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Urban Agriculture Practices and Health Problems among Farmers Operating on a University Campus in Kumasi, Ghana

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Abstract. Urban agriculture, a world-wide practice, faces both environmental and health challenges. Farmers are susceptible to occupational and other water-related health risks. The research identified health problems related to urban agricultural farming through farmers' social characteristics and agricultural practices. Thorough interviews, using structured questionnaires, were carried out. Sixty three farmers responded to questions ranging from agricultural practices to health problems encountered. The findings showed that farmers apply both organic and inorganic fertilisers while 97% used pesticides of varying active ingredients at different application rates. Only 10% used personal protective clothing during the application of pesticides. Overhead irrigation was carried out using a watering can. Eighty four percent and 13% of the respondents utilised water from shallow wells and shallow wells mixed with contaminated stream, respectively. Besides schistosomiasis and cholera, other bacterial diseases, nematode infections, malaria, headaches, dermatological, visual, cardiac, and respiratory problems were common health complaints. Headache complaints were the most common (75%).

Keywords. Urban agriculture, irrigation, pesticide, disease.

1 Introduction

In the urban areas the use of wastewater in agriculture is a centuries-old practice that is receiving renewed attention with the increasing scarcity of freshwater resources in many arid and semiarid regions. The growing wastewater volumes are driven by rapid urbanization (Scott *et al*., 2004). Africa's rate of urbanization is estimated to be about 3.5% per annum, which is one of the highest in the world (UN Population Division, 2004). Also, by 2015 there will be 25 countries in Sub-Saharan Africa with higher urban than rural populations (UN-HABITAT, 2001). The upsurge of urban populations has far outpaced urban sanitation infrastructure (Obuobie *et al*., 2006).

According to WHO (2005), about 3 billion people lack access to adequate sanitation and 5 million people die annually due to lack of adequate sanitation. About two-thirds of the population in the developing world have no hygienic means of disposing of excreta with even a greater number lacking an adequate means of disposing of wastewater (UNDP, 2002). The millennium development goals seek to decrease the number of people without access to adequate sanitation by 50% by the year 2015 (Cosgrove and Rijsberman, 2000). In order to meet these goals, about 460,000 people must be provided with improved sanitation daily (WHO, 2005). About 18% of Ghana's population has improved sanitation coverage and 75% has improved drinking water coverage, an improvement on previous data (1990) (WHO/UNICEF, 2006).

Most urban centres in Ghana have no means of treating wastewater and the sewage network serves 4.5% of the total population (Ghana Statistical Service, 2002). Thus the bulk of the generated wastewater enters the environment without treatment. This is likely to contaminate water bodies. However, urban vegetable farmers in search of water for irrigation often rely on wastewater for year-round production. Other available water sources used are shallow (dugout) wells, pipe-borne water, and inland valley (Obuobie *et al*., 2006).

Wastewater irrigation has created a convenient means of disposing waste products, adding valuable plant nutrients and organic matter to the soil (van der Hoek *et al*. 2002), and improves urban food (vegetable) security (Sawio and Spies, 1999) and the livelihood of farmers and traders as well (Keraita *et al*., 2008). However, the environmental and public health risks posed by wastewater irrigation are alarming, especially when untreated and/or partially treated wastewater is used for such purposes. The microbial quality of vegetables is equally alarming. This is due to the presence of pathogenic microorganisms (bacteria, viruses, helminths, and protozoa).

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The harmful human microbial pathogens most frequently detected in wastewater are of enteric origin. Enteric pathogens enter the environment through the faeces of infected hosts and can enter water through defecation into water, contamination with sewage effluent or run-off from soil and other land surfaces (Feachem *et al*., 1983). Wastewater can potentially be responsible for several diseases and conditions resulting from infection with these pathogens. These include typhoid (*Salmonella* spp.), dysentery (*Shigella* spp. and *Entamoeba hystolytica*), gastroenteritis (enteropathogenic *Escherichia coli*), diarrhoea, vomiting (*adenovirus, rotavirus, Cryptosporidium parvum, Giardia lamblia*, and *Trichuris trichiura*), cholera (*Vibrio cholera*), and ascariasis (*Ascaris lumbricoides*) (Yates and Gerba, 1998). The pathogens are transmitted by direct contact to farmers and also to the general public through consumption of irrigated produce, especially crops eaten raw (Blumenthal *et al*., 2000).

