CHRONIC KIDNEY DISEASE
(Risk factor identification)
(Secondary data analysis)

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Abbreviations

AFCKDI - Asian Forum on Chronic Kidney Disease Initiative
AIHW - Australian Institute of Health and Welfare
CKD - Chronic Kidney Disease
CRF - Chronic Renal Failure
EPA - Environmental Protection Agency
ESRD - End-Stage Renal Disease
GFR - Glomerular Filtration Rate
IFS - Institute of Fundamental Studies
MCL - Maximum Contaminant Level
RNSA - UK Radiation and Nuclear Safety Authority
WHO - World Health Organization
OA - Ochratoxin-A
Summary

Kidney is playing very vital role in human body. Filter out all the waste product from the blood. Maintain the blood pressure like functions are very vital. But some time these functions are not happening in proper manner and there are gradual reductions of kidney functions without showing Symptoms. This kind of abnormality notice as Chronic Kidney Disease (CKDu), this is kind of unknown aetiology.

There is specific evidence have found to identified the origin of this aetiology but in 1950 there was similar kind of disease in Europe (Balkan region). But in SriLanka some medical scientist are noticed there is rapid increase of CKDu patients in Dry zone SriLanka in 2000.

After year 2000, there was rapid increment of the CKDu patients in SriLanka, from those majority were in Dry zone specially Anuradhapura and Pollonaruwa districts. There was big impact of the disease on Social, Economic, political, and Environmental background of the country.

Identifying causal factors is very essential to answer this problem. So there are numbers of researches have done and going on based on different disciplinarians. Still SriLankan researchers have not found specific reason for this disease or CKDu.

In broader sense there are major three causal factors can be affected to this unknown aetiology?
1).Fixed factors such as Family history and genetic, increasing age, previous kidney damage, low birth weight and male sex. 2).behavioral factors such as Tabaco smoking, physical inactivity and poor nutrition and 3). Biomedical factors such as diabetes, high blood pressure, cardiovascular disease, over weight and obesity. If these three major factors effect to CKDu, there are number of other environmental factors can be directly impact to this disease.

In this report, maximum available risk factors are going analysis according to available secondary data which already have published in SriLanka as well in other countries.
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INTRODUCTION

Chronic Kidney Disease (CKDu)
The two kidneys lie behind the intestines either side of the spine. Each kidney is about the size of a large orange, but bean-shaped. A large artery - the renal artery - takes blood to each kidney where it is filtered and the waste products drain as urine into the bladder.

There are number of function are doing by the kidney from those can be identified following function as main

- Filter out waste products from the bloodstream to be passed out in the urine.
- Help control blood pressure - partly by the amount of water passed out of the body as urine and partly by making hormones which are involved in blood pressure control.
- Make a hormone which stimulates the bone marrow to make red blood cells. This is needed to prevent anemia.
- Help keep various salts and chemicals in the blood at the right level.

Chronic: means ongoing (persistent or long-term). It does not mean 'severe'. In medicine, a chronic disease is a disease that is long-lasting or recurrent. The term chronic describes the course of the disease, or its rate of onset and development.

Renal: means 'relating to the kidney'
What is CKD?

There are numbers of definition and description about chronic kidney disease (CKD), also known as chronic renal disease.

CKD is a progressive loss of renal function over a period of months or years. The symptoms of worsening kidney function are unspecific, and might include feeling generally unwell and experiencing a reduced appetite. (www.wikipedia.org/wiki/Chronic kidney disease)

Retains fluids and harmful wastes build up because the kidneys no longer work properly (www.cdc.gov/diabetes/pubs/tycd/appendix.htm)

A condition which occurs when the kidneys cannot do their job of cleaning blood of toxins and waste products (www.anemia.org/patients/glossary/)

CKD is a long-term abnormality of the kidneys. The severity of the disease is classified into 5 stages. The QOF refers to care for patients with stages 3-5, who by definition have less than 60% of their kidney function. (www.qof.ic.nhs.uk/glossary.asp)

A gradual reduction in kidney function that occurs over months or years, and results in the buildup of waste products Stages 1-5 with 1 mild and 5 severe (www.kidney.org.uk/kids/crf/page17.html)

A term used widely to describe kidney damage or reduced kidney function (irrespective of the cause) that persists for more than 3 months. Sometimes CKD leads to kidney failure, requiring dialysis or a kidney transplant to keep you alive. (Also see acute renal failure.) (www.pbs.org/secondopinion/episodes/kidneydisease/medicalglossary/story655.html)

A form of kidney disease that occurs over time when the kidneys do not remove toxins, waste products, and fluids from the body properly CKD can be managed to slow the progression of the disease(www.swkidney.com/index.php/education/glossary/)
A prolonged kidney ailment that may progress in seriousness over time

(www.uhhospitals.org/Home/ClinicalServices/AreasofSpecialty/NR/Nephrology/TermsandDefinitions/tabid/463/Default.aspx)

CKDu is long term reduction of proper function of the kidney. Which can be happened due to mix of risk factors, normally it progressive condition without showing symptoms?

