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Abstract:

Aims: The study was performed to assess gingival health status among the arsenicosis patients in comparison with the non-arsenicosis healthy individuals.

Methods: A cross-sectional comparative type of study was conducted. One hundred and ninety two (192) arsenicosis patients and 96 non-arsenicosis healthy individuals were recruited purposively on the basis of defined selection criteria from January 2010 to June 2012. Research instrument was an interviewer questionnaire with gingival examination checklist. The questionnaire included socioeconomic family profile and the gingival checklist included attrition, pigmentation, gingivitis, and periodontitis.

Results: One hundred and thirty seven (71.35%; n=137) of arsenicosis patients suffered from gingival attrition in comparison with the healthy individuals (38.54%; n=37). Gingival pigmentation was seen 61.98% (n=119) and 29.16% (n=28), respectively, among arsenicosis and non-arsenicosis individuals. Results also showed that 89.58% (n=172) of arsenicosis patients suffered from gingivitis, whereas, 44.79% (n=43) did not. In addition, 46.88% (n=90) and 25.00% (n=24) of arsenicosis and non-arsenicosis patients, respectively, were found suffered from periodontitis.

Conclusion: Gingival health status of the arsenicosis patients was found relatively higher vulnerable to gingival attrition, pigmentation, gingivitis and periodontitis than that of non-arsenicosis healthy individuals. Health education intervention programs among the risk population and arsenicosis patients, and ensure of arsenic-free safe drinking and household use of water may be one of the most important applicable way to control and prevention of arsenicosis and gingival health problems in Bangladesh.

Key words: Arsenicosis, gingival health, gingival pigmentation, gingivitis, periodontitis.

Introduction:

Millions of people in Bangladesh are consuming arsenic through drinking water and food that leads to pigmentary changes (melanosis). Melanosis is found on trunk and gradually covers the whole body.¹⁻³ Some signs are also seen in other tissues of the body like tongue, gingival and buccal mucosa.² Arsenic was once used topically as pulp devitalizer for endodontic treatment. Arsenic is toxic to vital pulp due to prolonged leakage of arsenic trioxide that can cause severe damage to

periodontal tissues and also can widespread necrosis of gingiva and bone, which can lead to osteomyelitis of the jaws.⁴⁻⁶

So far knowledge goes, any significant study on oral health in relation to arsenic has not been done in Bangladesh. So this study will help in endeavors towards reducing the effects caused by arsenicosis in the oral cavity. The arsenic hazard in Bangladesh villagers now appeared as a 'real disaster', affecting thousands physically, physiologically, mentally and

economically; it is intensifying malnutrition, poverty and destitution among the already poor villagers.^{2,4,7,8} The future of the Bangladesh villagers are jeopardized. Arsenic contaminated underground water is one of such severe problems that the government has been failed to manage properly.¹⁰ Five years after the approval of National Policy for Arsenic Mitigation and Implementation Plan, 2 lacs people still face the threat of cancer annually due to drinking of arsenic contaminated water in Bangladesh, says a report of World Health Organisation (WHO).^{7,10} The Lancet Medical Journal reported that up to 77 million Bangladeshis have been exposed to toxic levels of arsenic from contaminated drinking water, and even low-level exposure to the poison is not risk-free.⁹⁻⁸ The British Geological Survey (2001) reports even normal amounts (1-10 mg/kg) of arsenic are sufficient to give excessive arsenic in the groundwater if dissolved or desorbed in sufficient quantity.⁸ Arsenic contamination of groundwater is a global environmental problem affecting a large number of population, especially in developing countries. The "blackfoot disease" that occurred in Taiwan more than half of a century ago was attributed to drinking arsenic-contaminated water from deep wells containing high concentrations of the trivalent arsenite species.^{7,10} Similar arsenic poisoning cases were reported later in Chinese, Inner Mongolia, Bangladesh and India found all related to drinking groundwater contaminated with arsenic.¹⁵ The maximum contaminant level (MCL) of arsenic in drinking water has been changed recently by the U.S. EPA from 50 ppb to 10 ppb; the compliance date is January 2006. An environmental health disaster is unfolding in West Bengal and Bangladesh. Tens of millions of persons in many districts are drinking groundwater with arsenic concentrations far above acceptable levels. Thousands of people have already been diagnosed with poisoning symptoms, even though much of the at-risk population has not yet been assessed for arsenic-related health problems.^{6,7} Over the last two decades in Bengal, untreated tube well water was heavily promoted and developed as a safe and environmentally acceptable alternative to microbiologically unsafe untreated surface water. In the 1980s, scientists began finding evidence of arsenic contamination, but only very recently (mid-1990s) has the crisis emerged into broad public awareness. The origin of the arsenic pollution is geological in this case- the arsenic is released to groundwater under naturally occurring aquifer conditions.^{7,10,15}

Methodology:

A cross-sectional study was conducted in several villages of Raipura upozilla and UHC&H of Raipura,

Norsingdi district where arsenic contamination of tube well were >0.05 mg/L with the signs and without signs of arsenicosis i.e., melanosis, leukomelanosis, keratosis and hyperkeratosis. For comparison, groups of respondents from several villages of Shreepur and Kapasia upozilla in Gazipur district and Bhairab and Karimganj upozilla in Kishoreganj district were included where the tube wells water contained the arsenic level was <0.01mg/L that was confirmed by the NIPSOM arsenic test kit¹¹. The study was conducted during the period of January to June 2010. Standard formula was used in estimating sample size. As prevalence is not known, sample size was determined by taking 50% prevalence and 10% error. Exposed with arsenicosis sings=96, exposed without arsenicosis sings=96, non-exposed (0.01 mg/L in drinking water)=96. So, the total sample size was (69X3)=288. Sampling technique was purposive.

