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Study of association of maternal serum calcium on fetal birth weight

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Abstract
It is essential to educate pregnant women's about the need for calcium. Maternal calcium supplementation of about2 g/day in the mid pregnancy period can influence the mineralization of the fetal bone. Hence the study was planned to establish the effects of calcium on the fetal birth weight.
The study was conducted in the Department of Paediatrics and Gynaecology in Anugrah Narayan Magadh Medical College and Hospital. The data from the 50 patients were collected and presented as below.
Maternal calcium is thus create to perform a significant role in responsible the fetal birth weight. In our country, most of the pregnant women fail to consume the recommended amount of nutrition needed for the fetal growth. Hence it is essential to educate the pregnant women about the importance of calcium on fetal growth. The required supplements must be provided during their antenatal visits.

Keywords: serum calcium, fetal growth, calcium supplement in pregnancy, etc.

Introduction
Birth weight is the body weight of a baby at its birth [1]. The average birth weight in babies of European heritage is 3.5 kilograms (7.7 lb), though the range of normal is between 2.5 kilograms (5.5 lb) and 5 kilograms (11 lb) (all but 5% of newborns will fall into this range). Babies of south Asian and Chinese heritage weigh about 240 grams (0.53 lb) less [2, 3].
There have been numerous studies that have attempted, with varying degrees of success, to show links between birth weight and later-life conditions, including diabetes, obesity, tobacco smoking and intelligence. Low birth weight is associated with neonatal infection.
There are basically two distinct determinants for birth weight:

- The duration of gestation prior to birth, that is, the gestational age at which the child is born

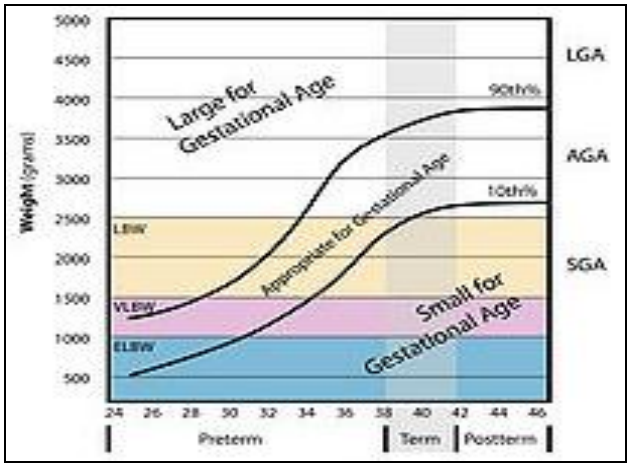

Fig 1: Weeks of gestation

- Relation of weight and gestational age.
- The prenatal growth rate, generally measured in relation to what weight is expected for any gestational age.

The incidence of birth weight being outside what is normal is influenced by the parents in numerous ways, including:

- Genetics
- The health of the mother, particularly during the pregnancy. Intercurrent diseases in pregnancy are sometimes associated with decreased birth weight. For example, Celiac disease confers an odds ratio of low birth weight of approximately 1.8 [4].
- Environmental factors, including exposure of the mother to secondhand smoke [5]
- Economic status of the parents gives inconsistent study findings according to a review on 2010, and remains speculative as a determinant [6].
- Other factors, like multiple births, where each baby is likely to be outside the AGA (appropriate for gestational age), one more so than the other.

A low birth weight can be caused either by a preterm birth (low gestational age at birth) or of the infant being small for gestational age (slow prenatal growth rate), or a combination of both. A very large birth weight is usually caused by the infant having been large for gestational age.
Poor maternal and newborn health and nutrition remain significant contributors to the burden of disease. In 2010, 3.1 million babies died in the first 28 days of life, mostly due to low birth weight, severe infections, asphyxia and preterm birth.
Calcium is the most abundant mineral in the body and is essential for many diverse processes, including bone formation, muscle contraction, and enzyme and hormone

functioning. Most of the body's calcium is found in the bones and teeth; approximately 1% is present in the intracellular structures, cell membrane and extracellular fluids. Calcium absorption increases during pregnancy and no additional intake is needed. A dietary intake of 1200 mg/day of calcium for pregnant women is recommended by WHO and the Food and Agriculture Organization of the United Nations (FAO). Inadequate consumption of this nutrient by pregnant women can lead to adverse effects in both the mother and the fetus, including osteopenia, tremor, paraesthesia, muscle cramping, tetanus, delayed fetal growth, low birth weight and poor fetal mineralization. Serum calcium concentrations are maintained within narrow limits in the body and thus have limited use for the assessment of calcium nutritional status at both the individual and the population levels. Calcium intake could be a useful indicator of status at the population level [7].

It is essential to educate pregnant womens about the need for calcium. Maternal calcium supplementation of about2 g/day in the mid pregnancy period can influence the mineralization of the fetal bone. Hence the study was planned to establishes the effects of calcium on the fetal birth weight.