Chronic kidney disease (CKDu) can be identified by a blood test for creatinine. Higher levels of creatinine indicate a falling glomerular filtration rate (GFR) and as a result a decreased capability of the kidneys to excrete waste products. Creatinine levels may be normal in the early stages of CKD, and the condition is discovered if urinalysis (testing of a urine sample) shows that the kidney is allowing the loss of protein or red blood cells into the urine. To fully investigate the underlying cause of kidney damage, various forms of medical imaging, blood tests and often renal biopsy (removing a small sample of kidney tissue) are employed to find out if there is a reversible cause for the kidney malfunction. Recent professional guidelines classify the severity of chronic kidney disease in five stages, with stage 1 being the mildest and usually causing few symptoms and stage 5 being a severe illness with poor life expectancy if untreated. Stage 5 CKD is also called established chronic kidney disease and is synonymous with the now outdated terms end-stage renal disease (ESRD), chronic kidney failure (CKF) or chronic renal failure (CRF).

(http://en.wikipedia.org/wiki/Chronic_kidney_disease)

### STAGE OF CKDu

<table>
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<tr>
<th>Stage</th>
<th>Description</th>
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<td>Chronic renal insufficiency, Late renal</td>
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CKDu EMERGING

At the beginning of the 21st century, the unknown kidney disease started to spread mostly in dry zone Sri Lanka (CKDu). Traditional type of kidney disease having in Sri Lanka had good correlation between factors like diabetes, hypertension, snake bite. But according to the World Health Organization (WHO), there is no any positive relationship between CKDu and factors mentioning above. Specific character of this disease is asymptomatic development; and also slow, progressive. Majority of people who engage in agriculture (age 40-60) are highly reported as CKDu patient in dry zone Sri Lanka.

There are no specific evidences to find out exact day of origin of the CKDu in Sri Lanka as well in world. But in 1950 there was similar case have found in Balkan region of Europe. It's called Balkan Endemic Nephropathy and its aetiology is still not well established. Sri Lanka’s neighboring countries do not seem to have a problem of this nature. The problem was first noted in 2000 when doctors working in Anuradhapura and Polonnaruwa noticed an unusually high level of chronic kidney disease (CKD) patients.

There are numbers of studies have done and also going on to identify causal factors, nature, solution and preventive measure for this disease (CKDu). Also these studies are going through the various type of disciplinarians such as medical sciences, Agriculture, ecology, microbiology, social sciences...etc. But up to date any of these disciplinarians were unable to identify more specific causal factor/factors for this disease. According to the data reported in the Annual Health Bulletin 2005, Ministry of health. The hospital mortality rate for diseases of the genitourinary system has doubled during the period 1980 to 2005.

<table>
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<th>Stage</th>
<th>Condition</th>
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<td>End-stage renal disease</td>
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Table: Five stages of CKDu disease (Mai Rosenberg, 2007)
The main objective and target of this report is to identify the maximum numbers of imaginative or possible causal factors for this disease according to the available secondary data, with related to Sri Lankan condition and also try to find out similar conditions in global scenario. Final outcome of this secondary data analysis will be helpful to the students who are interesting field like this and researchers who are going to implement their research related to CKDu in different disciplinarians.

These are the area including in this report: Agro-chemical (Fertilizer, Pesticide), Hard water (calcium chloride, fluoride), Alcohol addiction, Average water consumption, Salinity level in dry zone water, Bio-remediate plant consumption (Tank eco system plant, Irrigation canal plant) Inland fish consumption, Algae effect- toxic compound, Soil type, Source of drinking water (tank, agro well, canal), Food habit/food source, Other disease –malaria, Drug for other disease, Beverage, Job factors, Farming type (tenure, owner), Aluminum utensils, Malnutrition, Sea water pollution, Ayurveda medicine.
SRILANKA

Chronic kidney disease (CKD) is a growing worldwide health problem as well as Sri Lanka. Especially dry zone in SriLanka is the place highly dominant in reporting CKDu patients. In last ten years, there are abnormal increase in the number of patients with chronic kidney Disease in certain parts of north central, Eastern and Uva Provinces in Sri Lanka. Some SriLankan people are tent name this disease as Rajarata Kidney Disease. According to the information of Ministry of health, higher number of CKDu patients from the villages located adjacent to so called Madawachchiya, Padaviya, Sripura, Madirigiriya, Girandurukotte and some area of Anuradhapura and Kurunegalla district.

