

Skin Diseases Among People Using Urban Wastewater in Phnom Penh

The major challenge in sustainable use of wastewater in agriculture and aquaculture is to optimise the benefits of wastewater as a resource (both the water and the nutrients it contains) and to minimise the negative impacts on human health. Epidemiological studies in different countries have established that the highest risk to human health of using wastewater in agriculture and aquaculture is posed by worm infections.

In countries where wastewater and its nutrients are used to grow fish, there are important risks for infection with flukes. Foodborne trematode (fluke) infections, which often affect the functioning of the liver, are a serious and growing public health problem with an estimated 40 million persons worldwide affected, especially in Southeast Asia. Transmission to humans occurs mostly via consumption of raw freshwater fish and aquatic plants vegetables. International guidelines for the safe use of wastewater and excreta in agriculture and aquaculture (Mara and Cairncross, 1989), are currently being revised and separate guidelines for agricultural and aquacultural use will shortly be available. The revised guidelines are based on epidemiological studies on excess risk of infection attributable to the use of wastewater and quantitative microbial risk assessment models. For agriculture guideline values are $\leq 10^3$ faecal coliform bacteria per 100 ml for irrigation water and ≤ 1 intestinal nematode egg per litre. For aquaculture the guideline values are $\leq 10^4$ faecal coliform bacteria per 100 ml for fishpond water and absence of viable trematode eggs. It should be noted that very little research and risk assessment have been carried out on possible transmission of trematode parasites in wastewater-fed aquaculture. Although the guidelines state that no viable trematode eggs should be present in

wastewater to be used in aquaculture, standard methods for enumeration and identification of trematode eggs are not available. It is currently unknown if methods used for helminth egg enumeration may also be appropriate for trematode eggs. Furthermore, the differentiation of trematode eggs is notoriously difficult and can only be done by experienced laboratory staff. Finally, simple standardised methods for viability testing of eggs are not available. It is therefore clear that research is urgently needed on these and other issues if the actual risks for trematode parasite transmission in wastewater-fed aquaculture are to be assessed. These serious health risks have however meant that other chronic occupational impacts of wastewater aquaculture have been relatively ignored. Consistently, sewage treatment plant workers and farmers in Europe, North America, and developing countries mention skin irritation as a major health problem that they perceive as being related to wastewater exposure. Studies in France, Spain, the UK, Canada, and the USA have noted an increased occurrence of “itchy skin”, “skin rash”, or “skin irritation”. But in all cases the description was rather aspecific and the cause of the perceived skin problems remained obscure. It was hypothesised that the skin problems could be related to allergic and non-allergic reactions to chemicals in the water, perhaps also involving interactions of chemicals with pathogens. However, the information available today is largely anecdotal.

There can be many substances in the water, biological and chemical, that can cause skin problems. Certain biological agents such as cercariae of animal schistosomes (cercarial dermatitis, “swimmers itch”), mycobacteria of fish, leptospira, and hookworm can cause local



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Women preparing harvested water plants for sale to middleman

skin reactions. These reactions are expected to be of short (<1 week) duration but are very relevant from a public health point of view. For example cercarial dermatitis has been mentioned as an emerging disease in Europe and globally (de Gentile et al., 1996). Toxins produced by cyanobacteria can cause skin irritation from direct contact but chronic exposure through drinking water leads to more serious effects, such as liver damage. Long-lasting skin diseases could be caused by chemicals and other substances in the wastewater that have a local action on the skin, especially of hands and feet. This can lead to contact dermatitis (eczema), with clearly demarcated areas of rash at sites of exposure. One group of chemicals are irritants that directly damage the skin such as certain heavy metals (chromium, cadmium, arsenic), certain pesticides, industrial solvents, detergents, and even water itself. The other group are sensitizers (certain metals such as nickel, dyes, oils, plant materials) that can produce allergic reactions.

PHNOM PENH, CAMBODIA

Most of the urban domestic and industrial wastewater of Phnom Penh city drains to the Boeung Cheung (BC) Ek Lake / wetland. Cultivation of aquatic vegetables is an important activity that sustains the livelihoods of many families around this

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Main inlet Phnom Penh wastewater into the Boeung Cheung Ek Lake

lake. Water spinach (*Ipomoea aquatica*) is the major crop grown in BC Ek Lake. The upper part of the stem and the upper leaves with leaf stalks are used for human consumption whereas the lower part of the plant with leaf, stem and root may be used as pig feed. Water spinach or morning glory is also planted on land and watered from a pond near the village with a motor pump and hosepipe. These plants serve as seedlings and will be planted in the lake as the water level rises. Large water surface areas near the villages are overgrown with water morning glory and to a lesser extent with water hyacinth and water mimosa. There is extensive human contact with the water during the various production activities. Women and children living nearby often harvest the plants and make bundles which are collected by middleman with a truck on a daily basis.

