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Discovering Efficient Method Extracting Arsenic from Human Milk Samples

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ABSTRACT- In this article, the arsenic levels in drinking water were investigated. Hair and nail arsenic is strongly related, however, according to principal component analysis (PCA). According to our findings, lactating women with hypertension higher levels. Arsenic levels in infants' blood, nails, and urine were examined, and the findings indicated a substantially high body burden of arsenic in regions. The hair and nail arsenic levels were shown to be age-dependent utilizing PCA. The methods for extracting arsenic from human milk samples are effective in both literatures. These results would help in the development of a faster and more efficient technique for removing arsenic from milk samples. Although the procedure will take longer than anticipated, it does not exceed 5-6 hours. Furthermore, such studies reveal the degree of arsenic exposure in individuals living in complicated settings. People are exposed to less arsenic as a result of this, which may lead to severe cases of chronic arsenic poisoning. Prenatal exposure to babies may possibly cause genetic abnormalities as well as physical and mental problems.

KEYWORDS- Arsenic Levels, Drinking Water, Human Milk, Samples, Skin Lesions, West Bengal.

I. INTRODUCTION

Arsenic was used as a medicinal agent by the ancient Greeks and Romans because it was considered a form of Sulphur. Arsenic trioxide possesses all of the characteristics of a perfect homicidal poison, earning it the moniker King of Poisons. Women were thought to buy arsenic to kill rats, with the rodents symbolizing their husbands. In 1836, a Marsh study ruled out the lethal toxin that Arsenic is used for. Arsenic trioxide is toxic to living organisms, but metallic arsenic is not poisonous because it is insoluble in liquids. Arsenic is a naturally occurring poison that may be found in both soil and water. Humans in the Indian Subcontinent are mainly exposed to arsenic via their drinking water. The majority of people in Southeast Asia are at high risk of arsenic poisoning [1].

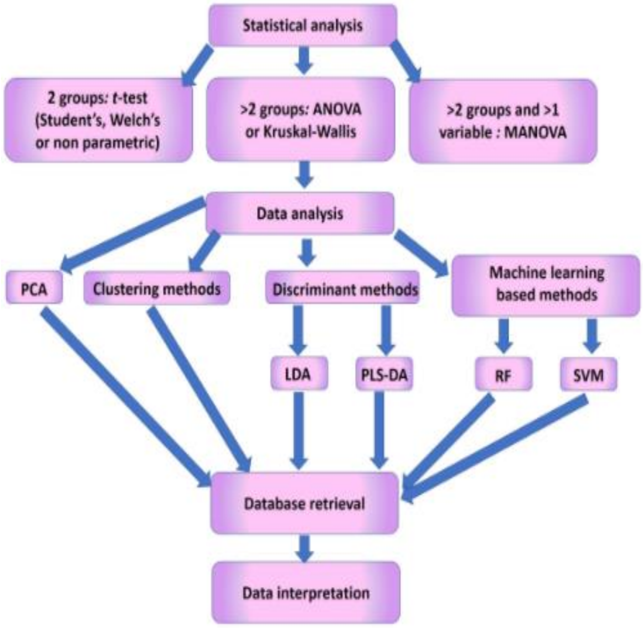

Figure 1: A Typical Workflow of Bioinformatics Data Processing in Lipidomics

A lot of epidemiological investigations have shown that inorganic arsenic is a potent carcinogen, having effects on the urinary bladder, lungs, skin, as well as perhaps the kidneys as well. Hyperpigmentation, hypopigmentation, and keratosis suggest early poisoning. In the world, arsenic may be used in a various methods. A list of them is provided below. Exposure of both the toxin and the carcinogen causes significant health consequences in humans. Fig. 1 a typical workflow of bioinformatics data processing in lipidomics.