In addition, the use of pesticides in urban agriculture has adverse health effects on the farmers such as impotency in men and infertility in women in Ghana (Mensah *et al*., 2001). The use of watering cans for manual irrigation induces muscle pain. Occupational risks in urban agriculture are relatively high. It is therefore expedient to ascertain the health problems encountered in urban agriculture. The objective of this research was to identify health problems related to urban agricultural farming through farmers' social characteristics and agricultural practices.

Kumasi is the capital town of the Ashanti Region and the second largest city in Ghana with a population of 1 million and an annual growth rate of 5.9% (Ghana Statistical Service, 2002). It represents the middle belt of Ghana. Kumasi has a total area of 225 km² of which about 40% is open land. Kumasi has a semi-humid tropical climate and lies in the tropical forest zone with an annual mean rainfall of 1420 mm and a mean monthly temperature ranging from 24°C to 27°C.

2 Materials and methods

2.1 Study area

The study was carried out on the Kwame Nkrumah University of Science and Technology (KNUST) campus, Kumasi, Ghana. The University is located in the eastern section of the Kumasi metropolis (MLGRDE, 2006). The University's plots of land, which are undeveloped, are used for vegetable farming by both immigrants from rural areas and the indigenous community. There were five major identifiable urban vegetable farming sites on campus. These farming sites are:

- Behind the Materials Engineering, and Environmental Quality Engineering Laboratories,
- Behind the KNUST School of Business (KSB),
- Between the School of Medical Sciences and KSB,
- Areas around the University Sewage treatment plant, and
- Areas around the entrance of the University at Ahinsan gate.

Farmers are involved in all year-round irrigated vegetable farming, which is a commercial market-oriented activity. High valued and easily perishable exotic vegetables, which include lettuce, carrot, cabbage, spring onions, green pepper, and cauliflower, are cultivated on raised beds. The sources of irrigation water are shallow wells and streams. Irrigation is carried out with buckets and watering cans. Some farmers also use motorised-pumps with hose pipes.

2.2 Data collection

Data for the research were collected using questionnaire surveys. Structured questionnaires were administered during the surveys. The questionnaires were composed of general information and social profile, agricultural practices, and health. The respondents were farmers and other farm workers (labourers) who have been employed and worked for at least 6 months. In all, 63 respondents were interviewed. During the structured interview, the researcher went to the farms and filled out the questionnaires based on the answers of the respondents. The interview was conducted in the dialect of the respondents.

2.3 Data analysis

Data was analysed using Statistical Package for Social Science (SPSS) for Windows 16 and Microsoft® Office Excel® 2007.

3 Results and discussion

3.1 Social characteristics

Majority (98%) of the farmers practicing urban agriculture were males. Females were not so much involved in the vegetable farming. Sixty three percent of the farmers were in the age bracket of 21 to 40 years (fig. 1). Farmers above the age of 60 years were retirees and have never had any formal education. Urban agriculture on KNUST campus is predominantly practised by youths who want to make a living out of it.

