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ORIGINAL PAPER

Iodine Nutritional Status Among Neonates in the Solan District, Himachal Pradesh, India

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Abstract Iodine nutrition status amongst neonates can be assessed by estimating thyroid stimulating hormone (TSH). According to WHO, if more than 3 % of the neonates have TSH levels of 5 mlU/l and more in a population, it indicates presence of iodine deficiency (ID). Iodine deficiency is an endemic health problem in Solan district, Himachal Pradesh (HP) state. ID leads to mental retardation, deaf mutism, squint, dwarfism, spastic diplegia, neurological defects and congenital anomalies. The aim is to determine iodine nutrition status of neonates of Solan district. In Solan district, six hospitals/community health centers providing obstetric services and conducting more than 100 deliveries per annum were identified and enlisted. Two hospitals were selected keeping in view of operational feasibility. A total of 683 umbilical cord blood samples of neonates were collected on filter paper and analyzed for TSH. It was found that 63.2 % of the neonates had TSH levels of more than 5 mlU/l indicating iodine deficiency in the Solan district. Iodine deficiency was a public health problem in Solan district, HP.

Keywords Iodine · Nutrition · Thyroid stimulating hormone · Neonates

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Introduction

Iodine deficiency disorder (IDD) is a public health problem in India. It is estimated that 8 million newborns are annually unprotected from consequences of IDD [1]. Iodine deficiency (ID) in neonates leads to cretinism including mental deficiency, mutism, spastic diplegia, squint, hypothyroidism and short stature. The most critical period for fetus is from the second trimester of pregnancy. Iodine is required for the production of thyroid hormones which are essential for optimal development of the brain. Thyroid hormones are required for the differentiation and maturation of brain cells [2]. When a fetal iodine intake is low, the fetal thyroid is not able to synthesize sufficient amounts of thyroid hormones leading to compromised development of the brain [3].

Solan district, Himachal Pradesh (HP) is a known endemic region for ID. Studies are available on status of iodine nutrition amongst school age children [4, 5]; however there is a lack of data on status of iodine nutrition amongst Neonates. The present study was conducted with an objective to assess the iodine nutrition status amongst Neonates in Solan district, HP, with an aim to provide evidence to state health authorities to strengthen the IDD program, if required.

Materials and Methods

The study was carried out in 2013. In Solan district, six hospitals/community health centers providing obstetric

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services and conducting more than 100 deliveries per annum were identified and enlisted. Two hospitals were selected keeping in view of operational feasibility. The 683 births occurring consecutively in these two hospitals were included for estimation of iodine nutrition amongst neonates. Informed written consent of the mothers (of the neonates) was taken. The umbilical cord blood sample was taken on a filter paper.

Cord blood was collected before placental delivery within 5 min after birth to avoid clotting. Blood drop was applied on filter paper. The spots were dried at room temperature and filter paper were sealed and kept in a freezer until assayed in the laboratory. The samples were stored at 4 °C before analysis.

The samples were estimated for thyroid stimulating hormone (TSH) by using sandwich enzyme linked immuno-sorbent assay method. Dry blood spot eluted in anti-TSH antibodies coated micro wells and were incubated with peroxidase labeled anti-TSH monoclonal antibodies. After washing, the unbound antibodies were washed off and bound conjugate remains in micro well. These bound conjugates further react with substrate 3,3′,5,5′-tetramethylbenzidine (TMB) and produces a color product. Concentration of TSH is directly proportional to color produced. Absorbance was read at 450 nm and a value of TSH was expressed in the units' mlU/l of blood. In order to measure the concentration of TSH in the test sample, the calibration standards and controls were used. The calibration standards and controls were assayed for producing a standard curve of TSH by optical density (OD) versus TSH concentration (mlU/l). By comparing the OD of the test samples to this standard curve, the concentration of the TSH was determined [6, 7].

Newborns from caesarean delivery, delivery in which iodine preparations have been used, mother on iodine supplementation and on anti thyroid therapies were excluded from the study.

The ethical approval of research study was obtained from All India Institute of Medical Sciences, New Delhi.

Sample Size

Keeping in view the anticipated prevalence of 2.9 % [8], a confidence level of 95 %, absolute precision of 2.0 and a design effect of 2, a total sample size of 541 was calculated. However we studied a total of 683 subjects.

Statistical Analysis

Mean, median and standard deviation of the cord blood TSH values of the neonates were considered in reporting the result.

Table 1 Distribution of neonates according to gestational age, birth weight and TSH levels (N = 683)

Category	N (%)
Gestational age	
Pre-term (<37 weeks)	327 (47.9)
Term (37–42 weeks)	356 (52.1)
Post-term (>42 weeks)	0
Birth weight	
Very low (<1.5 kg)	3 (0.4)
Low (1.5 to <2.49 kg)	53 (7.8)
Normal (2.5 to <3.9 kg)	625 (91.5)
Overweight (≥4 kg)	2 (0.3)
Thyroid stimulating hormone levels (mlU/l)	
>5	432 (63.2)
≤5	251 (36.8)

Results

A total of 683 umbilical cord blood samples of neonates (361 males and 322 females) were collected on filter paper and analyzed for TSH. It was found that 63.2 % of the neonates had TSH level of more than 5 mlU/l, thus indicating prevalence of ID in the population studied. Table 1 depicts the distribution of neonates according to their gestational age, birth weight and TSH levels.

Discussion

Neonates are the most vulnerable group for ID. Raised serum TSH in the neonates indicates insufficient supply of thyroid hormones to the developing brain [2]. Cord blood sample is preferred for estimation of TSH levels in newborns because of its (1) ease of collection, (2) higher rate of coverage, (3) more practical for mothers with short hospital stay following delivery and its utility as an indicator of the prevalence of IDD [9, 10].

Earlier studies conducted have reported the TSH level of more than 5 mlU/l in 2.95 % of the neonates. Another study has documented TSH level of more than 20 mlU/l in 1.83 % of the neonates [8, 11].

Studies conducted in different countries have reported the TSH level of 5 mlU/l and more; 20–32 % (Western Uganda), 18.1 % (Estonia), 14.4 % (Italy), 9.08 % (Spain), 8.9 % (Thailand), 6.8 % (Australia), 3–5 % (Poland) and 3.6 % (Iran), respectively [12–19].

There is limited published data on the TSH levels amongst neonates from iodine endemic regions of India. Therefore we could not compare our research findings with other studies.

Findings of our present study indicated that there was a low iodine nutrition status amongst neonates and IDD is a public health problem in Solan district. There is a need of strengthening the supply of adequately iodized salt to pregnant mothers.

Limitation of Study

We could not conduct the study in all the six hospitals enlisted and selected due to resource constraint.

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Conflict of interest The authors declare no conflict of interest.

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