

Community perceptions of human excreta as fertilizer in peri-urban agriculture in Ghana

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Abstract

Although human excreta contain the necessary nutrients for plant growth, local authorities in Ghana spend huge sums of money to dispose them as waste. Reusing excreta for agricultural purposes saves expenditure for chemical fertilizers, improves soil fertility, reduces poverty and ensures food security. People's attitudes and perceptions about excreta vary between cultures and even within specific cultures. This study aimed to explore attitudes and perceptions among a peri-urban agricultural community towards sanitized human excreta and its use. The study adopted an exploratory design and collected data from 154 randomly selected households using questionnaires and focus group discussions. It was found that there is a general negative attitude to fresh excreta and the handling of it. However, the residents accept that excreta can be used as fertilizer, but they are not willing to use it on their own crops or consume crops fertilized with excreta. The study recommends open discussions in the community for a successful implementation of ecological sanitation.

Keywords

Sanitized excreta, perceptions, ecological sanitation, peri-urban, nutrients, reuse

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Background

Peri-urban agriculture is gradually becoming heavily dependent on chemical fertilizer due to decreasing soil fertility and land space (Asare et al., 2003). However, conventional chemical fertilizers are becoming more expensive (Cordell et al., 2009) and they have the potential to pollute both surface and ground water and cause accumulation of heavy metals in the soil. As a result, there have been calls by environmental civil society organizations and experts to look for alternative fertilizers that can increase food production. To minimize the use of chemical fertilizer and its associated pollution, agricultural engineers and scientists have, for some time now, advocated the use of organic manure (both human and animal) as alternatives to chemical fertilizer. Whereas animal manure can be obtained from the fields and farms, human excreta form part of the total household waste or wastewater, and hence need to be collected and treated (sanitized) before use in agriculture.

Household wastewater can be divided into three fractions by origin; urine, faeces and greywater. In spite of its small volume, only some 1.5 L per person per day (Hellstrom and Karrman, 1996), human urine contributes most of the

nutrients to household wastewater; 80% of the nitrogen, 55% of the phosphorus and 60% of the potassium (Jonsson et al., 2000; SEPA, 1995). The second most nutrient-rich fraction is the faecal matter. This fraction (faeces and toilet paper) has the smallest mass of the three, approximately 60 kg of wet weight per person-year (Vinneras, 2002). If these nutrients in human excreta are reclaimed using hygienically safe pathways, they can be used locally as a fertilizer for sustainable agriculture.

Traditionally, human excreta have been used for crop fertilization in many countries including Japan, China and Sweden. For example, in Japan the recycling of urine and faeces was introduced in the twelfth century and in China fresh human and animal excreta have been applied to fields

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for thousands of years (Esrey et al., 1998). Numerous ancient Arab, Chinese, Greek, Roman and Spanish authors extolled the benefits of human manure, and some gave specific instructions on how to process it and get a product that was odourless and useful as a fertilizer (Thurston, 1992). Vinneras et al. (2006) have provided convincing evidence to support the fact that crop yields resulting from the use of human manure are very large.

However, the use of sanitized human excreta for agricultural purposes is not widespread in most African countries, and Ghana is no exception. In Ghana, for instance, excreta are perceived as waste and municipal authorities spend huge sums (50–75% of municipal budget) to dispose the ever-increasing amounts of waste, including wastewater and solid waste (Cofie et al., 2005). While this essential organic manure is thrown away, the government spends scarce foreign exchange to import chemical fertilizer. Ecological sanitation is a new paradigm in sanitation that recognizes human excreta and water from households not as a waste but as resources that can be recovered, treated where necessary, and safely used again (WHO, 2006). New affordable technologies based on ecological sanitation, which save water, recycle local nutrients and extract energy, provide sustainable options for all, both in rich and in poor countries.

Actual use of human excreta for agricultural purposes depends on how people perceive them. Mary Douglas (1966) maintains that 'dirt is matter out of place' and the same matter is viewed as dirt in some places and not dirt in other. As Gibson (1979) aptly puts it: 'perceptions determines our behaviour (what we perceive determines what we do next)'. Against this background, this paper assesses community perceptions regarding the use of human excreta for peri-urban agriculture. Specifically, the paper explores residents' knowledge, attitudes and perceptions towards fresh human excreta; assesses residents' level of knowledge on the utilization of human excreta; and then draws implications for ecological or sustainable sanitation in Ghana.

