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Sammanfattning

Uganda är ett utvecklingsland i östra Afrika. Landet har närmare 36 miljoner invånare och populationen är den fjärde snabbaste växande i världen. Det är ett underutvecklat land som är hårt drabbat av fattigdom och HIV/AIDS. Jordbrukssektorn är en av landets viktigaste inkomstkällor och även den största arbetsgivaren. Jordbruket gynnas av klimatet och landets bördiga jordar, men är underutvecklat och saknar moderna jordbrukstekniker.

I slumområden i huvudstaden Kampala utfodrar bönder grisar med matavfall från hotell och restauranger. Matavfall är det billigaste fodret för grisar och innehåller främst matrester men även fysisk kontamination som inkluderar icke smältbara material och benrester. Syftet med studien var att kvantifiera och kategorisera den fysiska kontaminationen inklusive benrester samt att utreda hur frekvent förekommande respektive kategori är.

Studien ägde rum i slumorådet Kabalagala där ett samarbete etablerades med fem bönder vars uppgift var att utföra det praktiska arbetet. Bönderna valde slumpvis ut säckar med matavfall och respektive säck vägdes och dess innehåll sorterades i olika kategorier som vägdes och data noterades. Totalt undersöktes 38 säckar vid 11 tillfällen vilket resulterade i 3,5 säckar/tillfälle. Den fysiska kontaminationen delades in i kategorierna plast, metall, papper, gummi, tyg, övrigt samt en kategori för benrester. Andelen matavfall i en medelsäck var 93,8% och andelen fysisk kontamination inklusive benrester var 6,2%. Av de 6,2 % representerade plast 37%, benrester 24% och papper 22%. Papper återfanns i alla säckar, metal och plast återfanns i alla utom två och benrester fanns i nästan hälften av alla säckar, de resterande kategorier återfanns i färre än 10 säckar.

Fysisk kontamination har en negativ påverkan på djurets hälsa, tillväxt och böndernas ekonomi. Hårda material så som hårdplast och metall kan skada grisens mag-tarmkanal. Metall kan innehålla tungmetaller som påverkar köttkonsumentens hälsa negativt. Benrester kan sprida sjukdomarna svinfeber och salmonella vilket kräver kostsam veterinärvård. Det är ej skadligt för en gris att äta papper men kombination av papper försämrar fodrets näringsvärde.

Eftersom matavfall är det billigaste fodret för grisar, kommer användningen inte att upphöra trots dess negativa påverkan på djurproduktionen. Det är därför viktigt att fortsätta utreda problemet med fysisk kontamination i matavfall och hur man på bästa sätt kan minska det.

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Introduction

General facts about Uganda

The republic of Uganda is a developing country in East Africa. Uganda is located at the equator with a total area of 241,038 square kilometers (sq km) and borders to Democratic republic of Congo, Sudan, Kenya, Tanzania and Rwanda. The country is landlocked and border in the south to Lake Victoria. The climate is tropical and the northern part it is semiarid. There are two rainfall seasons in a year, the first rainfall season is March to May and the second is September to November (CIA, 2012).

Uganda's population is estimated to approximately 36 million in 2012 and increase with 3.6% every year which makes Uganda the fourth fastest growing population in the world. The median age is 15.1 years and the life expectancy is 53.4 years. Above 35 % of the population lives below the poverty line (CIA, 2012) and 45 % of the rural population are estimated to be very poor (FAO, 2005).

The epidemic of HIV/AIDS in the 90s hard-hit Uganda but has reduced in prevalence from 14% 1995 to 6.1% in 2000, and in 2012 6.5 % were infected by HIV/AIDS. Additional high risk diseases within the country are; bacterial diarrhea, hepatitis A, typhoid fever**,** malaria and African trypanosomiasis (sleeping sickness) (CIA, 2012).

Uganda's climate with regular rainfall and fertile soils is favorably for agriculture (SIDA, 2009a) which is the most important sector of the economy and employing 80 % of the countries work force. Agriculture is contributing to 38.8 % of the total Gross Domestic Product (GDP) and livestock holding is the major sub-sector of agriculture and it contributes to 14.4 % to the total Agriculture (GDP) (FAO, 2005).