Up to-date there is no national Chronic Kidney Disease database is available in Sri Lanka. But according to statistics of ministry of health, there are more than 6,000 cases have been reported for the last 5 years. Most of them are from above mentioned areas which we can dub "CKD Belt".

Figure 1: Chronic Kidney disease (CKDu) distribution in SriLanka, (source : http://www.docstoc.com/docs)
RISK FACTORS FOR CKDU

CADMIUM

Cadmium can be identified as one of main heavy metal water pollution. The main Natural sources for Cadmium are zinc, lead and copper ores, in coal and other fossil fuels, and also release during volcanic action. Also industrial waste and leaching of landfills cause to add the cadmium to the water source. Cadmium is found in drinking water supplies as a result of deterioration of galvanized plumbing, along with industrial waste contamination, or surface water contamination by certain fertilizers.

According to Environmental Protection Agency (EPA) of United States the Maximum Contaminant Level (MCL) of 0.005 milligrams per liter (mg/L) for cadmium in drinking water. 0.005mg/L for a long term exposure (up to 7 years) but for short term exposure it can be 0.04mg/L (also cadmium can cause for disorder such as nausea, vomiting, diarrhea, muscle cramps, salivation, liver injury).

According to the world Health organization (WHO), Cadmium level in unpolluted natural water is below the 1µg/L. Contamination of drinking-water may occur as a result of the presence of cadmium as an impurity in the zinc of galvanized pipes or cadmium-containing solders in fittings, water heaters, water coolers and taps.

Sometime cadmium concentration in water from shallow well is higher than the deep well. Top soil layers of soil profile may higher acidify than the down layers.

pH level of the water also impact on level of cadmium in drinking water sometimes plumbing systems containing cadmium. Because low pH level is really helpful to dissolving cadmium in water.

Food is the main source of cadmium intake for non-occupationally exposed people. Crops grown in polluted soil or irrigated with polluted water may contain increased concentrations; also, animals that are grazing on contaminated pastures may help to concentrate the level of cadmium through the food chain as result of that: level of cadmium in animal product like milk, meat may be increased.

Smoking is one of outside factor is directly impact on increase the level of cadmium in human blood.

Cadmium that is come in to the body through food and water can be absorbed through the gastrointestinal tract. In Healthy person normally absorb 3% to 7% of the cadmium ingested. If people show the iron deficient this figure may reach up to 15% to 20%.

Other thing is, Cadmium concentration of human tissue is increasing with age. Both kidney and liver are act as Cadmium storage body part: nearly 50% to 85% of body burden is stored in kidney and liver. From that 30% to 60% is stored in kidney alone. Biological half-life in human body is 10 to 35 years so there is considerable time is available to accumulate the cadmium in –side the human body. Only very small part of the cadmium may excrete with urine: nearly 0.007% of the body burden.

So final result is level cadmium in human blood may increase it can be lead to impact on CKDu.
FLUORIDE

Fluoride (F) is one major element include in dry zone water in Sri Lanka. According to the Institute of Fundamental Studies (IFS), the element fluoride is cause for CKDu. The research done by IFS have found high fluoride content in the water had an impact on the high concentration of patients with kidney diseases in the north central province. So fluoride play big role with related CKDu in dry zone Sri Lanka. World Health Organization (WHO) defined 1.5 mg/L of Fluoride concentration as the safe level for drinking water but this number should ideally be around 0.8 mg/L in tropical countries. (US-EPA) defined maximum contaminant level as 4mg/L) But SriLankan figures are far away from the recommended level some dry zone area this level is exceed 5mg/L. country like SriLanka majority of people use ground water as main water source for their drinking purpose. So there may be big impact of Fluoride (F) for CKDu dry zone SriLanka. National kidney foundation (US) says if any person exposure to 4mg/L concentration of fluoride in life time there is very high possibilities to impact with kidney disease (CKDu)

Figure 2: Geochemical classification of ground water Sri Lanka (Fluoride distribution the ground water SriLanka in ppm, C.B Dissanayaka, 2005)
Above two maps are showing how CKDu hot spots and fluoride concentration in deep well SriLanka. Most of the area with CKDu and high fluoride concentration are really overlap. How about other area like Galle and Matara? Interesting thing is these are the area in SriLanka newly identified as CKDu emerging area in SriLanka. There is 10mg/L of Fluoride concentration (C.B.Dissanayaka, 2005) Anuradhapura, Madawachchiya, and polonaruwa area. This value is very higher than the recommended value as well these are the area highly influence by the CKDu. Fluoride combine with Sodium make Sodium-Fluoride this compound is highly toxic compound. This compound can cause significant toxic to human kidney. So there should be done more research related to this risk factor in SriLanka.
**Uranium**

There are no any research done in Sri Lanka to find out relationship between level of uranium in drinking water and CKDu. But According to the Radiation and Nuclear Safety Authority (RNSA-UK) have found positive correlation between uranium concentration and kidney failure. Uranium occurs naturally in the earth’s crust and surface and ground waters. If the bedrock consists mainly of uranium-rich granitoids and granites and contains soft, slightly alkaline bicarbonate waters, Uranium is highly soluble under oxidizing conditions at a wide pH range.