After preliminary observation and literature review questionnaire was developed. It was pretested, modified and finalized for data collection. Data were collected by a semi-structured questionnaire. Questionnaire was developed after preliminary observation and literature reviews. It was pretested, modified and finalized for data collection. Verbal and written consents were obtained after explaining purpose of the study to the respondents. The researcher himself interviewed and examined all the respondents by asking questions in Bangla. Data were analyzed by using software SPSS win version 11.5. Frequency tables were produced for population characteristics, dependent variables and independent variables. Then cross-tables were produced between dependent variables and independent variables as well as population characteristics and mean values were produced for continuous variables. At last appropriate graphs and figures were prepared for data presentation. Ethical clearance was taken from ethical committee of NIPSOM before data collection; permission was taken from the concerned Union Parishad Chairman. Informed risk, burden, benefit about the research and written consent of individual patient was taken. During data collection, privacy of the respondents was maintained strictly. Confidentiality of the data was also maintained properly. Gingival health, gingivitis and periodontitis were confirmed after Loe H: J Periodontol 1967; 38 (suppl): 610.

Results:

The study group of both the case and comparison was selected from several villages of different districts of Bangladesh. A total of 288 respondents were interviewed and examined through structured questionnaire accordingly the data were collected.

The findings were as follows:

Table no.1: Distribution of the respondents by Age.

Age group in full years	Arsenicosis patient		Exposed non-patient		Non-exposed		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
11-20	7	7.3	10	10.4	6	6.3	23	8.0
21-30	19	19.8	30	31.3	25	26.0	74	25.7
31-40	33	34.4	29	30.2	30	31.3	92	31.9
41-50	22	22.9	15	15.6	18	18.8	55	19.1
51	15	15.6	12	12.5	17	17.7	44	15.3
Total	96	100	96	100	96	100	288	100

Mean \pm SD: 40.15 \pm 14.28 36.15 \pm 12.96 40.03 \pm 13.71 38.77 \pm 13.75

Table no.1 shows the highest proportion (31.9%) out of the total (288) respondents was in the age group of 31-40 years. Among the arsenic exposed patient group (n=96), 34.4% were in the age group 31-40 years and followed by 22.9% in the 41-50 years. Among the arsenic exposed non-patient group (n=96), 31.3% were in the age group 21-30 years and followed by 30.2% in the 31-40 years. Among the arsenic non-exposed non-patient group (n=96), 31.3% were in the age group 31-40 years and followed by 26.0% in the 21-30 years. Comparison between the mean and standard deviation of the age of arsenicosis patient, exposed patient and exposed non-patient groups, exposed patient and non-exposed patient and non-exposed non-patients group (t-test analysis) revealed no statistically significant age differences between the groups (P>0.05).

Table no.2: Distribution of the respondents by Habit.

Habit	Arsenicosis patient		Exposed non-patient		Non-exposed		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Non-smoker	36	37.5	45	46.9	25	26.0	106	36.8
Smoker	39	40.6	30	31.3	37	38.5	106	36.8
Betel leaf	16	16.7	21	21.9	33	34.4	70	24.3
Tea	5	5.2	45	46.9	1	1.0	06	2.08
Total	96	100	96	100	96	100	288	100

Table no.2 shows that 36.8% respondents out of 288 were habituated with smoking, 24.3%, with betel leaf, 2.08% were with tea.

Discussion:

This cross-sectional study was undertaken with the aim to assess and compare the state of gingival health among the arsenicosis patients. Gingival health is an essential and integral component of health throughout life. No one can be truly healthy

unless he or she is free from the burden of oral and craniofacial diseases and condition. A study found that oral diseases had a significant impact on quality of life, the strong correlation found between perceived general health and gingival health marks the first scientifically based evidence supporting the common view that gingival health is part of general

Table no.3: Distribution of respondents by Gingival Pigmentation.

