JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue

JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)

An International Scholarly Open Access, Peer-reviewed, Refereed Journal

The Estimation of Serum Magnesium Levels in Preterm Pregnancy

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ABSTRACT

Background: Short- and long-term consequences like as impairments and stunted physical and mental development are more common in premature newborns. Therefore, it would greatly benefit public health if premature labor and delivery could be anticipated and prevented. In low-income nations like Bangladesh, where the standard of living is poor, premature labor and birth are serious problems. There are several potential causes of preterm labor, and one of them is a change in biochemistry, such as a lack of magnesium. Recent studies have further highlighted magnesium's importance in human health and illness. Mounting data suggests that magnesium metabolism changes negatively affect pregnancy outcomes. Our research set out to determine whether or whether there was a correlation between maternal magnesium status and the risk of delivering prematurely, identify symptoms and indicators that could be related, and propose dietary correction that would have predictive value.

Methods: This case-control study was carried out to evaluate serum magnesium levels and associated symptoms in women with preterm labour (28-36 weeks), n=200 and compare them with patients in same gestational age who delivered at term (37-40 weeks), n=200.

Results: During the study, both group-1 and group-2 majority were belong to 30-32 years age group 45% and 46%. 47.5% patients in Group-1 belonged to low socio-economic class, whereas in Group-2 46.5% patients belonged to this class. 12% and 15% patients in Group-1 and Group-2 respectively belonged to high socioeconomic class. Besides that, There was statistically significant difference between the two groups (P=0.001). In addition, in group-1 56% had followed diet which rich in fat. Whereas in group-2 60.5% had followed diet which rich in proteins, fruits, vegetables and cereals. Plus, history of muscle cramp seen in higher in group-1, 90% than group-2 55%. Moreover, fall in the value of serum magnesium levels was of a greater magnitude in Group-1 as compared to Group-2. The mean serum magnesium level at 28-30 weeks of gestation was 1.38±0.056mg/dl in Group-1 as compared to a value of 1.95±0.073mg/dl in Group-2. In fact, the mean serum magnesium level in Group-1 (case group) was found to be 1.345 mg/dl with a SD of 0.08. The mean serum magnesium level in Group-2 (control group) was 1.876 mg/dl with a SD of 0.012. The difference between the two groups was found to be statistically highly significant ($p<0.001$).

Conclusion: When pregnant, serum magnesium estimate is necessary because it may be used as a predictor of preterm labor and because it can help avoid premature labor. If a patient's blood magnesium level is low, they may want to take a magnesium supplement to make sure they don't go into labor too soon.

Keywords: *Preterm pregnancy, term pregnancy, serum Magnesium level*

INTRODUCTION

The occurrence of premature birth has increased in frequency, making it a major obstetrical issue. There has been a 30% rise in premature births since 1981 [1]. One in eight infants are delivered prematurely nowadays [2, 3], while the prevalence varies greatly depending on the demographic investigated and the vast majority are brought into the world by means of spontaneous preterm labor. The term "preterm delivery" refers to a birth that occurs before 37 completed weeks of gestation [4, 5], while the term "preterm labor" refers to labor that begins before 37 completed weeks of gestation and is characterized by regular and frequent uterine contractions that result in progressive cervical changes. It's responsible for between 10% and 15% of pregnancies [5]. As with prevalence, variation in incidence is seen across different populations. Besides being a major contributor to neonatal morbidity and death [3, 6], the long-term complications associated with preterm birth are a major issue for both the newborn and the mother. While various risk factors have been found, the precise etiology of preterm labor and delivery remains unknown and is likely multifaceted; in 50% of instances, it is spontaneous and idiopathic. Multiple pregnancies, polyhydramnios, hypertensive diseases of pregnancy, infections, cervical incompetence, antepartum hemorrhage, fetal and uterine malformations, anemia, excessive work, smoking, and so on are all risk factors for premature membrane rupture (PROM) [8, 9]. Location and socioeconomic class are other factors [8-10].