Radiation and Nuclear Safety Authority (UK) is recommended 2 µg/L to 100 µg/L level of uranium concentration for safe drinking water. These values are based on animal studies. WHO and the U.S. Environmental Protection Agency (U.S.EPA) are recommended 2µg/L and 30µg/L respectively for safe drinking water. There is chemical kidney toxicity rather than radiation impact.

When consider the CKDu affected regions in Sri Lanka, mostly affected the dry zone area. Rice farming is the most common livelihood practice. In dry zone soils, Ca, K, Ba, Pb and Zr contents were higher and Fe, Mn, Cr, Ni and Zn contents were lower compared to that of soils from the wet zone non-CKD region. According to some study done in Sri Lanka have found 3.6mg/Kg of mean Uranium (U) content in dry zone soil and also extremely high uranium contents have found in some fertilizer samples particularly in the triple super-phosphates. Most Uranium applied via fertilizer could contaminate the drinking water sources and even low Uranium concentrations in drinking water may cause nephrotoxic effects.

As solution for supply safe drinking water some people are going to suggest the drilled well for dry zone but with drilled well there very high possibility to contaminate water by Uranium. Because drilled well is going through the bed-rock to find ground water table. In dry zone bed – rock is different than other area of the country because it consists of Miocene limestone. Because of that there may be enormous possibilities to contaminate water with other impurities. So sometimes solution may be cause for the problem.

In Sri Lanka there is no well up-dated and informative soil map. Because of that people and scientist are not having enough information of soil type, qualities and their properties. There are numbers of Soil patches all over the dry zone which are not having adequate information. So there may be some possibilities to include Uranium as element in those soils. It can be leaded to initiate Chronic Kidney Disease in Dry zone Sri Lanka.
THE CYANOBACTERIAL TOXINS

Very latest factor is identified by the researcher of university of Peradeniya for causal factor to chronic kidney disease (CKDu)

According to this ongoing research studies, it is substantiate that toxins produced by the cyanobacteria may have a role in the pathogenesis of CKDu in Sri Lanka. Further this researcher is suggesting that the cyanobacterial toxin could be the causative agent for the nephropathy in Balkan countries because there are very close similarities between Balkan Nephropathy and CKDu in Sri Lanka. Environmental factors such as global warming and admixing of Nitrogen, Phosphate and Potassium of chemical fertilizers with run-off water provide a favorable ecological background for the blooming and toxin production of cyanobacteria. The presence of large number of the water reservoirs within a given area in the North Central Region of Sri Lanka due to unique cascade irrigation systems could have been another reason for the disease. Control use of agrochemical and control of global warming are mandatory to control this disease.

Figure: picture of Cyanobacteria producing toxic compound
Alcohol

Alcohol is a regular beverage within Sri Lankan farming community. From that illegal alcohol is most famous one. Anyone can drink alcohol in safety manner but drinking too much alcohol that are produced illegally even for a completely healthy person can cause heart disease, liver disease, high blood pressure and kidney disease. Drinking too much alcohol can also lead to more other physiological disorder.

Also there are number of negative impact on drinking alcohol for the kidney according to the medical studies.

1. increase the chance of developing high blood pressure, which is the second leading cause of kidney disease
2. Interfere with medicines making it harder to control high blood pressure. Uncontrolled high blood pressure is more likely to damage kidneys.
3. cause more frequent urination, which can lead to dehydration
4. prevent the kidneys from maintaining a proper balance of body fluids and minerals
5. damage kidney cells changing the structure and function of the kidneys

People who are having high blood pressure and high blood sugar are more susceptible for Chronic Kidney Disease (CKDu).

World Health Organization (WHO, 2004) is reported, Much of the alcohol consumed in Sri Lanka is moonshine (hooch), known in common parlance as ‘pot arrack’ and which, according to some guestimates, amounts to about 90% of the total volume of alcohol consumed in the country. This would denote that Sri Lankans consume an annual average of over 33 litres of moonshine per capita or over 627 million litres of moonshine in total (not in pure alcohol terms). Also, The unrecorded alcohol consumption in Sri Lanka is estimated to be 0.5 litres pure alcohol per capita for population older than 15 for the years after 1995.