The main agriculture products are cassava, potatoes, corn, millet, beef, goat meat, milk and poultry, furthermore, cash crops such as coffee, tea, cotton and tobacco are grown (CIA, 2012). The major livestock species includes sheep, pigs, cattle and poultry. Small holders own more than 90 % of the cattle livestock and almost 100 % of the poultry, sheep and goats. The main farming system is mixed farming with a combination of crops and livestock keeping (FAO, 2005).

Uganda has several natural resources such as copper, gold and other minerals, and recently oil has been discovered. However, the informal economic and undeveloped infrastructure delay Uganda's possibility for development and makes Uganda one of the poorest country in the world (SIDA, 2009a). Uganda has a need of foreign aid which consists of 11.5 % of GDP (SIDA 2009b), Sweden donated 265 million SEK in 2011 (SIDA, 2009c).

Kampala

Kampala is the capital of the republic of Uganda and the only district in Uganda with a city status. Kampala is a district divided into five political administrative divisions (sub-counties) (Central, Kawempe, Rubaga, Makindye and Nakawa), the divisions are divided into different villages/zones which constitute a parish. Between the 1600's and 1893 Kampala was the capital of the tribal Kingdom "Buganda", 1893 Uganda was colonized by United Kingdom and the British declared Entebbe as a capital. Since Uganda's independence 1962, Kampala has returned as the capital of Uganda. The city has evolved from eight hills with an area of eight square kilometers in 1962 and is now located at 25 hills in an area of approximately 195

sq km, a result of the urbanization. Kampala's population was estimated to reach 1.7 million people in 2011 and projected to reach about 3.0 million people in 2020, representing an average annual growth rate of 5 % (Sabiiti *et al*., 2007). Life expectancy is 50.5 years and 20 % of the population lives under the poverty line (KCC, 2003).

Urbanization

Urbanization is largely caused by rural-urban migration in combination with natural population increase (Drescher *et al.,* 2002). The persistent rural poverty causes people to migrate to urban areas with the hope of improving their livelihood. The high urban population growth results in a rapidly increasing demand for food. However, the rapid urbanization in most cities has not been in tandem with economic growth and development. Consequently, many low income households are finding it difficult to meet their daily food requirements. One of the major coping mechanisms to urban poverty and hunger is urban farming (Garnett, 2000; Gonzalez Novo and Murphy, 2000).

Urban/peri-urban farming

Rapid increase of urban farming in Uganda dates to the Idi Amin regime (1972-1979) (Maxwell, 1995) when Uganda's formal economic failed by the "war of economic independence" of the dictator regime, this was followed by the guerilla in the early 1980s. These two facts had a damaging impact on the urban economy and resulted in a monetary inflation and in formalization of Kampala's economy (Bigsten *et al*., 1992). During this period many urban household resorted to all kind of activities in the informal sector in order to improve livelihood, urban agriculture was one of such options (Tinker, 1994; Drakakis-Smith *et al.,* 1995).

In Kampala, urban agriculture has proved to be a significant contributor to the food basket in the city. Unlike the past when urban farmers in Kampala belonged to low income groups, they now belong to all sorts of economic status. According to Cofie *et al.* (2003), up to 60% of the food consumed by low-income groups in Kampala is self-produced. Urban faming for food production is increasing in Kampala, the proportion of households engaged in urban/peri-urban agriculture in Kampala increased from between 25 – 36% in the early 1990's to 49.2% in 2003 (Ssemwanga, 2001; David *et al.,* 2010). The major motivation for engaging in urban agriculture is food production for home consumption and/or sale for an income (David *et al.*, 2010; Katongole *et al*., 2011).

Farming system

Kampala's farming households have been categorized into four: Commercial farmers; Food self-sufficiency farmers, Food security farmers and Survival farmers (Lee-Smith, 2008). The "commercial farmers" are very few and well-off, found mostly at the peri-urban periphery. These farmers produce almost entirely for the urban market. The "food self-sufficiency" farmers are mostly well-off and found in all areas except the inner urban neighbourhood. The "food security" farmers have other sources of income with farming helping them to save or supplement urban life-styles. The "survival farmers" include the very large numbers farming for survival so that they would not starve. The majority of these survival farmers are women-headed household (recently widowed or abandoned by their husbands) and they have very limited economic options (have limited access to other forms of urban employment; hence can barely make ends meet). Such households are found in urban areas where people cannot get enough food from the small pieces of land and are more desperate for survival (David *et al.*, 2010).