Between April 1995 and March 1996, a cross-sectional research was performed in West Bengal, India, to examine arsenic related skin lesions of keratosis and hyperpigmentation and their relation to arsenic water levels. In total, 7683 people were tested and questioned, and the levels of arsenic in their drinking water were determined. Despite the fact that arsenic levels in the water ranged up to 3400 g/l, over 80 percent of the participants consumed water with less than 500 g/l. The age-adjusted incidence significantly linked, increasing category drinking water containing > 800 g/l) exposed to arsenic levels of 100 g/l in their drinking water. Hyperpigmentation results were close, with good doseresponse relationships. 29 cases of hyperpigmentation were exposed to drinking water with a concentration of 100 g/l. Men had about rate dosage, according to calculations based on dose per body weight. The frequency of keratoses was 1.6 times higher in people who were under 80 percent of the normal, suggesting that hunger may play a minor rise. The unexpected result associated with people who had a moderate exposure to arsenic in infancy confirmed in trials with more thorough exposure assessments. More research on susceptibility is highly needed and have been done [2].

Arsenic levels in groundwater are above the World Health Organization's maximum allowed limit of 50 g/L in nine districts in West Bengal, India, and 42 districts in Bangladesh. The specialists observed area and population of Bangladesh's 42 districts and West Bengal's 9 districts. Researcher found throughout our preliminary investigation. Researcher discovered everywhere in Bangladesh. Researcher's gathered 10,991 water samples for study from 42 arsenic-affected districts in Bangladesh, and 58,166 water samples from nine arsenic-affected districts in West Bengal. Arsenic levels above 50 g/L were found in 59 and 34 percent of the water samples were analyzed, respectively. Thousands of scalp, analyzed to yet; on average, 93 and 77 percent of samples contained arsenic above the normal/toxic level in Bangladesh and West Bengal, respectively. Researcher looked for arsenic patients in 27 of Bangladesh's 42 districts, and researcher found people with arsenical skin lesions in 25 of them. Researcher randomly tested; 24.47 and 15.02 percent, respectively. Researcher believe that they have just scratched the tip of the iceberg after 10 years of research in Bangladesh and five years in West Bengal [3].

Despite early survey studies pollution results in the Terai area of Nepal, the pandemic of arsenic poisoning caused to pollute was believed to be limited to the Ganges Delta. Researcher studied arsenic toxicity revealed that 56.8 percent of those over 50 g/L. Upon health evaluation, 13 percent of adults and 6.3 percent of children in a self-selected sample of 550 exhibited normal skin lesions, an unusually high proportion, even in acute exposures related. Arsenic concentrations in urine, blood, and nails were found to be strongly associated with identified in 63 percent of the adults on neurologic assessment, prevalence previously only observed in severe. Researcher has found an increase in fetal mortality born in the women who had levels in their drinking water. Other areas in the Middle and Upper Ganga Plain should be investigated for the risk of polluted groundwater [4].

Mass arsenic poisoning cases have been reported in the last 2-3 decades which have proved disastrous to the society in some areas. Reports of such occurrences have been greatest in the South East Asian countries and the Indian Subcontinent. Arsenic poisoning is seen often in Bangladesh and other low developed countries. World Health Organization (WHO) estimates that the exposure of Arsenic to Bangladeshi people varies from 28-35 million people to 77 million people which is almost half the total population. This is not only limited to impoverished countries. In Western areas of United States of America (USA), 13 million people drink arsenic polluted water. Though this is not a huge number as compared to Bangladesh, it is nevertheless a growing mortality [5].

Also, it is a well-known fact that the amount of arsenic poisoning seen in less developed countries and especially areas near the dumping sites of companies is the greatest. Even though the quantity of arsenic in the soil, water or any other consumable biological material may be small on inspection, the repeated ingestion of the same may lead to serious poisoning. This in turn affects the overall health of the individuals living in and around the area and also presents a risk to the future generations' completely [6].

II. LITERATURE REVIEW

G. Samanta et al. reported in the paper about two hundred samples of gathered from nursing women in three West Bengal's arsenic-affected regions. Just 39 of the 226 samples tested positive for arsenic. The arsenic body load of nursing women was assessed using urine, scalp, and nail samples. Arsenic levels in drinking water were also examined. Hair and nail arsenic is strongly related, however, according to principal component analysis (PCA). According to our findings, lactating women with high arsenic body pressure higher levels. Arsenic levels in infants' blood, examined, and the findings indicated a substantially higher body burden of arsenic in those regions. The hair and nail arsenic levels of the mothers and their children were shown to be age dependent using PCA [7].