The majority of people in dry zone Sri Lanka are drinking illegal alcohol type in their day today life. According to the local term; it’s called “kassippu” (moonshine). This kind of production are done in very uncontrolled local condition in Sri Lanka because of that there may be lot of unknown chemical compound which can be toxic to the human body. Some because of this uncontrolled condition there may be chance to produce toxic carbonic within the distillation process and also sometime lead and glycol can be produced because of the illegal ingredients which are added to the alcohol. Because of these reasons there may be some possibilities to alcohol make positive impact on chronic kidney disease in Sri Lanka.
OTHER MINOR FACTORS

In this report there numbers of factors have considered which can be impact to the CKDu according to the available research data. But there may be numbers of other factors can be directly or indirectly impact on CKDu in SriLanka.

PHYTO-REMIDIATE PLANTS

Phyto-Remediation can simply define as the treatment of environmental problems (bioremediation) through the use of plants which mitigate the environmental problem without the need to excavate the contaminant material and dispose of it elsewhere.

(en.wikipedia.org/wiki/Phytoremediation)

Even we not purposively use plants for this work naturally plants are doing these kinds of work in their eco-system. People in the Dry zone are highly consuming this kind of plant without knowledge. (Plants in tank eco-system, plant in canals, plant in paddy field) Heavy metals other toxic materials can be extract by plant from the soil and water so these materials can be go in to human body.

ALUMINUM UTENSILS

To increase the energy use efficiency majority of rural farmer are change their day today life pattern as result of that they did big change in their kitchen also. Rural people introduced Aluminum utensils for cooking purpose. Some scientist in SriLanka, they believe using of aluminum utensils is one main risk factor CKDu in dry zone SriLanka. The use of Aluminum utensils made out of low quality cheap Aluminum to store water and to prepare food. The fluoride content found in the ground water reacts with the Aluminum creating Toxic compounds (ALF x). There are no research finding related to aluminum toxicity in SriLanka. But majority of SriLankan scientist are believe using of poor quality aluminum utensils as one of main risk factor for CKDu in dry zone SriLanka.,

MAL-NUTRITION

Some other scientists believe mal-nutrition also one of risk factor CKDu in SriLanka. Dry zone of the country shows comparatively higher rate of malnutrition than other part of the country. Especially Protein-energy malnutrition is highly associated with CKDu in dry zone SriLanka.
NITROGEN and PHOSPHOROUS

When consider the nitrogen and phosphorus level in dry zone water bodies are very high some researcher have found nitrate level in some water body in dry zone vary 10mg/L to 30mg/L, WHO recommended level for nitrate is 10mg/L. this is mainly because of high application rate of urea fertilizer for cropping area in the dry zone. With the fertilizer subsidy program farmer are tend to use higher quantity of fertilizer than earlier. Phosphate accumulation is very high in dry zone water body because of eutrophication can be happened in most of the water bodies in dry zone. If there is any algae how are producing toxic compound in this water, ecology is ideal for that to grow well in this water body. Nitrate and phosphate level in ground water also higher this is happening mainly because of nutrient leaching to the ground water table.

SELENIUM

The trace element selenium is a co-factor for enzymes including glutathione peroxidase. According to the medical research whole blood and plasma selenium concentrations and glutathione peroxidase activity were significantly reduced in stage 4-5 CKD patients not on dialysis compared with healthy controls. Also they found selenium concentrations and glutathione peroxidase activity to significantly decline as the CKD stage increased.

Factors such as age, inflammation, fluid retention and dialysis treatment may increase the levels of oxidative stress in patients with chronic kidney disease (CKD), so people who are having selenium deficiency there may be chance to effect by the CKDu.

ARSENIC

According to the WHO guideline recommended level of the Arsenic in drinking water is 10µg/L with relevant to up-dated scientific evidence. Normally ground water arsenic level is below than the WHO recommended level but some time arsenic mobilization in water is favored under some specific geochemical and hydrogeological conditions and concentrations can reach two orders of magnitude higher than this in the worst cases. Most occurrences of high-arsenic groundwater are undoubtedly of natural origin. But according to the SriLankan finding arsenic concentrate is nearly 100 – 200 µg/L. this level is very higher compare to the recommend level. Agrochemical and pesticide can include Arsenic as an element but these Arsenic amounts are not enough to increase this level of Arsenic concentration in drinking water. So there may other factors can be influenced on water to increase Arsenic level. So alluvial and deltaic plains and inland basins composed of young sediments are particularly prone to developing groundwater arsenic problems. Less oxygen level in water is one of cause to increase Arsenic dissolve in water; eutrophication is one of main factor to reduce dissolve oxygen level in water so there are high possibilities to increase the dissolve of Arsenic in dry zone water bodies. When consider the
ground water with high dissolved iron and manganese concentrations. High-pH, oxidizing (aerobic) have also been linked with high groundwater arsenic concentrations. Also slow ground water movement effect to increase the level of Arsenic in in ground water.