Kampala City Council Authority, before called Kampala City Council (KCC) divides Kampala into four different farming styles: peri-urban, peri-urban to transition, urban new and urban old. The farming styles are categorized on land ability for agriculture, the peri-urban having the biggest area of land and the urban-old category having the least (KCC, 2003).

Kabalagala

Kabalagala parish is located in Makindye division. Makindye has an area of 40.5 sq km and a population density of about 7 500 people per sq km. Makindye is divided into 22 parishes and Kabalagala is one of this parishes. Kabalagala is a slum area with needs of improvement of existing conditions such as upgrading of houses, roads, provisions of water and sanitation. (KCC, 2003). Kabalagala was until the 1980's an uncultivated bush land, people emigrated from rural areas to Kabalagala during the 80's declare. The soil in Kabalagala was ideal for making bricks and become the main income source. During the beginning of the 90's Kabalagalas population increased and houses occupied the area, the bricklayers stopped the soil extraction and pig rearing became a new income source (Ssempa, 2012 personal communication).

Pig farming in Kabalagala

At the moment an average of five farmers exercise pig farming at this place. Everyone owns their own land plot, stall and pigs. The farmers' daily work considering the pigs is performed individually, except such as medical treatment, transportation of pigs to the livestock market and sharing each other's boars for breeding (Ssempa, 2012 personal communication).

The pig-stalls are made of wood and built on poles that are standing close to each other. The construction is wide open and the floor is made of wood with small separations to let faeces pass, there is no using of litter (see appendix 1). The pigs are kept individually in an area of approximately 5 square meters. Feeding occurs ones a day and consists of left-over food and water, the water resource is a small river nearby the stall. The pigs' are sold directly to the livestock market when they are about 7 months and have reached the ultimate weight of approximately 35 kilo. If the farmers have a need of money, they may sell the pigs' before them reaching the ultimate weight. There is no existing breeding program and the breeds are often unknown, the sow gets an average of 7 piglets born alive and the piglets has a generally high survival rate. During the beginning of lactation the piglets are kept separately and by hand the piglets allow suckle milk from the sow. After about three weeks the piglets start to eat solid feed such as left-over food, weaning occurs within two months (Bisaso, 2012 personal communication).

Challenges

Despite the significant contribution of urban agriculture to the general food basket of city dwellers, farmers in Kampala are facing a lot of challenges, which include among others limited access to land and capital, social conflicts between neighbours, negative reception from urban authorities and adverse weather conditions (climate changes), which make access to feed an even greater issue.

Feed scarcity is one of the major challenges faced due to the high population density, land area available for the cultivation of forage and grazing is limiting, while commercial feeds or agro-industrial by-products often are too expensive for the resource-poor urban farmers. The farmers rely on unconventional feed resources. For instance, the majority of pig farmers depend on kitchen/plate leftover food, which is obtained from waste dump sites, households, restaurants/hotels, schools etc. However, there are several concerns about the utilization of

these wastes as animal feeds, which include among others poor storage ability and heavy contamination due to indiscriminate dumping. Results of the on-going collaborative research project between SLU and Makerere University on "feed for livestock in urban/peri-urban areas of Kampala" indicate that the utilization of leftover food as pig feed is chiefly constrained by contamination with unsafe materials especially plastic bags, metals and broken glass that are serious hazards to animal health and livestock production.

Left-over food

The description of food waste is any edible waste from food production, transportation, distribution and consumption (Price *et al*., 1985), it is also referred to as garbage, swill, and/or kitchen waste (Kornegay *et al*., 1965). Feeding food waste to livestock has been practice throughout the world a long time and is most common in urban farming (Derr *et al*., 1988; Westendorf *et al*., 1998). Furthermore, urban waste in developing countries has become increasingly hazardous as it contain more physical contamination such as plastic and glass (Harris *et al*.,. 2001).

At big restaurants and hotels in Kampala solid wastes from different sources (guest/office rooms, kitchen/restaurants, bar and garden) are indiscriminately put together in polyethylene bags, loaded on trucks and delivered to slummy areas in Kampala. The truck driver work as an intermediator and are selling the left-over food as pig-feed. Many low income households in this area have resorted to pig rearing and use the left-over food as a feed.