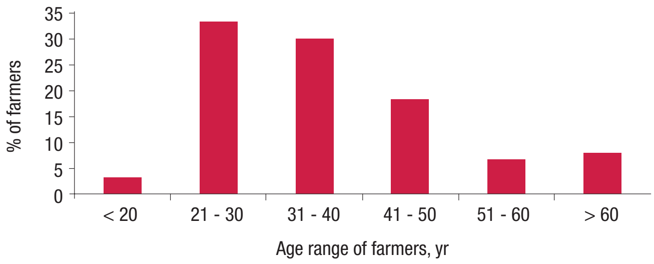

Figure 1. The age of farmers in urban agricultural farming on KNUST campus

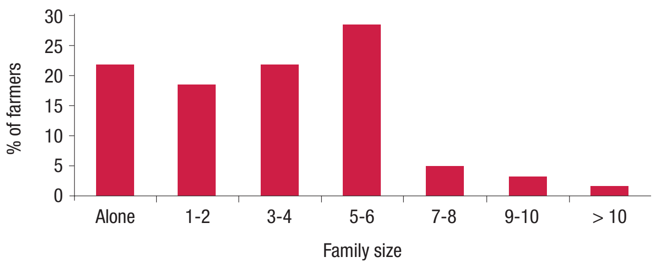

Figure 2. Family size of farmers on KNUST campus

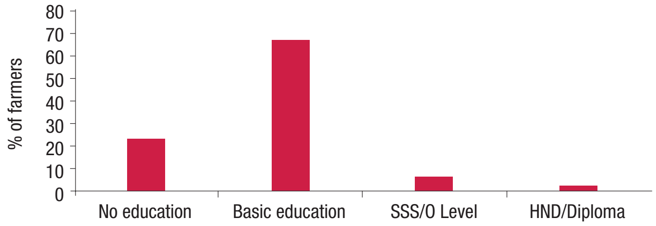

Figure 3. Educational Level of urban agricultural farmers on KNUST campus

Drechsel *et al*. (2006) also in their survey comparing 20 cities in West Africa reported similar results of male dominance in Ghana. Male predominance in vegetable farming on KNUST campus may be due to the nature of the farming. Irrigated vegetable farming is laborious. It can also be attributed to cultural and economic constraints as well as access to land (Obuobie *et al*., 2006; Zibrilla and Salifu, 2004).

Though 78% of the farmers had families (nuclear family) - that is married (fig. 2), none of the members of the (nuclear) family was involved in the farming. Most had their wives and children into other occupation and education respectively.

Obuobie *et al*. (2006) reported that more than 50% of farmers in Accra, Kumasi and Tamale were married. There was a significant difference ($p \leq 0.05$; $\alpha = 0.00$) between the age of farmers and their family size. Ninety two of the farmers who were alone were less than 30 years. The older farmers had the largest family. Farmers with family size greater than 6 were predominantly (100%) above 60 years.

About 67% of the farmers have dropped out or completed the basic education level (fig. 3). That is, 90% of the farmers were almost illiterate.

Obuobie *et al* (2006) also reported of high illiteracy among open-space urban farmers in Ghana. This may be due to the fact that most farmers learn from their parents in the rural areas and in their quest to make money in the urban centres engage in urban agriculture on any available land. There was significant difference ($p \leq 0.05$; $\alpha = 0.011$) between education and age of farmers. About 95% and 89 % of the farmers in the age bracket of 21-30 and 31-40 years respectively at most completed basic education. There was statistical significance ($\alpha = 0.036$) between famer's education and family size, family sizes increased with low education. This may be because the illiterates do not practice family planning and therefore produce more children.

Farmers who were engaged in other work were 37%. These farmers were either workers on campus (cleaners, security men, technicians) or off campus (drivers, masons, carpenters, electricians). Majority of these farmers (52%) were below 41 years since they have the strength to work more for money though no significant difference ($p \leq 0.05$) was detected between age of farmer and farmers' involvement in other work.

3.2 Agricultural practices

3.2.1 Time Spent

Time (h) spent on the farm each day is shown in fig. 4. The figure illustrates that majority of the farmers spend more than 8 h a day. These figures change at times since reporting and departure times are from time to time inconsistent. Farmers often spent less time on the farm or do not go to farm when the rains set in. Time spent on the farm depends on the work for the day, the size of the farm, the labourers available, and farmer's involvement in other work aside farming. These reasons also correspond with time spent on irrigation. Seventy three percent of farmers who have other work to do, worked 12 h or less a day. Nonetheless, there was no significant difference ($p \leq 0.05$). Depending on their duty period, they either started work late or close early. There was significant difference ($\alpha = 0.00$) between farmers' education and time spent on the farm. Farmers of higher education did not spend a lot of time on the farm a day. This may be due to their knowledge of the risk involved in overworking the human body.

About 53%, 45% and 2% of the farmers spent 7, 6, and 4 days a week respectively on the farm. This means majority of the farmers have adopted urban agriculture as a full time work.

Farmers had a wide range of experience and different period of year(s) in which they had cultivated on the same piece of land (fig. 5). About 73% of the farmers had spent between 1 to 10 years in vegetable farming inferring that people are always going into urban vegetable farming mainly for monetary gains.

Farmers' age was significant ($p \leq 0.05$; $\alpha = 0.032$) with the period of cultivation on the same piece of land. The maximum period of years spent by farmers < 20 years was 1-5 years while farmers above 60 years were > 20 years. If farmers continue this practice in old age and new farmers enter this business as anticipated, space for urban farming will be highly limited especially so when land on the University campus is being rapidly developed. Farmers should begin to look for other areas or negotiate with the University for land.