HERBAL MEDICINE

There are some researches finding in Taiwan and China about herbal medicine impact to the CKDu. There is big discussion also going on SriLanka as well about that. There is enough literature to prove herbal medicine impact on kidney disease in SriLanka but there is some finding in Taiwan about this. According to some research regular use of chines herbal drug had played big role in CKDu group in Taiwan. Intake of Chinese herbs containing aristolochic acid has been reported as the cause of advanced renal failure in Taiwan. Most of herbal medicine are not producing proper manner and sometime producer may not be known chemical contain of the ingredients so there are big possibility to produce toxic compound within the herbal medicine.

FOOD IMPACT

According to some study done by SriLankan scientist there is big role is play by food commodities for influence for CKDu in SriLanka. Food commodities with mycotoxin have significant impact on CKDu in dry zone. Such kind of mycotoxin is Ochratoxin-A (OA) this toxic compound naturally produced by Penicillium and Aspergillus fungi species. A natural contaminant of many food items, ochratoxin is mutagenic, oncogenic and nephrotoxic.

The study has found out Parboiled Oryza sativa and Glycine max contain comparatively higher levels of OA than other food items tested. This may be due to contamination with the fungi during storage and processing. Rice is soaked in water for 24-48 h before processing as parboiled rice and the same water is used repeatedly for soaking. Fungal growth depends on the moisture content of the grain. The North Central Province (NCP) is in the dry zone of Sri Lanka, and there is no dramatic change in climatic conditions between the dry and monsoon seasons. Therefore it is unlikely that climatic conditions influence the OA levels in the food commodities. However there is no OA at maxim available level in dry zone grains.

AGROCHEMICAL

PESTICIDE/ FERTILIZER

People in Chronic kidney disease impact area are mainly doing rice farming as their livelihood activity. Most of them are intensive rice farmer because of that they use very high amount of
agrochemical for their farming. Most time these amounts are far higher than the recommended level of the Department of Agriculture (DOA).

Chemical fertilizers are play big role in supplying large number of heavy metal to the soil or water eco –system. Phosphate fertilizer is the main contributor from those. Abundance of toxic metals in phosphate rocks and phosphate fertilizers and their impact on soil pollution, accumulation in plants and effects on human health,

SOIL

SriLanka, There is no well descriptive soil map so there may be some soil type unknown to the scientist. This unknown soil may be included higher amount of heavy metal sometime radioactive elements. Therefore making descriptive soil map for the country may useful.

Also there are number of physical and social factors may be influenced on CKDu directly or indirectly such as job factor, farming type (tenure famer or owner farming) water consuming behavior, drugs for other disease, other beverages like things can be effect to CKDu in SriLanka but still there are no any research going on find out causal factors related to this
Impact of CKDu in SriLanka

Quality of life

Majority of people who report as kidney patients are doing agriculture as their main livelihood activities, Most of them are poor income or middle income people. Unfortunately higher potions of the patients are male. In Dry zone SriLanka, women engage in income generation activities are very less, major role of the women in these areas are caring children and helping to the husband for his agricultural activities. Man is play big role with respect to the strengthening the economy of the family. So problem is 2/3 of patients are male it directly impact to the quality of life people in dry zone. Stopping main income source of the family is negatively impact on the family member.

Less income of the family, first impact is nutrition of the family member. Reducing income level of the people directly impact to reduce the buying capacity of people. So result is they change their food habit and go to the poor quality food stuff it cause to mal-nutrition of the people specially in mal-nutrition in children.

This mal-nutrition is directly effect to the level of education of people; less income level of the family and mal-nutrition are main factors causes to poor performance of the children in this area. Because of above two factor children are going stop their education and try to engage in income generation activity. Mainly they try to engage in agriculture related activity.

Poor income of the family directly impact to mal-nutrition of the children then mal-nutrition is cause for poor education of the children because of that again poor income to the family. Because of above reasons quality of life people in these areas are highly effect by CKDu.

Health sector of this areas are not much developed than other area in the country and poor development of infrastructure in this areas to course less entering of new technologies to these area .most of time Doctors are not willing go hospital in this area because of this remoteness of these area. So patients have to go far distance place like Kandy for take medicine for their illness. Implementing some program related to CKDu also difficult because of above practical problem in Dry zone SriLanka.
Health expenditure

SriLanka is one of the country in the world is providing free health facility to their people. Because of that annually country has to spent huge amount of money for health sector in SriLanka.