Respondents from a questionnaire made by Department of Agricultural Production at Makerere University shows that the pig-farmers' observe impact when using left-over food as pig feed. The left-over food gives an opportunity to a higher feed intake and less variation in faeces quality. In addition, good growth performance and improved body condition has been observed, also good reproductive performance measured as timely estrus, large litters and piglets with good body weight at birth have been observed. The farmers describe effects such as fair ability to produce lean carcasses (less fatty pork), furthermore left-over food improve the sows milk production for piglets during lactation.

A study was performed in New Jersey which aimed to compare growth, meat quality and diet digestibility when pigs were fed left-over food from a cafeteria or a corn/soya meal diet. The result shows that left-over foods have good nutritionally quality, digestibility, and protein availability. Nutrient analysis of the left-over food showed that most nutrients had a digestibility similar to or greater then corn/soya meal diet, acid detergent fiber (ADF) being the exception. The essential amino acid content was greater and the fiber levels were higher. The carcass quality of pigs receiving left-over food was similar to that pigs were receiving a corn/soya meal diet. A taste test showed that the quality of pork meat was similar, and for some attributes higher. The high moisture content of the left-over food reduced dry matter (with approximately 25 percent) and nutrient intake, however due to the low dry matter content the pigs needed to consume nearly four times higher volume of left-over food than the corn/soya meal to obtain the same amount of dry matter. Therefore, pigs fed with left-over food grew more slowly and had a lower slaughter weight compared to pigs fed the corn/soya meal diet (Westendorf *et al*., 1998).

A review for Kenya's pig sector, developed in collaboration with FAO ECTAD, describe that the drawbacks when using left-over food as pig feed are that the safety, amount and quality of feed is not guaranteed and pigs fed inadequate and unbalanced diets will have low weight gains (FAO, 2012).

Objectives

The major contents in a left-over food sack (sack) are edible kitchen waste (left over food) as well as an inedible quantity of physical contamination which propose inorganic material and bones. The objectives of this study was to categorize and quantify the physical composition of left-over food collected from hotels and restaurants dump sites and to assess the frequency of physical contamination in an average sack. This study aim to be a first step to show the pig farmers that physical contamination can affect and decrease the production and without physical contamination the production can be improved.

Material and Method

The study was a Minor Field Study and conducted during April and May 2012. It was a part of the project "Feed for livestock in urban/peri-urban areas of Kampala" which aims to identify, quantify and nutritionally classify available feed resources in urban/ peri-urban areas of Kampala city. This study took place in Kabalagala, Kampala and the project was a collaboration between the Department of Animal Nutrition and Management at SLU and the Department of Agricultural Production at Makerere University, Kampala, Uganda.

Experimental design

Five pig farmers were previously selected by Dr Constantine Katongole based on a questionnaire conducted in "feed for livestock in urban/peri-urban areas of Kampala" (Table 1). To establish good relations with the cooperating farmers a visit at the pig area were done to examine their diverse situations and prerequisites and to get a comprehensive impression of the farmers' daily routines and activities in order to meet there demands and stress the importance of their participation. Focus was set upon dialogues, without taking notes. The first visit was also accomplished to make the farmers aware of the subject and also to decide a schedule for data collection. The practical work in the study was to sort the sacks contents in categories and weigh each category. Each time of sample collection three of the five cooperating farmers contributed to collect samples. Each time of sampling a truck delivered daily fresh sacks to the slum area and a cooperating farmer randomly selected a different amount of sacks depending on access.

The left-over sacks used in this study came from different sources each day and each sack had a varying content, diverse amount and different contents of vegetable, fruits and meat (appendix 2). Therefore the nutritional value will differ widely from day to day and there is no chemical analysis made of the left-over food for this study (Katongole, 2012 personal communication).

