IRAQI Academic Scientific Journals
العراقية المجلات الأكاديمية العلمية
ISSN:1813-1646 (Print); 2664-0597 (Online)
The Medical Journal of Tikrit University
Journal Homepage: http://mjtu.tu.edu.iq
MJTU
The Medical Journal of Tikrit University

The Correlation between Calcium Levels of Pregnant Women Whom Take Adequate and Inadequate amount of Dietary Calcium and Their Neonate

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Received: **15/05/2017**
Accepted: **16/07/2017**
Available:online:31/**12/2023**

KEY WORDS:
Calcium, pregnant women, neonate.

ABSTRACT
Calcium is an element that is a fundamental part of the body and its importance is related to the functions it performs in bone mineralization, primarily related to bone health which include formation and maintenance of the structure and rigidity of the skeleton. For many years, women have been advised to increase their calcium intake substantially during pregnancy, and there has been concern that many pregnant women do not ingest enough calcium to maintain their own skeletons while providing for fetal needs. **Aims of the study**: To evaluate the effect of dietary calcium on maternal calcium level and their neonate. **Patients and Methods**: 146 pregnant women were recruited from Sammaraa General hospitals during the period November 2016 – May 2017. Maternal and their neonate blood samples were taken at delivery. The serum was assayed for calcium. All the women were in the last trimester of gestation (37 – 41 weeks). **Results**: Our study showed that although 63.01% of pregnant women didn't get adequate amount of dietary calcium < 500 mg per day, but the serum calcium levels stay within normal ranges. **Conclusions:** We concluded that the pregnancy women have the ability to adapt to wide ranges of calcium intakes and still meet the fetal demand for calcium.

DOI: http://doi.org/10.25130/mjotu.29.1.13

INTRODUCTION

Calcium is an element that is a fundamental part of the body and its importance is related to the functions it performs in bone mineralization, primarily related to bone health which include formation and maintenance of the structure and rigidity of the skeleton [1,2]. For many years, women have been advised to increase their calcium intake substantially during pregnancy, and there has been concern that many pregnant women do not ingest enough calcium to maintain their own skeletons while providing for fetal needs [3].

Maternal nutrition during pregnancy is known to have an effect on fetal growth and development. It is recommended that women increase their calcium intake during pregnancy and lactation, although the recommended dosage varies among professionals [4].

The calcium for skeletal mineralization is supplied by the mother across the placenta during fetal life and through breast milk during infancy. At birth, an infant's body contains 20-30 g Ca, almost all of which is in the skeleton [5,6].

About 80% of the calcium present in the fetal skeleton at the end of gestation crossed the placenta during the third trimester and is mostly derived from dietary absorption of calcium during pregnancy. Intestinal calcium absorption doubles during pregnancy, driven by 1,25-dihydroxyvitamin D (calcitriol) and other factors, and this appears to be the main adaptation through which women meet the calcium demands of pregnancy [6]. Intestinal absorption of calcium doubles as early as 12 weeks of pregnancy and appears to be the major maternal adaptation to meet the fetal need for calcium. Common dogma is that the doubling or tripling of calcitriol levels is responsible for this by stimulating an increase in intestinal calbindin 9k -D, TRPV6, Ca 2+ -ATPase, and other proteins; however, intestinal calcium absorption doubles in the first trimester, well before the rise in free calcitriol levels during the third trimester. Animal studies have indicated that placental lactogen, prolactin, and other factors may stimulate intestinal calcium absorption [7], and that calcitriol or the vitamin D receptor are not required [8]. The peak fetal demand for calcium does not occur until the third trimester and so it is unclear why intestinal calcium absorption should be upregulated in the first trimester. It may allow the maternal skeleton to store calcium in advance of the peak fetal demands that occur later in pregnancy; some studies in rodents have shown this to be the case with the bone mineral content rising significantly before term [9].

MATERIAL AND METHODS

The present study done on pregnant women attending the Samara general hospital, Salahuddin city from tenth of November 2016 to last of May 2017. one ml Blood samples were drawn from mother and their neonate and centrifuged for 15 minutes in the hospital lab.

Subjects: this study include 146 pregnant women with age (15 – 37) years, (37 – 41) gestation weeks, Exclusion criteria were those with a known history or evidence of rheumatoid arthritis thyroid, parathyroid or adrenal diseases, malabsorption, or medications influencing bone, vitamin D or calcium metabolism.