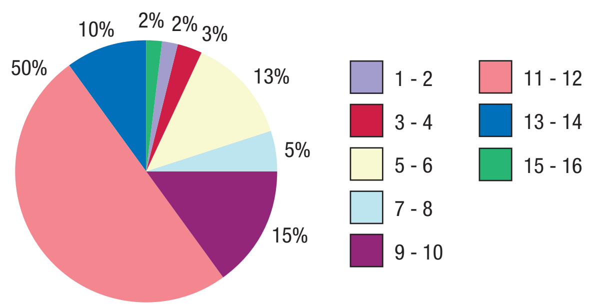

Figure 4. Time spent by farmers on the farm daily (h)

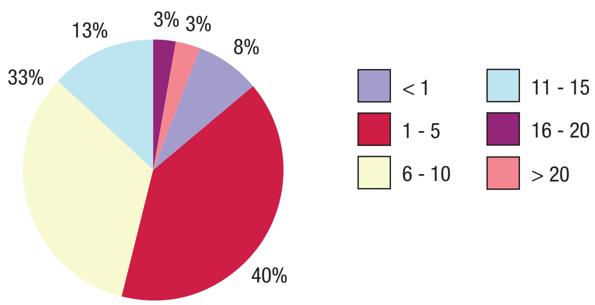

Figure 5. Farmers who have cultivated the same land for period of time (yr)

3.2.2 Fertiliser and Pesticide Application

Fertiliser adds nutrients to the soil for high yields of vegetables, improves the soil structure and water-retention capacity within the root zone, increases aeration of the rooting medium, lowers bulk density, and holds major nutrients like nitrogen (N) and phosphorus (P) (Martin *et al*., 2006; Williams *et al*., 1991). Fertilisers applied by at least every farmer were either organic, inorganic, or both (table 1).

Table 1. Types of fertiliser used by farmers

Type of fertiliser used	Percentage (%) of farmers
Organic only	53.3
Inorganic only	3.3
Organic and inorganic	43.3
None	0

Organic fertiliser used was predominantly poultry manure; which was also the most predominant fertiliser used by farmers because it is relatively cheap and easy to acquire. This confirms what was reported by Keraita *et al*. (2008) that poultry manure is predominantly used in Kumasi by urban agricultural farmers. Inorganic fertiliser, on the other hand, used, was predominantly N-P-K, 15-15-15. Inorganic fertilisers were often used by farmers cultivating cabbages and aubergines (garden eggs).

Farmers using both types of fertiliser were into mixed vegetable cropping. The frequency of fertiliser application per farming season by farmers is shown in table 2.

Table 2. Frequency of fertiliser application per farming season

Frequency of fertiliser application per season	Percentage (%) of farmers
1	70
2	20
3	3
4	5
Conditional	2

The respondents in the category of conditional, applied fertiliser as and when necessary, an indication of inconsistencies in the use of fertiliser. Farmers who applied the fertiliser more than once were often the inorganic fertiliser users. The vegetables cultivated by these farmers take up to or more than 3 months to mature for harvest, and this accounts for the frequent application.

Although there was no significant diference between period of years of cultivation and fertiliser types and their frequency of application, in all category of period of years of cultivation the most used frequency of application is once per cropping season. This is because the farmers were using poultry manure and apply it to mainly lettuce once. That is new farmers are learning from the old and experienced ones. There was significant difference ($p \leq 0.05$) between the type of fertiliser used and the frequency of application of fertiliser.

Ninety seven percent (97%) of the respondents used different types of pesticides (table 3) whiles 3% did not apply pesticides of any kind. The reasons given by the latter were adoption of better farming practices which prevented fungi, insects, or other pest infestation; the health risk associated with the use of pesticides; and financial constraints.

Table 3. Some pesticides used by farmers on KNUST campus and their active ingredients

