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Study of TSH hormones and arsenic in pregnant women compared to umbilical cord blood for neonate in Basrah. Iraq

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Abstract:

Arsenic exposure during pregnancy may have relatively few and uncertain effects on the mother and the unborn child with regard to thyrotoxicosis. In a prospective birth cohort research, the objectives of this investigation were to investigate the correlation between maternal and newborn thyroid hormone parameters and levels of arsenic exposure in cord and mother serum.

Methods: The birth research conducted at the Basrah Maternity Hospital served as the basis for the study, which included 108 mother-neonatal pairings. The chemiluminescence ICP-OES Spectroscopy Technique was used to measure the exposure variables, including maternal serum arsenic levels and TSH levels, in the third trimester. The geometric averages of arsenic exposure levels during the ninth month of pregnancy were (1.110.50) g/L and (1.020.48 g/L in cord serum, respectively. maternal TSH levels were (1.971.36 IU/mL) and (3.342.99) by geometric means in the third trimester.

Keywords: Arsenic, Thyroid hormones, neonate and maternal in basra

Introduction:

Pregnancy is a complex biological phenomenon characterized by a series of internal physiological transformations that women undergo [1]. The present stage is distinguished by a notable increase and differentiation of cells taking place in both the maternal and newborn organisms. Hence, this period is of utmost importance as individuals become very susceptible to alterations in their nutritional consumption, particularly with regards to nutrients that are already lacking under normal circumstances. The era of prenatal nourishment, growth, and development is well acknowledged as a crucial stage that has a substantial influence on the nutritional well-being of the fetus [2]. Insufficient access to or intake of micronutrients during this timeframe can have adverse effects on the maternal population, leading to illnesses such as anemia, hypertension, complications during birth, and potentially even mortality [3]. Multiple studies have provided evidence indicating that levels of many trace elements experience modifications over the course of pregnancy. Nevertheless, the predominant focus of these investigations was around the analysis of a solitary micronutrient, employing cross-sectional research designs [4]. Furthermore, the aforementioned investigations encompassed a heterogeneous cohort of women at different gestational periods [5]. Presently, there exists a dearth of longitudinal studies with larger sample sizes that examine a full range of micronutrients in the context of both typical pregnant women and their corresponding cord blood in Iraq. Arsenic, a prevalent contaminant, may exist in two distinct forms: organic forms, including arsenobetaine and arsenosugars, and inorganic forms, such as arsenites and arsenates [6,7,8] Inorganic arsenic (iAs) has been recognized as a harmful material and a well-established carcinogen due to its occurrence in groundwater and

some food sources. Therefore, the presence of arsenic presents a substantial global public health concern [9,10] Moreover, previous studies have demonstrated that arsenic has the capacity to cross the blood-brain barrier and mostly accumulate in the pituitary gland [11,12,13]. This phenomenon has significant prominence in instances when the blood-brain barrier is in a condition of immaturity [14,15]. Pregnant women and developing fetuses are vulnerable to the adverse impacts of toxic substances, therefore warranting heightened attention towards the possible hazards linked to arsenic exposure during pregnancy. Previous studies [16,17,18,19,20] have established that maintaining appropriate levels of thyroid hormones (THs) during pregnancy and early life is essential for optimal fetal and neonatal growth and development, including fetal neurogenesis [21,22,23]. Therefore, the progression and maturation of the embryo during the early phases of gestation are significantly dependent on the presence of maternal thyroxine. Thyroid-stimulating hormone (TSH) is commonly utilized as a major marker in evaluating thyroid function in human studies, as it is under the regulation of the hypothalamic-pituitary-thyroid (HPT) axis. The current understanding and research on the effects of arsenic exposure on maternal and neonatal thyroid function during pregnancy is limited and incomplete. Arsenic is well acknowledged as a prominent environmental agent capable of disrupting endocrine function. [14,15]

Materials & Methods:

One hundred and eight mother - neonate pairs who visited the Basra maternity hospital during the period between March 2022 – July 2022. Their ages ranged between 16-42 years. The research excluded female participants who presented with alternative forms of infertility, such as tubal obstruction and male infertility. Additionally, those with endocrine

issues, including thyroid condition, adrenal disorder, diabetes mellitus, and pituitary disorder, were also omitted from the study. A volume of three milliliters of venous blood was obtained using vacuum tubes containing gel/clot activator. The collected blood samples were then allowed to stand at room temperature for a duration of one hour to facilitate the development of clots. After centrifugation at a speed of 2000 rpm for a duration of ten minutes, the serum was carefully aspirated and thereafter distributed into sterile tubes. Following this, the tubes were kept at a deep freeze temperature. The repetition of freezing and thawing cycles in the serological investigation using chemiluminescence immunoassay was prevented. The levels of TSH were determined by using a competitive binding immunoenzymatically assay to evaluate the quantities of TSH in serum. The results were assessed with the Mindray CL-series chemiluminescence immunoassay instrument.

