A STUDY OF RELATIONSHIP BETWEEN MATERNAL SERUM CALCIUM LEVEL AND NEONATAL BIRTH WEIGHT IN FULL TERM DELIVERED BABIES.
Dr.Ananya Debbarma(3rd Year Resident),Dept.of Physiology
P.G Teacher:Dr.NeetaMehta,Professor,Dept.of Physiology,B.J.M.C,Ahmedabad

Key words: Maternal serum calcium,foetal birth weight.

Abstract: Pregnancy is a period of physiological changes in body during which the nutritional needs of developing foetus depends on the mother. This study establishes the effects of maternal calcium on the neonatal birth weight in full term delivered babies.

Method: A comparative study was performed on 60 antenatal women divided into 2 groups. Group1 comprised of 30 antenatal women who received calcium supplements and Group2 having 30 antenatal women who did not take calcium supplements. Permission from Dept.of OB&G,B.J.M.C and Civil Hospital,Ahmedabad obtained. Biochemical analysis of calcium was done. Birth weight of neonates born at full term was noted.

Result: Women with normal serum calcium levels delivered full term babies with normal birth weight. Women with low serum calcium levels delivered full term babies with low birth weight. Calcium levels were high in women who took regular calcium supplements in their antenatal period than the women who were not on calcium supplements.

Conclusion: Calcium is an essential nutrient during pregnancy that supports the growth and development of the foetus, especially because of its maternal-foetal transfer. Maternal calcium level thus can be responsible for determining the neonatal birth weight. Therefore, it is necessary to educate all pregnant women about the need for adequate calcium supplementation during pregnancy and thereafter.

Key Words: Maternal serum calcium, foetal birth weight.

Introduction:
Calcium (Ca^{2+}) is crucial for a healthy diet. It plays a key role in cell signaling for regulating various cellular processes. It helps in mineralizing bones and teeth. Calcium is the primary mineral in the human body. Normal serum level is 8.4-10.4 mg/dl. Calcium is most abundant in Bones (99%) & about 1% resides as freely available extracellular fluid. Daily calcium recommendation is 1000 mg/day. During Pregnancy calcium metabolism is significantly affected as calcium is crucial for the fetal bone development. Calcium is constantly transported to the developing foetus through the placenta, mainly during the third trimester of pregnancy. To sustain the accelerated demand for calcium during pregnancy, the body increases the intestinal absorption of calcium; decreases calcium excretion and also increases the resorption of calcium from the maternal skeleton. Low intake of calcium may have negative affects on foetal bone development. In India, almost half of the pregnant women do not have access to recommended dose calcium crucial for maintaining a healthy body during pregnancy and lactation. Decreased supply of calcium during pregnancy results in preeclampsia, low birth weight, preterm delivery, neonatal low bone mineral density and caesarean section. In 2011 & 2012, WHO recommended the dose of calcium supplementation in pregnant women to prevent and treat pre-eclampsia and eclampsia. In both guidelines, WHO strongly recommends supplements of about 1.5 grams to 2.0 grams of elemental calcium daily in areas of low dietary intake of calcium and for those at high risk of developing hypertensive disorders during pregnancy. Despite being prescribed 1000 mg/day of calcium supplements, most women ignore the consumption of calcium rich diet primarily due to the lack of awareness about its importance. The following study demonstrates the effects of calcium on the neonatal birth weight.
Materials and Methods:

This is a comparative Study conducted in the Departments of Obstetrics & Gynecology and Physiology, B.J. Medical College and Civil Hospital, Ahmedabad. Required permission and clearance was obtained from Obstetrics & Gynecology Department, B.J. Medical College and Civil Hospital, Ahmedabad. 60 pregnant women in last trimester of pregnancy were enrolled. Written informed consent was taken from all the subjects. Confidentiality of all the subjects was maintained. The sample size of the study was 60 pregnant women with in the age range of 19 to 35yrs. Duration of this study was 3 months (June-August 2017). A full medical history of all the subjects was first obtained including their obstetric history by administering a detailed questioner. Inclusion criteria for these study was healthy pregnant women in their last trimester. Exclusion criteria were subjects with any complication during antenatal period, metabolic or endocrine disorders. Pregnant ladies with history of Hypertension, Diabetes mellitus, Heart disease, any other chronic infection or renal disease were excluded from this study. History of Preterm deliveries and Intra uterine growth restrictions were also excluded.

All the Subjects were divided into two groups:
Group 1: This group comprised of, 30 pregnant female who were supplemented with 1000mg/day of calcium during antenatal period.
Group 2: This group included 30 pregnant female who were not consuming additional calcium during antenatal period.

Each of the pregnant women was subjected to a thorough medical examination. 5 ml of venous blood was collected from each subject under aseptic precautions, for estimation of serum calcium. To record the details of delivery & the new born follow-up was done.

RESULT:

By using the serum calcium levels and the neonatal delivery details, the neonatal birth weights was compared among the low calcium group and the normal calcium group. Furthermore, Calcium supplementations and gravida analysis was done using the serum calcium levels and the neonatal delivery details, with calcium levels. The data obtained were tabulated in MS Excel Worksheet & were expressed as mean ± SD. For parametric variability considering p < 0.05 to be statistically significant, independent t-test was applied.