Total expenditure on health goods and services and capital formation in Sri Lanka in 2006 is estimated as Rs.117.9 billion. This represented an increase of Rs.21.4 billion over the preceding year, which is a 22% increase in nominal terms. In real terms this was equivalent to an increase of 11%. The ratio of Sri Lanka’s health expenditure to GDP (health to GDP ratio) provides an indication of the proportion of overall economic activity contributed by the health sector. It is estimated that spending on health accounted for 4.2% of GDP in 2006, which is a significant increase from the level of 3.6% of GDP in 1990 (WHO 2006).

Figure: Total health expenditure in constant price, 1990 to 2006 (source-WHO report 2006)

CKDu is becoming one main health problem in SriLanka because of that money have to allocate for this. Government has to cut down the share for other field in health expenditure or increase the expenditure for health sector to cater cost for CKDu. Because of free health government should increase the expenditure for health so it may be badly effect developing country like SriLanka.
ECO FRIENDLY SOLUTION

There are numbers of researching about CKDu and its causal factors. But when we implementing the solution for those causal factors sometime not particle Majority of people who are affected from this disease couldn’t be adapted to those suggesting solution. But many part of the world, people have found their own solution to protect their kidney by different kind of kidney disease.

**Breadfruit leaf**

Scientific name is *Artocarpus altilis*. Normally people notice as breadfruit. People in the Indonesia like country are drinking water which gains from the boiling of the half mature breadfruit leaf. Poor people are regularly drinking this solution to prevent the kidney disease. ([http://herbalmiracles.blogspot.com](http://herbalmiracles.blogspot.com))

**Murunga**

Scientific name is *Moringa oleifera*. Normally people notice as Murunga with respect to SriLankan phenomena. The Island highlights the need to address the growing incidence of chronic renal disease in Sri Lanka and points to the use of *Moringa oleifera* as a potential means of combating the disease through water purification. People in the Sudanese and other African populations have effectively used murunga seeds as a flocculent to clear bacteria and other chemical elements out of drinking water. Normally dry Murunga seed should crush well and put it in to the water. This seed cake is making colloidal with all the minute chemical element and microorganism like Bacteria. Then this colloidal form of all the unnecessary things in the water can be filtered easily. Or otherwise people can be made eco-filter using these seed cake and use for filtering water. Every other day this seed cake should renew.

Figure: breadfruit leaf and moringa seed
GLOBAL IMPACT OF CKD

Overview

Chronic Kidney Disease (CKDu) is not only local threat but also it is global threat according to the information WHO. Majority of countries in the world have faced this threat. Developing countries are highly effect from this disease economically as well socially.

There are no specific evidences to find out exact day of origin of the CKDu in SriLanka as well in world. But in 1950 there was similar case have found in Balkan region of Europe. It’s called Balkan Endemic Nephropathy and its aetiology is still not well established.

Country like India who are having less developed health sector and poor income level, are major concern preventing the CKDu. As example in India ~90% patients cannot afford the cost. Incidence of CKD has doubled in the last 15 years. In the USA, ~30 million people suffer from CKDu. When 2010 there should be more than 600 000 need renal replacement therapy, costing is nearly 28 billion only in USA. In 2003, the prevalence was around 1800 patients per million populations (pmp) in Japan and 1600 pmp in Taiwan. Prevalence is a little lower in the United States (1500 pmp) and Spain (1000 pmp) the Prevalence in developing countries are lower than those from developed countries, perhaps reflecting the lower quality of the public health systems.

According to the renal transplant unit in Netherland, Chronic Kidney Disease (CKDu) has emerged in 16th century in Europe. World Health Organization (WHO) in 2005 emphasized that chronic diseases are a global priority. There was big impact of CKDu to health sector as well as economic sector.10% of income lost in developing countries that amount is around $8 billion in 2005.

There are 5% - 10% of CKDu patients within the world population (http://www.nature.com). it mean nearly 500 million So this is becoming real problem in world health sector. Because of that find out specific risk factor for CKDu is very important to the world. Especially people who are in developing world are highly impact by this disease. Main reason is low life condition and poor income level .they can’t afford this huge cost they have to spend at the renal replacement or any other medical treatment.
ASIAN SITUATION

Asian pacific region is represented more than 50% of the global population. With including highest populated countries like India and China. More than 35% of the people in these two countries are some relationship between CKDu. Other countries are also in same condition related to CKDu because of that collective approach is very essential to work against this problem. There are number of organizational bodies to work against CKDu in Asian region Japanese Society of Nephrology, Asian Forum on Chronic Kidney Disease Initiative (AFCKDI) Asian Pacific Society of Nephrology, Australian and New Zealand Society of Nephrology, Malaysian Society of Nephrology, Kandy kidney protection agencies in Sri Lanka, more than 90% of the countries in Asia have form specific organization body for work on CKDu in their countries.