M. R. Islam et al. noted in the paper that inorganic arsenic exposure during infancy may be linked to substantial health effects later in adulthood. However, there is a lack of data on postnatal arsenic toxicity through human milk. The aim of this research was to investigate the levels of arsenic in human milk and the relationship between arsenic in human milk and arsenic in the urine of mothers and babies. This prospective study identified 120 new mother baby pairs in Kashiani (sub district), Bangladesh, between March 2011 and March 2012. Thirty women were selected at random for human milk samples at one, six, and nine months following birth, and chosen one and six months. For arsenic speciation, 12 chosen at random. The quantity of arsenic in human milk was modest and unevenly distributed. For all three phase phases, stood at 1/2 gram/Liter. Arsenic concentration decreased by.0.035 g/L between 1 and 6 months and between 6 and 9 months, according to mixed model estimates. The quantity of arsenic detected in an infant's urine rose by 0.13 g/L with time, which was not statistically significant (95 percent). Arsenic in foetal milk was not linked with arsenic in the 6 months ($r = 0.09$ at 6 months). Total urinary arsenic was made up of arsenite (As III), arsenate (As V), monomethyl arsonic acid (MMA), and arsenobetaine (AsB); dimethyl arsinic acid (DMA) was the most common arsenic metabolite in child urine. Arsenic levels in human milk were found to be low. The concentration was lower than the level set by the World Health Organization (WHO). Also in arsenic-contaminated environments, our results support the safety of nursing [8].

P. Verma et al. showed in the paper that arsenic is a radioactive metal that is found in many natural environments. It is a human carcinogen in water over a broad pH range, and even at low amounts, it has significant effects on both human health and the environment. To protect customers serviced by municipal water systems, WHO as well as the US Environmental Protection Agency

(USEPA) set the arsenic limit for drinking water at 0.010 particles per million. Arsenic-contaminated water has been recorded in several countries, with Bangladesh having the largest vulnerable population, followed by India (West Bengal). For arsenic poisoning, there is no appropriate therapy. And by removing arsenic from the water can the poisoning be avoided. While significant research has been done in recent decades to reduce arsenic levels in drinking water, there is still a need to find low-cost feasible solutions. Oxidation, adsorption, absorption, coagulation, and membrane separation are some of the main arsenic reduction techniques currently in use. Recent research in the field of arsenic recovery from polluted water, as well as an overview of all known techniques, with a focus on adsorption [9].

H. R. Lohokare et al. noted in the paper that to our knowledge, this is the first time has been shown to be effective in removing arsenic. By using the Donnan exclusion principle, the surfaces by NaOH resulted in the production of carboxylate (single bond COO) capacity, resulting in As-V rejection capacity. The decrease-increase polyethylene glycol (PEG) rejection showed a reduction in pore capacity. Fourier Transform Infrared – Attenuated Total Reflection (FTIR-ATR) study indicated that NaOH treatment resulted in the formation of a carboxylate group on the membrane surface, while contact angle measurements suggested increased hydrophilicity. SEM and AFM studies revealed that this technique resulted in smoothing of the membrane interface. After the NaOH procedure, the molecular weight limit was determined to be about 6 kDa. With different feed quantities, rate, strain, the rejection of pentavalent arsenic examined. Experiments with 50 ppb As-V in feed revealed nearly 100 percent and stayed steady for up to 6 hours. The rejection coefficient was not affected by strain for arsenic contents less than 50 ppm in the diet. As the concentration polarization was significant, the rejection for 1000 ppm As-V concentration ranged from 40 to 65 percent depending on strain [10].

III. DISCUSSION

The primary aim of the research is to look at the various techniques for eliminating arsenic from human milk. The research also includes an in-depth evaluation of the current extraction techniques available today, as well as possible improvements and changes that could be made to the procedures. Additional steps are created in the processes because the aim of the research is to establish a new pattern in arsenic extraction while keeping laboratory facilities in mind. When combining the phases, the time spent is often taken into consideration, since it is essential in the current scenario.

