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Open Access Journal of Veterinary Science & Research
ISSN: 2474-9222

Use and Possible Reproductive Effects of Contaminated River Water on Pigs Kept in Urban Informal Settlements of Nairobi City

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Short Communication

Volume 1 Issue 2

Received Date: July 08, 2016

Published Date: August 23, 2016

Abstract

Pig farmers in the informal settlements of Nairobi Kenya were interviewed to evaluate the use and possible effects of polluted river water on the reproduction of their boars. 80 farms were purposively selected and questionnaires administered to the pig owners as respondents. Among the persons interviewed a majority; (38.8%) had attained secondary level of education. 72.5% were involved in urban farming as supplementary source of income while the rest had farming as their main occupation. N=34, (42.5%) respondents used polluted river water for their pigs, with n=14 citing reason for its use as; free source while n=20 cited it as being easily available. The male reproductive defect reported was that of retained testis. The occurrence of retained testis in pigs was higher (n=22) among the group which used contaminated river water for their pigs. The study concludes that most households living in informal settlement of Nairobi city access and use polluted river water in their livestock especially the pigs. This is precipitated by the lack of knowledge on side effects, free and easy access of water and free range farming system adopted.

Introduction

Farming is an important activity in many urban informal settlements of the world [1]. In African cities, an average of 35% of households engage in agriculture [2] for food security, employment and re-use of wastes [3]. In Kenya, urban farming was identified as a response to limited alternative livelihood options. In urban farming wastewater is an important source of water [3] 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 discharge 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 [4]. 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 [5]

which are associated with adverse reproductive defects in aquatic organisms [6]. 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 [7].

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.

Materials and Method

Study area

The study was carried out in the informal settlements in Nairobi city, Kenya. The sites selected were Kibera, Motherland 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 during the entire study duration. A total of 80Pig farms in informal settlements were purposively selected for this study. A semi structured questionnaire was used to obtain information from the willing pig owner's 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 pigs and the reproductive problems suffered by the pigs due to access to effluent contaminated water. Data collected were entered and later analysed using Microsoft office excel.

Results

A total of 80 informal settlement households were interviewed in this study. Among the persons interviewed n=21 lived in Kibera informal settlement, n=21 lived in Dandora and n=38 lived in Mathare informal settlement. All were male and a majority (38.8%) had attained secondary level of education. 72.5% were involved in urban farming as supplementary source of income while the rest had farming as their main occupation (Table 1).

Variable	Category	Frequency	Percentage
Location	Kibera	21	26.3
	Mathare	38	47.5
	Dandora	21	26.3
Education status	Primary	24	30
	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

Table 1: Profiles of respondents in the survey on use of polluted river water for pig farming in the slum areas of Nairobi city.

Among the people interviewed34 (42.5%) respondents used contaminated river water/wastewater for their pigs, the majority of which (n=21) were from kibera while the rest (n=13) were from Dandora. Those who used tap water for their pigs were 46 (57.5%) and the majority of them (n=38) from Mathare slums (Table 2).

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)

Table 2: Water source preferred by pig farmers in the informal settlements of Nairobi city.

Out of those farmers who used contaminated river water/wastewater for their pigs, n=14 cited reason for its use as; free source while n=20 cited it as being easily available (Table 3).

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%)

Table 3: Reason given for use of wastewater/ contaminated river water in pig farming.

The male reproductive defect reported was that of retained testis. The occurrence of retained testis was higher (n=22) among the group which used contaminated river water for their pigs (Table 4).

Water source	Male Defects		
	None	Retained Testis	Total
Contaminated river water	12 (23.1%)	22 (78.6%)	34
Tap water	40 (76.9%)	6 (21.4%)	46
Total	52	28	80

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

Discussion

Results of the present study revealed that most pigs keepers in the areas surveyed were literate with majority having secondary level of education. The pig farming is operated on minimal inputs as earlier reported by Ishani [8]. This was evidenced by feed source identified by the respondents which included dumpsites, hotel remains while others left their animals to scavenge for food.

In the current study wastewater was mainly generated from households and small industries. Due to inadequate sewerage facilities the water ended up in drainage canals, streams and rivers where they are easily accessed by the scavenging pigs. In some areas toilets are put up directly on top of such canals or streams. Such scenes, of untreated sewage into streams, were reported in Zimbabwe and cited as a global source of river water pollution [9].

The respondents in Dandora indicated that they use only tap water supplied by the city council for their pigs while those in Kibera and Dandora admitted to their pigs accessing contaminated river water, either while scavenging or as availed to them. This finding is entirely due to the fact that most pigs kept in urban informal settlements are free roaming [10]. Additionally, the respondents identified the ease of availability, convenience and no cost attached to its use as the main reasons for contaminated river water use. Similar reasons have been reported before by those who used contaminated river water for irrigation [11].

Access to contaminated river water has been shown to cause various health and reproductive problems [12]. In the current study the respondents are aware of the possible health effects but not the reproductive effects of access to such waters. They however believe that pigs are able to buffer such effects.

Retained testis was reported as the most observed male defect, with 65% of those who used contaminated river water reporting having observed this condition in their male pigs while only 13% of those who used tap water reported the condition. This finding corroborates reports that access to contaminated river water is indeed a factor contributing to reproductive abnormalities especially testicular retention. A study by Paul, et al [7] demonstrated that prolonged exposure of ewes to sewage caused a disruption of testicular growth in their lamps. Similarly, Svechnikov, et al [13] in their review pointed out an increased risk of having cryptorchid sons by mothers occupationally exposed to pesticides during pregnancy. Other epidemiological studies showed links between environmental factors and cryptorchidism [13].

Endocrine disrupting chemicals with anti-androgenic [14] or estrogenic effects [15] have the potential of disturbing cellular events that control the testicular descent in humans [13]. Consequently, sewage has been shown to contain a complex mix of several chemicals [7] which include these EDC and thus the potential to cause testicular retention upon prolonged exposure.

The study concludes that most households living in informal settlement of Nairobi city access and use contaminated river water in their livestock especially the pigs. This is precipitated by the lack of knowledge on side effects, free and easy access of water and free range farming system adopted. Cryptorchidism was the main reproductive defect noted in the pigs accessing the contaminated river water. It is however important to note that the informal settlement residents viewed the river as a disposal site since it carries the waste away from them.

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