Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Obs & Gynae

Association of Maternal Serum Zinc Level with Neonatal Birth Weight in Term Deliveries

Dr. Farida Yasmin Eti[1*], Dr. Mohammad Masudur Rahman[2], Dr. Nasima Akther[3], Dr. Layla Nasrin[4], Dr. Muhammad Bipul Islam[5]

[1]Assistant Professor (Obs & Gynae), BCS (Health), DGO (Obs & Gynae), Shaheed Tajuddin Ahmed Medical College & Hospital, Gazipur, Bangladesh
[2]BCS (Health), DA (Anesthesiology), Attached Directorate General of Health Services, Bangladesh
[3]BCS, DGO, FCPS (Gynae & Obs), Assistant Professor (Institute), UHC, Bandar, Narayanganj, Bangladesh
[4]Associate Professor (Paediatrics), Shaheed Tajuddin Ahmed Medical College & Hospital, Gazipur, Bangladesh
[5]Associate Professor (ENT), Shaheed Tajuddin Ahmed Medical College & Hospital, Gazipur, Bangladesh

DOI: https://doi.org/10.36347/sjams.2026.v14i01.012 | **Received:** 03.11.2025 | **Accepted:** 12.01.2025 | **Published:** 22.01.2026

***Corresponding author:** Dr. Farida Yasmin Eti
Assistant Professor (Obs & Gynae), BCS (Health), DGO (Obs & Gynae), Shaheed Tajuddin Ahmed Medical College & Hospital, Gazipur, Bangladesh

Abstract **Original Research Article**

***Background*:** Zinc is an essential micronutrient involved in cellular growth, protein synthesis, and immune regulation. During pregnancy, maternal zinc requirements increase, and deficiency has been implicated in adverse birth outcomes, including low birth weight (LBW). LBW remains a major public health concern in Bangladesh, where maternal malnutrition is prevalent. ***Objective*:** To investigate the association between maternal serum zinc levels and neonatal birth weight in term deliveries. ***Methods*:** This case-control study was conducted at the Department of Obstetrics and Gynaecology, Shaheed Tajuddin Ahmed Medical College & Hospital, Bangladesh between July 2024 and June 2025. A total of 130 term pregnant women were enrolled, comprising 65 cases (mothers of LBW neonates <2500 g) and 65 controls (mothers of normal birth weight neonates ≥2500 g). Maternal demographic and obstetric data were collected, and serum zinc levels were measured immediately after delivery. Neonatal anthropometric parameters were assessed within 24 hours of birth. Data were analyzed using SPSS 25, with chi-square and t-tests applied for group comparisons, and Pearson's correlation used to assess associations. ***Results*:** The mean maternal age was significantly higher in the case group compared to controls (30.89±6.10 vs. 27.03±5.33 years, p<0.001). No significant differences were observed regarding parity and mode of delivery between groups. Neonates of LBW mothers had significantly lower crown-heel length, head circumference, and ponderal index (all p<0.001). Zinc deficiency (<60 µg/dL) was markedly more prevalent in the case group (72.3%) than in controls (24.6%) (p<0.001). A positive correlation was observed between maternal serum zinc levels and neonatal birth weight (r=0.551, p<0.001). ***Conclusion*:** Maternal zinc deficiency and advanced maternal age were significantly associated with LBW in term neonates, whereas parity and mode of delivery showed no independent effect. These findings underscore the importance of early detection and correction of micronutrient deficiencies, particularly zinc, during pregnancy to improve neonatal outcomes in resource-limited settings.

Keywords: Maternal Zinc Deficiency, Low Birth Weight, Term Delivery, Neonatal Anthropometry, Bangladesh.

INTRODUCTION

Neonatal birth weight is a crucial indicator of intrauterine growth and overall perinatal health, strongly influencing neonatal survival, childhood development, and long-term health outcomes. Low birth weight (LBW), defined as a birth weight of less than 2500 g, remains a significant public health challenge, particularly in low- and middle-income countries. Infants born with low birth weight are at increased risk of neonatal morbidity and mortality, impaired cognitive development, and a higher likelihood of developing chronic diseases later in life [1-3]. Maternal nutritional status during pregnancy plays a pivotal role in determining fetal growth and birth outcomes.

Among essential micronutrients, zinc is vital for numerous biological processes, including cellular growth, DNA synthesis, protein metabolism, and immune function. During pregnancy, zinc requirements increase substantially to support rapid fetal cell division, placental development, and maternal tissue expansion [4, 5]. Zinc deficiency in pregnant women has been associated with adverse pregnancy outcomes such as prolonged labor, preterm birth, intrauterine growth restriction, and congenital anomalies, highlighting its importance in optimal fetal development.