Because of the potential consequences for mother, child, and society, one of the primary goals of prenatal care is screening to prevent viable spontaneous preterm delivery. More intense prenatal monitoring and preventative treatments may be directed toward high-risk women if they are detected early in pregnancy (primary prevention). However, little is known about the illness processes that underlie these issues. Therefore, there is a lack of effective diagnostic tools and preventative therapies. Knowing who is likely to give birth prematurely might be helpful clinically. These predictors may be utilized as part of a management protocol to tailor treatment to the specific needs of each patient [11, 12], and they may also be used to the care of women who are at high risk for preterm labor due to factors such having given birth prematurely before. Cervical ultrasonography measurement, fetal fibronectin (FFN), salivary estriol, serum CRH, and bacterial vaginosis are only few of the primary causes of preterm labor that have led to the recent proposal of several indicators more directly associated to preterm labor [13]. None of them are frequently utilized in Nigeria, despite the fact that some of them have predictive values that might be beneficial in clinical practice [13].

Alterations in the body's fundamental metabolic activities at the cellular level may also contribute to preterm labor [14], in addition to the many known aetiologies. This lends credence to the idea that studying the link between trace elements and premature birth is important. Trace elements such as magnesium are of particular importance in this context [15]. Low magnesium concentration in pregnant human myometrium has been linked to premature labor [16-18]. Hypomagnesaemia is a condition in which magnesium levels drop dangerously low. Magnesium sulphate was formerly used as a tocolytic agent in North American pregnancies [14, 19], however a Cochrane systematic review found that it is useless as a tocolytic agent and may even be hazardous to the unborn child [20]. Increasing blood magnesium levels relax the uterine smooth muscle.

Moreover, pregnant women require higher magnesium intake than the normal non-pregnant women of same age. Normal serum levels of magnesium in third trimester of pregnancy range from 1.1 to 2.2 mg/dL.2 Magnesium deficiency results in fatigue, confusion, irritability, weakness and hypertension, loss of appetite, insomnia, nausea, vomiting, diarrhoea, defect in nerve conduction and muscle contraction. Its deficiency during pregnancy is also associated with preterm labour, pre-eclampsia, small for gestational age (IUGR) foetus, leg cramps as well as sudden infant death syndrome. [5]

Therefore, this study is designed to estimation of serum magnesium levels in preterm pregnancy may prove to be a valuable tool in the prediction of preterm onset of labour.

OBJECTIVE OF THE STUDY

1. General Objective

- To estimate of serum magnesium levels in preterm pregnancy may prove to be a valuable tool in the prediction of preterm onset of labour.

2. Specific Objective

The specific objectives of the study are as follows:

1. To identify economic status of preterm and term pregnant Women.
2. To estimate serum magnesium levels in term pregnancy.
3. Outcome of preterm pregnancy.

RATIONALE OF THE STUDY

Birth before the age of viability, that is, before the baby has developed enough to survive outside the womb, is known as preterm birth. Due to the prevalence of preterm births (which account for up to half of all perinatal and neonatal mortality and morbidity) and the prevalence of the various short- and long-term consequences associated with preterm low birth weight, this issue has received more attention than it previously has.

In general, preterm births are defined as occurring before 37 weeks of gestation, however the majority of infant fatalities and diseases occur in preterm births occurring before 32 weeks of gestation. Although some possible risk factors have been found, the exact causes of preterm labor remain unknown; in about half of all instances, it occurs spontaneously and idiopathically. Up to 30 percent of preterm births are caused by premature membrane rupture (PROM), while another 15 to 20 percent are secondary to other conditions such as multiple pregnancy, polyhydramnios, infection, uterine anomalies, cervical incompetence, antepartum hemorrhage, hypertensive disorder of pregnancy, anemia, smoking, fetal anomalies, and intrauterine device (IUD). Both income and geography have a role in this phenomenon. 4-6

Magnesium, the second most abundant intracellular cation after potassium, plays a role in the biochemical alterations in body function that lead to premature labor alongside these causes. [7,8] Intracellular ionized magnesium is required for nerve transmission and muscle contraction, only two of its many crucial physiological and metabolic activities. [9]

Magnesium is a bivalent cation and essential trace element. There are several potential causes of premature labor, but one theory involves a disruption in magnesium's role in the body's metabolic processes at the cellular level. Pregnancy is associated with hypomagnesemia, and premature births are often accompanied by varying degrees of hypomagnesemia. As a result, magnesium is thought to be critically important in premature labor6,7. Serum magnesium level changes during healthy pregnancy and pregnancy complicated by illness have attracted a lot of attention. Several hundred enzyme processes need magnesium as a cofactor. It plays an essential part in the mechanics of nerve transmission, uterine contractility, and contractile response of other smooth muscles by activating those enzymes.

