

7.1.11 AGROCHEMICALS AND NCP KIDNEY DISEASE THE REALITY

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By Dr.C. S. Weeraratna

Former Professor of Soils and Water Resources, Rajarata University



Since the year 2000, Chronic Kidney Disease of unknown etiology (CKDU) also called Chronic Renal Failure (CRF) has been reported in several areas of Sri Lanka, mostly in the North Central Province (NCP). A large number from the Badulla and Kurunegala districts are also affected by CKDU.

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Ministry of Health (MOH) initiated a research study in Oct. 2008 on CKDU to be carried out in collaboration with WHO- Colombo. The study was conducted by the National Research Programme for CKDU, to find the causal factor of CKDU and other related issues. The major finding of this study according to some news paper reports is that exposure to a combination of factors that are toxic to the kidney seems to cause this disease, and toxic factors identified up to now include arsenic, cadmium and nephrotoxic agrochemicals. However, according to the third report the study did not find high levels of cadmium exposure as reported in the previous study. The second report of the study released by WHO in October 2011 recommends that urgent action needs to be taken to implement a multisectoral strategic plan jointly with relevant ministries with short, medium and long term measures as

early as possible in 2012 to minimize the growing public health risks to the population.

A seminar on CKDU, organized by the Ministry of Water Supply and Drainage was held in Anuradhapura where a report of the study on CKDU, conducted by Centre for Science and Environment (CSE) in India and Centre for Environmental Justice, Sri Lanka (CEJ) was presented by Chandra Bhushan of CSE and Hemantha Withanage of CEJ. The results of this study indicate that water samples collected from North Central Region are not contaminated with heavy metals and arsenic; nor are there any other heavy metals.

Only fluoride levels detected in the water samples were between 0.5 and 1.7 mg/l, a little above twice the desirable levels set by Sri Lanka standards. As the desirable limit for fluoride is 0.6 mg/L in Sri Lanka and levels detected in the present study are higher, fluoride at these levels over a long period of time is a possible risk factor responsible for kidney diseases.

Arsenic in Fertilizers and Pesticides:

Some are of the view that fertilizers and pesticides are the sources of arsenic, and hence, importation and use of such agrochemicals should be banned. However, before it is implemented it is necessary that the fertilizers and pesticides which are supposed to contain arsenic are identified by appropriate tests. If the source of arsenic is fertilizers and/ or pesticides, then water in other districts such as Kandy, Nuwara Eliya, Hambantota etc. where large amounts of fertilizers and pesticides are used should also have high contents of these heavy metals, and the people in those areas should also be affected by CKDU. Fertilizer and pesticides are not the only sources of arsenic and other heavy metals. Some organic fertilizers such as compost may also contain these heavy metals if solid waste has been used in its manufacture.

Fertilizers and Pesticides

Authors of some articles appear to be of the opinion that we need not use chemical fertilizers (Fs) and

“ FERTILIZER AND PESTICIDES ARE NOT THE ONLY SOURCES OF ARSENIC AND OTHER HEAVY METALS ”

pesticides (Ps), because in the past these were not used in crop production. Use of these Fs and Ps cause environmental pollution and tend to increase cost of production. All Pesticides are toxic compounds. Toxicity is indicated by what is called LD 50 values. Those of low LD 50 values are more toxic than others. Insecticides and mosquito coils which we use to control household pests such as cockroaches also contain toxic compounds but their LD values are very high. Although Fs and Ps were not used a few decades ago, the biotic environment including the level of the fertility of the soil is not the same as was in the past. There may be a few plots cultivated without Fs and Ps using modified/different and traditional methods. If they are effective, the researchers of the Dep. of Agriculture need to make recommendations based on their findings. It is also necessary that Integrated Pest Management (IPM) methods are developed and applied so that we could give up the use of synthetic toxic chemicals to control pests.

A large number of people in the North Central Province are affected by CKDU. In order to take necessary remedial measures, the scientists are conducting studies on different aspects of CKDU. While such studies are carried out, it is extremely important that action is taken to reduce the prevalence of this lethal renal disease which is causing untold hardships to the thousands of poor people in the dry zone. There is a need for a comprehensive public health effort to effectively address the problem of CKDU. This should

be taken as a National Priority with the main responsibility resting on the Ministry of Health.

From the observations and results of various studies carried out so far it could be assumed that CKDU is caused by a toxic element/s or compounds in water.

Hence, methods of detoxifying water needs to be developed. A filter has been developed by the Water Supply and Drainage Board to remove fluoride from water. Institute of Fundamental studies has developed an electro-chemical method of removing fluoride from water. The suitability of these methods needs to be tested by an appropriate authority. One way of reducing the incidence of CKDU is implementing a programme to supply good quality water to those in the affected areas.

Rainwater:

Rainwater is the most pure form of water. It is almost free of toxic elements/compounds. A considerable portion of the rainwater that falls on the roofs of buildings can be collected in tanks in the premises itself. Water thus collected would be free of toxic substances and could be used for numerous domestic purposes including drinking.