A. Mechanism of Action

- Absorbed through all ports of entry (oral, nasal, cutaneous)
- Trivalent Arsenic (As^{3+}) has affinity to sulfhydryl groups and bind to the mitochondrial membrane SH groups and kills them. Cytochrome c is produced which activates caspases and results in apoptosis.
- Downregulates gene expression of B-Cell Lymphoma 2 (BCL2), a pro-survival protein.
- Inhibits pyruvate dehydrogenase complex leading to impairment of oxidative phosphorylation.
- Replaces phosphorous in the bone where it remains for prolonged length of time.

Monitor samples were obtained from two villages with arsenic-free groundwater. Table 2 shows the arsenic concentrations in the control samples. Both water tests revealed arsenic concentrations level, and the (maximum 36 g/L). Just 5 of the 10 contained arsenic, with a mean arsenic concentration of 5.0 g/L.

The study's aim was to extract and evaluate the amount of arsenic in milk, as well as the effects on babies and nursing mothers. Previous studies of the presence of arsenic in ground water in Kashiani Sub District in Gopalgonj, Bangladesh, led to the selection of the study location. It lasted 13 months, and 120 mother-infant pairs were chosen to participate. Thirty couples were chosen at random from the 120 to collect milk samples. Each mother's milk was collected ethically and stored in an ice box after being securely sealed with paraffin and properly labelled. Ultrex high purity Nitric Acid HNO_3 was used in the extraction process. 2 mL of very pure H_2O_2 was added to the tubes, which were then heated for 20 minutes in a microwave oven at 1600W power and 180ºC. The mixture was then allowed to cool for 10 minutes before being done twice more. Using ultra-pure (18.2M) water, the volume of each sample was adjusted to 5mL. Arsenic was detected in the samples using the Graphite Furnace-Atomic Absorption Spectroscopy (AAS).

The extraction process comprises three stages of wet digestion, followed by volume adjustments for the analytical technique to be used. Because of the heavy metal toxicity of the region's ground water, it's not unexpected if additional metals like Mercury, Lead, or Cadmium are detected in the tests owing to long-term exposure. Since a consequence, complete digestion and analysis are needed for Arsenic determination, since preliminary testing will result in false positive results when conducted.

In this investigation, the extraction of arsenic from milk took about three days in total. This is also without taking into account the time needed to keep the samples in the laboratory prior to extraction. The region under investigation has significant levels of arsenic poisoning, which needs a thorough research. There is a significant variation in the time periods used in both studies. The extraction of arsenic from milk samples takes about 3 hours in the first analysis. The extraction of the same from the samples in the second analysis takes about three days and is a time demanding procedure.

The materials used in both techniques are different. The materials and chemicals used in the first research indicate that the extraction was performed in a high-performance, well-equipped laboratory. The second research, on the other hand, utilizes more traditional and easy-to-handle materials. The technique employed in the first analysis is a well-established approach for extracting arsenic. However, the second study advises utilizing conventional methods for the same. In the first sample, arsenic was found in very tiny quantities as well. The identification of arsenic was not detected in any samples in the second study, despite high levels of arsenic toxicity in the regions where the samples were collected.

IV. CONCLUSION

This article shows that the methods for eliminating arsenic from human milk samples are successful. These findings help in the creation of a less time-consuming and more efficient method for removing arsenic from milk samples. A few changes to the procedures outlined may potentially be made if needed. Employing a water bath instead of a microwave oven and utilizing more nitric acid and hydrogen peroxide as a more traditional but less time-consuming method of extraction may be helpful. This treatment will take longer than anticipated, but it should not take more than 5-6 hours. Furthermore, research of this kind show the amount of arsenic concentration in individuals living in specific locations. This tends to decrease the amount of arsenic people are exposed to, which may result in severe cases of chronic arsenic poisoning. Furthermore, prenatal exposure to babies may result in a variety of genetic defects as well as physical and mental problems. Scalp, and nails were high, and as they grew older, the levels of arsenic increased. This may be related to an increase in arsenic-contaminated water or food intake as people get older. As a result, further research is needed to evaluate reasons bigger cohort of babies.

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