Farmers

Table 1. The following table will give an overview of the cooperation farmers participating in the study

characteristic	Sebina John Bisco	Mugooba Lawrence	Patrick Ssekitoleko	Lugonya Amos	Bisaso Joseph
sex	male	male	male	male	male
age	30	38	-	32	25
marital status	married	married	married	married	single
highest level of education	primary	upper primary	upper primary	secondary	diploma, agriculture production
members of household above age 18	2	2	2	2	3
members of household below age 18	3	2	3	0	0
total size of land	> 15x15 meters (m)	between 15x15 m and 15x30 m	> 15x15 m	> 15x15 m	> 15x15 m
Number of pigs	32	11	10	32	35
breed	landrace	un-defined cross	un-defined cross	large whiteX local breed	large whiteX local breed
feed resource ranked 1,2	1. left-over food	1. left-over food 2. local brew	1. left-over food 2. local brew	1. left-over food 2. banana peels	1. left-over food 2. banana peels
sorting left-over food	no	no	yes	yes	yes
major challengers ranked 1,2	1.feed scarcity 2.different diseases	1.feed scarcity 2. high costs of drugs	1.feed scarcity 2. high costs of drugs	1.expensive drugs 2.cost of transporting left-over food	1.expensive drugs 2.cost of transporting left-over food
major diseases	swine fever, body swelling, cough	swine fever, worms	swine fever	worms, skin mange	worms, skin mange

Data Collection

The examination was conducted during four weeks and samples were collected three times a week. Each time of sample collecting the cooperating farmers randomly select a various amount of sacks depending on access. Each sack was separately weighed and thereafter unwrapped, the cooperating farmers sorted the content of sacks into the categories; leftover food (to include fruit, meat and vegetable left-over), plastic, metal, glass, paper, rubber, cloth, bone (from chicken, pig, cattle and fish) and others contaminants (some physical contamination was not frequently observed and had a negligible weight therefore categorized as others, including china, wood, cement, cork).Thereafter, each categories were separately

weighed and data was registered. Each time of collecting data, Linn Frendberg managed and observed the work, furthermore reading the scale and registered data.

Data Analysis

Circle diagrams and mean value of collected data was managed in Microsoft Excel.

Results

The examination resulted into a total of 11 times of sampling and a total amount of 38 sacks. Each time of sampling an average of 3.5 sacks was evaluated.The content of each sack was both edible left-over food and inedible physical contamination.

Figure 1 show the percentage of the different categories weight in an average sack. The share of left-over food was 93.8% and physical contaminations was 6.2% of the total content. Figure 2 shows the percentage of different categories of physical contamination in relation to the total physical contamination in an average sack. Table 2 shows the mean weight of a sack and the average weight and standard deviation of each category. The weight of an average sack was 36.3 kg and an average sack contained approximately 2.2 kg of physical contamination and 34.0 kg of edible left-over food. Furthermore Table 3 shows the frequency of each category of physical contamination in each sack. All sacks in the study contained left-over food and plastic and nearly all contained paper and metal, furthermore less than half of the sacks contained bone and one fifth contained cloth and one fifth contained rubber.

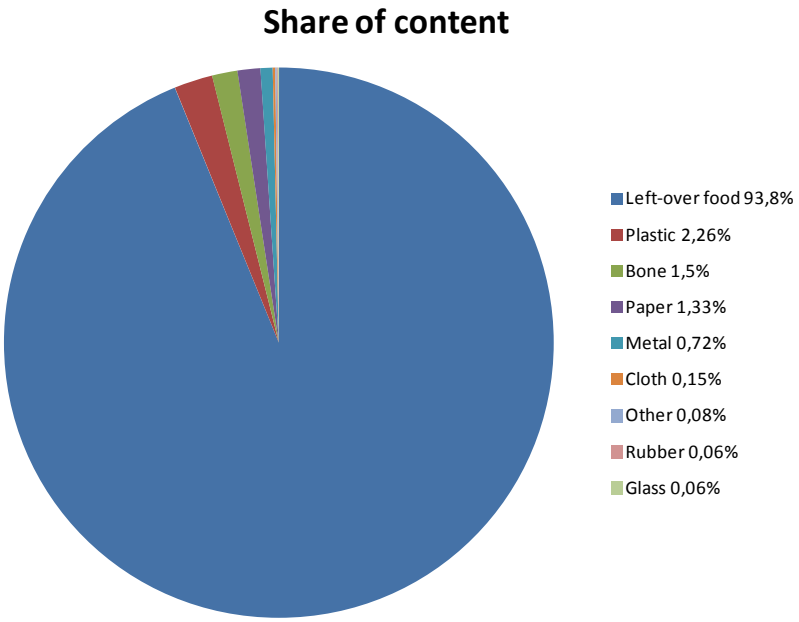

Figure 1. The percentage of the different categories weight in an average sack.

