MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2024.4.479.482

A Comparative Analysis of Thyroid Hormone Levels in Healthy Newborns from Hypothyroid and Healthy Mothers

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ABSTRACT

Thyroid gland disorders stand as the most prevalent endocrine disorder in India, representing the leading preventable cause of intellectual disability. The absence of a neonatal screening program results in undiagnosed thyroid disorders among Indian children. The objective of this study was to assess the thyroid hormone levels in healthy newborns whose mothers had hypothyroidism during pregnancy. A total of 132 pregnant women were included in the study. The participants were divided into two groups: the Study group, consisting of hypothyroid pregnant women and the Control group. Blood samples were collected from all newborns on day 4 of life for thyroid profile evaluation. Statistical analysis was performed using Microsoft Excel and SPSS software, employing Chi-square test and student t test to determine significance levels. The findings revealed that majority of newborns in the Study group and in the Control group were appropriate for their gestational age. Notably, there were significant differences in weight for gestational age between the two groups. However, when comparing the thyroid profiles, no significant differences were observed. Thyroid disorders during pregnancy can impact fetal development, potentially leading to neonatal thyroid dysfunction, which may be temporary or permanent. This can contribute to metabolic and cardiovascular complications, emphasizing the importance of monitoring thyroid function during pregnancy.

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Key Words
Hypothyroidism, mother, newborn, thyroid

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Received: 2 March 2024
Accepted: 20 April 2024
Published: 27 April 2024

Citation: Shashank Tyagi, Ruchita Ranka, Ketan Chaturvedi and Amita Sharma, 2024. A Comparative Analysis of Thyroid Hormone Levels in Healthy Newborns from Hypothyroid and Healthy Mothers. Res. J. Med. Sci., 18: 479-482, doi: 10.59218/makrjms.2024.4.479.482

INTRODUCTION

Thyroid gland disorders are highly prevalent in India, representing the most common endocrine disorder and the primary preventable cause of intellectual disability. Without a neonatal screening program, these disorders often go undetected in Indian children. Hypothyroidism, whether overt or subclinical, is notably common among women of reproductive age and during pregnancy, occurring at frequencies ranging from 0.3-2.5%. Maternal hypothyroidism carries various adverse effects on pregnancy, the postpartum period, and fetal development. Previous studies have linked unrecognized and untreated maternal hypothyroidism to an increased risk of neonatal intensive care treatment. However, there remains a lack of comprehensive investigation into the association between thyroid diseases and neonatal morbidity in the existing literature[1-3]. Increased awareness has led many pediatricians in private institutions to screen newborns, while some state governments also support screening in government facilities. The complexity arises in screening newborns for congenital hypothyroidism due to significant fluctuations in thyroid-stimulating hormone (TSH) and thyroid hormone levels shortly after birth and in the first month. These levels vary among preterm infants, small-for-gestational-age infants and normal-term neonates, making a single measurement challenging to interpret. An ideal approach would involve universal screening at days of age for detecting congenital hypothyroidism. Alternatively, cord blood can serve as a screening tool specifically for congenital hypothyroidism if no other inborn errors of metabolism are being screened for[4-6]. Typical symptoms and signs of hypothyroidism manifest gradually during the early weeks and months after birth. The lack of these manifestations in most affected neonates suggests that either fetal metabolism and development do not rely heavily on thyroxine (T4) or that the minimal amounts of maternal thyroid hormone in the fetal circulation suffice to prevent most clinical signs of thyroid deficiency[7]. Therefore, this study aimed to assess thyroid hormone levels in healthy newborns born to mothers with hypothyroidism during pregnancy.

MATERIALS AND METHODS

The primary objective of this study was to assess the thyroid hormone levels in healthy newborns born to mothers with hypothyroidism during pregnancy. 132 pregnant women were included in the study. These participants were divided into two groups: the Study group, comprising hypothyroid pregnant women, and the Control group (66 participants in each group). On the fourth day of life, venous blood samples were collected from all newborns for thyroid profile evaluation and statistical analyses were performed to interpret the results. Exclusion criteria for this study encompassed pregnant subjects with any additional coexisting medical conditions. The data collected were meticulously recorded in a Microsoft Excel spreadsheet and subjected to statistical analysis using SPSS software. The Chi-square test and Student t-test were employed to determine the level of significance in the results.