JAPAN

Japan is one of the Asian country is highly affected by the CKDu. According to the data 2008 there are 282,000 numbers of patients are undergoing kidney treatment in japan or 1 out of 450 people have dialysis patients in japan. Nearly 10% of total population shows at least stage 3 or 4 in CKDu. Majority of them are elderly people with more than 65 or more, There have been approximately 37,000 new dialysis patients every year, According to the Japanese society for dialysis therapy, there are five different type of kidney disease in japan from that 23% represent the CKDu. Some Japanese literatures highlight the metabolic disorder and hypertension can be causal factors for Japanese CKDu. Japan and Taiwan are countries show highest number CKDu patients in the world. Here are number of risk factors have been identified by Japanese scientist with related to CKDu in japan. Japan is very popular because of Itai-itai disease. This one kind of kidney disease because of Cadmium water pollution in japan this disease is entirely different from the CKDu. Because this disease softening the born and highly paining one there are few symptoms are such as coughing, anemia, and kidney failure, leading to death. Because of these symptoms itai-itai can be identified but CKDu is asymptotic disease.

Following graph is showing how the increment of Japanese kidney patients is year by year.
India is one of the countries with a highly populated and low-income population in South Asia. Within the country, there are huge variations between different food, cultural traditions, and lifestyle habits… etc. India is not maintaining a database for CKDu patients. Also, there is no large-scale study going on about CKDu. The approximate prevalence of CKD is 800 per million populations (pmp). Until recently, the Indian government did not put good attention on this hidden epidemic.
TAIWAN

Taiwan is one of the country in the world with highly impact with CKDu. It is only to second to japan. According to some literature a low awareness rate in contrast to high prevalence of CKD is a serious public health problem in Taiwan. 6.9% is prevalence rate and overall awareness rate of CKD of 9.7%. Low socio economic and educational level in Taiwan is one of main factor to increase the prevalence rate in Taiwan. Because of that increasing awareness of CKD is very important work through patient education and an intensive screening program. Majority of CKDu patients’ elderly people with age more than 65 with diabetics.

When consider the main risk factor CKDu in Taiwan have been identified as falls

Older age, diabetes, hypertension, smoking, obesity and regular use of herbal medicine according to some finding in Taiwan the use of Chinese herbal drug are highly associated with CKDu in Taiwan. Intake of Chinese herbs containing aristolochic acid has been reported as the cause of advanced renal failure in Taiwan. Because of that Chinese herbal products containing aristolochic acid, Mu-ton and Fangi have been banned by the Department of Health (DOH) in Taiwan since 2003. Also heavy metals (lead) are main risk factor in CKDu in Taiwan. There are some finding hepatitis c have some associate with CKDu in Taiwan.

CHINA

Within the chaines community the CKDu is comparatively less. According to the chaines literature the main factor for CKDu in chaines is metabolic syndrome it indicate lipid cause for renal injuries. Age, sex like factors are not showing relationship between CKDu in china. Most of chaines literatures indicate diabetes and hypertensions are the major factors associated with the development and progression of CKDu in china.

LATIN AMERICA

Latin America is collection of numbers countries such as Brazil, Argentina, Chile Mexico, Bolivia, Peru, Cuba... etc. most of these Latin American countries are highly impacted by the CKDu. Most these countries are developing countries because of that they have to spent huge amount of money to work against this disease. But still it’s progressive so the costs for medicine have become unaffordable amount of the countries.
**Figure:** prevalence rate progression in Latin America (Cusumano A.M / http://cjASN.asnjournals.org/content/3/2/594.full)

**Figure:** prevalence of dialysis patients in Brazil (Jocemir R & Lugon, M.D)
AUSTRALIA
CKDu is one of major health problem in Australia. One in three every Australian adult are risk at of CKDu. One in seven has some degree of CKDu.

According to the Australian scientist, there are number of risk factors are causing for CKDu in Australia. These risks have categorized in to three major groups like: fixed, behavioral and biomedical as example fixed: (Family history and genetic, increasing age, previous kidney damage, low birth weight and male sex), behavioral (Tabaco smoking, physical inactivity and poor nutrition) biomedical (diabetes, high blood pressure, cardiovascular disease, over weight and obesity) CKDu is one main contributor of the death of Australia nearly it contribute one fifth from total death in Australia. Also CKDu is highest contributor for mortality of the indigenous people in the Australia. (Australian Institute of Health and Welfare report-2009)

Figure 1: Trend in incidence of treated end-stage kidney disease, 2000–2007
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