The effects of calcium are countered by magnesium. By activating the beta-2 adrenergic receptor and cyclic AMP, it also exerts a relaxing effect on the uterine myometrium. As a result of its competition with calcium ion, phosphorylated myosine8 levels are reduced and myosine kinase is inhibited. Inhibition of adenyl cyclase, leading to a rise in cytoplasmic calcium level9, is another potential mechanism by which hypomagnesemia causes uterine irritability. Preterm labor may be caused by a lack of magnesium in the pregnant woman's myometrium, which is why it is important to prevent hypomagnesemia. Magnesium sulphate is used as a tocolytic because an increase in blood magnesium level causes relaxation of the uterine smooth muscle. Therefore, premature labor may result from a low blood magnesium content during pregnancy.

Preterm birth has a complex set of causes, which makes it difficult to accurately forecast when it will occur. Being able to anticipate who would give birth prematurely would be helpful from a clinical standpoint. The predictors may be utilized as part of a management protocol to individualize patient care13, and they may also be used to treat women at high risk for preterm labor, such as those with a history of preterm labor. If we can utilize serum magnesium for predicting preterm pregnancy, then we can take steps to reduce health complications in pregnant women much sooner, which is especially important in impoverished countries like Bangladesh.

METHODOLOGY OF THE STUDY

1. Study design:

The study was a case control observational study.

2. Study area

The study was carried out in the Out-Patient department of gynecology Dhaka Medical College Hospital and Add Din Medical College Hospital.

3. Sampling method:

Random sampling method was used for the study.

4. Sample Size:

Total 400 respondents were selected for the study. 200 Patients of preterm pregnancy women were selected as case and 200 Patients of term pregnant women were selected.

5. Selecting Criteria

Inclusion Criteria

- For pre term pregnancy considered those who had gestation period between 28 and 37 weeks of
- For term pregnancy considered those who had gestation period from 28-37 weeks

Exclusion Criteria

Patients with any known high risk factor for preterm labour were excluded from the study as follows:

- Previous history of recurrent abortions or preterm delivery.
- Patients with recurrent urinary tract infections.
- Patients with pre-eclampsia, polyhydramnios, antepartum haemorrhage, fetal congenital
- Malformations, intrauterine death.
- Patients with premature rupture of membranes.
- Patients with any significant medical or surgical illness.
- Patients with cervical incompetence or any uterine malformations.
- Multigravida patients were not included in the study.

6. Tools for data collection:
Questionnaire and prescriptions were the tools for data collection.

7. Method of data collection: Data were collected by face to face interview with the respondents.

8. Data analysis and presentation:
Statistical analyses were carried out by using Windows based Statistical Package for Social Sciences (SPSS-23).The descriptive statistics of the study was presented in tables, figures or suitable graphs, mean ± SD as per the requirement of qualitative and quantitative variables. Mean comparison between two groups were done by Student's t-test. The results of the study were presented in tables, figures and diagrams.

9. Data quality management:
Data quality management has been performed based on data integrity, completeness, validity, uniqueness, accuracy and consistency. Data quality management started with finding out missing value, omit the repeated data, managed multiple data carefully. By this following data quality management was done.

RESULTS
Table-1 Shows age distribution of the study group where both group-1 and group-2 majority were belong to 30-32 years age group 45% and 46%. Followed by in group-1 35% belong to 27-29 years age group, 15% belong to 24-26 years age group, 3.5% belong to 33-35 years age group and only 1.5% belong to >36 years age group. Whereas in group-2 37.5% belong to 27-29 years age group, 12.5% belong to 24-26 years age group, 2.5% belong to 33-35 years age group and only 1.5% belong to >36 years age group. There was no statistically significant difference between the two groups (P=0.234).

Table-1: Age distribution of the study group

Age group	Group-1		Group-2		P value
	N	%	N	%	
24-26	30	15%	25	12.5%	0.234
27-29	70	35%	75	37.5%	
30-32	90	45%	92	46%	
33-35	7	3.5%	5	2.5%	
>36	3	1.5%	3	1.5%	
Total	200	100	200	100	

Table-2 shows economic status of the study group where 47.5% patients in Group-1 belonged to low socio-economic class, whereas in Group-2 46.5% patients belonged to this class. 12% and 15% patients in Group-1 and Group-2 respectively belonged to high socioeconomic class. Besides that, There was statistically significant difference between the two groups (P=0.001).