7.1.12 CHRONIC RENAL FAILURE IN NCP AND ARSENIC SCIENCE VERSUS MYTH

By Prof. Oliver A. Ileperuma

The media recently highlighted the claims by a group of Kelaniya University scientists and others that arsenic in pesticides was the factor responsible for chronic renal failure or chronic kidney disease of unknown origin (CKDU) in the North-Central Province. This disease was first detected by Dr. Tilak Abeyesekera, Consultant Nephrologist who was at that time working at the Anuradhapura general hospital.



Could people in Anuradhapura town be getting loads of arsenic from the tank water which gets contaminated with pesticides?

Soon there were many media reports highlighting this issue and in February, 2003, the Water Board took the initiative to get stakeholders including scientists to discuss the problem. At that time it was thought that this was an environmental related disease due to some toxic compounds in drinking water. This writer along with Dr. Dharmagunawardane, a geologist was given the task of investigating any possible geo-environmental causes. This initiated a collaborative research programme with medical personnel involved.

We visited the affected villages with the medical team comprising Dr. Tilak Abeyesekera and Dr. Nimmi Athureliye where positive CKDU patients were identified. Our team then visited the people so identified to observe their lifestyles including the water they drank, the food they ate and the utensils used for cooking and storing water. In less than six months we were able to identify one environmental factor which could be the most significant one involved in this disease. The geographic distribution of the disease closely paralleled

the fluoride levels of drinking water. Almost all patients who reported to the Anuradhapura hospital with this disease came from high fluoride areas. As early as 2004, I put forward the hypothesis that fluoride in drinking water was the most likely reason for the prevalence of this disease.

Role of fluoride

A chance observation during the examination of the water storage pots and cooking utensils showed they developed holes in them after prolonged use. Chemically this is a well-known fact where aluminium dissolves forming fluoro complexes under high fluoride stress compared to low fluoride water in the wet zone. What is worse is that these holes are often sealed with lead solder and lead is known to be toxic to the kidney. These complexes are easily absorbed by the body and once inside the body, excessive fluoride is released into the different organs.

In experiments conducted in the USA on rats, it was found that the presence of fluoride as low as 1 part per million (ppm) in aluminium resulted in the death of the animals and the postmortem examinations revealed that the rats died due to kidney failure. Fluoride in excessive amounts is particularly toxic to the kidney and hence it is a reasonable theory to explain the occurrence of the disease. The type of aluminium pots used were of inferior quality and are made by melting scrap aluminum and usually contains other heavy metals as impurities such as lead, chromium and nickel. Good quality aluminium cooking pots are anodized and this gives a protective layer of aluminium oxide to the pot while these inferior quality pots are not anodized.

All these heavy metals are toxic to the kidney since they are finally filtered by the kidney before they are excreted. Furthermore, the use of sub-standard aluminium pots results in enhancing the fluoride intake since each Al can carry six fluoride ions into the body when it forms aluminofluoro complexes and they have the special ability to travel through biological membranes.

The use of aluminium pots came into practice only in the past two decades. Clay pots used earlier have the ability to absorb fluoride present in water and this explains why the disease was noted only in the last decade. Generally it requires at least 10-15 years of continuous exposure for this type of chronic poisoning to occur and damage the kidney.

There are some areas such as the Hambantota district where there is high fluoride but the salinity of such waters is so high that people generally do not consume such water. Instead they resort to streams, rivers or wells located near these waterways to supply their drinking water. Similarly, although Ampara has some areas of high fluoride containing wells, most people live close to the irrigation canals of the Senanayake samudra and all these have low levels of fluoride. Unlike the Anuradhapura district Ampara is a relatively recently colonized area and there are only a few "purana" villages away from the main irrigation canals.

We were able to establish the role of fluoride owing to the financial support given by the Water Board. We did not receive any funding from the Rs. 400 million committed by the World Bank. This is a problem which needs an interdisciplinary approach where scientists and health professionals have to work in close collaboration. A similar chronic kidney disease in the Balkan states in Eastern Europe is still under investigation. Chemists from the US Geological Survey have worked on this and their work has established the role of polyaromatic compounds leaching out of lignitic rocks which is now generally accepted as the causative factor. My fluoride theory has to be further substantiated by other researchers so that the root causes of this disease can be established. Most scientists and doctors were sceptical about this theory at first but now the link between fluoride and CKDU is generally accepted. Of course there may be other additional factors involved which can be investigated through co-operation with the health sector.

Role of Cadmium

In 2007, some scientists reported that the rice, fish and some vegetables people consume in these areas were contaminated with high levels of cadmium and this was the causative factor for CKDU. However, no other research group has been able to duplicate these high values of cadmium and more recently cadmium analysis carried out in reputed laboratories in Europe and Japan have failed to confirm such high levels of cadmium. My argument is, if indeed cadmium is the causative factor, why is CKDU not prevalent in other rice growing areas such as the Eastern Province, Uda-Walawe and Hambantota. What is even more interesting is that people in Anuradhapura town and those living close to the Padaviya tank are not affected. This supports my hypothesis since these tank waters and even the wells situated close to large tanks have low fluoride levels.