Study design: cross sectional study. The information included age, neonate sequence, sex of neonate, maternal calcium level, neonate calcium. Dietary calcium amount was calculated by using food and nutrition board, institute of medicine, National Academies. Serum calcium was measured by *Bio Vision's Colorimetric Calcium Assay Kit.* Pearson correlation was used to investigate correlation between two variables. In all tests, the level of significance was 0.05.

RESULTS

About 146 women investigated in the study, 47(31.1%) aged 15-20 years followed by age group 26-30 years 46(31.5%), as shown in table 1 and figure 1.

Table 1: The age distribution of mothers

Age	Frequency	Percent
15-20	47	32.2
21-25	26	17.8
26-30	46	31.5
31-35	23	15.8
>35	4	2.7
Total	146	100.0

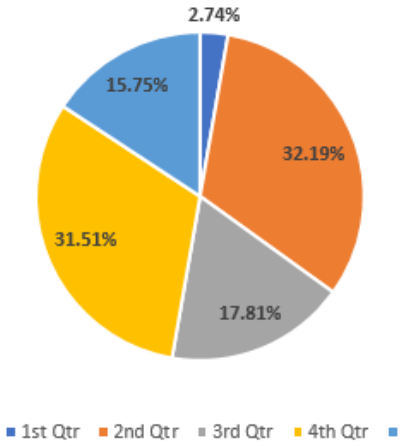

Figure 1: The age distribution of mothers

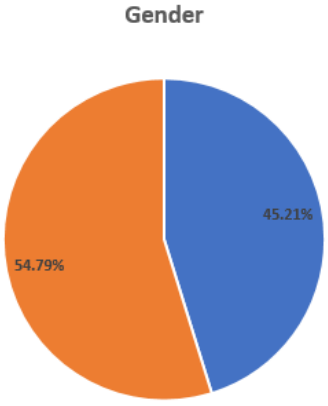

Figure 2: The gender distribution of the neonatal

The mean maternal calcium was 9.155±0.29, and the neonatal calcium was 9.22±0.21, when the

calcium level of the mothers compared with neonatal calcium level we found increment in neonatal calcium level with maternal calcium increment, this relation was statically significant, as shown in table 2.

Table 2: The mean ± Standard Deviation maternal and neonatal calcium

Maternal calcium	No.	Mean	Std. Deviation
8.5	1	9.1	0
8.7	12	9.0	0.1
8.8	13	9.0	0.2
8.9	15	9.1	0.1
9	10	9.1	0.2
9.1	20	9.2	0.1
9.2	26	9.3	0.1
9.3	18	9.3	0.1
9.4	9	9.3	0.2
9.5	4	9.4	0.2
9.6	8	9.3	0.2
9.7	4	9.4	0.3
9.8	4	9.4	0.3
9.9	2	9.6	0.1
Total	146	9.2	0.2

F=9.7, df=13, P≤0.05 significant

There is a positive correlation 0.63 between maternal calcium and neonatal calcium, this relation was statistically significant, P value < 0.05, and the neonatal calcium level can be expected the following formula (neonatal calcium = 0.8* Maternal calcium+1.8) is as shown in table 3 and figure 3.

Table 3: The correlation between maternal and neonatal calcium level

		Maternal calcium
Calcium level in neonate	Person Correlation	0.630
	Sig. (2-tailed)	.000
	No.	146

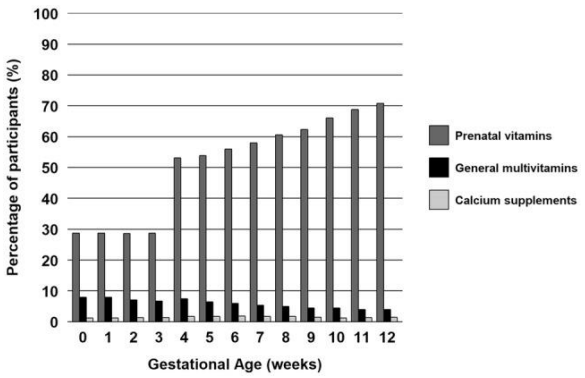

Figure 3: The correlation between maternal and neonatal calcium

The dietary calcium was less than 500 mg/dl among 92(63.01%) as compared with 54(39.99%) that eat more than 500 mg/dl as shown in figure 4. The mean maternal calcium for those takes less than 500 mg/dl was 9.15±0.31 as compared with 9.16±0.28, this relation was statistically significant. The maternal calcium = 0.25* birth sequence +8.25. Figure 6 show that there is weak positive correlation 0.164, between maternal calcium level and age, this relation was statistically significant. The maternal calcium = 0.06* Age +7. The mean maternal calcium among those aged 15-20 years was 9.12±0.3, and among age group > 35 was 9.1±0.3, as shown in table 6 this relation was statistically not significant.