Data Statistical

The data was subjected to statistical analysis using the Statistical Package for Social Science (SPSS). The findings were presented in numerical form, including percentages, as well as the mean ± S.D. (standard deviation). The analysis of variance (ANOVA) was used to assess the disparities between groups, with a significance level of $p < 0.05$ serving as the lower threshold for statistical significance.

Results:

Demographic of the studied groups a sample of (108) participants engaged in this study, to investigate some hormone and trace element in the one hundred eight pregnancy women and comparison with a (108) there neonate. The mean age of cases in pregnant women group was (26.79 ± 6.85) years. Furthermore, 14.9% in this women group aged >35

years and the remaining cases (50%) aged among women 50% aged 16-20 years with mean (26.60±6.60). And result in rural that see more than urban with percent (58.4%) and number of (n=64). As well as the weight of neonate that highest result with (3.09±0.41) according to the weight in numeber (n=10) and percent (9.25%).

Table (1): Age Residence and neonate weight distribution of the studied groups.

Parameters		Study Groups		
		Mother		
		N	%	Mean±Sd
Age (years)	16-25	54	50.0	26.60±6.66
	26-35	38	35.1	26.70±6.58
	≥35	16	14.9	26.79±6.85
	Total	108	100.0	
Residence	Rural	63	58.4	
	Urban	45	41.6	
	≤2.5 kg	4	3.70	3.05±0.42
	3 kg	94	87.05	3.04±0.41
	4kg	10	9.25	3.09±0.41

Table (2) correlation of Age with TSH and Arsenic in study group.

		TSH	As
Age (years)	r	.085	-.007
	P-value	.282	.941
		108	108

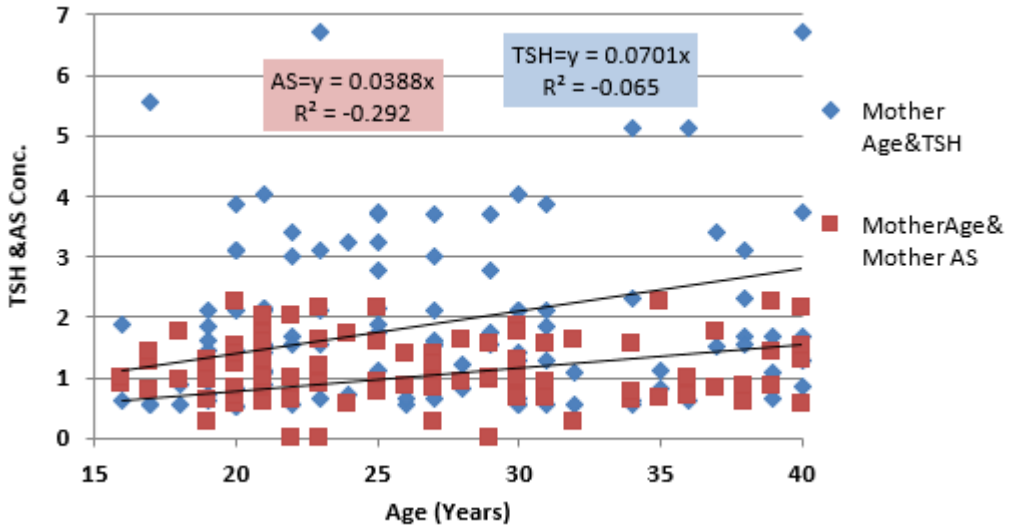

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Figure (1) show the correlation of TSH and As according to age

The correlation of age with tow variable (TSH) and (As) frequency were mostly founded at table (2) as it observe in figure (1) (As r^2=0.292) and (TSH r^2=0.065)

Table (3): Total concentrations of (TSH) in mothers and neonate

TSH concentration (mIu/ml)		P-value
Mothers	Neonate	
1.97±1.36	3.34±2.99	≤0.001

The concentrations of TSH hormone were detected from serum of mother and fetus by chemiluminescent Technique. Among the two groups women and compare with their child group the highest percent of TSH level was found in the group (neonate) of (3.34±2.99), while the lowest percent was found in mother group, (1.97±1.36), statistically this difference was highly – significant

Table (4): Total concentrations of As in mothers and neonate.		
As concentration (µg/L)		P-value
Mothers	Neonate	
1.11±0.50	1.02±0.48	0.20

The concentrations of Arsenic were detected from serum of mother and fetus by ICP-OES spectroscopy Technique. Among the two groups women and compare with their neonate group the highest level of Arsenic was found in the group mother of (1.11±0.50), while the lowest level was found in neonate group, (1.02±0.48), statistically this difference was non – significant P-value (0.20)

Table (5) the correlation between TSH trace element (As)		
		As
TSH	r	-.186**
	P-value	.005
	N	216

**correlation is significant at P-value 0.05

The summary of correlation in table (5) between TSH and As that explain effect of TSH on value (As) when evaluated TSH that decrease of the vale of As .