All those afflicted with CKDU have consumed high fluoride sometimes as high as 7 parts per million (ppm). The World Health Organization's standard for fluoride in drinking water is 1 ppm which assumes that on the average, a person consumes one litre of water a day. Thus, the total intake of fluoride into the body should not exceed 1 milligramme per day. This is not a suitable standard for tropical countries such as ours where people drink several litres of water while working under the hot sun resulting in dangerously high levels of fluoride uptake. For example, if a person drinks four litres of water a day (including tea) from water containing 2.5 ppm of fluoride, then the total intake is 10 mg which is ten times the desirable level! During the use of aluminium pots this can be further amplified by a factor of up to a maximum of 6, thereby enhancing the fluoride intake to extremely toxic levels. This also explains why men are more prone to this disease since they are the ones who work in the paddy fields consuming large quantities of water. There are some unconfirmed reports that Hitler planned to poison the water supplies of some European countries with excessive fluoride in his war plan. Drinking tea also adds to the fluoride intake since tea contains a considerable amount of fluoride. This too gets exacerbated if poor quality aluminium utensils are used for tea preparation.

Arsenic and its role

The latest discovery is that arsenic in pesticides combined with the hardness in water which results in calcium arsenate is the causative factor. This contradicts the well-known chemistry of arsenic since lime is sometimes even added to remove dissolved arsenic from waste water as it is insoluble calcium arsenate. What is more potent is soluble arsenic and this theory does not explain why the insoluble form is more toxic than the soluble form. For example, people in Anuradhapura town may be getting loads of arsenic from the tank water which gets contaminated with these pesticides. Also, it does not explain why this disease is not found in other hard water areas such as Dambulla, Jaffna and Matale districts where there is extensive use of pesticides. Calcium arsenate was extensively used in a lot of countries as a pesticide prior to the 1970's and its main health effects on humans do not tally with those symptoms found in the CKDU patients here.

This arsenic hypothesis cannot explain why this disease is not found in other agricultural areas of the country where pesticide use is widespread. More importantly, this cannot explain why people in Anuradhapura town or Padaviya town are not affected by this disease. Do they eat only imported rice? This was similar to the cadmium theory when it was claimed that people in the town eat sea fish and not tilapia. It is inconceivable as a theory because it cannot explain simple scientific facts. According to the doctors at both the Kandy Nephrology Unit and the Anuradhapura hospital, no clinical symptoms of arsenic poisoning have been observed in any of the patients numbering over 300, they have treated at these two hospitals.

Arsenic poisoning is common in Bangladesh where people show clinical symptoms such as skin lesions, pigmentation, etc. There is no independent confirmation of this hypothesis and also no clear details of their analytical techniques are given. Reporting arsenic levels at the parts per billion range (ppb) requires extremely careful instrumentation, supervision of the experiments by a trained analytical chemist and eliminating interferences. This needs a sophisticated atomic absorption spectrophotometer with a hydride generation apparatus to detect such low levels of arsenic. It is not clear whether the Kelaniya University's hydride generator was indeed used during this analysis.

Prof. Janitha Liyanage who has experience with this instrument has refuted these claims in one of her articles to the newspapers. Very recently, the Minister of Agriculture explained that out of the 60 samples of rice analyzed at the Industrial Technology Institute, none were found to contain arsenic. Similarly out of the 16 pesticide formulations analysed, except for two, none had detectable levels of arsenic. These two samples too had quite low levels of arsenic probably originating from the dolomite used in their formulations. Even if traces of arsenic are found, they are excreted by the body causing no harm and only prolonged exposure to relatively higher concentrations can cause arsenic poisoning.

Giving wide publicity that arsenic has invaded all our agricultural products can create unnecessary fear amongst people who consume our rice and vegetables. A more serious problem would be that now exporters of fresh produce from Sri Lanka will have to test each batch of produce to confirm that they are free from arsenic to satisfy their buyers abroad. This is costly and only a few laboratories are available to produce such reports. Therefore, this will create a multitude of problems for our export sector which is unwarranted. Also discontinued application of pesticides may seriously affect our agricultural productivity.

The role of arsenic has to be tested by other laboratories and it is not just enough to analyse rice samples from the affected areas. Those scientists involved in proposing the arsenic theory should get together with the other scientists and commence a healthy discussion on the validity of their proposition. To claim that they have discovered the cause of the Rajarata disease without general acceptance can only result in similar fracas like that of the cadmium theory. They should take the proactive step to get their result independently verified by reputed laboratories with ISO certification to carry out such analysis such as the ITI, Government Analyst's Department, other Universities and the Institute of Fundamental Studies where appropriate instrumentation is available. Then only can they be confident of stating their results with confidence. The media also has a role to play by first verifying facts with other researchers who have worked on this problem for the past eight years so that giving a wrong message to the general public can be averted.