Table-2: Economic status of the study group

Economic Status	Group-1		Group-2		P value
	N	%	N	%	
High	**24**	**12%**	30	15%	0.001
Middle	**81**	**40.5%**	77	38.5%	
Low	95	47.5%	93	46.5%	
Total	200	100	200	100	

Table-3 shows diet status of the study group where in group-1 56% had followed diet which rich in fat. Whereas in group-2 60.5% had followed diet which rich in proteins, fruits, vegetables and cereals.

Table-3: Diet status of the study group

Diet pattern	Group-1		Group-2	
	N	%	N	%
Diet rich in proteins, fruits, vegetables and cereals	88	44%	121	60.5%
Diet Rich in fact	112	56%	79	39.5%

Figure-1 shows History of muscle cramps in study group where history of muscle cramp seen in higher in group-1, 90% than group-2 55%.

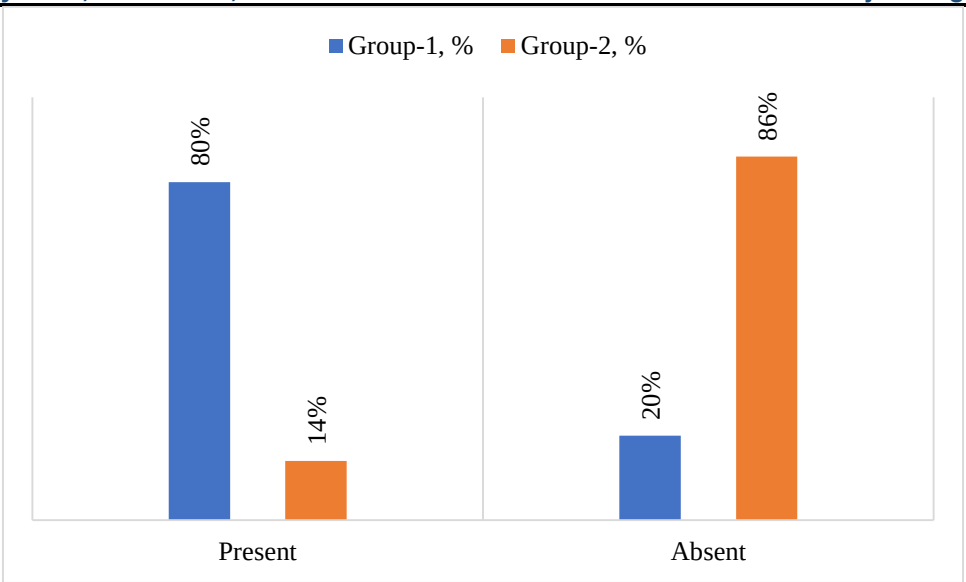

Figure-1: History of muscle cramps in study group

In figure-2 shows History of changes in quality or quantity of vaginal discharge in preceding seven days in the study group where History of change in the quality or quantity of vaginal discharge in the preceding seven days was given by 80% patients in Group-1 while as only 14% patients in Group-2 revealed this history. The difference between the two groups was found to be statistically highly significant (p<0.001).