Maternal serum zinc levels serve as a useful biomarker for assessing zinc status during pregnancy. However, physiological changes during gestation, including plasma volume expansion and altered zinc metabolism, may influence circulating zinc concentrations. Inadequate dietary intake, poor bioavailability of zinc, frequent infections, and socioeconomic factors further contribute to maternal zinc deficiency, particularly in developing regions [6, 7]. These factors underscore the need to examine the relationship between maternal zinc status and fetal growth indicators such as birth weight.

Several studies have suggested a positive association between maternal zinc levels and neonatal birth weight, proposing that adequate zinc availability supports placental function and nutrient transport to the fetus. Zinc is involved in insulin-like growth factor regulation and antioxidant defense mechanisms, both of which are essential for normal fetal growth [8-10]. Conversely, low maternal zinc levels may impair placental efficiency and fetal nutrient utilization, potentially resulting in reduced birth weight.

Despite growing evidence, findings across studies remain inconsistent, with some reporting weak or non-significant associations between maternal zinc status and neonatal birth weight. These discrepancies may be attributed to differences in study design, timing of zinc assessment, population characteristics, and confounding nutritional or environmental factors. Moreover, limited data are available from South Asian populations, where micronutrient deficiencies are highly prevalent and contribute substantially to adverse birth outcomes.

Objective

Therefore, this study aims to assess the association between maternal serum zinc levels and neonatal birth weight among term deliveries. Understanding this relationship may provide valuable insights into the role of maternal micronutrient status in fetal growth and help inform nutritional interventions and antenatal care strategies to improve birth outcomes and reduce the burden of low birth weight infants.

METHODOLOGY

This case–control study was conducted in the Department of Obstetrics and Gynaecology, at Shaheed Tajuddin Ahmed Medical College & Hospital, Bangladesh between July 2024 and June 2025 one-year period. The study population comprised pregnant women with term gestation who were admitted for delivery during the study period. A purposive sampling technique was applied to recruit participants. The sample size was determined using the formula for comparison of two means, and a total of 130 women were enrolled, including 65 cases and 65 controls.

Women aged 18–45 years with a body mass index between 18 and 24.9 kg/m², who had completed 37–42 weeks of gestation and delivered apparently healthy live-born neonates without congenital anomalies, were eligible for inclusion. Only those who provided informed consent and were able to understand and respond to the study questionnaire were included. Pregnancies complicated by hypertensive disorders, gestational diabetes, pre-existing diabetes mellitus, renal, hepatic, cardiac, autoimmune, or connective tissue diseases were excluded. Women receiving medications such as anticonvulsants, anticoagulants, or anti-epileptics were also excluded. Additional exclusion criteria included haemoglobin levels below 10 g/dl, multiple pregnancies, fetal congenital anomalies, stillbirths or intrauterine fetal deaths, and a history of fever with rash during the antenatal period.

After obtaining written informed consent, eligible mothers with singleton term pregnancies and their newborns were enrolled. The case group consisted of mothers who delivered low birth weight infants weighing less than 2500 g, while the control group included mothers who delivered neonates with birth weights of 2500 g or more. Maternal demographic characteristics and obstetric information were collected through face-to-face interviews using a semi-structured questionnaire and verified from medical records. Gestational age was determined based on the last menstrual period and early ultrasonography reports.

Neonatal birth weight was measured immediately after delivery using a calibrated baby weighing scale with an accuracy of 0.1 kg. Additional anthropometric measurements were obtained within 12–24 hours of birth. Crown–heel length was measured using an oilcloth measuring tape, and head circumference was measured at the maximum occipitofrontal diameter. The ponderal index was calculated using Rohrer's formula to assess neonatal body proportionality.

For biochemical analysis, 5 ml of venous blood was collected aseptically from each mother immediately after delivery using disposable syringes and transferred into clean, zinc-free containers. The samples were allowed to clot at room temperature for 20 minutes and then centrifuged at 3500 rpm for 10 minutes. Serum was carefully separated without disturbing the buffy coat, transferred into zinc-free polypropylene tubes, and stored at –20°C until laboratory analysis for serum zinc concentration.

