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Comparing the operations and challenges of pig butchers in rural and peri-urban settings of western Kenya

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The purpose of this cross-sectional, observational study was to describe the pig butcher enterprises in western Kenya; highlighting differences in the operational processes and challenges between rural and peri-urban settings. Fifty pig butchers were interviewed using questionnaires in two districts, Kakamega (peri-urban) and Busia (rural). Results showed that pig butchers were central to the coordination of activities required to connect pig farmers to pork consumers in their communities. Several differences between rural and peri-urban enterprises included use of agents to find pigs, average market weight of pigs, pig prices per kilogram, transport and marketing. Butchers were challenged by credit and capital constraints, seasonality, high pig prices and high search costs. Butchers should be encouraged to have pork inspected and should be included in outreach programs intended to prevent the spread of zoonotic pathogens since they are the last intervention point before pork is consumed. Use of the tape measure for estimating pig weight could help remove inequalities between farmers and butchers abilities to estimate pig weights and could help to reduce search costs for the butcher, thus increasing equity and efficiency of trade between farmers and pig butchers in western Kenya.

Key words: Africa, Kenya, pig butchers, marketing channel, smallholder.

INTRODUCTION

In rural economies of many tropical countries, pigs are an important livelihood activity (Mutua et al., 2011; Lekule and Kyvsgaard, 2003). In western Kenya, almost 90% of pigs are sold to local pig butchers who sell pork in their butcheries (butcher shops) (Kagira et al., 2010; FAO, 2012). The appreciation for pork as an animal food source in the Western Province has been recognized (Kagira et al., 2010b; Mutua et al., 2011) and the number of pigs slaughtered in Kenya has been steadily rising (FAOSTAT, 2009). Approximately 280,000 pigs were slaughtered in Kenya in 2009, compared to 163,908 in 2000, representing an annual growth rate of 8% (FAOSTAT, 2009). As pig slaughter numbers increase there is value in furthering our understanding of pig marketing, particularly in rural areas where farmers often face challenging marketing conditions (Chamberlin and Jayne, 2013). The financial benefit to farmers for rearing pigs depends on remunerative marketing opportunities.

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Improvements to marketing systems not only increase the economic benefits of livestock to the individual producer but also reduce food costs to consumers and stabilize food supply for the communities which these markets serve (World Bank, 2008; Randolph et al., 2007).

The Western Province has a very high prevalence of poverty (Krishna et al., 2004), and has the 2nd highest population of pigs in Kenya (FAO, 2012), so studying the marketing opportunity for pig farmers in this location is important. In contrast, pig-rearing in the Central province is more intensive and farmers can market their pigs to butcheries in urban centers and to pork processing factories within their proximity (FAO, 2012). Smallholder farms in the Western Province range from 0.2 to 2.5 acres and average seven people per household (Rarieya and Fortun, 2010). Mixed crop and livestock farms are the most common and in farms with low acreage, chickens and pigs tend to be the most commonly chosen livestock (Kagira et al., 2010). Traditional pig management is the dominant pig rearing system in western Kenya, with 95% of the nearly 90,000 pigs raised in this manner (FAO, 2012). The pigs are native or crossbred species and are allowed to scavenge for food during non-harvest seasons to keep input costs low (Mutua et al., 2010; Lekule and Kyvsgaard, 2003). Farmers have been encouraged by researchers and local government staff to keep their pigs tethered during education workshops intended to reduce the transmission of the *Taenia solium* parasite (Wohlgemut et al., 2010). Farmers keep between 1 and 3 growing pigs on their farms and women are predominantly responsible for their care (Kagira et al., 2010; Mutua et al., 2010).