Rationale for the study

The findings from the study would provide an understanding of the social and mental fabric concerning people's perception towards the use of human excreta herein referred to as ecological or sustainable sanitation. This understanding would offer an avenue for sensitizing residents towards using human excreta and to indicate the entry point for the introduction of the ecological or sustainable sanitation concept in Ghana, hence improving sustainable livelihoods and reducing poverty.

Furthermore, the study findings would provide environmental planners and other professionals with understanding of the perception of communities on environmental practices. As Drangert (2004) points out, health risks and recirculation of nutrients may be instrumental in enlightening authorities

about motivational factors behind people's acceptance or rejection.

Sanitation practice is to a large extent a social phenomenon, rather than a technical one, and therefore it is essential that background information on cultural, social and economic factors influencing sanitation behaviour is acquired before actual planning can start (Wegelin-Schuringa, 2000). Investigating residents' socio-economic background in relation to their perceptions about the use of sanitized excreta was deemed important because according to Tanner (1995 cited in WHO, 2006) every social group has a social policy for excreting and that some norms of conduct will vary with age, marital status, sex, education, class, religion, locality, employment and physical capacity.

Lastly, in the face of dwindling potable water and fertilizer resources and increasing human population with its attendant pollution from sewers, there is a search for collective effort among nations and the international community to safeguard the environment by recirculation of resources. Since the present study is related to the efficient use of human urine and treated faecal matter, it will contribute to the general effort to adopt ecological sanitation in peri-urban areas.

Theory of planned behaviour

This study is guided by Ajzen's (2002) theory of planned behaviour, which provides a framework for studying human action (Figure 1). According to Ajzen, human behaviour is guided by three kinds of considerations: beliefs about the likely outcomes of the behaviour and the evaluations of these outcomes (behavioural beliefs), beliefs about the normative expectations of others and motivation to comply with these expectations (normative beliefs), and beliefs about the presence of factors that may facilitate or impede performance of the behaviour (control beliefs).

The combination of the three considerations (attitude towards the behaviour, subjective norm, and perception of behavioural control) guide the individual to form a behavioural intention. As a general rule, the more favourable the attitude and subjective norm, and the greater the perceived control, the stronger should be the person's intention to perform the behaviour in question. Intention is assumed to be the immediate antecedent of behaviour or action.

The theory of planned behaviour is useful to this study because perceptions, like behaviour, are influenced by our knowledge, beliefs, values, and norms but can be formed without experience and knowledge of the person. The more knowledgeable we are about human excreta, the clearer our opinion tends to be, and the stronger our (feelings) perception. Similarly, being informed about an issue is even more likely to influence behaviour when knowledge is gained from first-hand experience (Fazio & Zama, 1981). One study found

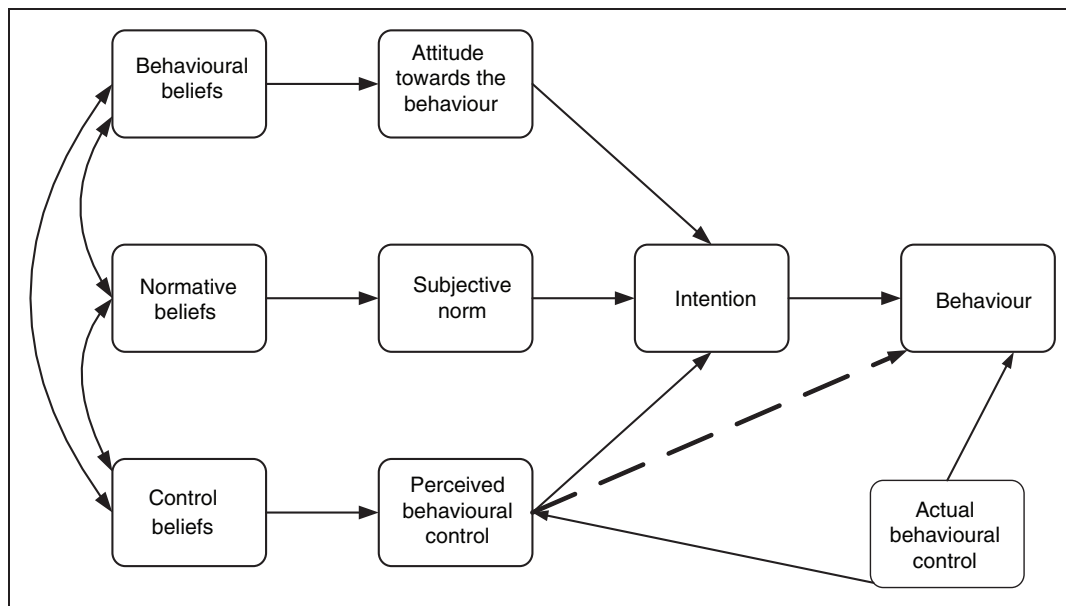


Figure 1. Theory of planned behaviour (TPB). Adapted from Ajzen (2002) with permission from Wiley-Blackwell.

that knowledge about the nutritional value of human excreta will help us to understand and promote behaviour consistent with beliefs and feelings (Wortman et al., 1992).

