8.2 COULD OCHRATOXIN A IN FOOD COMMORDITIES BE THE CAUSE OF CHRONIC KIDNEY DISEASE IN SRI LANKA?

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SHORT COMMUNICATION

Could ochratoxin A in food commodities be the cause of chronic kidney disease in Sri Lanka?

Kamani P. Wanigasuriya[a,*], Hemantha Peiris[b], Nalaka Ileperuma[b], Roshini J. Peiris-John[c], Rajitha Wickremasinghe[d]

[a] *Department of Medicine, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[b] *Department of Biochemistry, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[c] *Department of Physiology, Faculty of Medical Sciences, University of Sri Jayewardenepura, Nugegoda, Sri Lanka*
[d] *Department of Public Health, Faculty of Medicine, University of Kelaniya, Kelaniya, Sri Lanka*

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Summary Ochratoxin A (OA) is a naturally occurring mycotoxin with nephrotoxic properties that can contaminate plant food products. OA concentrations were assessed in commonly consumed food items in the North Central Province of Sri Lanka, where chronic kidney disease is diagnosed at epidemic proportions. Ninety-eight randomly selected food samples were analysed. Mycotoxin was detected in the extract by using a MycoMonitor Ochratoxin A ELISA assay kit (Helica Biosystems Inc., USA). The levels of OA found in these food commodities were below the recommended statutory maximum limit and are unlikely to be a potential risk factor for nephropathy in the North Central Province of Sri Lanka.

1. Introduction

Ochratoxin A (OA) is a mycotoxin produced by*Penicillium* and *Aspergillus* fungi species. A natural contaminant of many food items, ochratoxin is mutagenic, oncogenic and nephrotoxic. A causal relationship has been shown between ochratoxin and porcine nephropathy in northern Europe (Hald, 1991). The nephrotoxic properties of OA have been established in pigs and canines (Gekle et al., 1993; Krogh et al., 1974). It has also been suggested as an aetiological agent of human interstitial nephritis and urinary tract tumours (Kuiper-Goodman and Scott, 1989; Petkova-Bocharova and Castegnaro, 1985). The Joint FAO/WHO Expert Committee on Food Additives (JECFA) in 1991 recommended a tolerable daily intake of 16 ng/kg body weight based on the nephrotoxic effect of OA (see the Ochratoxins Basic Fact Sheet online at: http://www.mycotoxins.org/ [accessed January 2008]).

There is a high prevalence of chronic kidney disease of unknown aetiology in the North Central Province (NCP) of Sri Lanka (Ministry of Health, 2000). Evidence of an environmental factor contributing to the emergence of the disease in the region has been shown (Wanigasuriya et al., 2007).

* Corresponding author. Tel.: +94 11 2793323.
E-mail address:kamaniw@sltnet.lk(K.P. Wanigasuriya)

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This exploratory study was conducted to determine the natural occurrence of OA in cereals and pulses produced in this region in order to determine whether or not further investigation is warranted.

2. Materials and methods

2.1. Sample collection

OA levels were tested in 98 samples, comprising two principal types of cereals predominantly cultivated and consumed by people in the NCP [maize (*Zea mays*) and raw and parboiled rice (*Oryza sativa*)] and five pulses and legumes [mung (*Vigna radiate*), cowpea (*Vigna unguiculata*), kurukkan (*Eleusine corocana*), soya bean (*Glycine max*) and undu (*Vigna mungo*)]. During the period July to August 2006 the samples were collected randomly from retail outlets in Medawachchiya, Padaviya and Rajanganaya, 6–8 weeks after harvesting, during the dry season of the year. Sub-samples were ground and sealed in polythene bags before transporting to the laboratory.

2.2. Analysis of samples

The samples were further ground to pass through a 20 mm mesh screen. Extraction of OA was done by mixing 20 g of the particles with 70% methanol. The measurement of OA levels in the extract was done by solid-phase direct competitive enzyme immunoassay technique using MycoMonitor Ochratoxin A ELISA assay kit (Helica Biosystems Inc., Fullerton, CA, USA). All samples were analysed in duplicate. A dose–response curve using standards of OA (2–40 ppb) was constructed and unknowns were measured by interpolation from the standard curve.

3. Results

OA was found to be a natural contaminant of the food commodities tested. The OA content of food items analysed ranged from 0.3 to 3.2μg/kg (Table 1). Parboiled *Oryza sativa* contained higher levels of OA compared with raw *Oryza sativa* ($P < 0.05$). The difference in the OA content of raw *Oryza sativa*, *Vigna unguiculata*, *Zea mays*, *Vigna radiate* and *Eleusine corocana* was not statistically significant. The *Glycine max* samples tested were found to have comparatively high OA levels.

4. Discussion

Contamination of cereals by OA is more frequent in areas of Bulgaria where nephropathy is more common compared with areas in which the disease is absent (Petkova-Bocharova and Castegnaro, 1985). Studies have also demonstrated higher blood levels of OA in patients with Balkan endemic nephropathy compared to unaffected people from endemic areas (Petkova-Bocharova and Castegnaro, 1991). More recently, however, Mally et al. (2007) reported pathological changes in the kidneys of OA-treated rats to be different to those observed in endemic nephropathy, raising doubts about the role of OA in the aetiology of endemic nephropathy.

Parboiled *Oryza sativa* and *Glycine max* contain comparatively higher levels of OA than other food items tested in the current study. 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; a moisture content more than 15% favours fungal growth. The pulses and cereals tested in this study had a moisture content of 8 and 10%, respectively. The samples had been stored for 6–8 weeks only. Therefore it is unlikely that storage time influenced the OA levels found in parboiled *Oryza sativa and Glycine max* in this study.

The 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 tested.

The results indicate that OA is a natural contaminant of cereals and pulses cultivated in these areas, but the levels detected were below the statutory maximal limit. Therefore regular consumption of OA at levels present in the food items tested is unlikely to be a direct cause of chronic kidney disease in the NCP of Sri Lanka. These findings and those from other published work indicate that further studies on

Table 1 Natural occurrence of ochratoxin A in cereal and pulse samples from food items produced in the North Central Province of Sri Lanka

Food tested	Ochratoxin A content±SD (μg/kg)		
	Padaviya	Medawachchiya	Rajanganaya
Vigna unguiculata	1.1±0.1	1.2±0.4	0.3±0.1
Zea mays	1.0±0.2	1.1±0.3	–
Raw *Oryza sativa*	0.6±0.2	0.9±0.4	0.4±0.1
Parboiled *Oryza sativa*	1.0±0.2	1.6±0.3	3.2±0.4
Vigna radiate	1.0±0.2	1.3±0.3	0.1±0.1
Eleusine corocana	1.0±0.2	1.4±0.4	2.2±0.5
Vigna mungo	1.0±0.2	–	2.2±0.4
Glycine max	–	–	3.1±0.3

the association between OA and chronic kidney disease are not warranted, highlighting the need for further investigations on other aetiological factors of this epidemic kidney disease.

Authors' contributions: KPW, HP, NI, RJPJ and RW designed the study protocol; KPW carried out the data collection; HP and NI conducted the sample analysis; RW and RJPJ carried out the analysis and interpretation of the data; KPW, HP, RJPJ and RW drafted the manuscript. All authors read and approved the final manuscript. KPW is guarantor of the paper.

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