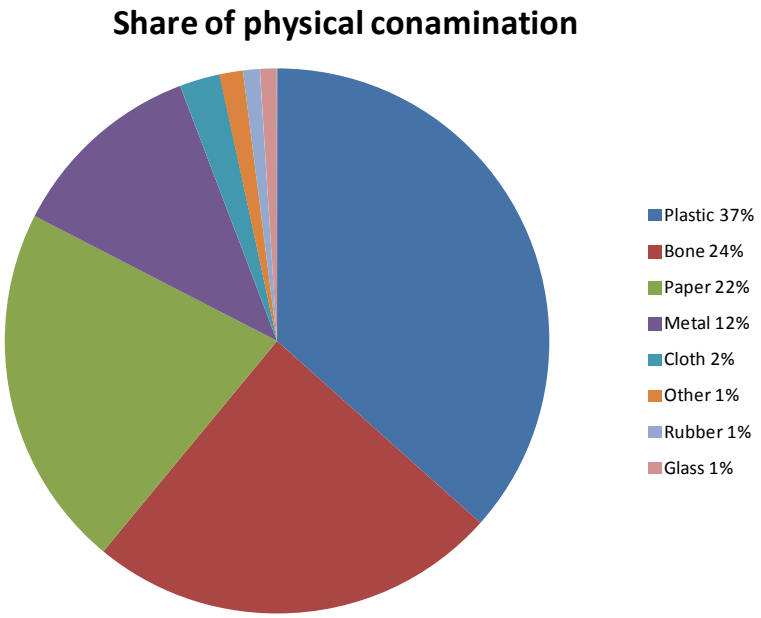

Figure 2. The percentage of physical contamination categories according to the total physical contamination in an average sack (without left-over food).

Table 2. The mean weight (in kg) ± standard deviation of an average sack and the mean weight ± standard deviation of each category estimated from a total of 38 sacks

	total weight	**left-over food**	**plastic**	**bone**	**Paper**	**metal**	**cloth**	**other**	**Glass**	**rubber**
kilogram (kg)/sack	36.28	34.05	0.82	0.55	0.48	0.26	0.055	0.03	0.02	0.02
standard deviation (kg)	14.30	13.70	0.60	0.95	0.39	0.32	0.10	0.17	0.11	0.06

Table 3. The frequency of each categories of physical contamination in each of the 38 sacks

	left-over food	**plastic**	**paper**	**metal**	**bone**	**cloth**	**rubber**	**other**	**glass**
frequenzies of physical contamination of total sacks (38)	38/38	38/38	36/38	36/38	24/38	10/38	8/38	5/38	4/38

Discussion

According to Katongole (2012, personal communication) the duration of the study and the amount of sacks are adequate to give a good picture of the major type of physical contaminations. The average of 6.2% (2.24 kg) of physical contamination in a sack is a noticeable quantity and makes this study relevant. In Sweden physical contamination in pig-feed is totally forbidden since it affect animal welfare and decrease the livestock production

(Eliasson, 2012 personal communication). There is a big difference between farming system in Sweden compared to Uganda. Uganda has a less intensive farming system, therefore effects of physical contamination will affect the livestock production in different ways. However, since the pig's biology is equal the livestock production will always be affected when feed has physical contamination.

The most interesting result is the levels of plastic and metal, both are impossible for pigs to digest and hard plastic and metal can harm the digestive system and cause death. Metal may also contain heavy metal which affect the pork quality, heavy metal are stored in pig muscles and become a health risk for the meat consumer. The result of this study shows a high amount of physical contamination of bones, according to Eliasson (2012, personal communication) it is an increasing risk of diseases such as swine fever, Porcine Reproductive Respiratory Syndrome (PRRS) and salmonella if pig feed contain pork bone (cannibalism) and meat from other animal sources. Different types of diseases will affect the animals' health and growth performance, and consequently have a negative effect on the livestock production. Paper was the third highest level of physical contamination. According to Eliasson (2012, personal communication) paper cannot be digested by pigs but it can pass the digestion system without harm the intestine. Spill of news paper are in some Swedish pig-stalls used as a litter and it is common that pigs are eating it. This can prove that physical contamination such as paper does not harm the pigs, but it is still a filler which has a cost.