Study area and methodology

The study was conducted in a peri-urban farming community of Efutu in the Cape Coast Metropolitan Area in Ghana. The 2000 Population and Housing Census found that Efutu had a total population of 2214 inhabitants, 1052 males and 1162 females. There were 349 houses and 427 households with an average household size of 5.2 (GSS, 2005).

Data for the study were gathered in December 2008, using face-to-face interviews to obtain responses to a survey questionnaire. Two hundred (200) households, about half of all households, were randomly selected from a household list. In each selected household, the head or any other adult member who gave consent was interviewed. In total, 154 interviewees completed the interview, and 46 households were not included because they were either absent during the period of the study or they did not complete the process.

The questionnaire comprised three sections. The first dealt with residents' knowledge of the nutritional content of excreta. The second section dealt with residents' attitudes and perceptions of human faeces and urine. A three-point Likert-type scale ranging from 1 (disagree) to 3 (agree) was used to measure residents' knowledge and attitudes as evidenced in their response to ten pre-set statements. The final section elicited basic background data on age, sex, education level, income, and religious affiliation of respondents.

Additionally, two focus group discussion (FGD) sessions (comprising a male and a female group) were conducted to

complement the findings from the interviews. The convenience sampling method was adopted to choose the discussants for the FGDs. Consent was sought to tape-record the session and this was later transcribed to enrich the qualitative analysis. All the instruments were administered by the researcher in the local language - 'Fante'.

In the analysis of the data, a *t*-test was used for the variable that has only two categories and a one-way analysis of variance (ANOVA) approach for variables with three or more categories. To arrive at an overall statement for the attitudes and perceptions, the means [1 for agree (A), 2 for don't know (DK) and 3 for disagree (D)] of all the responses were added and the ANOVA and *t*-test were computed and the significance level was 0.05. A *p*-value of less than 0.05 indicates that a significant difference exists. The data from the FGDs were transcribed and analysed thematically to support the findings from the interviews.

Main findings

Socio-economic profile of respondents

The study area shows little variation in socio-demographic and economic characteristics among the residents. Table 1 presents the socio-economic characteristics of the interview respondents. Of the 154 heads of households or their representatives who participated in the survey, 55% were male and 45% were female. One reason for there being more men is that they are most often the heads of household and that most women expected their husbands or male heads of household to discuss issues relating to the entire household. A majority (37%) have lived in the same community between 10 and 20 years, and another 34% even longer. A total of 31% belong to the age group 30–40 years. The respondents

Table 1. Socio-economic profile of the respondents

Variable	Frequency	Percentage
Age		
<30	42	27.3
30–40	48	31.2
40–50	45	29.3
51+	19	12.3
Sex		
Male	85	55.2
Female	69	44.8
Education		
None	34	22.1
Basic	96	62.3
Sec/voc/tech	21	13.6
Higher	3	1.9
Religious affiliation		
Christian	144	93.5
Muslim	8	5.2
Traditionalist	2	1.3
Marital status		
Married	120	77.9
Never married	18	11.7
Widowed	5	3.2
Divorced	4	2.6
Separated	7	4.5
*Household monthly income		
Below GH¢50	58	37.7
GH¢ 50–100	34	35.1
GH¢ 101–200	32	20.8
Over GH¢200	10	6.5
Primary occupation		
Farming	61	39.6
Trading	41	26.6
Artisan	36	23.4
Other	16	10.3
Length of stay		
Below 10 years	44	28.6
10–20 years	57	37.0
21–30 years	31	20.1
Over 31 years	22	14.3

*\$1 = GH¢1.2 at the time of data collection.
 Sec/voc/tech, secondary/vocational/technical.
 Source: Fieldwork, 2008.

have no or short formal education: 22 % had no formal schooling, 62% had primary education, 14% had secondary/vocational or technical education, and 2% post-secondary and tertiary education. Almost all respondents were Christians (94%). 78% were married at the time of the interview. The income levels of the households were generally found to be low: 38% of the respondents claimed to earn below GH¢50 (US\$42) per month and 35% earned between GH¢50 (US\$42) and GH¢100 (US\$83). The major

occupation of the respondents was farming (40%), trading (27%) and artisan (23%).