Discussion:

The regulation of thyroid hormone homeostasis is of utmost importance in the control of metabolic processes in both maternal and fetal physiology. This delicate balance might potentially be affected by environmental endocrine disruptors. This work represents the inaugural examination of the associations between maternal and cord serum arsenic exposure levels during pregnancy

and the thyroid hormone parameters of mothers and neonates, as seen in a birth cohort study. The findings of our investigation indicate a negative correlation between maternal blood arsenic concentrations during pregnancy and newborn thyroid-stimulating hormone (TSH) levels. Furthermore, a significant correlation was identified between the amounts of arsenic in cord serum and the levels of newborn thyroid-stimulating hormone (TSH). Nevertheless, no significant correlations were observed between the factors related to arsenic exposure during pregnancy and the parameters of maternal thyroid hormone levels. The results suggest that prenatal exposure to low quantities of arsenic might potentially affect newborn thyroid hormone characteristics, regardless of any effect from the mother. The levels of arsenic in the maternal blood during pregnancy and the levels of arsenic in the cord serum are possible risk factors that have the potential to impact the levels of thyroid hormones in neonates. The findings of this study indicate that neonates have heightened vulnerability to the detrimental impacts of arsenic exposure on thyroid functionality, even when exposed to modest quantities of the substance. The concentrations of thyroid-stimulating hormone (TSH) in the blood of both the maternal and fetal subjects were assessed using the chemiluminescent method, as shown in Table 3. The TSH levels of the group of children were found to be the highest (M ± SD: 3.34±2.99), while the group of mothers exhibited the lowest levels (M ± SD: 1.97±1.36). The observed difference exhibited statistical significance, as shown by a p-value of ≤ 0.001. Multiple clinical research have substantiated the notion that the evaluation of fetal hormones during pregnancy includes the examination of thyroid hormone levels. Currently, the recommendations of the Endocrinology Society recommend thyroid monitoring only for pregnant women who are identified as being at a high risk. However, in the year 2012, the board of the Endocrinology Society had challenges in achieving consensus over the recommendations for the administration of thyroid

function tests in pregnant people, leading to the release of updated guidelines. A number of board members have put out a proposal regarding the incorporation of thyroid screening for pregnant women in the ninth week of gestation. In contrast, several experts propose that thyroid screening should be limited to those with an elevated risk. Nevertheless, it is contended that the final decision should be left to the discretion of each physician, who should consider the unique requirements of their patients [24]. significant findings pertaining to the arsenic content (As) among the study group. The statistical analysis shown in Table 4 provides data on the serum of both the mother and neonate, obtained using the ICP-OES spectroscopic technique. The group of women exhibited the greatest level of Arsenic (1.11±0.50) compared to the group of children. Conversely, the lowest level of Arsenic (1.02±0.48) was discovered in the group of mothers. However, this difference was not statistically significant, as shown by a P-value of 0.20. The study conducted by Hameed et al. 2020 [25]. revealed that there was no statistically significant link seen between the amounts of arsenic and cadmium in maternal blood and the corresponding quantities of these elements in cord blood ($P>0.05$). Recent research has confirmed the findings of low levels of a certain substance in pregnant women and their neonate. There is a correlation between elevated levels of arsenic exposure during pregnancy and a reduction in birth weight. According to a study conducted by Kile et al.2016 [26] there is a correlation between arsenic exposure and a reduction in birth weight. Notably, only the research done in communities characterized by very low-level exposure levels have shown adverse impacts of arsenic on birth weight. There is a potential correlation between the reproductive toxicity of arsenic and its dosage, as well as its causative relationship with variables that impact fetal development and survival. This is supported by evidence indicating that elevated levels of arsenic exposure are associated with higher rates of spontaneous abortion and newborn mortality. Additionally, the study demonstrates a robust inverse

causal association between prenatal exposure to arsenic and gestational age[27].

Conclusion:

in summary, in basrah southren of iraq cohort, we found no clear evidence for an adverse effect of arsenic exposure during pregnancy on TSH function according to age. If replicated in other cohorts, our finding has implications for surveillance ovarian homeostasis among women in arsenic endemic areas

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