

## SHORT COMMUNICATION

## Prevalence of neonatal hypothyroidism in Kangra Valley, Himachal Pradesh

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Iodine deficiency (ID) is an endemic health problem in Kangra District, Himachal Pradesh (HP). ID in pregnant mothers leads to neonatal hypothyroidism (NH), mental retardation, deaf mutism, squint, dwarfism, spastic dysplasia, neurological defects and congenital anomalies. NH can be assessed by estimating the thyroid stimulating hormone (TSH) in cord blood samples. The present study was conducted with an objective to assess the prevalence of NH in district Kangra, HP. In district Kangra, all the hospitals providing obstetric services were enlisted. Three hospitals conducting more than 100 deliveries per year were selected randomly. A total of 613 umbilical cord blood samples of neonates were collected on filter papers and analyzed for TSH. TSH was estimated by enzyme-linked immunosorbent assay method. Neonates with TSH levels  $\geq 20$  mIU/l were recalled for reassessment of TSH for confirmation of NH. Prevalence of NH was found to be 4.4%. This finding suggests the need for the implementation of a neonatal screening program for early detection of children with ID.

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## INTRODUCTION

Iodine deficiency disorder (IDD) is a global public health problem that is estimated to affect about one billion people across the world. ID during pregnancy leads to cretinism, squint, hypothyroidism and deaf mutism in neonates. Thyroid hormone affects development of central nervous system, particularly its myelination in fetus. Iodine has a major role in human body; it is crucial for the production of thyroid hormones. ID among neonates lowers circulating thyroxine level and raises serum thyroid stimulating hormone (TSH). Hence, iodine-deficient neonates have higher serum TSH concentration compared with iodine-sufficient neonates. In an iodine-sufficient population, incidence of neonatal hypothyroidism (NH) is about one in 4000, usually because of thyroid dysplasia.<sup>1</sup>

Kangra district, HP is a known endemic region for ID. Scientific evidences are available on poor iodine nutrition status among school age children.<sup>2,3</sup> These studies have documented IDD as a public health problem. A recent study conducted amongst pregnant mothers also revealed existence of IDD among them.<sup>4</sup> We do not have any data on the prevalence of NH from Kangra District. Therefore, to fill the gap in the existing knowledge, the present study was conducted during the year 2013 with an aim of providing scientific evidence to state health planners and health authorities to strengthen the Universal Salt Iodization program, if required.

## MATERIALS AND METHODS

In Kangra district, a total of nine Hospitals/ Community Health Centers, which conducted more than 100 deliveries per annum, were selected. Of these, three hospitals were randomly selected. A total of 619 births occurring consecutively in these three Hospitals during the study period were included for assessing NH. Umbilical cord blood sample was

collected on a filter paper within 1 hour of delivery. Blood drops were applied on a filter paper. The spots were dried at room temperature. The filter papers were sealed and stored in a freezer at 4 °C until assayed in the central laboratory. The samples were transported to the Central Laboratory in Delhi for estimation of TSH.

Neonates with TSH levels 20 mIU/l and higher were identified and were recalled for reassessment of TSH levels. The venous blood was utilized for repeat TSH estimation. All the samples were estimated for TSH by using the sandwich enzyme-linked immunosorbent assay. Dry blood spots were eluted in anti-TSH antibody-coated micro wells and were incubated with peroxidase-labeled anti-TSH monoclonal antibodies. After washing, the unbound antibodies were washed off and the bound conjugate remained in the micro well. These bound conjugates further react with substrate 3,3',5,5'-Tetramethylbenzidine and produce a color product. Concentration of TSH is directly proportional to the color produced. Absorbance was read at 450 nm and a value of TSH was expressed in mIU/l of blood. In order to measure the concentration of TSH in the test sample, calibration standards and controls were used. Calibration standards and controls were assayed for producing a standard curve of TSH by optical density versus TSH concentration. Therefore, by comparing the optical density of the test samples to this standard curve, the concentration of TSH was determined.<sup>5,6</sup>

Ethical approval was obtained from ethics committee of All India Institute of Medical Sciences, New Delhi. Blood samples were collected after the written consent of mothers (of the neonates). Patient Information Sheet was provided to each participating mother.

Exclusion criteria were as follows: (i) Newborns from Caesarean deliveries; (ii) deliveries in which iodine preparations were used; and (iii) pregnant mothers on iodine supplementation or anti-thyroid therapies.

## Sample Size

Keeping in view the anticipated prevalence of 2.9% reported in an earlier study in India,<sup>7</sup> 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 included a total of 619 subjects.

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**Table 1.** TSH levels at screening and at recall for confirmation of neonatal hypothyroidism

TSH category	N (%; n = 619)
<b>TSH levels (mIU/l) at birth</b>	
N = 613	
< 5	162 (26.4)
5 to < 10	174 (28.4)
10 to < 20	217 (35.4)
20 to < 30	17 (2.8)
≥ 30	43 (7.0)
<b>TSH levels at recall</b>	
N = 52	
< 10	25 (48.1)
10 to < 20	19 (36.5)
≥ 20	8 (15.4)

Abbreviation: TSH, thyroid stimulating hormone. Six samples at screening level were rejected and could not be analyzed due to insufficient blood.

## RESULTS

The cord blood samples from 619 neonates were collected. Six samples could not be analyzed due to insufficient blood. Out of 613 samples analyzed, TSH levels of 20 mIU/l and higher were found in 60 newborns. These children with high TSH were recalled for repeat TSH estimation for confirmation of NH. Eight children migrated from the study area and their repeat TSH levels could not be ascertained.

Out of the 52 samples collected for repeat TSH level estimation, 27 samples had TSH levels of 10 mIU/l and higher and were diagnosed to be suffering from NH (Table 1). The prevalence of NH was found to be 4.4% (1:23) in Kangra district.

It was found that five children with TSH levels of 10 mIU/l and higher were low birth weight (< 2.5 kg) newborns.

## DISCUSSION

In India, out of 457 districts, 344 districts have been surveyed for IDD. In all, 263 districts have been found to be endemic to IDD.<sup>8</sup> However, no data are available on prevalence of NH from these endemic districts. The prevention of IDD is presently being given low priority by health planners and administrators as total goiter prevalence has reduced due to universal salt iodization program. Generally, visible goiter and IDD are considered as the same by health planners and administrators.

Determination of NH by measuring TSH on a filter paper is a useful tool as: (i) it measures thyroid function at a vulnerable age, (ii) storage on filter paper is simple, (iii) blood spots can be stored at cool, dry room temperatures, (iv) it is operationally feasible, (v) provides successful valid assessment of ID, (vi) it is cost-effective and (vii) biological samples can be transported at ambient temperature.<sup>1</sup>

There is a lack of data on community-based studies conducted in iodine endemic districts. The present study revealed a prevalence of NH as 4.4% (1:23). Earlier studies conducted in India reported the prevalence of CH as 1:476, 1:1700 and 1:2804, respectively.<sup>9–11</sup>

## CONCLUSION

The present study documented the prevalence of NH as 4.4%, indicating a need for initiating a neonatal screening program for assessment of NH. This strategy can help in early detection of children with ID.

## Limitations of the study

1. We could not assess the size of thyroid dysplasia using the ultrasound due to lack of resources.
2. We could not assess these parameters due to lack of resources.
3. Low birth weight could possibly be the reason for high TSH levels among 18.5% of the neonates.

## CONFLICT OF INTEREST

The authors declare no conflict of interest.

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