

Knowledge and Practices of the residents living along the Nairobi River Riparian on the use of the contaminated river for farming and its effects on animal reproduction

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Abstract: Residents practising pig farming along the Nairobi River Riparian in Kenyawere interviewed to evaluate their knowledge and practices on the use of the contaminated river for farming and its effects on animal reproduction. Eighty (80) farms were purposively selected and questionnaires administered to the pig owners as respondents. Majority (72.5%) were involved in urban farming as supplementary source of income while the rest had farming as their main occupation. Over a third of them (38.8%) had attained secondary level of education. Over forty percent (42.5%, N=34) respondents used the contaminated river for pig farming. The main reason cited for the use of the river water for farming were that it is a free source and readily available (N=20). The main reproductive effect noted on the male pigs was abnormally testes. The reproductive defect points towards environmental estrogen toxicant within the water of the Nairobi rivers suggesting the residents need to be made aware of the potential danger of the use of the contaminated water for farming.

I. Introduction

Farming is an important activity in many urban residences of the world (Lee-Smith, 2010). In African cities, an average of 35% of households engage in agriculture (Nabulo *et al.*, 2006) for food security, employment and re-use of wastes (Drechselet *et al.*, 2002). In Kenya, urban farming was identified as a response to limited alternative livelihood options. In urban farming river water; most often contaminated, is an important source of water (Drechselet *et al.*, 2002) despite the health and environmental risk associated with its use.

Informal settlements often lack connectivity to sewerage facility hence substantial volumes of domestic and industrial wastewater is discharged into surface water. Urban rivers are for this reason heavily polluted with toxic contaminants likely to affect users of such water. In many cities, urban livestock farming takes place in densely populated neighbourhoods and characterised by free range systems which require low inputs. The animals kept include ruminants, pigs, chicken, ducks, dogs and cats (Lupala, 2002). Among these, Pig farming is the most remarkable in urban slum areas of developing countries. Pigs are spotted rooting in garbage disposal points, wastewater drainage channels and rivers. Due to this, exposure to pollutants is possibly very high.

Urban draining rivers have been reported to be contaminated with Endocrine disrupting chemicals (Kolpin *et al.*, 2002) which are associated with adverse reproductive defects in aquatic organisms (Hecker *et al.*, 2002). In ruminants, adverse reproductive effects were reported on lambs whose mothers were exposed to low-level doses of a variety of compounds in sewage sludge (Paul *et al.*, 2005).

This study aimed at investigating the knowledge and perception of urban informal settlement pig farmers on the use of wastewater or effluent contaminated water on the reproductive health of boars.

II. Materials and method

Study area

The study was carried out in the informal settlements in Nairobi city, Kenya. The sites selected were Kibera, Mathare and Dandora. These locations were selected for the study for three main reasons; proximity to a city river, the physical appearance of the water and a high number of small holder pig keeping activities, with the animals scavenging in wastewater canal and polluted rivers.

Study design and data management

This was a cross-sectional study in which selected households were visited once for interview. A total of 80 Pig farms in informal settlements along the Nairobi River riparian were purposively selected for this study. A semi structured questionnaire was used to obtain information from the willing pig owners living not more than 50 metres from a visibly polluted river. An adult member of the family was picked as a respondent based on willingness to take the interview; this was regardless of the education status, gender and occupation. The interview aimed at establishing the use of contaminated water for pig farming and the knowledge on any noticed pig reproductive. Data collected were entered and later analysed using Microsoft office excel.

III. Results

Among the persons interviewed 21 (n=21) lived in Kibera informal settlement, 21 (n=21) lived in Dandora and 38 (n=38) lived in Mathare informal settlement. All were male and over thirty percent (38.8%) had attained secondary level of education. Over seventy percent (72.5%) were involved in urban pig farming as supplementary source of income while the rest practised pig farming as their main source of income (Table 1)

Table 1: Characteristics of the respondents surveyed

Variable	Category	Frequency	Percentage
Location	Kibera	21	26.3
	Mathare	38	47.5
	Dandora	21	26.3
Education status	Primary	24	30.0
	Secondary	31	38.8
	Tertiary	2	2.5
	Undisclosed	23	28.8
Occupation	Full time farming	22	27.5
	Part time farming	58	72.5

Among the people interviewed over forty percent (42.5%, n=34) respondents used contaminated river water for pig farming, the majority of which (n=21) being from Kibera while the rest (n=13) were from Dandora. Those others, mainly from Mathare used clean tap water for pig farming (Table 2).

Table 2: Preferred water source for pig farming among the respondents

Location of informal settlement	River/wastewater	Tap water
Kibera	21 (61.8)	0 (0%)
Mathare	0 (0%)	38 (82.6%)
Dandora	13 (38.2%)	8 (17.4)

Out of those farmers who used contaminated river water for pig farming, 14 (n=14) cited the reason for the use as being a free source while 20 (n=20) indicated also it was free and readily available (Table 3).

Table 3: Reasons given for use of contaminated water for pig farming

Location of informal settlement	Reasons for preferred source of water	
	Free source of water	Easily accessible
Kibera	10 (58.8%)	11 (44%)
Mathare	3 (17.6%)	5 (20%)
Dandora	4 (23.5%)	9 (36%)

The reproductive problem of abnormally retained testes was reported among the farms of respondents using contaminated water. The occurrence of retained testis was significantly higher ($p \leq 0.05$, n=22) in farms using contaminated river water (Table 4).

Table 4: Table showing the male defects reported in relation to the water source

Water source	Male defects		Total
	None	Retained testis	
Contaminated river water	12 (23.1%)	22 (78.6%) ^a	34
Tap water	40 (76.9%)	6 (21.4%) ^b	46
Total	52	28	80

A is significantly higher than b (p ≤ 0.05)

IV. Discussion

Access to contaminated river water has been shown to cause various health and reproductive problems (Bellinghan *et al.*, 2012). In this study, the main finding reported by the respondents is the problem of abnormally retained testes for the male pigs farmed using contaminated river water. This finding confirms earlier reports of similar reproductive abnormalities of testicular retention. Paul *et al.* (2005) demonstrated that prolonged exposure of ewes to water contaminated with sewage caused a disruption of testicular growth. Similarly, Svechnikov *et al.* (2014) indicated there is increased risk of having cryptorchid sons from mothers occupationally exposed to such contaminated water. This finding points towards effects of estrogen toxicant within the contaminated water, as previous studies of Svechnikov *et al.* (2014) demonstrated.

Endocrine disrupting chemicals with anti-androgenic (Stoker *et al.*, 2005) or estrogenic effects (Main *et al.*, 2007) have the potential of disturbing cellular events that control the testicular descent in humans (Svechnikov *et al.*, 2014). Consequently, sewage has been shown to contain a complex mix of several

chemicals(Paulet *al.*, 2005) which include these EDC and thus the potential to cause testicular retention upon prolonged exposure.

The respondents identified the ease of availability, convenience and no cost attached to its use as the main reasons for using contaminated river water to practise pig farming. Similar reasons have been reported before by those who used contaminated river water for irrigation (Ndunda and Mungatana 2013).

Conclusion

The reproductive defect reported by this study points towards environmental estrogen toxicant within the water of the Nairobi river suggesting the residents need to be made aware of the potential danger of the use of the contaminated water in farming.

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