Journal of Trace Elements in Medicine and Biology xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Journal of Trace Elements in Medicine and Biology

journal homepage: www.elsevier.de/jtemb

Short communication

Iodine nutrition status amongst neonates in Kangra district, Himachal Pradesh

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ARTICLE INFO

Article history:
Received 21 January 2014
Accepted 26 March 2014

Keywords:
Iodine
Nutrition
Thyroid stimulating hormone
Neonates
Himachal Pradesh

ABSTRACT

Iodine deficiency (ID) is an endemic health problem in Kangra district, Himachal Pradesh (HP) state. ID leads to mental retardation, deaf mutism, squint, dwarfism, spastic diplegia, neurological defects and congenital anomalies. Iodine nutrition status amongst neonates can be assessed by estimating thyroid stimulating hormone (TSH). The present study was conducted with an objective to assess the iodine nutrition status amongst Neonates in Kangra district, HP. All of the hospitals in the district which provide obstetric services were enlisted, of which three were selected for this survey. A total of 613 umbilical cord blood samples of neonates were collected on filter paper and analyzed for TSH. WHO (2007) reported that that a <3% frequency of TSH concentrations above 5 mIU/L in samples collected 3–4 days after birth indicates iodine sufficiency in a population. In our study we found that 73.4% of the neonates had TSH levels of more than 5 mIU/l, thus indicating ID in the population studied. Iodine deficiency continues to be a public health problem in Kangra district, Himachal Pradesh.

Introduction

Iodine deficiency disorders (IDD) is a serious global public health problem estimated to affect about one billion people across the world [1]. ID in neonates leads to cretinism including mental deficiency with a mixture of mutism, spastic diplegia, squint, hypothyroidism and short stature. Iodine deficiency amongst neonates lowers circulating thyroxin level and raises serum TSH. Hence, iodine deficient neonates have higher serum TSH concentration than do iodine sufficient neonates. In iodine-sufficient populations, about one in 4000 neonates may have congenital hypothyroidism, usually because of thyroid dysplasia. Thyroid stimulating hormone affects proper development of the central nervous system, particularly its myelination [2].

Kangra district, HP is a known endemic region for ID. The salt iodization programme in Kangra district was initiated in 1962, and thus has been running for over 50 years. Studies are available on the status of iodine nutrition in School Age Children (SAC) during the iodization programme which has documented the prevalence of ID as 12.1% (1999), 19.8% (2007) and 15.8% (2013), respectively [3–5]; however, there is a lack of data on the status of iodine nutrition amongst neonates from this district. The present study was conducted with an objective to assess the iodine nutrition status amongst neonates in Kangra district, HP, with an aim to provide evidence to state health authorities to strengthen the IDD programme, if required.

Materials and methods

The study was carried out from May 2013–July 2013. In Kangra district a total of nine Hospitals/Community Health Centres which conducted more than 100 deliveries per annum were selected. Of these, three hospitals were randomly selected. The 613 births occurring consecutively in these three hospitals during the study period were included for estimation of iodine nutrition amongst neonates. The blood samples were collected after the written consent of the mothers (of the neonates). The umbilical cord blood sample was taken on a filter paper and was transported to the Central Laboratory in Delhi for estimation of TSH. Caesarean delivery, delivery in which iodine preparations were used and pregnant mothers who were on anti thyroid therapies were excluded from the study.

Umbilical cord blood collection

Cord blood was collected before placental delivery within five minutes after birth to avoid clotting. One drop of blood was applied

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http://dx.doi.org/10.1016/j.jtemb.2014.03.009
0946-672X/

to filter paper. The spots were dried at room temperature and the filter papers 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 TSH by using sandwich enzyme linked immuno-sorbent assay (ELISA) method. Dry blood spots were eluted in anti-TSH antibodies coated with micro wells and were incubated with peroxidase labelled 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 (TMB) and produce a colour product. The concentration of TSH is directly proportional to the colour 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 O.D versus TSH concentration (mlU/l). Therefore, by comparing the O.D of the test samples to this standard curve, the concentration of the TSH was determined [6–8].

