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A Microbial and Chemical Assessment of Abattoir Effluent Used for Vegetable Irrigation in Sokoto, Nigeria

A. A. Yakubu[*1], H. S. Garba[2] and S. A. Habibullah[3]

[1]Department of Agricultural Economics and Extension; [2]Department of Veterinary Medicine, Surgery, and Theriogenology and [3]Department of Veterinary Physiology, Pharmacology and Biochemistry, Usmanu Danfodiyo University, P. M. B. 2346, Sokoto, Nigeria

ABSTRACT

Wastewater from Sokoto Abattoir used for irrigation farming by vegetable farmers in Sokoto, Nigeria, was investigated with the aim of identifying the risk of microbial, parasitic and chemical contamination, which may have negative consequences on the health of consumers. The waste water from the abattoir at the point of irrigation was investigated using microbiological techniques. Elemental analysis was also conducted on the vegetables watered with the effluent. It was found that stagnant water in ponds around the abattoir were used by the butchers while the effluent flows through a natural channel into the river Dundaye and is being utilized along its course by vegetable farmers. Organisms found include pathogenic bacterial organism, proglottids of *Taenea* sp. and some helminth eggs among others. Vegetable sampled (*Amaranthus* sp. Garden egg and pepper) were found to have high iron content (17.7, 24.0 and 57.0 mg/100 g) and calcium 415.0, 25.0, 27.0, 560.0, 4.0 and 430.0 mg/100 g respectively.

Key words: Wastewater, microbial, chemical assessment, vegetable

INTRODUCTION

Irrigation using untreated wastewater is practiced in many countries (Arar, 1991) particularly where sanitation and treatment facilities are poorly developed (Anon, 1998). Wastewater is basically the waste suspended in water derived from industrial and other forms of economic activities. Concern about water quality for irrigation and the criteria as well as the standard for it assessment has been expressed in different parts of the world (Ayer *et al.*, 1985; Bamgboye, 1986; Bala, 2003). In Nigeria there has not been a comprehensive assessment of the quality of water used for irrigation despite the fact that most wastewater from industries and other economic activities discharge their effluent into ponds and streams used for drinking and irrigation by farmers in utter disregard for environmental regulations (Aguwambara, 2000).

Even though wastewater is known to contain some level of nutrients which may be beneficial to plants (Bernard, 2002; Anon, 2000) they do pose public health food safety problems resulting from contaminations with heavy metals, parasitic organisms and infectious agents (Babagana and Abubakar, 2000; Alonge, 2002).

This paper reports on the health problems associated with the utilization of effluent from the Sokoto abattoir, Sokoto, Nigeria, for vegetable farming.

MATERIALS AND METHODS

The Sokoto abattoir services the Sokoto metropolis with about 80 heads of cattle, 120 sheep and goats, 12 camels slaughtered daily. Water supply to the abattoir relies on a borehole, which is unreliable. The butchers often resort to the use of water from some stagnant ponds around the abattoir to clean up themselves, their meat and the abattoir. The effluent from the water drains into a collection chamber outside the abattoir premises and overflows through natural channels into streams to the river Dundaye. Along the stream, the effluent is used by the farmers for irrigation of vegetable farms along its course.

Sample of the effluent at the points of irrigation was aseptically collected in sterile bottles daily for one week (Monday to Sunday). The effluents were investigated for parasitic and microbial agents.

Direct smear and floatation techniques were employed to detect parasitic organisms while pathogenic bacteria

*Author for correspondence

were investigated through bacteriological techniques (Arar, 1991).

The levels of three (3) vegetable plants (*Amaranthus* sp., garden egg and pepper) watered by the abattoir effluent were collected and tested for phosphorus using the Bray number 1 method for phosphorus, Potassium, EDTA titration for calcium, and 1, 10-phenonthroline method for iron. Data obtained was compared to standard values as provided by Aduku, (1993).

RESULTS

Investigation of the effluent (Table 1) showed that apart from other impurities such as blood and scrap of flesh, fats, faeces and fore stomach ingesta among others, microscopic examination revealed presence of helminthes eggs (ascaris, cestodes and strongly egg) adult worms and oocyst. Bacterial organisms isolated (Table 2) included *Pasteurella* sp., *Salmonella* sp., *E. coli*, *Staphylococcus* sp., *Proteus* sp., *Streptococcus* sp and *Bacillus* sp.

