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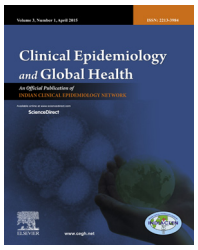

Original Article

Maternal nutrition and the risk of congenital malformations in the tea garden community of Assam, Northeast India

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ABSTRACT

Problem considered: There is a high prevalence of congenital malformations (CMs) in the tea garden community of Assam, Northeast India. The present cross-sectional study was carried out to assess if insufficiencies in maternal nutrition during the periconceptional period are associated with high incidence of CM in the said community.

Method: Over a period of 2 years, 156 pregnant women with a mean age of 25.7 years (SD 4.7) were enrolled. During an interview, anthropometric and obstetric data pertaining to periconceptional use of iron and folic acid (IFA) were collected. Adequate iodine intake during pregnancy was determined by measuring urinary iodine (UI) levels in each trimester.

Results: Malformations were noted in 16 babies, giving an uncorrected incidence rate of 102.5/1000 births. Among the participants, 87 (55.8%) were underweight and 6 (3.8%) were overweight. Periconceptional IFA supplementation was self-reported by 31 (19.8%). The median urinary iodine concentrations (MUICs) in the 1st, 2nd and 3rd trimesters were 170 μg/l (IQR 100 μg/l), 275 μg/l (IQR 166 μg/l), and 265 μg/l (IQR 160 μg/l), respectively. An analysis of maternal nutrition indicated that IFA supplementation reduced the risk of birth defects. However, a pre-pregnancy BMI > 23 kg/m^2 and a 1st trimester MUIC < 150 μg/l increased the odds of having an infant with CM. Maternal age <20 years and illiteracy also elevated the risk.

Conclusion: Inadequacies in periconceptional maternal nutrition are associated with the high incidence of CM. Community members should also be sensitized against early pregnancy and educated to minimize the risk.

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1. Introduction

Congenital malformations (CMs) are one of the leading causes of high neonatal deaths in India,[1] and a high incidence of these malformations have been reported from the tea garden communities in Assam.[2] Apart from the genetic predispositions, the incidence of which is considered to be similar throughout the world,[3] the regional variation in its prevalence can be attributed to other epidemiologic factors. Periconceptional maternal nutrition is an important determinant of pregnancy outcomes, as the availability and supply of essential nutrients to the developing fetus depends on maternal nutritional status. Iron and iodine are essential for development of the central nervous system, whereas folic acid and vitamins, such as A, B-6, and B-12, influence oxidative pathways and methylation.[4] Although supplementation of diet with iron and folic acid (IFA) tablets, and iodized salt has been a part of the Ministry of Health and Family Welfare Program, their levels of intake have been low.[5] In light of the above, the present study was conducted among a section of pregnant women, visiting the tertiary health care facility at Dibrugarh, to assess the relation between periconceptional maternal nutrition and risk of CMs in the community.

2. Methods

2.1. Study design

This cross-sectional study was conducted among pregnant mothers from the tea garden community attending a tertiary health care center in Assam. The sample size was calculated using an anticipated incidence rate of 12.6% for the tea garden community (based on retrospective review of our hospital records) and an overall incidence of CM, which was 1.2% at this facility.[6] The study had a power of 80% and the values of α and β were 0.05 and 0.2, respectively. All pregnant women in their first trimester, who were reportedly from the tea garden community, were included in the study. Pregnant women suffering from any acute or chronic illness, thyroid disorders, or ingesting iodine-containing products like cough syrups were excluded from the study. To identify associated risk factors, participating pregnant women were classified into two groups. The cases were mothers who gave birth to babies with CM, while controls were mothers of children with no apparent CM at the time of birth. Overall, 156 pregnant women and 160 non-pregnant women were recruited in the study, spanning 2 years. The non-pregnant women were recruited to know the status of iodine nutrition in the community. All the participants provided written informed consent. Demographics, obstetric and dietary information were collected using a precoded questionnaire.

2.2. Sample collection

Sampling of urine for pregnant women was carried out during each trimester for each participant: first trimester (GW4-8), second trimester (GW14-19) and third trimester (GW27-30) during their antenatal visits to the facility. The urine samples of pregnant and non-pregnant women were stored at −80 °C. Urine iodine estimation was done using the Sandell–Kolthoff formula.

2.3. Definitions of variables

Preterm birth was defined as duration of pregnancy between 20 weeks 0 days and 36 weeks and 6 days.[7] BMI (kg/m^2) was classified according to the criteria suggested by WHO for the Asian populations as follows: underweight (<18.5 kg/m^2), normal-weight (18.5–22.9 kg/m^2), overweight, and obese (>23 kg/m^2) women.[8] The iodine intake was classified as deficient, adequate, or excessive according to the WHO reference medians.[9] Ministry of Health and Family Welfare, Govt. of India directs all pregnant women to consume 1 tablet containing 100 mg elemental iron and 0.5 mg folic acid daily for 100 days. Periconceptional IFA supplementation was self-reported, and based on the duration of supplementation, it was categorized into three groups: IFA intake ≥90 days, IFA intake <90 days, and no supplementation.

2.4. Statistical analysis

Conditional logistic regression was used to describe the associations between the variables and CMs. The average concentrations of iodine in the urine were calculated as medians because of the skewed data distribution. Student's t-test was employed to compare data between pregnant and non-pregnant, primi- and multigravida women. All the statistical results were considered significant at $p < 0.05$ (two-tailed). IBM SPSS statistics 20 (SPSS Inc., Chicago, IL, USA) was used for the data analysis.

2.5. Ethical approval

This cross-sectional study was approved by the Institutional ethical committee.

3. Results

There were 12 preterm deliveries and a single stillbirth who had myelocele with bilateral telepes. Malformations were noted in 16 babies. The anthropometric, obstetric, and socio-demographics characters of the 156 pregnant women who were recruited for the study are shown in Table 1. Within the study group, 87 (55.8%) pregnant women were underweight and 6 (3.8%) were overweight. Although all respondents reportedly used iodized salt, periconceptional IFA supplementation was self-reported by only 31 (19.9%) participants. The median urinary iodine concentrations (MUIC) of pregnant women in their 1st, 2nd, and 3rd trimesters were 170 μg/l (IQR 100 μg/l), 275 μg/l (IQR 166 μg/l) and 265 μg/l (IQR 160 μg/l), respectively, as compared to 117.94 μg/l among non-pregnant women of the same community. A significant rise in UI was noted during the 2nd trimester (Fig. 1, Tables 2 and 3).

3.1. Risk factors associated with CMs

From Table 4, it is evident that the prevalence of CM was significant among pregnant women suffering from iodine