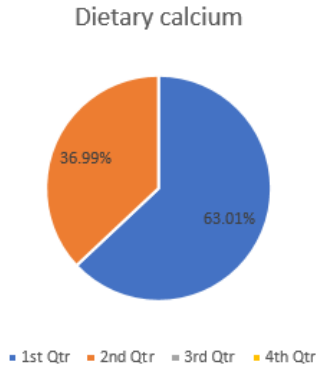

Figure 4: Dietary calcium distribution among study subjects

Table 4: The mean maternal calcium according to dietary intake.

Dietary calcium	Maternal calcium		
	No.	Mean	Std. D
Less than 500 mg/dl	92	9.15	0.31
More than 500 mg/dl	54	9.16	0.28

T=0.33, df=144, P>0.05 not significant

Table 5: The mean maternal calcium level according to birth sequences.

Birth sequences	Maternal calcium		
	No.	Mean	S. D
1	27	9.07	0.31
2	44	9.12	0.28
3	29	9.15	0.29
4	24	9.18	0.31
5	16	9.32	0.31
6	5	9.28	0.16
7	1	9.30	0.0
Total	146	9.15	0.30

F=1.5, df=6, P>0.05 not significant

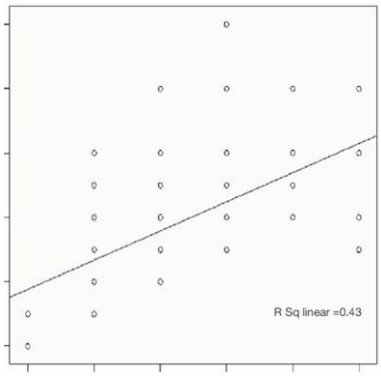

Figure 5: The Correlation between maternal calcium level and birth sequence.

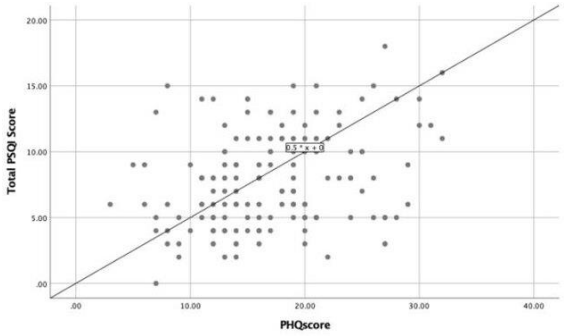

Table 6: The mean maternal calcium level according to maternal age.

Maternal calcium	Maternal calcium		
	No.	Mean	Std. Deviation
15-20	47	9.12	0.30
21-25	26	9.08	0.29
26-30	46	9.18	0.33
31-35	23	9.28	0.20
>35	4	9.10	0.32
total	146	9.15	0.30

F=1.85, df=4, P>0.05 not significant (ANOVA)

DISCUSSION

Our study showed that although 63.01% of pregnant women didn't get adequate amount of dietary calcium < 500 mg per day, but the serum calcium levels stay within normal ranges. These finding suggest that the pregnant women depend on other mechanism to ensure normal level of calcium for their neonate. These finding go with *Zeni et al* [10]. Reported that, as dietary calcium intake increased in women with previously low intakes, production of 1-a-hydroxylase was upregulated to increase activation of $1,25(OH)_2$ D, resulting in increased calcium absorption. Animal studies have indicated that placental lactogen, prolactin, and other factors may stimulate intestinal calcium absorption [11], and that calcitriol or the vitamin D receptor are not required [11].

In present study, we found increment in neonatal calcium level with maternal calcium increment (F=9.7, df=13, P<0.05) (Table 2), these finding confirm that the neonates depended completely on their mothers to get enough amount of calcium. These finding go with *Amina lmene Benali et al* [12], who was reported that there was a frank correlation is noted between the maternal serum calcium and serum calcium levels of the newborn (R=0.34).

Current study revealed, that there was a weak positive correlation (0.234), between maternal calcium level and birth sequences (Table 5), and this may be due to adaptation of the pregnant women to get enough amount of calcium among recurrent pregnancy.

Table 6 show (among extreme ages < 20 and > 35 the calcium was low while in-between ages increased with increasing age this may be due to menopause effect in > 35 and adolescent and growth needs of mother in < 20 years).

CONCLUSION

The current study revealed that the pregnant women keep their calcium levels, within normal range even when take inadequate amount of dietary calcium, and improved the normal calcium levels for their neonate.

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