



**Memo n°3: CHANNA JAYASUMANA**

**Health Expert , Sri Lanka**

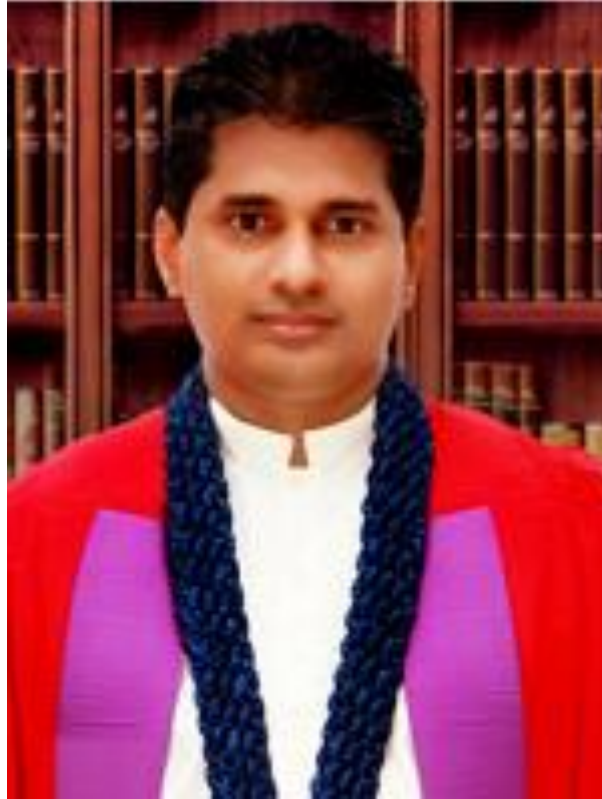
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Research Interest: Chronic Kidney Disease of unknown origin – aetiological factors and therapeutics, nephrotoxins, epistemology, traditional medicine systems

## **Testimony: Dr. Channa Jayasumana**

I am Channa Jayasumana a citizen of Sri Lanka and currently working as the Head of the department of Pharmacology at Faculty of Medicine and allied sciences, Rajarata University of Sri Lanka. I have been engaging in research activities on epidemic of chronic kidney disease (CKD) among agricultural communities in Sri Lanka since 2008.

CKD is a public health problem worldwide with increasing prevalence and incidence, high cost and adverse outcomes such as vascular disease and premature death. Given the limited access to health services including availability of renal replacement therapy, CKD is a terminal diagnosis in the low and mid income countries (LMIC). Well-known causative factors of CKD include mainly diabetes, hypertension and well-characterized renal syndromes.

Since the early 1990s, coinciding with a more productive and extensive exploitation of land for agriculture, an increase in CKD prevalence related to non-traditional risk factors primarily affecting male farmers has been reported in Sri Lanka. The disease is also known as Chronic Interstitial Nephritis in Agricultural Communities (CINAC).

Classic presentations of CINAC are it is common in young men, between the third and fifth decades of life, mostly among paddy farmers. However, there are CINAC cases, among women and children who live in the same environment. Another important fact is that these agricultural activities are conducted at lower altitudes with high humidity and temperatures, both characteristics of tropical climates. Indeed, this is the type of land where rice has been cultivated since 3<sup>rd</sup> century BC in Sri Lanka.

Twenty years after the reporting of a first case, CINAC is the most significant public health issue in the fertile dry zone in Sri Lanka with more than 60,000 estimated patients and more than 20,000 deaths. The disease is spreading in epidemic scale. The affected

area covers one third of the landmass in Sri Lanka. It is important to note that only very few patients were reported from Northern province of Sri Lanka, which shares similar conditions including soil, climate, agriculture and occupational patterns with the other CINAC endemic regions. The available CINAC statistics based upon hospital records show a steady increase of cases from 2000 to 2015. The underlying cause of renal failure was not attributed to known aetiology in 82% of CKD patients (compatible with CINAC) seen in the renal clinic at Anuradhapura teaching hospital between 2000 and 2002. According to the NCP statistics from 2009 to 2011, aetiology is not attributed to known causes in 2809 (70.2%) of the newly diagnosed CKD patients and only 15.7% and 9.6% were diagnosed as patients with hypertension and diabetes. Male to female ratio was 2.6:1. The majority of patients with CINAC were in stage 4 (40%) at the presentation. 31.8% and 4.5% were in stage 3 and stage 5 respectively. Patients with stage 1 and 2 accounted for only 3.4%. Markers of Kidney damage were found even in children living in agricultural communities. Women, men, adolescents and children who live in these farming communities are also affected to lesser extent, irrespective of whether they work in the fields or not.

The CINAC is a disease that progresses slowly. The majority of patients are asymptomatic during the early stages of the disease. The morphological pattern of CINAC is described as chronic tubulointerstitial nephritis. The main findings are interstitial fibrosis and tubular atrophy with or without inflammatory monocyte infiltration.

I started investigations on to CINAC on 2008 and later I selected the same topic for my PhD study. It was composed of several component: epidemiological, Clinical and analytical study.

Epidemiological study was a case control study and it was carried out in Padavi-Sripura area. CINAC patients were defined using health ministry criteria. All confirmed cases (N=125) fulfilling the entry criteria were recruited to the study. Control selection (N=180) was done from people visiting the hospital for CINAC screening. Socio-

demographic and data related to usage of applying pesticides and fertilizers were also studied. Drinking water was also analyzed using ICP-MS and ELISA. According to findings majority of patients were farmers (N = 107, 85.6%). We specifically analyzed for the effect modification of, farming by sex, which showed a significantly higher risk for male farmers with OR 4.69 (95% CI 1.06-20.69) in comparison to their female counterparts. In the multivariable analysis the highest risk for CINAC was observed among participants who drank well water (OR 2.52, 95% CI 1.12-5.70) and had history of drinking water from an abandoned well (OR 5.43, 95% CI 2.88-10.26) and spray glyphosate based herbicides (OR 5.12, 95% CI 2.33-11.26) as a pesticide. Water analysis showed significantly higher amount of hardness, electrical conductivity and glyphosate levels in abandoned wells. In addition calcium and magnesium levels were high in abandoned wells. Surface water from reservoirs in the endemic area also showed contamination with glyphosate but at a much lower level. Glyphosate was not seen in water samples in the capital city of Colombo where agricultural practices are not carried out.