Name of pesticide	Active ingredient
Attack - Broad spectrum insecticide	Emamectin benzoate 1.9% (w/v) EC, Non hazardous ingredients 98%
Benco	Mancozeb 80% w/w
Bendazim	Carbendazim 500 g/kg
Bossmate 2.5 EC	Lamba cyhalothrin 25 g/L
Champion	Cupric hydroxide 77% (active), Inert ingredient 23%
Cobox	Cupric hydroxide, Benomyl, Phosphate, Nitrogen, Trace element
Cobre Sandoz	Cupric oxide 56% w/w (equivalent to 50% w/w pure Cu metal
Conti-zeb “5” 80% WP	Mancozeb 80%
Foko	Mancozeb 800 g/kg
Golan SL	Acetamiprid 200 g/L
Hercules 50sc	Fipronil 50g/L
Ivory 80WP	Mancozeb 800 g/kg
Kadmaneb	Maneb 800 g/kg
Kilsect 2.5 EC	Lamba cyhalothrin 25 g
Maneb 80 WP	Maneb (Manganese ethylenebisdithiocarbonate 80%, Other ingredient 20%
Mektin 1.8 EC	Abamectin 18 g/L
Nordox 75 WG	Cuprous oxide 86%, Inert ingredient 14%
Percal 186 EC	Cypermethrine 36 g/L EC, Proferifos 150 g/L
Power	Glyphosphate 41% SL (in a form of 480 g)
Suncozeb	Mancozeb 80% w/w
Topsin- M	Thiophanate methyl 70%
Trimaneb	Maneb 800 g/kg WP

Majority applied the pesticides weekly because that is what they perceived to be the right frequency of application or the norm adopted by experienced farmers. They applied whether there were pests' infestations or not. They desire to avoid problems associated with pest, fungus, or insect that will minimise yield. The inconsistent appliers used pesticides when they observe anomalies in the vegetables and also when money and/or stock are available. Farmers applying pesticides every 3, 4, and 5 times a week often encounter pests, fungi, or insects infestations on the farm culminating in the frequent use of pesticides.

The farmers who were advanced in age frequently applied pesticide than the youth as detected in their significance ($\alpha = 0.002$). This may be due to the consciousness and perception of the youth on the risk of frequent usage of pesticide. Also, statistical significance ($p \leq 0.05$; $\alpha = 0.002$) existed between years of cultivation and pesticide application. Statistical significance ($\alpha = 0.028$) shows that farmers who were new in the practice frequently applied pesticide. They may probably not be able to differentiate between diseased and pest-infected vegetables and none infected ones. Ninety percent of the farmers who worked for 6-7 days a week applied pesticide weekly or less, that is to say a lot of money will be spent on pesticide decreasing profit. In addition, farmers who were not frequently applying fertiliser were not also frequent in the application of pesticide. This was significant ($\alpha = 0.011$). The farmers learn from each other.

3.2.3 Personal Protective Clothing

Personal protective clothing (PPC) is worn by farmers to protect them from hazards associated with vegetable farming. During the questionnaire survey, the PPC mostly owned by farmers was a pair of boots (fig. 7).

A pair of boots is affordable and readily available on the market. Although most farmers owned a pair of boots, it was not often used during all farming activities with the exception of pesticide spraying. Reason cited was inconvenience or discomfort in working with it. The reason is not different from that of farmers in Accra (Keraita *et al*., 2008). Other PPC used were a pair of goggles, a pair of gloves, and nose mask. Others did not have any of the PPC citing lack of finances as their reason.

There is significant difference between PPC worn during pesticide application and farming days per week (α=0.001) as well as farming year (α=0.028). These were worn due to the perceived hazard. Also significant difference was detected between PPC worn and both the use of pesticide (α=0.00) and frequency of pesticide application (α=0.016). The frequent pesticide appliers wear at least a pair of boots as protection mechanism against risk. However, other farmers had none of the PPCs. The higher rating of risk associated with pesticide use could be attributed to the high level of awareness created by Non Governmental Organisations (NGO) in advocating for Integrated Pest Management (IPM) (Keraita *et al*., 2008). Only 10% of the farmers used all PPC when applying pesticides.

3.2.4 Irrigation Practices

Sources of water used by farmers for irrigation included shallow wells (84%), stream (3%), and shallow wells mixed with