The challenges commonly identified include feeding, breeding, diseases and low selling prices (Mutua et al., 2011, 2010; Kagira et al., 2010). Strengthening extension services has been recommended to promote healthy pig production, improve breeding and increase farmers' knowledge of pig rearing (Mutua et al., 2011). The pig industry is monitored by the Kenyan government. The Pig Industry Act outlines the regulations for selling live pigs, the licenses required to slaughter pigs and the conditions upon which a pig butcher can sell pork (Anonymous, 2006). Although, the pig industry in Kenya is relatively small (0.3 million) compared to other livestock, the consumption of pig meat is anticipated to increase with urbanization and social views resulting from education (Wabacha et al., 2004; FAO, 2012). Pig marketing has been studied in Busia, western Kenya (Kagira et al., 2010b) where challenges and characteristics were highlighted. The challenges presented by Kagira et al. (2010b) included inter alia 'conflict with regulatory authorities', erratic pig supply particularly after an African swine fever (ASF) outbreak, excessive travelling distances to purchase pigs, seasonal fluctuations in the market, transport and competition. At the time our study began, there was a paucity of literature available on the subject of pig marketing in western Kenya. Our study provides a detailed description of the processes involved in getting a pig from the farm gate to the consumer which has not been previously documented for these locations. Our study is also an extension of the work by Kagira et al. (2010b) as it includes butchers from two districts; Busia which is rural, and Kakamega which is peri-urban, allowing us to compare the characteristics and challenges of butcher enterprises between the two districts.

The primary purposes of this research are to: 1) describe the pig butcher and his role in the process of marketing pork while assessing differences between rural and peri-urban settings; 2) assess the butchers' perspectives on the challenges facing their operations. Understanding the key differences will aid policy makers in addressing disadvantaged settings, or aid in prioritizing extension material and services for rural or peri-urban settings. A record of current pig marketing and the processes of pig butchers will allow for future monitoring of how the industry evolves.

MATERIALS AND METHODS

Study area

This cross-sectional, observational study was conducted in the Busia and Kakamega Districts of western Kenya. Busia is a rural district bordering on Uganda, with a population of 488,075 (Anonymous, 2009). Kakamega, the capital of the Western Province, is surrounded by peri-urban farms and is situated in the Kakamega District, with a population of 1,660,651 (Anonymous, 2009). Two sub-locations in each district, Butula and Funyula in rural Busia, and Shinyalu and Ikolomani in peri-urban Kakamega, chosen out of convenience because of their large population of pigs, history of pig keeping, high prevalence of poverty, and because smallholder farmers in these locations had been previously studied (Mutua et al., 2011; Kagira et al., 2010b; Thornton et al., 2002).

Butcher selection

All butchers known to source pigs from the villages within the four sub-locations were enumerated in 2008 and 2009 by local government meat inspectors, pig farmers and village elders based on their personal recollection. The enumeration process was repeated in 2009 to ensure that new butchers, or those not enumerated in 2008, were invited to participate. Each enumerated butcher was invited to participate in the study either in June of 2008 or June of 2009. To fit the inclusion criteria for the study, butchers had to purchase pigs at least once every month for the purpose of butchering and selling the pork; middlemen who purchased pigs for the purpose of reselling to butchers were excluded. Un-licensed butchers were allowed to participate in the study.

Survey design, questions and beta test

A structured questionnaire was designed to capture information about butchers, their processes and their opinions on the challenges of pig butcher operations in the areas of procurement, transport, slaughter, marketing and government regulation. Questions about the butcher included age, education levels, how long the butcher had been in the business, and how the butcher got

into the business. Questions about the procurement of pigs included who the butchers purchased pigs from, how many pigs were purchased weekly, whether or not they resold pigs they purchased, all of the methods they used to find pigs, and whether the butchers had contracts with farmers. Transport questions included methods of getting to the farm to see pigs, methods of transporting the pigs, how far the butcher typically travelled in a day searching for pigs, how much time the butcher spent in a day searching for pigs. Slaughter questions included how often the slaughter slab was used, what proportion of pigs were inspected by government inspectors, and the labour required for slaughter slab help. Questions about the marketing of pork included whether the butcher sold raw pork or both raw and cooked pork, the number of pigs purchased and sold in for the shop each month of the year, the number of employees in the shop, and whether ugali (staple food made with ground maize) was sold with cooked pork. Questions about government regulation included the costs of their license renewals, the nature of the licenses, and how often they were required to renew their licenses.