Our epidemiological study strongly favors the hypothesis that CINAC epidemic among farmers in dry zone of Sri Lanka is associated with drinking well water and with spraying glyphosate in paddy fields. This is the first time my attention was drawn to glyphosate with related to the epidemic kidney disease in Sri Lanka. These findings were published in Environmental Health journal. Thereafter we did a case control study to assess different toxins presence in urine samples of CINAC patients and healthy individuals in both disease endemic and non-endemic regions. We found urine samples were contaminated with different heavy metals and pesticide residues. Most abundantly present toxins were arsenic, cadmium and glyphosate. These results were published in BMC Nephrology journal. World Health Organization (WHO) has done a separate study in Sri Lanka and they also produced such a similar results. Based on our findings we developed a coherent theory to explain the occurrence of CINAC in Sri Lanka.

Following features of glyphosate based herbicides were helped us to develop the theory.

- (a) A compound made of recently (2–3 decades) introduced chemicals to the CINAC endemic area and used widely by the paddy farmers.
- (b) Ability to form stable complexes with hard water as disease is prevent among hard water drinking people.
- (c) Ability to capture and retain nephrotoxic metals and acts as a “carrier” in delivering these toxins to the kidney.
- (d) Possible multiple routes of exposure: ingestion, dermal and respiratory absorption.
- (e) Not having a significant first pass effect when complexed with hard water.
- (f) Presenting difficulties in identification when using conventional analytical methods.
- (g) Not used in the Northern region for last 2-3 decades.

Based on our theory we have identified 3 groups of risk factors for the development of epidemic of CINAC in rural Sri Lanka.

**Background factors** (these are basically natural factors): Ground water conditions (hardness- high calcium and magnesium and high fluoride levels), soil with high iron content, genetics, hot humid climate

**Essential factors:** Glyphosate based herbicides and heavy metals originating from chemical fertilisers

**Aggravating factors:** Chronic repeated dehydration, infections such as leptospirosis, snakebites.

Although Sri Lanka is a rice cultivation nation for 23 centuries CINAC was just appeared in mid 1990s. At the same time it is not reported in northern part of the country though paddy is a dominant crop. Further CINAC shows unique geographical distribution, which overlaps with places with high ground water hardness. Our theory explains the

geographical distribution of CINAC as well as the occurrence of the disease only after the 1990s. Political changes instituted in 1977 in Sri Lanka, have lead to economic policies that allowed the importation and application of agrochemicals on a large scale, especially for paddy farming. The low concentration of a cumulative nephrotoxin and its bioaccumulation could have taken 12–15 years to cause damage to the kidneys leading up to the level of clinically identifiable CINAC.

The increase in prevalence of CINAC and the shifting of age at diagnosis to younger age groups over the years are highly suggestive of the cumulative nature of the toxin. Furthermore, a comparatively low amount of agrochemicals including glyphosate-based herbicides have been used in the Northern Province of Sri Lanka, primarily due to a prohibition imposed by the government in this province. The prohibition was due to the potential of these agrochemicals being used in the production of Improvised Explosive Devices (IEDs). These IEDs were used abundantly by armed groups of the terrorist movement that plagued the country until 2009 for causing mass destruction. This is the explanation for the fact that CINAC is still not prevalent in the farming areas of the Northern Province of Sri Lanka where the ground water hardness has remained high.

Following our findings I was keen to learn more about glyphosate based herbicides and other chemicals widely used in the CINAC endemic regions. Soon I understood CINAC is one facet of the problem and other non-communicable disease are also emerged in epidemic scale in farming regions over the last two decades. Cancer, diabetes in young population and neurological abnormalities were among them. Further, many amphibians, fish and bird varieties were vanished from the region over the time. Nature of the soil has changed dramatically. Now the soil is almost sandy in paddy fields. I listen many old farmers who described the cascade of events nicely.

Following our findings and WHO findings government of Sri Lanka decided to ban the usage of glyphosate based herbicides in CINAC endemic regions in Sri Lanka on December 2014. Later it has been expanded to a countrywide ban on May 2015 as a



result of public pressure. Many religious leaders especially Buddhist monks, farmers, social activists, medical doctors and academics were in supportive of banning glyphosate. Nonetheless, agrochemical industry and their puppet academics have launched a very ugly campaign to protect their business. They initially attacked me and other members of research team through social media, web sites, printed and electronic media. My reputation was severely damaged by false accusations. Industry published a full-page paper advertisement in all national newspapers demanding withdrawal of our findings within two weeks if not they will go the court. We just neglected their hyping but nothing has happened. Then they threat me in various ways. They directly influenced my university via then vice chancellor. I had to cancel my PhD registration at University of Kelaniya and reregistered at Rajarata University as a result of their weight. My family, my self, friends and PhD supervisors have undergone severe mental pressure during this period.

At last what I have to say is considering our research findings, my experiences, observations I would say glyphosate based herbicides and other agrochemicals have affected every aspect of the eco system in rice farming areas in dry zone of Sri Lanka. The peaceful enjoyment by the inhabitants and all living beings of paddy farming areas has been severely diminished. I describe this as an ecocide.