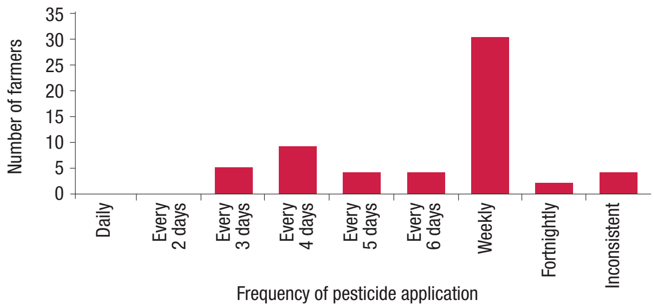

Figure 6. Frequency of pesticide application

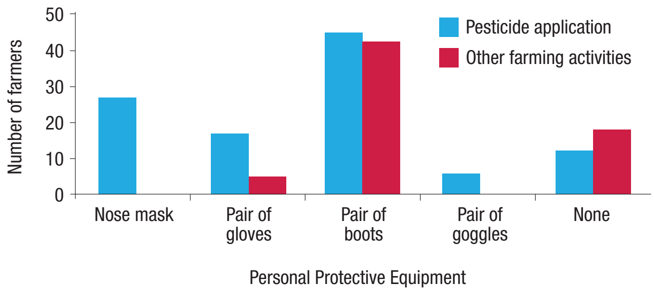

Figure 7. Personal Protective Equipment used by farmers

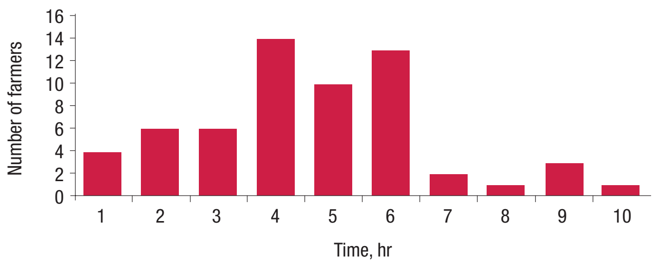

Figure 8. Time spent on irrigation daily

contaminated stream (13%). For farmers supplementing their shallow wells with wastewater, wastewater provided reliable water supply because flow is relatively continuous. These farmers have channelled the wastewater (stream) into their shallow wells. Irrigation is predominantly carried out using watering cans (88%), which is manual overhead irrigation method (Obuobie *et al*., 2006). Irrigation often started as early as 5am (often the reporting time to work). Though majority irrigated their vegetables once a day, others preferred twice. The latter took place early in the morning (5am) and the afternoon (2pm). Irrigation often takes 40 – 62% of the time farmers spent on the farm. Drechsel *et al*. (2006a) reported 40 – 75% as time spent by farmers in Kumasi on irrigation.

Irrigation in the rainy season took place once. Watering is not a necessity after heavy down pour; however this is done to wash soils away from vegetables, especially lettuce leaves, so that they do not make permanent brown spot (Keraita *et al*., 2008). Figure 8 illustrates the time spent on irrigation.

There was statistical difference ($p \leq 0.05$; α=0.005) between the type of irrigation water and age of farmers. Majority (66%) of the farmers using shallow wells were the youths. The youths are energetic and are able to dig shallow wells to exploit groundwater. The use of shallow wells was relatively high among farmers who were not using any PPC during irrigation. There is a significant difference (α=0.000). This may due to the perception that shallow wells are of higher quality and less hazardous. This is deceptive since microbiological assessment of irrigation water showed high levels of faecal coliform and helminth egg (Ackerson and Awuah, unpublished) contamination. Majority of farmers (62%) who were not owning any of the PPC irrigated twice a day (significant, α=0.000). About 26% (majority) of these farmers irrigated 6 h a day although no significant difference was detected. These farmers are exposed to high risk. This confirms the report by Blumenthal and Peasey (2002) that the greatest risk for farm workers in wastewater-irrigated agriculture is intestinal nematode infections.

3.3 Health complains

Farmers in one way or the other have been exposed to one or more of the diseases of concern. Types of diseases and frequency of contraction had a wide spectrum of variation (fig. 9 and 10). Majority of the farmers interviewed (100%) have never contracted schistosomiasis and cholera since going into vegetable farming. Cholera was supposedly not recorded because farmers might have misconstrued it for other diarrhoeal diseases and aware of its fatality may refuse to identify it so.

In addition, the failure of farmers to seek medical diagnoses is a contributing factor. Only 53% sought medical attention from the hospital, while 32% and 7% go to the chemical seller/“drug store” and employ self medication respectively. The other 8% opted for any of the three alternatives as and when necessary.

Farmers may also in the near future contract schistosomiasis if there are no health interventions for them. *Schistosoma* parasites were isolated in both the irrigation water and lettuce (Ackerson and Awuah, unpublished) and they are capable of penetrating the skin (WHO, 2006). Also, the water snails that harbour the parasites were found in large quantities in the shallow wells.