The sacks contained a lower amount of the categories glass, rubber and others. Also low amounts will affect pigs, but the hazard is more random since this was not frequently found.

Physical contamination has an impact of the farmers' economy since it decreases the livestock production and the pigs do not reach ultimate weight in expected time and off course it is also a huge economic loss when pigs die. The cooperation farmers mention that medical treatment is expensive which will increase when feed contain physical contamination.

This study gives knowledge about the composition and physical contamination levels of leftover food which can enable a better utilization of leftover food, and hence improve the profitability of pig production and in the end contribute to poverty reduction.

The correlation between sorting the physical contamination in left-over food and improved livestock production was dialogued with the cooperating farmers during the study. The cooperating farmers argue that the pigs are sorting the physical contamination themselves and the farmers had a low understanding of the importance of sorting physical contamination and its relevance to improve livestock production. Just one of the five cooperating farmers was in the end of the examination optimistic to the aim of the study. Their skepticism of receiving new procedures confirms that informing the farmers is slightly ineffective; therefore the government has to take their responsibility, for example introduce a recycling system in combination with educating the farmers.

Introduction of a recycling system for hotels and restaurants would be a great help to improve the left-over food. There are a number of good examples of successful community recycling and resource recovery schemes in developing countries (Practical action, 2001). According to Practical action (2001), the government or the municipality has the major responsibility of waste collection. Today there is an absence of a recycling system in Kampala city, that means Kampala's hotels and restaurants lack restrictions of handling waste. At the moment it seems like the government or the municipality are unable to fulfill their role either due to financial constraints, lack of will or lack of organizational skills (Practical action, 2001).

The restaurant/hotel companies' way of collect kitchen waste plays an important role for the composition and amount of physical contamination in each sack. When physical contamination are sorted directly at the waste source, the left-over food used as pig feed will be cleaner and the incidences of injuries and diseases can be decreased (Practical action, 2001).

As a start of solving the problem with physical contamination in left-over food, it is of great importance to inform the restaurants and hotels that the kitchen waste is used as pig-feed. It is also of importance to agree in a way of sorting physical contamination until a recycling system is adopted. At the moment there is no communication between the cooperating farmers and the restaurant/hotel managers. The cooperating farmers means that it would be very difficult to influence the big restaurants and hotels to start sorting the kitchen waste, as they lack economical resources and social power to force the companies. Furthermore it will be difficult to motivate the farmers to get involved and influence the hotels/ restaurants to sort kitchen waste since they don't think there is a problem with physical contamination.

The content in the sacks was fresh and used as pig-feed at the delivery day, therefore no decaying process had started in the left-over food and the hygienic quality was good. The bio-security may be improved if the left-over food is fermented or being heat-treated before feeding. That kind of processes would prevent microbial growth and decrease the risk of spreading diseases from bones. Fermentation could be economically profitable, and possible for the farmers to do buy them self, but they will need education. Heat-treatment of the left-over food could be a new business for the intermediators who are selling left-over food to the farmers, it will probably result in a higher price but a better quality.

The pig farmers will continue the use of left-over food as pig-feed since this is the most economic feed. A cost comparison carried out during the WAREN project (cited in a report titled 'Recycling activities in Metro Manila') shows that profit is more than doubled by feeding the pigs on organic waste, even when including all other costs, such as cost of medical treatment, transport, fuel etc. Therefore it is of great importance to improve the use of left-over food and continue investigating how to sort out the problems of physical contamination in left-over food (Practical action, 2001).

Conclusion

In conclusion there is a notable amount of physical contamination and bones in left-over food used as pig-feed in Kampala. The physical contamination includes hard and sharp-edged material that can harm pigs' digestive system, furthermore it contains bones that can spread serious diseases. Physical contamination affects the livestock production since it decrease growth, affect health negatively, cause pigs' death and consequently results in economic loss. Nevertheless the farmers will still use the feed since this is most economic alternative, therefore it is of great importance to minimize the contamination.

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Appendix

Appendix 1. Shows a pig-stall in Kabalagala, Kampala.

Appendix 2. Shows an average sacks content of vegetable, fruits and meat.

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