Methodology

The study was conducted in the Department of Paediatrics and Gynaecology in Anugrah Narayan Magadh Medical College and Hospital. The data from the 50 patients were collected and presented as below. The approval of the institutional ethic committee had been taken before the study. All the patients were informed consent. The aim and the objective of the study is conveyed to all patients.

Results & Discussion

In the current planned study the data from 50 patients were collected and presented as below. The serum calcium was estimated by routine laboratory testing. The foetal outcome was noted and the details are shown in below mentioned table. Bases in the variables like pregnant women's receiving Calcium supplement, Socio economic status, Gravida, Gestational period

Table 1: Serum Calcium Vs Birth Weight

Condition	Set	No. of Cases	Serum Calcium	Birth Weight
Calcium Supplement	Yes	40	9.12 ± 0.6	3.1 ± 0.35
	No	10	8.5 ± 0.5	2.4 ± 0.42
Gravida	Primary	12	9.25 ± 0.5	2.9 ± 0.5
	Multiple	48	8.85 ± 0.6	2.7 ± 0.4
Socio Economical Status	Lower	8	8.78 ± 0.7	2.50 ± 0.6
	Middle	30	8.82 ± 0.6	2.75 ± 0.3
	Upper Middle	12	9.05 ± 0.4	2.9 ± 0.4
Gestational Age	Premature	15	8.4 ± 0. 62	2.2 ± 0.51
	Terminal	35	9.23 ± 0.53	2.85 ± 032

From the results obtained, Table: 1 clearly shows that the serum calcium levels were normal in the group who took Ca2+ supplements regularly and the primi gravid group than the women not on calcium supplements and the multigravida group. They also delivered normal birth weight babies. Socioeconomic status was not found to be of much significance. It was also found that mothers with below normal calcium levels delivered preterm babies than the normal calciumgroup.

The three major sources of maternal calcium to maintain fetal bone growth are increased absorption ofintestinal calcium, reduced renal calcium excretion and calcium resorption from maternal skeleton [8]. Increased intestinal calcium absorption is an important compensatory mechanism for securingadditional calcium during pregnancy. It occurs along with increase in vitamin D concentrations (4–62%) in thethird trimester. Thus Ca2+homeostasis is maintained by the Ca2+sensing receptors that sense extracellular Ca2+levels and initiate parathyroid hormone and vitamin D levels [9]. In a study conducted, 15 women who electively terminated their pregnancy (8–10 weeks) showedincrease in bone resorption surfaces, cavities and reduced osteoids in their bone biopsy reports. These findingswere not present in biopsies done in non-pregnant controls, or in biopsies done at term for 13 women afterdelivery [10].

Many studies have reported that urinary markers (deoxypyridinoline, pyridinoline, and hydroxyproline) of boneresorption (24-h collection) are increased during the mid-pregnancy. Serum markers of bone formation (osteocalcin, procollagen I carboxypeptides and bone-specific alkaline phosphatase) are usually decreasedduring mid pregnancy on comparing with the pre pregnancy values. Recent studies included dual-energy x-rayabsorptiometry (DEXA) for analyzing the bone status before conception and after delivery, the maternal lumbarspine bone density showed reduced values when preconception and 4 to 6 weeks post-partum readings werecompared [11-12]. Daily loss of calcium in breast milk ranges from 280–400 mg. Low calcium concentrations in milkhave been noticed in women with vitamin D deficiency and low calcium diet [13]. Rarely, a woman suffersfrom fragility fracture during pregnancy or in the post-partum period. Some women have excessive resorption ofcalcium which may contribute to fracture risk.These consequences may be due to preexisting low bonedensity or increased bone turnover.Calcium needs increase during pregnancy, mainly for fetal skeletal calcification. The maximum rate ofincrease occurs in the final trimester [9]. The placenta transports calcium actively to the fetus and maintainstotal and ionized calcium at about 1mg/dl above maternal calcium levels. From 28 to 40 weeks of gestation,fetal weight triples but calcium content quadruples due to increased bone mineral mass. Several studies havesuggested that very low maternal calcium intake may be a risk for low bone mass in neonates [11]. The lowserum calcium levels during pregnancy limits the fetal

mineral accretion and the calcium concentration in breastmilk and these affect infant growth and bone mineral accretion. Calcium supplementation during pregnancyreduces the risk of preterm births [14].

Calcium is thus found to play an important role in determining the birth weight [14]. Calcium is not onlyessential during pregnancy, but also during lactation. During lactation, the loss of calcium in breast milk is about280-400 mg [11]. These help in the bone development of the fetus. These supplements are essential at differentphases of life as it protects the bone, especially during menopause when the bones become fragile (osteoporosis)and more prone for fractures [13]. The role of calcium continues throughout life as its main function is bonepreservation.

Conclusion

Maternal calcium is thus create to performansignificant role in responsible the fetal birth weight. In our country, most of the pregnant women fail to consume the recommended amount of nutrition needed for the fetal growth. Hence it is essential to educate the pregnant women about the importance of calcium on fetal growth. The required supplements must be provided during their antenatal visits.

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