With the exception of headache, majority of the farmers (40 – 94%) had not contracted any of the categories of diseases. One factor which might have influenced farmers’ responses to the health-related questions could be defensive strategies.

Keraita *et al*. (2008) reported that responsive strategies are as a result of negative media reports. Denial and defensive strategies can greatly hinder risk communication (Peres *et al*., 2006). Since farmers were formally prosecuted by health directorate, especially in Kumasi and Accra, which is not so now (Obuobie *et al*., 2006), this might as well informed their responses, though health risk may have been minimised. Covello and Johnson (1987) also reported that risks are exaggerated or minimised according to the social, cultural, and moral acceptability of the underlying activities.

Headache had the highest health complains (70%) among farmers. About 54%, 11%, and 5% of the respondents complained of headache once a month, once a week, and more than once a year respectively. This may be linked to manual water fetching and irrigation with watering cans which are very laborious and induce stress resulting in headaches. However, there was no statistical difference (p≤0.05). There was statistical difference (p≤0.05) between headache and education. There was however significant difference (p≤0.05) between headache and malaria. One of the symptoms of malaria is headache (Beare *et al*., 2006). Frequent occurrence of malaria may have increased the complaints of headache.

Water-related diseases like diarrhoea, typhoid fever, and guinea worm were diseases identified by respondent farmers to have ever suffered from. Only 6% had suffered from guinea worm and typhoid fever comparable to diarrhoea (24%). The incidence of guinea worm can exacerbate since cyclops were frequently seen in the irrigation water. The Ministries of Agriculture and Health ought to act promptly to control the cyclops in the irrigation water. Farmers must also wear a pair of boots during irrigation. The causes of diarrhoea and typhoid fever could be attributed to lack of improved water supply and low sanitation practices at homes. Typhoid fever may be the result of the consumption of vegetables. There was a significant difference ($p \leq 0.05$) between typhoid and number of farmers consuming vegetables and the type of water for washing vegetables. About 49% of the farmers who consumed their vegetables complained of typhoid. Different types of methods were used to treat vegetables (fig. 11) to remove dirt and decontaminate them. Laboratory analysis showed that the vegetables (lettuce) were microbiologically contaminated. During the survey majority of the farmers (95%) consumed their produce and 98% out of this number washed the vegetables before consumption.

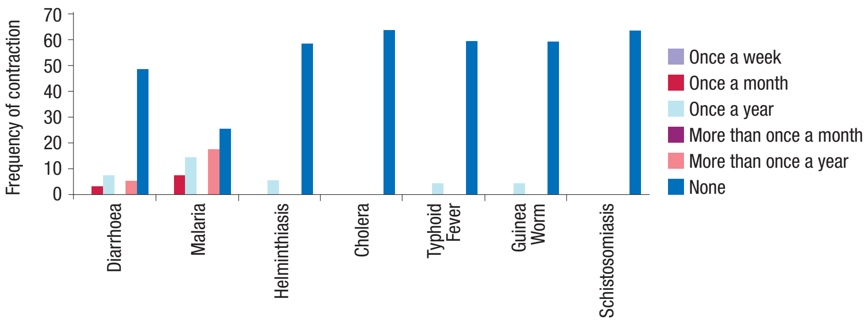

Figure 9. Health complains among urban agricultural farmers on KNUST campus

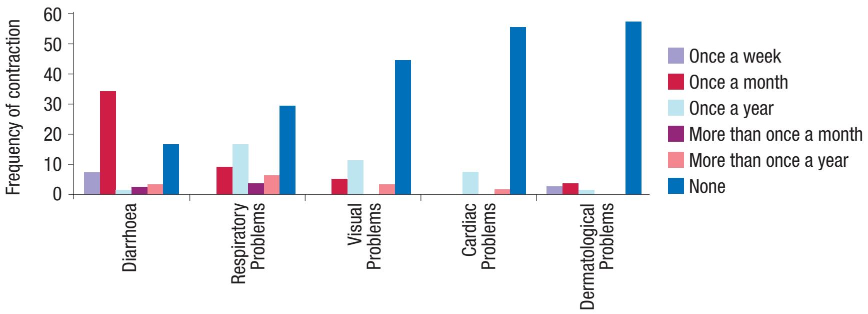

Figure 10. Health complains among urban agricultural farmers on KNUST campus

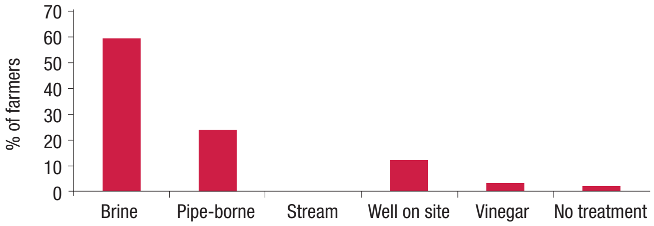

Figure 11. Treatment methods used by irrigated vegetable farmers on KNUST campus to wash vegetables