The official functions of the Boeung Cheung Ek wetlands are flood control and removal of pollutants from Phnom Penh city before the water eventually flows into the Mekong River. A previous study found high metal concentrations in wastewater sludge especially lead and mercury, which is not surprising as the untreated effluent of more than 3000 industries drains into BC Ek Lake (Muong, 2004). A study by the Ministry of the Environment of Cambodia estimated that 20% of the total daily vegetable consumption of Phnom Penh comes from BC Ek Lake and two smaller wetlands within the city (Muong, 2004). Therefore these waste water fed aquatic vegetables are, despite their potential health risks, very important in supplying the city's vegetable markets and thus meeting the demands of the growing population of Phnom Penh,.

SURVEY OF SKIN PROBLEMS

A recent systematic study with the PAPUSSA project was implemented focussing on skin problems among

wastewater users in the city of Phnom Penh, Cambodia. A total of 154 households living along the BC Ek Lake and 46 households living around a lake that received no wastewater were selected for an initial skin survey, which provided information on 713 individuals. In the households engaged in the culture of aquatic vegetables in BC Ek Lake, 134 (22%) of the members reported skin problems whilst there was only 1 person (1%) living along the non-wastewater lake that reported a skin problem. Those with skin problems were referred to a dermatologist for physical examination and treatment. The diagnosis by the dermatologist showed that contact dermatitis (74%) was the most common skin disease, followed by superficial fungal infection (18%) and urticaria (9%). Skin problems and diseases mostly



Man culturing morning glory in Boeung Cheung Ek Lake

appeared on the hands (56%), feet (36%) and legs (34%).

CONCLUSIONS

Preliminary results from this ongoing study suggest that exposure to wastewater is an important risk factor for skin diseases, especially dermatitis (eczema) of the hands and legs. So far we are unaware of any single biological or chemical agent in the wastewater that could cause skin disease in Phnom Penh. As in most other places, we are most likely dealing with a mix of agents and factors affecting skin conditions that may change over time and from place to place. The skin study will be further informed by the results from other research in the same area on environmental chemistry and toxicology of heavy metals. Through screening water and sediment for heavy metals we hope to assess and compare the impacts of relevant heavy metals to the findings of the study. Also, a rapid industrial survey of sources of industrial pollution in urban drainage systems will be carried out, including mapping of

industrial wastewater sources and key informant interviews, to obtain information about potentially harmful chemicals. Furthermore, the application of pesticides on crops is a well-known cause of certain skin and health problems and information about such usage will be collected and analysed in relation to the reported skin problems.

The initial findings suggest that the use of protective clothing may have potential to reduce the risk for skin problems and risk factor analyses will be used to assess the effect of such protective measures. Other similar PAPUSSA activities in Hanoi, Vietnam, show that farmers are increasingly using long rubber gloves and boots. Such protective measures were not popular in the past, but soft rubber gloves and boots that are easy to use and work with are now available at acceptable costs.

In addition to skin problem studies other research activities are being conducted or planned in Phnom Penh and Hanoi on, amongst other topics: wastewater treatment capacity of BC Lake in Phnom Penh and wastewater-fed aquatic systems in Hanoi microbiological (faecal pollution and enumeration of helminth eggs and protozoan parasites) and chemical (mainly toxic metals) quality of wastewater-fed fish and plants.

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References

- Gentile de L., Picot H., Bourdeau P., Bardet R., Kerjan A., Piriou M., Le Guennic A., Bayssade-Dufour C., Chabasse D. and Mott K.E. 1996. Cercarial dermatitis in Europe: a new public health problem? Bulletin of the World Health Organization 74: 159-163.
- Edwards P. 2001. Public health issues of wastewater-fed aquaculture. Urban Agriculture Magazine 3: 20-22.
- Mara D. and Cairncross S. 1989. Guidelines for the safe use of wastewater and excreta in agriculture and aquaculture. World Health Organization, Geneva.
- Muong S. 2004. Avoiding adverse health impacts from contaminated vegetables: Options for three wetlands in Phnom Penh, Cambodia. Ministry of Environment, Cambodia.