All collected data were thoroughly checked for completeness and consistency before entry into SPSS version 25 for statistical analysis. Descriptive statistics were used to summarize socio-demographic, clinical, and laboratory variables. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The chi-square test was used to assess associations between categorical variables, and independent Student's t-test was applied to compare means between groups. Pearson's correlation coefficient was used to evaluate linear relationships between continuous variables. Univariate and multivariate logistic regression analyses were performed to identify predictors of low birth weight. A p-value of less than 0.05 was considered statistically significant, with a 95% confidence interval.

RESULTS

The mean age of the mothers in the case group (30.89±6.10 years) was significantly higher (<.05) than that in the control group (27.03±5.33 years). The age distribution also differed significantly (<.05) between the two groups, with the majority of the case group falling within the 31-35 years range, while the control group was predominantly within the 21-25 years range.

Table 1: Distribution of Maternal Age (%) among Case and Control Groups

Maternal age (years)	Case (%)	Control (%)	p value
18–20	10.8	6.2	
21–25	7.7	40.0	
26–30	16.9	29.2	<0.001*
31–35	38.5	13.8	
36–40	21.5	10.8	
41–45	4.6	0.0	
Mean ± SD	**30.89 ± 6.10**	**27.03 ± 5.33**	**<0.001**

The distribution of parity was comparable between the case and control groups, with no statistically significant difference observed (p = 0.347). Primiparous women constituted the majority in both groups, accounting for 67.7% of cases and 55.4% of controls. Mothers with parity between one and three represented 16.9% of the case group and 24.6% of the control group, while higher parity (greater than three) was observed in 15.4% of cases and 20.0% of controls. Overall, parity did not show a significant association with case–control status in the study population.

Table 2: Distribution of the Respondents by Parity (n = 130)

Parity	Case (%)	Control (%)	p value
Primipara	67.7	55.4	
Para 1–3	16.9	24.6	0.347*
Para >3	15.4	20.0	

*Chi-square test

The mode of delivery did not differ significantly between the case and control groups (p = 0.345). Vaginal delivery was the predominant mode in both groups, accounting for 64.6% of cases and 72.3% of controls. Lower segment cesarean section was observed in 35.4% of the case group and 27.7% of the control group. Overall, no significant association was found between mode of delivery and case–control status.

Table 3: Distribution of Respondents by Mode of Delivery (n = 130)

Mode of delivery	Case (%)	Control (%)	p value
Vaginal delivery	64.6	72.3	0.345*
Lower segment cesarean section	35.4	27.7	

*Chi-square test

The anthropometric measurements of neonates showed significant differences between the case and control groups. Neonates in the case group had a mean crown–heel length of 42.71 ± 1.06 cm, which was significantly lower than 50.88 ± 1.60 cm observed in the control group (p < 0.001). Similarly, head circumference was smaller in the case group (31.55 ± 0.79 cm) compared to controls (34.91 ± 0.81 cm, p < 0.001). The ponderal index, an indicator of neonatal body proportionality, was also significantly lower in cases (2.31 ± 0.05) than in controls (2.51 ± 0.07, p < 0.001). These findings indicate that neonates in the case group had significantly reduced overall anthropometric measurements.

Table 4: Anthropometric Measurements of the Neonates (n = 130)

Anthropometric variable	Case (Mean ± SD)	Control (Mean ± SD)	p value
Crown–heel length (cm)	42.71 ± 1.06	50.88 ± 1.60	<0.001**
Head circumference (cm)	31.55 ± 0.79	34.91 ± 0.81	<0.001**
Ponderal index	2.31 ± 0.05	2.51 ± 0.07	<0.001**

** Independent Student's *t*-test

p Value Was Determined by Independent Student T Test**

Zinc deficiency was significantly more prevalent among mothers in the case group compared to the control group (72.3% vs. 24.6%, p < 0.001). Conversely, a higher proportion of mothers in the control group had normal zinc levels (75.4%) compared to cases (27.7%). These results demonstrate a strong association between maternal zinc deficiency and low birth weight in neonates.

Table 5: Distribution of Zinc Deficiency among the Study Participants (n = 130)

Zinc deficiency (<60 µg/dL)	Case (%)	Control (%)	p value
Yes	72.3	24.6	<0.001*
No	27.7	75.4	

* Chi-square test

The analysis of the association between maternal zinc deficiency and low birth weight revealed a strong and statistically significant relationship. Among the case group, 72.3% of mothers were zinc deficient, whereas only 24.6% of mothers in the control group had zinc deficiency (p < 0.001). Conversely, normal zinc levels were observed in 27.7% of cases compared to 75.4% of controls. These findings indicate that maternal zinc deficiency is significantly associated with the occurrence of low birth weight in neonates.