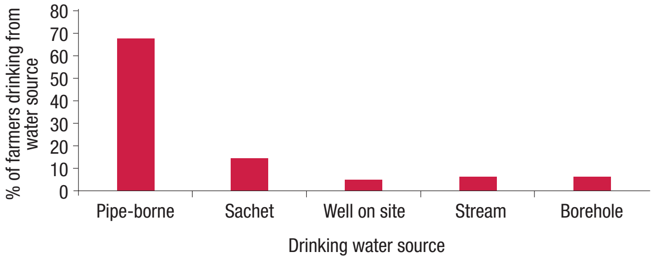

Figure 12. Sources of drinking water used by farmers on KNUST campus

Twelve percent washed with already contaminated on-site shallow wells. The number of farmers using brine was relatively high (59%) because of the periodic education undertaken by research institution like International Water Management Institute (IWMI).

Although different sources of water were used for drinking purposes by the farmers (fig. 12), there was no correlation of drinking water sources with neither typhoid nor diarrhoea. About 5% and 6% of the farmers drank water from the well on farming sites and streams respectively. Farmers perceived these sources of water as clean in view of the fact that they are visibly clean while laboratory assessment showed that microbial contamination levels were relatively high (Ackerson and Awuah, unpublished).

Helminthiasis was on the low side (8% of farmers get infected once a year). This is due to the intake of anti-helminth drug by majority of the farmers (67%). There was significant difference between helminthiasis and anti-helminth drug intake. Also, statistical difference was shown between helminthiasis and irrigation water used, periods of irrigation and frequency of fertiliser application. Farmers irrigating with stream (wastewater) as well as irrigating both in the morning and evening complained most of helminthiasis. The later may be due to frequent exposure to contaminated irrigation water.

Complains of malaria, the second highest (60%) complained disease, among farmers was relatively high. About 27%, 22%, and 11% of the farmers have suffered from malaria at least more than once a year, once a year, and once a month respectively. No significant difference was observed between complains of malaria and any agricultural practice or social characteristics. This may be due to the fact that malaria is contracted at home by farmers with insanitary environment creating breeding sites. Irrigated urban agriculture increases the urban malaria risk by creating breeding sites for the Anopheles vector (Klinkenberg *et al*., 2005; Afrane *et al*., 2004; Keating *et al*., 2004). In Kumasi and Accra researches conducted showed that malaria prevalence is inversely proportional to the distances of communities from the farming sites (Klinkeberg *et al*., 2008; Klinkenberg *et al*., 2006; Klinkenberg *et al*., 2005; Afrane *et al*., 2004). Therefore, farmers' nearness to irrigated farming sites, and poor sanitation and drainage practices at homes may account for the high incidence of malaria.

Dermatological, visual, cardiac, and respiratory problems were the other health problems mentioned. Statistical significant differences existed between respiratory disease and irrigation water used; visual disease and frequency of fertiliser application; and heart disease and year of farming. Although many studies have showed that exposure to pesticide has long-term health problems such as dizziness, eye problems (Ecobichon, 1996), respiratory problems, memory disorders, dermatologic conditions (Arcury *et al*., 2003), and neurological defects (Cordes and Rea, 2005), no significant difference was shown between these diseases and the use of pesticides.

4 Conclusions

Young people mostly with basic level (JHS/JSS) education were found practicing urban agriculture on KNUST campus. Most (77%) spent long hours on their farm (plot). Farmers used chemical fertiliser and poultry manure for crop production. Application of pesticides was practiced by majority (97%) of the farmers. The diseases most farmers complained of were headache (70%), malaria (60%) as well as helminthiasis. The study showed that the age of farmers had effect on respiratory and heart diseases as well as helminthiasis. The study revealed that the age of farmers had effect on respiratory and heart disease as well as helminthiasis.

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