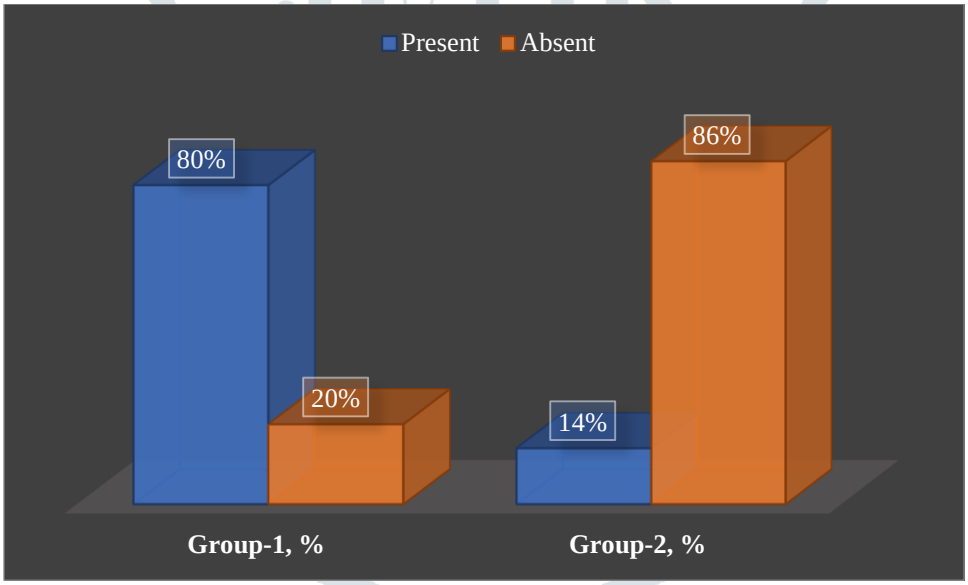

Figure-2: History of changes in quality or quantity of vaginal discharge in preceding seven days in the study group

Table-4 shows Serum magnesium levels at different gestational ages in the study group where fall in the value of serum magnesium levels was of a greater magnitude in Group-1 as compared to Group-2. The mean serum magnesium level at 28-30 weeks of gestation was 1.38±0.056mg/dl in Group-1 as compared to a value of 1.95±0.073mg/dl in Group-2. The difference was found to be statistically highly significant (p<0.001).

Table-4: Serum magnesium levels at different gestational ages in the study

Gestation weeks	Serum magnesium levels (mg/dl)		P value
	Group-1	Group-2	
28-30	1.38±0.056	1.95±0.073	<0.001
31-33	1.34±0.067	1.88±0.84	<0.001
34-36	1.30±0.060	1.75±0.111	<0.001

Table-5 shows Comparison of serum magnesium levels between Group-1 and Group-2 where The mean serum magnesium level in Group-1 (case group) was found to be 1.345 mg/dl with a SD of 0.08. The mean serum magnesium level in Group-2 (control group) was 1.876 mg/dl with a SD of 0.012. The difference between the two groups was found to be statistically highly significant (p<0.001).

Table-5: Comparison of serum magnesium levels between Group-1 and Group-2

Group	Serum magnesium levels (mg/dl)			P value
	Range	Mean	SD	
Group-1	1.21-1.64	1.345	0.08	<0.001
Group-2	1.61-2.07	1.876	0.012	

In table-6 shows use of corticosteroid prophylaxis in group-1, corticosteroid prophylaxis was given almost all study groups in group-1. The following table is given below in detail:

Table-6: Use of corticosteroid prophylaxis in group-1

corticosteroid prophylaxis	Group-1, n (%)
Yes	198, 99%
No	2, 1%

Table-7 shows overall outcome of the group-1 where 24% had LSCS cases, followed by 15% had normal delivery, 19.5% were discharged, 18% treated with vaginitis.

Table-7: Overall outcome of the group-1

Overall outcome of the group-1	N	%
Tocolysis Achieved	75	37.5%
LSCS	24	12%
Normal delivery	15	7.5%
Discharged	39	19.5%
Tocolysis failed	11	5.5%
Vaginitis Treated	36	18%

DISCUSSION

Over the past two decades a marked increase in the survival of very low birth weight infants has been seen. However, a reduction in mortality has not been accompanied by a reduction in neonatal morbidity or long term handicaps11. Premature infants are at a greater risk of short term and long term complications including disabilities and impediments in growth and mental development12. Hence, to predict and prevent the occurrence of preterm labour and delivery would go a long way to reduce the morbidity and mortality resulting from it. In our study, 47.5% patients in Group-1 belonged to low socio-economic class, whereas in Group-2 46.5% patients belonged to this class. 12% and 15% patients in Group-1 and Group-2 respectively belonged to high socioeconomic class. Besides that, There was statistically significant difference between the two groups (P=0.001). The aim of our investigation was to study the serum magnesium levels in preterm labour and to compare these values with those patients who had term delivery, to find associated signs and symptoms and to suggest nutritional correction of prognostic value.

