

## Effect of Arsenic on Breastfed Baby of Arsenic Affected Lactating Mother

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### Abstract

**Introduction:** In the endemic areas of chronic arsenic poisoning of Bangladesh (Cumilla, Noakhali, Laksham, Matlab) drinking water is heavily contaminated with arsenic. An estimated of about 70 million people are at risk from drinking water contaminated with arsenic. There are numerous data on effects of arsenic in adults but a few reports are available on the adverse effect of arsenic on infants and arsenic concentration in human milk, as human milk is the primary source of nutrition during first 6 months of life. Arsenic level found in the urine of infants reflects the intake of arsenic through breast milk.

**Objective:** To find out the effect of arsenic among the breastfed babies of arsenic affected mothers.

**Materials and Methods:** This cross sectional study was conducted in the arsenic exposed area of Bangladesh from January 2007 to July 2008. Thirty exclusively breastfed babies of arsenic affected mothers were enrolled as cases and 30 exclusively breastfed babies from non affected mothers were taken as control. Urinary arsenic concentration was considered for measurement of arsenic status. Mothers with their babies were thoroughly examined for length, weight, occipitofrontal circumference (OFC) and gross motor skills.

**Results:** Arsenic affected mothers excreted high concentration of arsenic (334.68 $\mu$ g/L $\pm$ 108.02) in their urine than control group (19.17 $\mu$ g/L $\pm$ 7.92) but the urinary arsenic concentrations from both groups of breast fed babies were found to be low. Growth and development parameters like length, weight, OFC and gross motor skills were also found to be normal in both groups of babies.

**Conclusion:** Exclusive breast feeding should be practiced in arsenic affected area to protect the babies from exposure to arsenic from water sources.

**Key-words:** Arsenic affected mother, Melanosis, Keratosis, Urinary arsenic concentration.

### Introduction

Today arsenic is known as one of the severely toxic industrial and geochemical pollutants<sup>1</sup>. Humans are exposed to arsenic through environmental and occupational sources<sup>2</sup>. The people of Bangladesh are getting exposed to arsenic through drinking water and suffering from health effects. Globally more than 100 million people are exposed to arsenic and Bangladesh is one of the most severely affected countries<sup>3</sup>. Approximately 50% of the tube well providing drinking water to about 57 million people contain arsenic >50 $\mu$ g/L<sup>1</sup>. Arsenic causes various effects that depend on the amount and duration of the intake. Long term exposure related to increase risk of cancer, skin lesion, peripheral neuropathy as well as hematological, liver and kidney effects<sup>3</sup>. There are also increased evidence of negative effects of exposure to arsenic through drinking water on fetal growth and infant mortality<sup>2,4-6</sup> as well as neuro-developmental status in school-aged children<sup>7-11</sup>.

In Bangladesh, a group of arsenic exposed women (arsenic in drinking water >100 $\mu$ g/L) experienced significantly high rate of spontaneous abortion, still birth and preterm birth<sup>12</sup>. Mother's milk is primary source of nutrition during first 6 months of life; so the composition of human milk is important<sup>13</sup>. It is well-known that toxic metals such as lead, cadmium and mercury are excreted in breast milk but there are very few reports available on arsenic concentration in human milk<sup>14</sup>. Some reports on arsenic concentration in human milk show low concentration of arsenic in breast milk (0.5-2 $\mu$ g/L) of lactating mother who were exposed to arsenic through drinking water (>200 $\mu$ g/L)<sup>15,16</sup>. Arsenic levels found in the urine samples of the infants reflect the intake of arsenic through

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breast milk<sup>15,16</sup> whereas the normal urinary level is 0-35µmg/L. Arsenic is metabolized in the body by methylation and the main metabolites produced are methylarsonic (MMA) and dimethylarsonic acid (DMA) which are readily excreted through urine<sup>17</sup>. The objective of this study was to find out the effect of arsenic in the breast fed babies of arsenic affected lactating mothers. The technique for the measurement of arsenic directly from breast milk is not available in Bangladesh. World Health Organization (WHO) recommends urinary arsenic and it has been considered as a reliable index for ongoing exposure to arsenic<sup>18</sup>.

### Materials and Methods

This descriptive cross sectional study was conducted in the arsenic exposed area (Laksam and Matlab) from January 2007 to July 2008. Thirty exclusively breast fed babies of arsenic affected mothers were enrolled as cases and 30 exclusively breast fed babies of non arsenic affected mothers with same age groups were taken as control. All control babies were taken from the register of Combined Military Hospital, Cumilla. Data about the arsenic affected mothers with their babies were taken from health worker in a upazilla health complex. Mothers were diagnosed both clinically and biochemically having cutaneous manifestation and other complications. In this study, urinary arsenic concentrations were considered for measurement of arsenic status and 10ml urine was collected in metal free plastic container from both mothers and babies and kept in cold chain maintaining box. These samples were stored in refrigerator and on the next day transported to the laboratory of Exonic technology centre in Ashulia. Atomic fluorescent spectrometer with continuous flow hybrid generation system was used to detect arsenic in urine. Mothers were thoroughly interviewed and examined; detail histories particularly feeding history were taken. Babies were also examined clinically to see weight, length (supine), OFC and neck control, supine to prone position. Babies sit with support were included but the babies who were prematurely born, having neurological disorder and very sick were excluded from this study. Collected data were processed and analyzed by Statistical Package for the Social Sciences (SPSS) version 20.0, T-test was done to compare the qualitative data and p-value <0.05 was considered as test of significance.