Ethical approval was obtained from the ethics committee of the All India Institute of Medical Sciences, New Delhi.

Sample size

Keeping in view the anticipated prevalence of 2.9% [9], 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 613 subjects.

Statistical analysis

The TSH normality and abnormality was compared in gender by using chi-square test.

Results

A total of 613 umbilical cord blood samples of neonates (324 males and 289 females) on filter papers were collected and analyzed for TSH. Three hundred and thirty six (54.8%) samples had TSH level of <10 mlU/l, 217 (35.4%) had 10 to <20 mlU/l and 60 (9.8%) had ≥20 mlU/l. It was also found that 73.4% of the neonates had TSH levels of more than 5mlU/l, thus indicating prevalence of ID in a population studied. No statistically significant difference of gender on the TSH levels was observed.

Discussion

Neonates are the most vulnerable group for ID. Raised TSH in neonates is an indicator for ID. WHO (2007) reported that a <3% frequency of TSH concentrations above 5 mIU/l in samples collected 3–4 days after birth indicates iodine sufficiency in a population [2]. In the present study 73.4% of the neonates have TSH levels of more than 5mlU/l, thus indicating widespread presence of ID. This could be possibly due to higher percentage of families consuming salt with iodine content of less than 15 ppm [4,5]. Moreover, ID in soil leads to crops deficient in iodine and consumption of food deficient in iodine leads to poor iodine status in the population. Low birth weight could also be a reason for high TSH level amongst 8.4% of the neonates.

Many studies have attempted to apply the frequency of neonatal TSH values of more than 5 mIU/l in determining population iodine status and monitoring intervention programmes, and although some have proven to be successful, most have provided conflicting or uncertain data [10–17]. This is due to many technical issues that remain unresolved on the use of neonatal TSH screening for monitoring iodine status, making it doubtful as a sensitive and reliable quantitative tool [18].

Neonatal TSH should not be used as the sole indicator for monitoring ID control programmes, especially when samples are collected less than 48 hours after birth, as there are no established reference intervals. And the cord blood sample taken immediately after delivery could have false positive high values of TSH due to physiological neonatal TSH surge that elevates TSH level [19].

Studies have documented that ID during the initial phase of life affects the developing brain. Thyroid stimulating hormone affects proper development of the central nervous system [2]. Earlier studies conducted in different countries of the world reported the high TSH level of more than 5 mlU/l in; Western Uganda (20–32%), Estonia (18.1%), Italy (14.4%), Spain (9.08%), Thailand (8.9%), Australia (6.8%), Poland (3–5%) and Iran (3.6%), respectively [10–17].

A study conducted in West Bengal reported TSH levels of more than 5mlU/l in 2.9% of the neonates [9]. An Indian study conducted amongst 1200 neonates reported the high TSH level of more than 20mlU/l in 1.83% of the neonates [20]. The prevalence of IDD found in neonates in the current study was much higher than that found in urban metropolitan hospitals.

Our earlier studies conducted in Kangra district amongst SAC [3–5] have also documented that ID was a public health problem. Findings of our present study substantiated that there is a high prevalence of ID amongst neonates in Kangra district. There is a need to review the implementation of the iodized salt programme in Kangra district. Furthermore, there is an urgent need for a neonatal screening programme for early detection of children with ID.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgment

The Project was sanctioned by Government of India, Ministry of Science and Technology, Department of Biotechnology vide letter No: BT/PR-15435/FNS/20/521/2011.

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Please cite this article in press as: Kapil U, et al. Iodine nutrition status amongst neonates in Kangra district, Himachal Pradesh. J Trace Elem Med Biol (2014), http://dx.doi.org/10.1016/j.jtemb.2014.03.009

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Please cite this article in press as: Kapil U, et al. Iodine nutrition status amongst neonates in Kangra district, Himachal Pradesh. J Trace Elem Med Biol (2014), http://dx.doi.org/10.1016/j.jtemb.2014.03.009