Many recent findings have augmented the significance of magnesium in human health and disease13. There is mounting evidence that alterations in magnesium metabolism have a negative impact on pregnancy outcome13. Exact cause of hypomagne-semia in patients of preterm labour is not known but nutritional and socio-economic factors have been blamed for it. Neuromuscular hyper excitability is an initial problem cited in individuals who have or are developing magnesium deficiency. Neuromuscular hyper excitability in turn leads to uterine hyperactivity resulting in premature onset of labour14. The role of hypomagnesemia in preterm labour contractions is attributed to loss of antagonism of calcium mediated uterine contractions. 8

Previous clinical studies have also shown that the preterm birth rate was highest in low socio-economic class 5, 15, 16. A significantly higher incidence of muscle cramps and change in the quality or quantity of vaginal discharge as compared to normal pregnancy women delivering at term was seen in our study comparable to the observations of10, 17. The mechanism of preterm labour could be explained by hyperexcitability of uterine musculature induced by hypomagnesemia leading to increased cervical dilatation which in turn facilitates the approach of vaginal micro-organisms into the cervical canal and changes the quality and quantity of vaginal discharge.

Which was very much consistent to our study where history of muscle cramp seen in higher in group-1, 90% than group-2 55% and History of change in the quality or quantity of vaginal discharge in the preceding seven days was given by 80% patients in Group-1 while as only 14% patients in Group-2 revealed this history. The difference between the two groups was found to be statistically highly significant ($p<0.001$). In our study, fall in the value of serum magnesium levels was of a greater magnitude in Group-1 as compared to Group-2. The mean serum magnesium level at 28-30 weeks of gestation was 1.38±0.056mg/dl in Group-1 as compared to a value of 1.95±0.073mg/dl in Group-2. The difference was found to be statistically highly significant ($p<0.001$).

In one study it was even reported that, At 31-33 weeks of gestation, mean serum magnesium level in Group I was 1.35±0.063mg/dl as compared to 1.89±0.084mg/dl in Group II. The statistical difference between the two groups was highly significant ($p<0.001$). The serum magnesium level in Group I at the gestational ages of 34-36 weeks was 1.31±0.060mg/dl while as in Group II the mean was 1.77±0.111 ($p<0.001$, highly significant statistical difference). [11]Previous work has also found that the serum magnesium level is slightly depressed or unchanged during first and second trimester of pregnancy, but significantly decreases during third trimester especially in last two months of pregnancy [18, 19]. Lastly serum magnesium levels between Group I and Group II were compared. In Group I, serum magnesium levels ranged from 1.21 to 1.64 mg/dl with a mean of 1.343 mg/dl with a SD of 0.09. In Group II, serum magnesium levels ranged from 1.61 to 2.07 mg/dl with a mean of 1.875mg/dl with a SD of 0.129.

Hence, serum magnesium levels are lower in Group I as compared to Group II. The comparison between the two groups by using students 't' test revealed that there is a statistically highly significant difference between the two groups ($p<0.001$). Recent work has pointed towards hypo- magnesemia a significant risk factor for preterm labour and that serum magnesium estimation must be done in cases of pregnancy to predict and prevent preterm labour 5, 10, 19. Prophylactic magnesium supplementation in such cases is an issue of debate with some studies in favour [20, 21, 22, 23] whereas some studies showing no effect in preventing preterm labour [24, 25].

CONCLUSION

When pregnant, serum magnesium estimate is necessary because it may be used as a predictor of preterm labor and because it can help avoid premature labor. If a patient's blood magnesium level is low, they may want to take a magnesium supplement to make sure they don't go into labor too soon.

RECOMMENDATION

- Appropriate strategies based on the identified risk factors and dissemination of information through different public and private print and electronic media will be needed
- Need more research on preterm pregnancy
- Dedicated and trained Dr and stuff should be appointed only for preterm pregnancy management;
- Regular follow up