Table 1

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group</th>
<th>Sr.Calcium</th>
<th>p-value</th>
<th>Birth Weight</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca2+ supplementation</td>
<td>Yes (30)</td>
<td>9.06±0.58</td>
<td>0.007</td>
<td>2.80±0.47</td>
<td>0.003</td>
</tr>
<tr>
<td></td>
<td>No(30)</td>
<td>8.47±0.61</td>
<td></td>
<td>2.14±0.45</td>
<td></td>
</tr>
<tr>
<td>Ca2+ supplementation taken</td>
<td>Primi Gravida(20)</td>
<td>9.15±0.58</td>
<td>&lt;0.001</td>
<td>2.85±0.58</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Multi Gravida(10)</td>
<td>8.94±0.61</td>
<td></td>
<td>2.65±0.53</td>
<td></td>
</tr>
<tr>
<td>Ca2+ Supplementation not taken</td>
<td>Primi Gravida(14)</td>
<td>Multi Gravida(16)</td>
<td>p-value</td>
<td>p-value</td>
<td></td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------</td>
<td>-------------------</td>
<td>---------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>8.36±0.61</td>
<td>8.17±0.58</td>
<td>0.03</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.42±0.47</td>
<td>2.18±0.45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Graph 1**

**Table 2**

<table>
<thead>
<tr>
<th>Sr.Calcium</th>
<th>Birth Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.15</td>
<td>2.85</td>
</tr>
<tr>
<td>8.94</td>
<td>2.65</td>
</tr>
<tr>
<td>8.36</td>
<td>2.42</td>
</tr>
<tr>
<td>8.17</td>
<td>2.18</td>
</tr>
</tbody>
</table>

**Serum Ca2+ (8.4-10.4mg/dl)** | **Neonatal Birth Weight** | **p-value**
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 2 shows that mothers who had normal serum calcium levels delivered normal birth weight babies compared to the low calcium group (p-value < 0.001).

**Discussion:**

The findings of our study concur with that of Winston W. K. Koo et al [1]. The study showed that increase in the rate of calcium, is maximum in the final trimester while decreased level of Serum calcium was evidently related to the low birth weight of the neonates.
The findings of this study were also similar to the study conducted by Landing MA Jarjou et al[2] which states that Calcium is crucial in determining the birth weight and emphasizes on its vital role for lactation.

The three primary sources of calcium in pregnant woman to sustain fetal bone growth are accelerated absorption of intestinal calcium, reduced renal calcium excretion and calcium resorption from maternal skeleton. The surge in intestinal calcium absorption is vital compensatory mechanism for securing supplementary calcium during pregnancy. Simultaneously, vitamin D concentration also increases (4–62%) in the third trimester. As a result, Ca2+sensing receptors that sense extracellular Ca2+ levels and initiate parathyroid hormone and vitamin D levels maintain Ca2+homeostasis.

Christopher S. Kovacs et al [3] stated that absorption of calcium through intestine increases by 60–70% during pregnancy, from about 33–36% in the non-pregnant state to 50–56% in the second trimester and to 54–62% in the third trimester. Renal calcium absorption due to the increased glomerular filtration rate during pregnancy, is observed to increase by 46% during the period of pregnancy among women who consumer approx.1200 mg/d calcium.

His study states that foetal weight between 28 to 40 weeks of gestation triples but calcium content quadruples due to increased bone mineral mass. Several other studies suggest that extremely low maternal calcium consumption exposes the foetus to the risk of growing low bone mass. The placenta transports calcium actively to the foetus and maintains total and ionized calcium at about 1mg/dl above maternal calcium levels.

In another study Sana M Ceesay et al [4] demonstrated that the three primary sources of maternal calcium necessary for foetal bone growth are: higher absorption of intestinal calcium, reduction in excretion of renal calcium and calcium resorption from maternal skeleton.

Furthermore, study conducted by AdekunleDawoduand, Reginald, C. Tsang et al [5] emphasized that increase in intestinal calcium absorption is a crucial compensatory process for generating surplus calcium during pregnancy. Simultaneously, increase in vitamin D concentrations (4–62%) in the third trimester also occurs. Thus Ca2+homeostasis is maintained by the Ca2+sensing receptors that sense extracellular Ca2+ levels and initiate parathyroid hormone and vitamin D levels[6].

Conclusion:

Maternal calcium is therefore playing a significant influence upon neonatal birth weight. Most of the pregnant women in India, fail to ensure intake of the recommended amount of nutrition needed for the foetal growth. During pregnancy, about 1 g/day of calcium supplementation, especially during, the mid pregnancy period becomes essential for the mineralization of the foetal bone.

Thus pregnant women must be educated about importance of calcium consumption for neonatal growth. Necessary supplements of calcium should be provided during their antenatal visits. Calcium levels need to be sustained not only during pregnancy and lactation, but throughout entire life as it is needed for the maintenance of the bone.

References:


[6]. Steven A Abrams et al In utero physiology: role in nutrient delivery and neonatal development for calcium, phosphorus, and vitamin D1–4 Am J Clin Nutr 2007; 85(suppl):604S–7S.