Residents' attitudes and perceptions towards human excreta

The respondents were confronted with eight statements about attitudes and perceptions towards human excreta. Before the interview started, the researcher explained the purpose of the research to the respondents for them to understand the possibility of using sanitized excreta for agricultural purposes. As shown in Table 2, the study found that 84% of the respondents agree that human excreta is a waste and suitable only for disposal, and 97% agree that handling human excreta is a great health risk and for that matter human excreta should not be handled in any way (72%). This result might be due to the intensive hygiene education on radio and television that lay so much emphasis on hand washing after visiting the lavatory. This was corroborated by a 30-year old food-seller in one of the focused group discussions when she remarked:

They always educate us to wash our hands with soap after visiting the toilet. This is an indication that human excreta have high health risk to us and should not be handled. So I think that whatever the case, human excreta should not be handled in any way.

The facial expressions of the respondents when faeces and its use were mentioned provided a clue to the level of resentment people have towards excreta. While about 38% of the respondents agree that it is a taboo to handle urine, slightly more (45%) believe it is taboo to touch faeces. A much greater percentage, 72%, believe that excreta, whether treated or not, should not be handled in any way. In a focused group discussions this is how a 30-year-old farmer expressed it:

There is a Ghanaian proverb which says that 'a chamber pot will forever remain so even when it is bought new'. This means that faeces will also remain faeces whether treated or not. I don't think it is good to handle it in any way.

These responses indicate that touching faeces (treated or untreated) is not considered by the residents as a taboo in the strictest sense of taboo as a societal norm. There was a consensus that faeces of babies have little or no health risk and can therefore be handled. This was confirmed in the focused group discussions as a 51-year old farmer intimated:

Faeces of babies have no health risk to humans. We were made to believe that even if a baby accidentally defecates into your food, you only have to pour the faeces away and

Table 2. Residents' attitudes and perceptions towards human excreta

Statement	Level of agreement (%)			
	N	A	DK	D
Human excreta is a waste and suitable only for disposal	154	84.4	0.0	15.5
Handling excreta is great health risk	154	96.8	0.6	2.5
Human excreta should not be handled in any way	154	72.1	3.2	24.6
Human urine has no benefit to humans	154	74.0	8.4	17.5
It is a taboo to handle urine	154	37.7	11.7	50.7
Human faeces have no benefit to humans	154	70.8	5.8	23.4
It is a taboo to touch faeces	154	43.5	12.3	44.1
It is a taboo to touch treated faeces	154	38.9	13.0	48.0

*N, total sample; A, agree; DK, don't know; D, disagree.
Source: Fieldwork, 2008.

eat the rest of the food. This is due to the belief that a baby is too young to carry pathogens in its faeces.

Residents' perceptions by socio-demographic profile

In the previous section we reported the attitudes to excreta. Here, we try to find out if the attitudes differ between different categories of respondents. Table 3 presents the mean responses of residents' overall attitudes and perceptions of human excreta by their socio-demographic characteristics.

Sex emerges as an important divide and female respondents (1.52) are more negative to the use of human excreta for peri-urban agriculture than male respondents (1.84). More formal education seems to be linked to more positive attitude to use of excreta. The few respondents with higher formal education (2.66) are much more positive about the use of human excreta than all others. In contrast, residents with no formal education (1.44) have negative attitude towards excreta as they 'agree' that human excreta have no use for agriculture in their community.

Furthermore, significant differences exist between respondents' primary occupation ($p=0.045$) and, perhaps surprisingly, farmers (1.62) are least positive to using human excreta. No significant difference was observed between residents' perception of human excreta in relation to age, marital status and income status among respondents of Efutu.

Knowledge on utilization of human excreta and willingness to reuse excreta

The theoretical model indicates that knowledge about the uses or benefits of sanitized human excreta are likely to influence perceptions and attitudes as well as willingness to use it for agricultural purposes. For this reason, the study formulated ten statements to find out residents' knowledge on the

utilization of human excreta as well as their willingness to use it as fertilizer. The results are presented in Table 4. While 60% agree to the statement that human excreta are a resource to the soil and 57% that sanitized excreta can be used as fertilizer for crops, only 36% agree that they will use excreta on their crops even when sanitized. The first two statements have large 'do not know' responses, whereas 54% affirm that they will never use it on their own crop.