Table 6: Association between Zinc deficiency and low birth weight neonates among the study participants (n=130)

Zinc deficiency (<60 µg/dL)	Case n=65 n (%)	Control n=65 n (%)	p value
Yes	47 (72.3)	16 (24.6)	<0.001*
No	18 (27.7)	49 (75.4)	

Case: Mothers of neonates with low birth weight (<2500 gm)

Control: Mothers of neonates with normal weight (≥2500 gm)

p Value Was Determined by Chi Square Test*

A positive correlation was observed between maternal serum zinc level and neonatal birth weight, with a correlation coefficient (r) of 0.551 (p<.001).

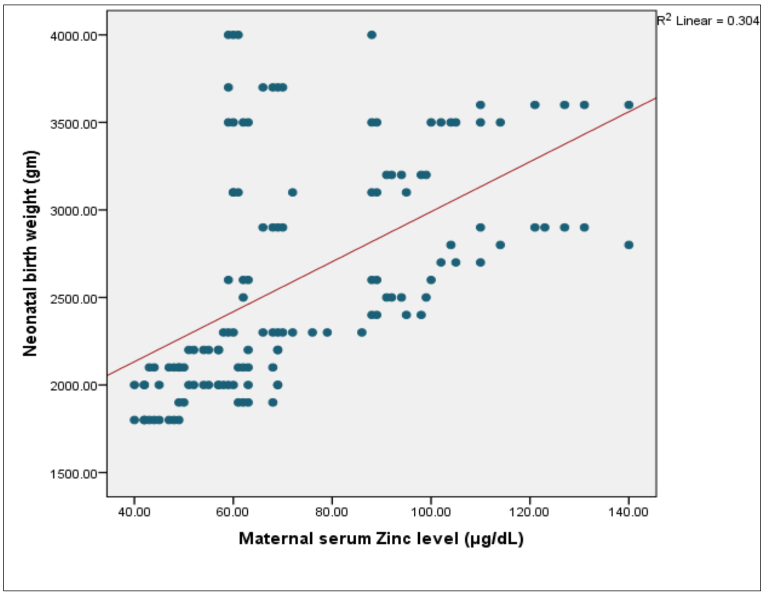

Figure 1: Scatter plot diagram showing correlation between maternal serum zinc level and neonatal birth weight

Discussion

The present study demonstrated a significant difference in maternal age between mothers of low birth weight (LBW) neonates and those with normal birth weight. The mean age of mothers in the case group was 30.89 ± 6.10 years, significantly higher than 27.03 ± 5.33 years in the control group ($p < 0.001$). The majority of cases were in the 31–35 years range, whereas controls were predominantly younger, falling within 21–25 years. These findings suggest that advanced maternal age may be a risk factor for delivering LBW infants, which aligns with the results of studies conducted in India and Nigeria, where higher maternal age was associated with an increased risk of low birth weight [10]. The observed trend may be attributed to age-related changes in uteroplacental function and nutrient transfer efficiency.

Parity, in contrast, did not show a significant association with birth weight in this study. Primiparous women constituted the majority in both the case (67.7%) and control groups (55.4%), with para 1–3 and para >3 showing similar distribution across groups ($p = 0.347$). This is consistent with findings from a study in Bangladesh which reported no significant relationship between parity and neonatal birth weight after adjusting for maternal nutritional status [11]. This suggests that maternal parity alone may not be a strong determinant of birth weight in the absence of other risk factors.

Similarly, the mode of delivery was not significantly associated with birth weight in the current study ($p = 0.345$), with vaginal delivery being predominant in both cases (64.6%) and controls (72.3%). Although cesarean delivery rates were slightly higher in the case group, this difference was not statistically significant. These results are in agreement with prior studies indicating that mode of delivery is more often influenced by obstetric indications rather than fetal birth weight itself [12].

Anthropometric measurements of neonates revealed marked differences between cases and controls. Neonates in the case group had significantly lower crown–heel length (42.71 ± 1.06 cm vs. 50.88 ± 1.60 cm), head circumference (31.55 ± 0.79 cm vs. 34.91 ± 0.81 cm), and ponderal index (2.31 ± 0.05 vs. 2.51 ± 0.07) compared to controls ($p < 0.001$ for all). These findings are consistent with the study which demonstrated that LBW infants have significantly reduced anthropometric measurements, reflecting restricted intrauterine growth [13].