RESULTS AND DISCUSSIONS

The average gestational age among the subjects in the study group was 38.51 weeks, while in the control group, it was 38.87 weeks. The majority of subjects in both groups were born at term (Table 1). Specifically, 89.39 percent of the study group subjects and 81.82 percent of the control group subjects were appropriate for their gestational age. Significant differences were observed when comparing the weight for gestational age between the two study groups (Table 2). However, when comparing the thyroid profile, no significant differences were found between the two study groups (Table 3). Thyroid dysfunction is prevalent among women of reproductive age and during pregnancy, with frequencies ranging from 0.3-5%, making it a significant concern. Hypothyroidism during pregnancy has adverse effects on pregnancy progression and the physical as well as neurodevelopmental aspects of the fetus. Various studies have indicated that maternal hypothyroidism is associated with higher risks of abortions, stillbirths, preterm delivery, pregnancy-induced hypertension, gestational diabetes mellitus, neonatal thyroid diseases and other complications. However, contradictory reports also exist, demonstrating successful pregnancy outcomes in profoundly hypothyroid women[8-10]. Current research focuses on the impact of thyroid dysfunction during pregnancy on fetal development, with one of the most concerning observations being the potential decrease in the offspring's intelligence quotient. During the first trimester of pregnancy, when organogenesis, especially neurodevelopment, is crucial, the fetus is entirely reliant on maternal thyroid hormone supply. This dependence has been supported by studies showing saturation of T3 receptors in the fetal brain early in the first trimester before the fetus begins producing its own thyroid hormones[11-14].

This study aimed to assess thyroid hormone levels in healthy newborns born to mothers with hypothyroidism during pregnancy. The majority of both study group subjects and control group subjects were full-term infants and appropriate for their gestational age. Basu *et al.*[10] compared newborns' thyroid profiles, term AGA babies' birth weight and normal birth weight babies over a period from 2015-2016. They screened 90 newborns, comprising three groups: preterm AGA, term SGA and term AGA, with 30 newborns in each group. Thyroid hormone levels (T3,

Table 1: Gestational age comparison between both groups

Gestational age (weeks)	Study Group		Control Group		
	n	Percentage	n	Percentage	p-value
Early preterm	3	4.55	5	7.58	
Late preterm	8	12.12	7	10.61	0.57
Term	55	83.33	54	81.82	
Total	66	100.00	66	100.00	
Mean Gestational age	38.51±1.19		38.87±1.23		

Table 2: Weight for gestational age comparison between both groups

Weight for Gestational age	Study Group		Control Group		
	n	Percentage	n	Percentage	p-value
Appropriate for gestation age	54	81.82	59	89.39	<0.05
Large for gestational age	7	10.61	3	4.55	
Small for gestational age	5	7.58	4	6.06	
Total	66	100.00	66	100.00	

Table 3: Thyroid profile comparison between both groups

Thyroid Hormone	Study Group	Control Group	p-value
Mean T3 (ng/mL)	1.15	1.26	0.77
Mean T4 (µg/dL)	12.62	12.3	0.49
Mean TSH (IU/mL)	2.61	3.5	0.96

T4, TSH) were evaluated between day 3 and day 7 of life. Both preterm AGA and term SGA babies exhibited significant thyroid profile abnormalities compared to term AGA newborns, showing lower T3 and T4 levels and higher TSH levels. Nam *et al*. investigated the relationships among neonatal hypothyroidism, family income and intellectual disability, highlighting a higher risk of intellectual disability in infants with hypothyroidism and low family income[11]. When comparing weight for gestational age between the two study groups, significant differences were observed. However, there were non-significant differences in thyroid profiles between the two study groups. Similar results were reported by Yadav *et al*.[12] Torky assessed the frequency of pediatric inpatient thyroid testing, abnormal test results and their impact on patient management. Out of 205 abnormal tests (17.1%), the most common abnormalities were normal FT4 with increased TSH, normal FT4 with TSH levels between 0.1-0.5 µIU/mL and high FT4 with normal TSH. Patients with new-onset type 1 diabetes showed borderline high or high TSH levels in about 20% of cases, which normalized during outpatient follow-up. Overall, 0.66% of patients were started on levothyroxine[13]. Desai *et al.* provided guidelines for newborn screening for congenital hypothyroidism, recommending screening preterm and low birth weight infants at 48-72 hours postnatal age and sick babies by 7 days of age. Confirmation of primary congenital hypothyroidism (CH) is indicated by venous TSH levels above 20 mIU/L before 2 weeks of age and above 10 mIU/L after 2 weeks of age, along with low T4 or FT4, prompting treatment initiation[14].

CONCLUSION

Thyroid disorders occurring during pregnancy indeed impact fetal development significantly. Prematurity and dysmaturity can potentially disrupt neonatal thyroid function, resulting in temporary or permanent thyroid dysfunction. These conditions may further contribute to the development of metabolic and cardiovascular disorders in newborns.

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