About 42% agree that crops fertilized with sanitized excreta are good for consumption, and 28% would actually consume such crops. The implication of this finding is that the residents are knowledgeable about the importance of excreta as fertilizer but due to their socio-cultural beliefs about excreta, only one-third are not willing to use it on their crops but two-thirds are prepared to eat if someone else produces it. Almost all believe animal manure (particularly chicken manure) can be used as fertilizer (94%) and that 60% of them have also applied it to their crops.

With slightly over half (54%) of the respondents not willing to use human excreta on their crops, they were asked to indicate factors that may prevent them from doing so. As shown in Table 5, the most important factors that will prevent a person from using sanitized faeces on their crops are health risk-associated with handling of faeces (39%). Although 97% indicate earlier that faeces pose greater health risks, only 39% think that health risk is most important preventing them from using it on their crops. Unpleasant appearance of faeces scores 18%, bad smell of faeces 18% and poor patronage for the faeces-fertilized crops 10%. For urine the most prominent factors that will prevent them from using it on their crops are smell (52%), health risk (21%) and poor patronage of urine-fertilized crops (10%).

Discussion

Attitudes and perceptions play an important role in the use of sanitized excreta for agricultural purposes. In a typical Ghanaian setting, people's attitude and perceptions about

Table 3. Mean values of residents' attitudes/perceptions of human excreta by socio-demographic characteristics. The total range is 1 to 3

Characteristic	N	Mean	Std. deviation	F/test statistic	p-value
Age					
<30 years	42	1.71	0.63	ANOVA	0.645
30–40 years	48	1.75	0.60		
41–50 years	45	1.71	0.69		
50+	19	1.52	0.69		
Sex					
Male	85	1.84	0.68	t-test	0.002*
Female	69	1.52	0.55		
Education					
None	34	1.44	0.61	ANOVA	0.003*
Basic	96	1.72	0.62		
SSS/Voc/Technical	21	1.85	0.65		
Higher	3	2.66	0.57		
Religious affiliation					
Christian	144	1.79	0.63	ANOVA	0.029*
Muslim	8	1.25	0.35		
Traditional	2	2.00	1.41		
Marital status					
Married	120	1.73	0.65	ANOVA	0.053
Single/never married	18	1.83	0.61		
Divorced	5	1.20	0.44		
Separated	4	1.75	0.50		
Widowed	7	1.70	0.53		
Income status					
<GH¢50	58	1.60	0.61	ANOVA	0.525
GH¢50–100	54	1.77	0.66		
GH¢101–200	32	1.75	0.62		
GH¢201–300	10	1.70	0.82		
Primary occupation					
Farming	61	1.62	0.61	ANOVA	0.045*
Artisan	36	1.88	0.62		
Trading	41	1.56	0.63		
Others	16	1.93	0.77		

*Significant at 0.05.

human excreta is generally considered negative. However, these attitudes and perceptions do not fit into the definition of taboos, and most people do not believe that it is a taboo to handle excreta as claimed in other cultures. In its strictest definition, taboos are viewed as actions and behaviours that tend to offend the gods, spirits or ancestors, and hence demand pacifications (which include punishing the offenders). In fact, handling excreta is not seen as an act that offends a god or a spirit but is rather seen as an act of uncleanness that can pose a health risk.

An interesting finding is that 92% of the respondents who said sanitized human excreta can be used as fertilizer were

willing to use human excreta on their crops, while only 2% of those who disagree to the statement that *sanitized human excreta can be used as fertilizer* said they would apply it on their crops. In the context of Ajzen's theory of planned behaviour, this finding is an example of how beliefs are likely to impact outcomes of the behaviour and the evaluations of these outcomes (behavioural beliefs). Thus, respondents who know about the likely positive outcomes (increased crop yield) of applying excreta as fertilizer on crops were distinctively more willing to apply it on their crops than those who don't know about it.

The most prominent factors that would prevent the respondents from using urine on their crops are smell (52%) and health risk (21%). This represents the behavioural control associated with the use of human excreta on crops in line with Ajzen's assumption (2002) that there are factors that facilitate or impede the performance of behaviour. The finding is also consistent with Drangert's (2004) assertion that people may still consider plain urine harmless and inoffensive as only one-fifth considered urine to pose a health risk. He further indicated that a reason for this may be the fact that urine is indistinguishable from water on the ground, and stepping into it is quite different from stepping into human faeces.