REFERENCES

1. March of Dimes, “Healthy babies, healthy business,” 2009, http://www.marchofdimes.com/hbhb/.
2. March of Dimes, “Premature birth,” 2009, http://www.marchofdimes.com/prematurity/21191.asp.
3. M. J. N. C. Kierse, “New perspectives for the effective treatment of preterm labour,*” The American Journal of Obstetrics and Gynaecology*, vol. 173, pp. 618–628, 1995.
4. R. L. Goldenberg, J. F. Culhane, J. D. Iams, and R. Romero, “Epidemiology and causes of preterm birth,” *The Lancet*, vol. 371, no. 9606, pp. 75–84, 2008
5. F. Arius, “Preterm labour,” in *Practical Guide to High Risk Pregnancy and Delivery*, pp. 71–99, Mosby-Year Book, Mosby, Mo, USA, 2nd edition, 1993.
6. Institute of Medicine, *Preterm Birth: Causes, Consequences, and Prevention*, National Academies Press, Washington, DC, USA, 2006.
7. P. L. Hofman, F. Regan, W. E. Jackson et al., “Premature birth and later insulin resistance,” *New England Journal of Medicine*, vol. 351, no. 21, pp. 2179–2186, 2004.
8. J. M. Moutquin, D. Cabrol, N. M. Fisk, A. H. MacLennan, K. Maršál, and J. Rabinovici, “Effectiveness and safety of the oxytocin antagonist atosiban versus beta-adrenergic agonists in the treatment of preterm labour,” *British Journal of Obstetrics and Gynaecology*, vol. 108, no. 2, pp. 133–142, 2001.
9. J. Lumley, “Defining the problem: the epidemiology of preterm birth,” *International Journal of Obstetrics and Gynaecology*, vol. 110, no. 20, pp. 3–7, 2003.
10. J. L. Peacock, J. M. Bland, and H. R. Anderson, “Preterm delivery: effects of socioeconomic factors, psychological stress, smoking, alcohol, and caffeine,” *The British Medical Journal*, vol. 311, no. 7004, pp. 531–536, 1995.
11. R. W. Martin, K. G. Perry Jr., W. Hess, J. N. Martin Jr., and J. C. Morrison, “Oral magnesium and the prevention of preterm labor in a high-risk group of patients,” *The American Journal of Obstetrics and Gynecology*, vol. 166, no. 1, pp. 144–147, 1992.
12. J. M. G. Crane, B. A. Armson, L. Dodds, R. F. Feinberg, W. Kennedy, and S. A. Kirkland, “Risk scoring, fetal fibronectin, and bacterial vaginosis to predict preterm delivery,” *Obstetrics and Gynecology*, vol. 93, no. 4, pp. 517–522, 1999.
13. F. Goffinet, “Primary predictors of preterm labour,” *International Journal of Obstetrics and Gynaecology*, vol. 112, supplement 1, pp. 38–47, 2005.
14. A. R. Shahid, A. U. Hosna, and H. Z. Tahmina, “Hypomagnesaemia in pregnancy: a predictor of preterm labour,” *Journal of Dhaka Medical College*, vol. 19, no. 1, pp. 51–57, 2010.
15. S. Kamal, A. Sharan, U. Kumar, and S. K. Shahi, “Serum magnesium level in preterm labour,” *Indian Journal of Pathology and Microbiology*, vol. 46, no. 2, pp. 271–273, 2003.

16. J. P. Elliot, "Magnesium sulfate as a tocolytic agent," *The American Journal of Obstetrics and Gynecology*, vol. 147, no. 3, pp. 277–284, 1983.
17. J. Watras, "Effects of Mg^{2+} on calcium accumulation by two fractions of sarcoplasmic reticulum from rabbit skeletal muscle," *Biochimica et Biophysica Acta: Biomembranes*, vol. 812, no. 2, pp. 333–344, 1985.
18. K. R. Spisso, G. M. Harbert Jr., and S. Thiagarajah, "The use of magnesium sulfate as the primary tocolytic agent to prevent premature delivery," *The American Journal of Obstetrics and Gynecology*, vol. 142, no. 7, pp. 840–845, 1982.
19. A. A. Begum and T. R. Das, "Low serum magnesium in preterm labour," *Journal of Bangladesh College of Physicians and Surgeons*, vol. 28, no. 2, pp. 85–91, 2010.
20. D. A. Grimes and K. Nanda, "Magnesium sulfate tocolysis: time to quit," *Obstetrics and Gynecology*, vol. 108, no. 4, pp. 986–989, 2006.
21. J. J. Schlesselman, "Sample size requirements in cohort and case-control studies of disease," *The American Journal of Epidemiology*, vol. 99, no. 6, pp. 381–384, 1974.
22. G. A. Oyedeji, "Socioeconomic status and cultural background of hospitalized children in Ilesa," *Nigerian Journal of Paediatrics*, vol. 12, no. 4, pp. 111–117, 1985.
23. "Magnesium colorimetric method," CHEMHOUSE, INS 069-1/2, 2005.
24. N. Tietz, *Textbook of Clinical Chemistry*, WB Saunders, 1986.
25. *The SPSS System for Windows [Computer Program] Version 17*, SPSS Institute Inc, Cary, NC, USA, 2008.