study participants.

Results

A total of 327 eligible booking antenatal women participated in the study. The average age of the participants was 29 ± 4.5 years and it ranged from 18 to 44 years. The average parity was 2 ± 1.6 childbirths and ranged from 0 to 9 childbirths. The mean *T*-score was −1.19 ± 4.9. Table 1 showed that osteoporosis was recorded in 119 women (36.4%) and osteopenia in 56 (17.1%) whereas 152 (46.5%) were within normal range. The effect of sociodemographic characteristics and calcium supplementation on osteopenia and osteoporosis among the antenatal women is contained in Table 2. The age distribution, parity, educational qualification, and adherence to calcium supplementation were not statistically significant on the reduction of osteopenia and osteoporosis among the women ($P \geq 0.05$). However, history of regular exercise by the respondents before the index pregnancy is statistically significant on the reduction of osteopenia ($P \leq 0.03$) and osteoporosis ($P \leq 0.03$). While history of ever use of calcium supplement by the study participants is statistically significant on the reduction of osteopenia ($P = 0.00$), it did not have any effect on osteoporosis ($P = 0.16$).

Table 1: The prevalence of osteoporosis and osteopenia among the antenatal women (*n*=327)

	n (%)
Osteoporosis	119 (36.39)
Osteopenia	56 (17.13)
Norma	152 (46.48)

Table 2: The effect of sociodemographic characteristics and calcium supplementation on osteopenia and osteoporosis among the antenatal women

Determinants	Normal value	Osteopenia	Osteoporosis	*P*	*P***
Age (years)					
<30	90	35	72	0.79	0.93
≥30	62	21	47		
Parity					
0	51	24	53	0.28	0.09
≥1	101	32	66		
Educational status					
≤Primary	18	4	6	0.45	0.08
≥Secondary	134	52	113		
Exercise programme					
Yes	88	23	52	0.05	0.03
No	64	33	67		
Ever use of calcium supplementation in the index pregnancy					
Yes	81	22	51	0.10	0.11
No	71	34	68		
Adherence to calcium supplementation in the index pregnancy					
Yes	4	1	0	1.0	0.13
No	148	55	119		

***P*-value for osteoporosis

Discussion

This study showed that there is a high prevalence of osteoporosis among pregnant women in Southeast Nigeria. With the exception of a history of regular exercise before the index pregnancy, the other sociodemographic characteristics did not have any statistically significant effect on the reduction of osteoporosis among the pregnant women.

The osteoporosis prevalence of 36.4% recorded in this study is higher than 17.83% and 20.25% reported in Pakistan and India, respectively (26.27). The reasons for this difference in osteoporosis prevalence between this study and the reports from the other centres may have been because of the different methodologies used in the studies. While quantitative ultrasound scan (QUS) was used in this study and, in Pakistan and India,[26,27] the study participants in this study were only pregnant women unlike both the reproductive age and postmenopausal women that participated in the Pakistani and Indian studies. The high osteoporosis prevalence in this study may also be due to the pregnancy which increases the risk of osteoporosis.[5] The Jordanian and Iranian studies, in which dual-energy X-ray absorptiometry (DEXA) was used, excluded the pregnant and lactating women.[25,28] The reason for exclusion of pregnant and lactating women in these studies was because of possible exposure to ionizing radiation which is not safe in pregnancy and lactation.

The 17.1% osteopenia prevalence in this study is much lower than 62.9% prevalence reported among the pre- and post-menopausal women in Pakistan.[26] The reason for this difference may be because of involvement of both pre- and post-menopausal women in the Pakistani study, unlike this study in which only pregnant women were

involved. This may also be due to differences in racial predisposition to bone fragility as it is more common among Asians than blacks.[29] The protective effect of regular exercise program, before the index pregnancy, against osteopenia and osteoporosis in this study is similar to the previous reports in Jordan and Pakistan, in which sedentary life style was a risk factor to osteoporosis.[25,26] Although less proportion of pregnant women on calcium supplementation were suffering from osteoporosis when compared with nonusers in this study, lack of significant protective effect of calcium supplementation to osteoporosis is against the reports in Pakistan, India, and Jordan.[26,30,31] Usually, in this environment, the readily available and affordable oral calcium supplement is calcium lactate and each tablet is 300 mg. A twice daily dose of calcium lactate 300 mg is recommended to every pregnant woman from booking at the study center. The 300 mg tablet of calcium lactate contains about 12% elemental calcium which is 36 mg.[30] Therefore, the recommended daily elemental calcium supplement for pregnant women at the study center is 72 mg. This is much less than the WHO recommended daily elemental calcium intake of 1.5–2.0 g by the pregnant women.[32] Based on this fact, calcium supplementation in pregnancy using twice daily dose of 300 mg calcium lactate will not significantly prevent osteoporosis in pregnancy. This might have been responsible for the insignificant effect of adherence to calcium supplementation to osteoporosis in pregnancy in this study. To reduce this public health challenge, the WHO recommended daily dose of elemental calcium supplement for pregnant women should be implemented in this environment. The dieticians should also be involved in counselling the pregnant women on taking high calcium-containing diets to help stem the tide of osteoporosis and its complications in Nigeria. The women should be counseled on the need for them to adhere to not only the calcium supplements but also other routine antenatal drugs through the mass media and at the preconceptional care and antenatal clinics.

Although the QUS used in this study is reliable, safe in pregnancy, and cheap,[33] the DEXA scan is still considered as the gold standard test for measuring BMD,[34] thereby limiting the validity of the results of this study. It is also weakened by nonscreening of the participants on endocrine disorders, nutritional deficiencies, and inflammatory disorders which are also the risk factors to osteoporosis. This study is further weakened by the cross-sectional design, and some of the information sought for is prone to recall bias. This is also a hospital-based study, in which its findings may not be a true reflection of what is happening in the society.

Conclusion

There is a high prevalent of osteoporosis among pregnant women in Southeast Nigeria. This may be due to the predominant poor adherence and low dose of calcium supplementation among pregnant women in this environment. Therefore, there is an urgent need for community sensitization on this public health problem and on the various ways of preventing it. The WHO recommended daily dose of elemental calcium supplement for pregnant women should be implemented in this environment to reduce high osteoporosis prevalence and its complications. The pregnant women should also be counseled to be taking high calcium containing diets to help stem the tide of osteoporosis and its complications in Nigeria. A randomized control community-based study on this subject matter is needed to further strengthen or refute the findings from this study.

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Conflicts of Interest

There are no conflicts of interest.

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