### Results

In this study 30 arsenic affected mothers were diagnosed both clinically and bio-chemically. They had history of

taking arsenic contaminated water having arsenic level exceeding the normal level (50µmg/l) for prolonged period (more than 6 months and developed cutaneous manifestation and or other complication) with their babies were taken as cases and 30 non affected mothers with their babies were enrolled as control. Arsenic affected mother showed 100% melanosis (Diffuse or spotted blacking/darkening of the skin due to deposition of melanin in skin and mucous membrane) and 26.7% keratosis (rough, dry, hard and thickening of palms and soles).

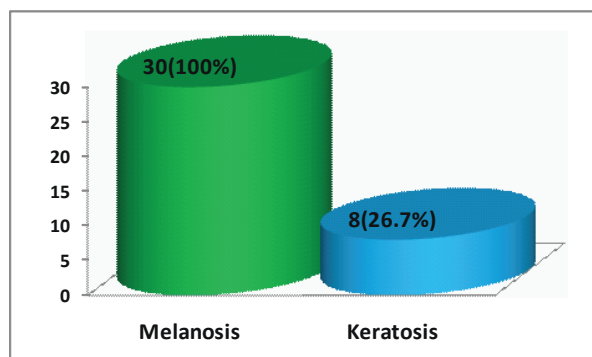


Fig-1: Bar diagram shows skin manifestation of arsenicosis mothers

All the 30 cases (100%) had melanosis and 8 cases (26.7%) had keratosis (Figure-1), thereby considered as arsenic affected mother.

Table-I: Urinary arsenic level (µgm/L) of mothers at 6 months age of their babies

Variables	Statistics	Group		P Value
		Cases (n=30)	Control (n=30)	
Urine arsenic in Mothers at 6 months age of babies(µgm/L)	Mean ± SD	334.68 ± 108.02	19.17 ± 7.92	0.001
	Median	348.55	16.5	
	(Min-Max)	(214-617)	(9-37)	

Table-I shows that arsenic affected mothers excreted higher concentration of arsenic (334.68µgm/L ±108.02) in their urine than control group (19.17µgm/L ±7.92).

Table-II: Urinary arsenic level (µgm/L) of babies at 6 months of their age

Variables	Statistics	Group		P Value
		Cases (n=30)	Control (n=30)	
Urine arsenic in Babies at 6 months (µgm/L)	Mean ± SD	6.02 ± 2.35	5.99 ± 2.27	0.964
	Median	6.90	6.91	
	(Min-Max)	(1.5-10.02)	(0.15-9.5)	

Arsenic concentration in urine was found out to be low in both groups of babies (Table-II). Distributions of the anthropometric measurements like weight, length, OFC of both groups of babies are shown in Table-III and no statistically significant difference was found between two groups. Gross motor skills like neck control, supine to prone position were also found to be normal in both groups.

**Table-III:** Weight, length and OFC of babies at 6 months of their age

Variables	Statistics	Group		P Value
		Cases (n=30)	Control (n=30)	
Weight (in kg) at 6 months	Mean ± SD	7.33 ± 0.30	7.43 ± 0.47	0.297
Length (in cm) at 6 months	Mean ± SD	63.27 ± 2.26	63.39 ± 3.57	0.880
OFC (in cm) at 6 months	Mean ± SD	42.93 ± 1.11	43.31 ± 0.51	0.091

## Discussion

In Bangladesh, a large number of shallow tube-wells have created a devastating threat of arsenic poisoning. An estimated of about 70 million people are at risk from drinking arsenic contaminated water<sup>19</sup>. Mother's milk is a primary source of infant nutrition and ensures proper development and protection from diseases. A few reports on the concentration of arsenic in milk have been published<sup>3,20-23</sup>. Breast milk contains almost entirely inorganic Arsenic (iAS), mainly in the trivalent form which implies that the infants are exposed mainly to arsenic via breast milk. The methylated arsenic metabolites in the blood plasma do not easily pass to the mammary gland. Thus an efficient maternal methylation leads to less excretion of arsenic in breast milk. Regarding cutaneous manifestation, this study observed that all (100%) (Fig-1) mothers with arsenicosis presented with melanosis and it is similar with the study of Tondel M et al<sup>24</sup>. Urinary concentrations of arsenic were measured in both groups of mothers and a very high concentration of arsenic was found in the urine of arsenic affected mothers when compared with the control group. This finding is similar with various studies<sup>2,12,13,25</sup>. Urinary arsenic is generally reported as the most reliable indicator of arsenic exposure<sup>2,26</sup>. Breast fed babies from both groups of mothers excreted low concentration of arsenic in urine and this difference is not statistically significant and this finding is also consistent with other studies<sup>15,16,25,26</sup>. Growth and development were found to be normal in both group of babies and these findings were similar with other studies<sup>3,26</sup>.

This study revealed that very little amount of arsenic is excreted in breast milk as indicated by low level arsenic existence in the urine of these babies. This finding reflects that breast fed infants particularly those who are exclusively breast fed are protected from exposure to arsenic during critical period of development (up to 6 months of age).

## Conclusion

Arsenic is found in very low concentration in the urine of breast-fed babies of arsenic affected mothers and it has no impact on growth and development of babies. Exclusive breast feeding practice in arsenic affected areas can protect the babies from arsenic poisoning during the critical period of development.

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