The results also show that education seems to be correlated to perception about reuse. The result that well educated respondents are more positive to reuse may be due to the fact that they dare to tell more freely what they think, but it may also be influenced by the fact that they can afford to hire people to do unpleasant tasks. However, this explanation is not supported by the result that respondents' income level was not a significant impact on the attitudes. Less formal education leads to more pleasing of the interviewer, and they may feel more vulnerable to transgressing norms. This lack of formal education would help to explain the perhaps unexpected result that farmers are more negative to reuse than other employment categories.

Some of the respondents' negative attitude to human excreta is translated into their unwillingness to use the nutrients of excreta on their crops or consume anything related to it. For example, some people don't even eat pig meat simply because the animal is mostly found in dirty places and eat faeces. Some people also do not consume crops that grow on dump sites because those crops are considered unclean. The unwillingness to use excreta as fertilizer can also be attributed to the normative beliefs which result in perceived social pressure or subjective norm in Ajzen's theory of planned behaviour. Thus, in addition to smell and health risk as well as the 'uncleanliness' associated with excreta, and non-patronage (which are perceived social pressure in Ajzen's theory) were mentioned as factors that can prevent respondents from using excreta as fertilizer.

Therefore, penetrating these socio-cultural barriers is not an easy task at all. It demands a lot of effort and of scientific

Table 4. Residents' knowledge on utilization of human excreta as fertilizer

Statement	Level of agreement (%)			
	N	A	DK	D
Human excreta are a resource for the soil	154	60.4	24.0	15.5
Sanitized human excreta can be used as fertilizer	154	57.1	29.2	13.6
I will use human excreta on my crops if sanitized	154	36.3	9.7	53.9
Taste of vegetables will change when fertilized with urine	154	25.3	28.6	46.1
Smell of vegetables will change when fertilized with urine	154	25.9	27.9	46.1
Crops can be killed when fertilized with urine	154	40.9	37.0	22.1
Crops fertilized with human excreta are good for consumption	154	42.2	14.9	42.9
I will never consume crops fertilized with human excreta	154	61.6	6.5	27.9
Animal manure can be used as fertilizer	154	93.5	2.6	3.9
Ever used animal manure as fertilizer	154	60.4	0.0	39.6

*N, total sample; A, agree; DK, don't know; D, disagree.

Source: Fieldwork, 2008.

Table 5. Factors that prevent residents from using sanitized excreta on their crops

Factors	Sanitized faeces		Sanitized urine	
	Frequency	Percent	Frequency	Percent
Smell	27	17.5	80	51.9
Health risk	60	39.0	32	20.9
Appearance	28	18.2	10	6.5
Patronage will be poor	16	10.4	15	9.7
People will mock at me	1	0.6	1	0.6
Religious belief	1	0.6	1	0.6
None	21	13.6	15	9.7
Total	154	100.0	154	100.0

Source: Fieldwork, 2008.

evidence in order to prove to people that it is safe or 'clean' to use the nutrients in human excreta to fertilize crops. Of course, enough evidence on the nutrient content of excreta already exists. For example, people know that plants grow very well on dump sites or abandoned latrine sites. They however, consider those plants as being 'unclean' for human consumption. This was revealed during the focus group discussions.

Conclusions and policy implications of the study

There is a mixed set of attitudes towards human excreta in the peri-urban community of Efutu in the Cape Coast Metropolis. A majority view human excreta, whether sanitized or not, as a waste and should be disposed of. At the same time, most accept the fact that human excreta can be useful as fertilizer. The majority of the respondents contend

that human excreta should not be handled in any way since it carries a greater health risk in the case of faeces and bad odour in the case of urine. Yet, only 42% were not willing to consume crops fertilized with excreta and two out of three indicated they did not want to use sanitized excreta on their own crops. Some (28%) of those who do not want to apply excreta are still willing to consume the products from human-derived fertilizers.

Since Efutu is predominantly a farming community, collection and reuse of human excreta would improve crop yield and ensure food security, hence reduce poverty. To achieve this, more open discussions around sanitation need to be undertaken in the community such that people can relate their cultural and religious knowledge and perceptions with scientific knowledge on sanitation, health, hygiene and recycling. Thus, with careful discussions with the community, alternative ecological sanitation systems could have a good chance of successful implementation.

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