The elemental analysis of the vegetable is presented in (Table 3). It was found that the level of iron was higher than the standard value, 17.7 against 8.9 mg/100 g, 5.7 against 2.6 mg/100 g and 2.4 against 1.3 mg/100 g for *Amaranthus* sp. Red pepper and garden egg respectively.

Table 1. Bacteria isolated from abattoir effluent at a point of irrigation

Water samples (Days)	*Staph*. sp	*Strep*. sp	*E .coli*	*Salmonella*	*Proteus* sp.	*Bacillus* sp.
1	+	+	-	-	+	+
2	+	+	-	-	+	+
3	+	+	+	-	+	+
4	+	+	-	-	+	+
5	+	+	-	+	+	+
6	+	+	+	-	+	+
7	+	+	-	-	+	+

- means not isolated; + means isolated

Table 2. Parasitic organisms identified from abattoir effluent

	Eggs/parasites				
Daily water Samples	Oocyst	Strongyle egg	Ascaris	Proglottids	Adult worms
1	+	+	-	+	+
2	-	+++	-	+	++
3	-	+	+	+	+
4	-	++	+	++	+
5	-	++	-	+	++
6	-	+	-	+	+
7	-	+	-	++	++

- means not isolated; + means isolated

DISCUSSION

The findings of this study are in consonance with studies carried out on a wide array of food crops (Shuval 1986; Abdulkadir 1993; Okereke 1998; Oyebode and Abdulkadir 2000; Kala et al., 2000). The impacts of wastewater irrigation on crops that are eaten raw such as lettuce or tomatoes are likely to pose greater health risk than crops that are cooked well. Lettuce is frequently contaminated with Listeria monocytogenes in other studies in Maiduguri. Epidemic and sporadic outbreaks of human listeriosis linked to food contamination by the organism have been reported in Canada, USA and Latin America (WHO, 1990).

Also presence of pathogenic bacteria such as *Staphylococcus* sp., *E. coli*, and *Salmonella* sp. may expose consumers to common enteric or gastric intestinal disease, particularly if this vegetables are improperly prepared,

eaten raw or unwashed.

Table 3. Elemental analysis (my/100 g) of the leaves of some vegetable plants watered by effluent from Sokoto abattoir

Vegetable	Fe	Ca	K	P
Amaranthus sp	17.7 (8.9)	41.5 (410)	560 (575)	97 (100)
Solanum	2.4 (1.3)	27.0 (19)	430 (440)	60 (61)
Melongena c*Capsicum* spp.	5.7 (2.6)	27.0 (19)	430 (440)	60 (61)

Figures in parenthesis are normal values of edible portion (Food and Nutrient Board, USA, 1968)

The presence of helminthes eggs and oocyst could constitute some risk to the farmers and consumers if ingested. This may be a source of disease to the community. Going by the life cycle of most helminthes, the eggs hatch by day 3 and the larvae released on the farms are likely to affect consumers.

Whereas effluent irrigation ensure re-use of resources and achieve the best treatment of municipal wastewater, efforts should be focused on maximizing the benefits, and on minimizing any detrimental effects to the environment, and to man himself.

The high iron content in the three vegetable analyzed, may be attributed to the blood that is carried in the abattoir effluent, since red blood cells contain a lot of iron. Even though, intestinal absorption of iron is regulated, body can accumulate abnormal amounts if there are larger amount of iron in the diet (Bloor, 1974). A general increase in iron levels in the tissues without any parenchyma cell damage (hemosiderosis) can lead to hemochromatosis, which is associated with cirrhosis, diabetes mellitus and brown pigmentation. The high calcium level recorded may be attributed to the increase of the mineral in the effluent. The other minerals K, and P do not seem to deviate much from the normal values (Aduku, 1993; Tomori and Obiloje, 2000).

It is therefore recommended that vegetables produced from irrigation with abattoir effluents should be hygienically treated before being consumed.

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