Maternal zinc deficiency emerged as a significant factor associated with LBW. In this study, 72.3% of mothers in the case group were zinc deficient, compared to only 24.6% in the control group ($p < 0.001$). A strong positive correlation was observed between maternal serum zinc levels and neonatal birth weight ($r = 0.551$, $p < 0.001$), indicating that higher maternal zinc status is associated with increased birth weight. These findings are in line with prior research in both developing and developed countries, including studies which reported that maternal zinc deficiency significantly increases the risk of LBW and intrauterine growth restriction. Zinc's role in cell division, DNA synthesis, and placental development may explain this association [14].

Conclusion

In conclusion, this study demonstrates that maternal zinc deficiency is significantly associated with the occurrence of low birth weight in term neonates, with lower maternal serum zinc levels correlating positively with reduced neonatal birth weight and compromised anthropometric measurements. Advanced maternal age also emerged as a contributing factor, whereas parity and mode of delivery did not show significant associations. These findings highlight the critical role of adequate maternal zinc status in promoting optimal fetal growth and suggest that routine assessment and supplementation of zinc during pregnancy may help reduce the incidence of low birth weight and improve neonatal outcomes.

References

1. Britto RP, Florêncio TM, B.S., 2013. Influence of maternal height and weight on low birth weight: a cross- sectional study in poor communities of northeastern Brazil. PLoS One, 8(11), 1-8.
2. Cedars, M., 2015. Childhood implications of parental aging. Fertil Steril., 103(6), 1379–80.
3. Chiudzu, G., Choko, A.T., Maluwa, A., Huber, S. & Odland, J., 2020. Maternal serum concentrations of selenium, copper, and zinc during pregnancy are associated with risk of spontaneous preterm birth: a case-control study from Malawi. Journal of Pregnancy, 2020(1), 1-7.
4. Christian, P., Khatry, S.K., Katz, J., Pradhan, E.K., LeClerq, S.C., Shrestha, S.R., et al., 2003. Effects of alternative maternal micronutrient supplements on low birth weight in rural nepal: Double blind randomised community trial. British Medical Journal, 326(7389), 571–574.
5. Davoudi-Kiakalayeh, A., Mohammadi, R., Pourfathollah, A.A., Siery, Z. & Davoudi-Kiakalayeh, S., 2017. Alloimmunization in thalassemia patients: New insight for healthcare. International journal of preventive medicine, 8(1), 101.
6. Doppalapudi Anveh, Girih G Joag, hrehta BR, K Mahendranath, S.M., 2023. Study of Cord Blood Zinc Levels in Low and Normal Birth Weight Neonates and Correlate with Their Mother's Serum Zinc Levels. Journal of Population Therapeutics and Clinical Pharmacology, 30(16), 78–83.
7. Dumrongwongsiri, O., Winichagoon, P., Chongviriyaphan, N., Suthutvoravut, U., Grote, V. & Koletzko, B., 2021. Effect of maternal nutritional

status and mode of delivery on zinc and iron stores at birth. Nutrients, 13(3), 860.
8. Eliyati N, Faruk A, Kresnawati ES, A.I., 2019. Support vector machines for classification of low birth weight in Indonesia. J Phy Conf Series., 1282(1), 1-8.
9. Fall CH, Sachdev HS, Osmond C, Restrepo-Mendez MC, Victora C, Martorell R, Stein AD, Sinha S, Tandon N, A.L., 2015. Association between maternal age at childbirth and child and adult outcomes in the offspring: a prospective study in five low-income and middle-income countries (COHORTS collaboration). Lancet Glob Health, 3(7), 366-77.
10. Fayed AA, Wahabi H, Mamdouh H, Kotb R, E.S., 2017. Demographic profile and pregnancy outcomes of adolescents and older mothers in Saudi Arabia: analysis from Riyadh Mother (RAHMA) and Baby cohort study. BMJ Open, 7(9), 1-11.
11. Gardosi, J.O., 2005. Prematurity and fetal growth restriction. Early Human Development, 81(1), 43-49.
12. He Z, Bishwajit G, Y.S., 2018. Prevalence of low birth weight and its association with maternal body weight status in selected countries in Africa: a cross-sectional study. BMJ Open, 8(8), 1-8.
13. Islam Pollob, S.M., Abedin, M.M., Islam, M.T., Islam, M.M. & Maniruzzaman, M., 2022. Predicting risks of low birth weight in Bangladesh with machine learning. PLOS ONE, 17(5), 1-12.
14. Jaafar, Z.A.A., Salman, D.A. & Obeid, R.Z., 2018. The role of maternal and fetal serum zinc level in low birth weight. Journal of Pharmaceutical Sciences and Research, 10(8), 2115–2118.