Gingival pigmentation	Arsenicosis patient	Non-arsenicosis individual patient	Total	Non-exposed		Exposed		Total	Exposed	Non-exposed	Total
				Frequency	%	Frequency	%				
Present	61(63.54%)	28(29.00%)	147	58(46.17%)	119(61.98%)	147(51.04%)	119(61.98%)	28(29.17%)	147(51.04%)	147(51.04%)	147(51.04%)
Absent	35(36.46%)	68(70.84%)	141	68(70.83%)	73(38.02%)	141(48.96%)	73(38.02%)	68(70.83%)	141(48.96%)	141(48.96%)	141(48.96%)
Total	96	96	288	96	192	288	192	96	288	288	288

$\chi^2=27.57$ df=1 p<0.05 statistically significant

Table no.3 shows that 61.98% of the respondents in the arsenicosis patient group had gingival pigmentation, while 29.00% of the respondents in the arsenic exposed non patient group had the same. But the difference in proportion of having gingival pigmentation between the groups was found not to be statistically significant (p>0.05). Results also show that 63.54% of the respondents in the arsenicosis patient group had gingival pigmentation; on the other hand, 29.17% of the respondents in the non exposed group had the same. But the difference in proportion of having gingival pigmentation between the groups was found not to be statistically significant (p>0.05). Table no.3 again shows that 61.98% of the respondents in the arsenic exposed non-patient group had gingival pigmentation; whereas, 29.17% of the respondents in the non-exposed group had the same. But the differences in proportion of having gingival pigmentation between the groups was found not to be statistically significant (p>0.05).

Table no.4: Distribution of respondents by Gingivitis.

Gingivitis	Arsenicosis patient	Non-arsenicosis individual patient	Total	Arsenicosis patient		Non-exposed		Total	Exposed non-patient	Non-exposed	Total
				Frequency	%	Frequency	%				
Present	172(89.58%)	43(44.79%)	215	88(91.67%)	82(85.42%)	170(88.54%)	84(87.50%)	215(89.58%)	82(85.42%)	166(86.46%)	215(89.58%)
Absent	20(10.42%)	53(55.21%)	73	8(8.33%)	14(11.46%)	22(11.46%)	12(12.50%)	73(28.42%)	14(14.58%)	26(13.54%)	73(28.42%)
Total	192	96	288	96	96	192	96	192	96	192	192

$\chi^2=0.88$ df=1 p>0.05 statistically insignificant

Table no.4 shows that 89.58% of the respondents in the arsenicosis patient group had gingivitis; on the other hand, 44.79% of the respondents in the arsenic exposed non-patient group had the same. But the difference in proportion of having gingivitis between the groups was found not to be statistically significant (p>0.05). Of the respondents, 91.67% in the arsenicosis patient group had gingivitis, while 85.42% of the respondents in the arsenic non-exposed group had the same. But the difference in proportion of having gingivitis between the groups was found not to be statistically significant (p>0.05). Table no.4 shows 87.50% of the respondents in the arsenic exposed non-patient group had gingivitis; whereas, 85.42% of the respondents in the non-exposed group had the same. But the difference in proportion of having gingivitis between the groups was found not to be statistically significant (p>0.05).

health.^{12,13} Gingival health is usually determined by the prevalence of caries and periodontal disease, the latter being one of the most widespread chronic diseases in the world.¹⁴ A total of 288 respondents were interviewed through structured questionnaire among them, 192 were exposed to arsenic in drinking water, 96 of the respondents were with sign

and symptoms of arsenicosis. On examination pigmentation on gingiva was found 51.04% respondents out of 96. In many studies, the prevalence of periodontal disease has been found to be 100% in adults and older.^{13,14} The number of cases of periodontal disease in persons with poor oral hygiene is more than 20 times that for persons

Table no 5. Distribution of respondents by Periodontitis.

Periodontitis	Exposed group	Non-arsenicosis individual patient	Total
Present	90(46.88%)	24(25.00%)	114
Absent	102(53.12%)	72(75.00%)	174
Total	192	96	288

$\chi^2=1.82$ df=1 p>0.05 statistically insignificant

Table no.5 shows that 46.88% of the respondents in the arsenic exposed group had periodontitis; on the other hand, 25% of the respondents in the arsenic non-exposed group had the same. But the difference in proportion of having periodontitis between the groups was found to be statistically non significant (p>0.05).

who have good oral care practices.¹⁴ In this study out of 288 respondents, 89.58% arsenic exposed patients had gingivitis and 46.88% had periodontitis (table no.4&5).

In this study the smoking habit were found statistically non significant (table no.2) among the arsenic exposed and non-exposed persons. But betel nut chewing habit were found statistically significant (table no.2). This result may be due to the unadjustment of the habit of the respondents. Pigmentation on gingiva of arsenic exposed and non-exposed patients were found statistically significant. It is known that toxic effect of fluoride was not influenced by arsenic. In this respect there was a case-control study which showed that the student who had lived in the arsenic endemic area had higher prevalence of enamel hyperplasia, lower caries experience and higher percentage of children who were free from periodontal disease than those of the control group.³ Whether arsenic is in same way related to the cause of enamel hypoplasia though there were no obviously combined effects of arsenic and fluoride on dental tissues.

Conclusions:

Arsenic has an impact over gingival health. By these field worker (such as HA, FWA, etc.) intervention program have to do to ward level. With this counseling health guide has to be given to upozilla health complex. More priority should be given on alternative source with counseling. Oral hygiene instructions has to be given through written documents and training.

So this can be a tool for early diagnosis of the arsenicosis. It was felt that further study may be conducted particularly on teeth, periodontia and attrition as a consistent sign for arsenicosis. This will definitely be helpful for the development of community health program.

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