The survey also included a 5-point Likert scale rankings for a list of potential challenges in the areas of procurement, slaughter, inspection, transport, capital, marketing and regulation. In 2008, the pre-designed questionnaire was beta tested on one butcher in the field and then modified before other interviews were conducted. The questionnaires may be obtained by request to the authors.

Interview process

Pig butchers were initially contacted by telephone or in person by a village elder or a government inspector who described the research study. The butchers who were willing to participate provided a convenient time and location for an interview. An individual, face-to-face interview was conducted with each butcher in either 2008 or 2009 by one of the researchers and a local villager who spoke both English and Swahili. The survey questions were asked in Swahili unless the butcher was comfortable responding in English. All answers were translated into English and transcribed by the researcher onto the data collection form. Neither the government inspectors nor the village elders were present for the interview. The butchers were assured that the information they provided was confidential and that only aggregated data would be used for the study. The butchers were interviewed at their shop or home, or while they were in transit searching for pigs. All butchers volunteered to be part of the survey and gave approximately 1.5 h of their time of each visit to complete a questionnaire. As a gesture of appreciation, butchers were given a package of 100 small bags which are commonly provided to customers to carry purchased pork. Research ethics approval was granted by the University of Guelph in Ontario, Canada and by the Veterinary Director General in Nairobi, Kenya before the interviews were conducted.

Data management and analysis

The data were entered into Microsoft Excel 2007 (Microsoft, Redmond, WA, USA) by one researcher and then validated independently by a second researcher. All analyses were conducted in SAS 9.1. (SAS Institute Inc. Cary, NC).

Describing butchers and assessing differences across district

Descriptive tables were created using means and standard deviations (SD) for continuous variables, and proportions for categorical variables. To assess differences experienced by butchers across districts (rural Busia or peri-urban Kakamega), Student's t-tests were used on continuous variables. To assess differences experienced by butchers across districts, chi-squared analysis was used and odds ratios were calculated on categorical variables. A Fisher's exact test was used rather than the chi-square test if an expected cell value for any categorical outcome was less than 5 (Davis, 2007). Where variables differed between districts, they were presented separately in the results section; otherwise the overall result was presented.

Assessing butcher challenges and seasonal variation

To assess the differences between butchers' scores given to the challenges between districts, a Kruskal-Wallis test was performed. Each challenge was then individually assessed using a Wilcoxin-Mann-Whitney test. Bonferroni and Sidak adjustments were performed on p-values to control for experiment-wise error rates. To assess the differences of monthly pig purchases between districts, the Kruskal-Wallis and Wilcoxin-Mann-Whiteney tests were performed as described earlier for the butchers' challenges.

RESULTS

The butchers

Table 1 provides the number of butchers who were enumerated and the number of butchers who participated in the study. In total, 51 pig butchers were enumerated, and 50 were studied; 25 from rural Busia and 25 from peri-urban Kakamega. The majority of butchers were interviewed in 2008 however additional butchers were added in 2009 because they were either missed in the 2008 enumeration or they were new to the business in 2009 (Table 1). One butcher that was enumerated in 2008 could not be reached in either year, and was not interviewed (Table 1). One farmer who purchased pigs only in the busy season and then slaughtered and sold the pork from his farm and one middleman were interviewed but excluded from the study. All butchers were male except one. The butchers were between the ages of 20 and 60 with a median age of 33 years [mean age of 36.5 years (sd = 10.71)]. On average, the butchers had been in the business for 8.5 years (sd = 7.41). There were several new butchers in the business with 19% having less than 1 year, 12% between 1 and 2 years, 16% between 3 and 5 years, and 53% with more than 5 years experience. Twenty-six percent (26%) of the butchers also identified farming as another livelihood activity but none of the pig butchers butchered other livestock. Education levels varied: 10% had no education, 20% attended some primary school, 37% completed primary, 6% attended some secondary school, 25% completed secondary school and 2% completed college.

Many butchers learned the butchering business from a family member (44%). Others learned on their own (19%), from working for another butcher (17%), from a friend (14%), from a farmer group, co-operative (3%) or in school (3%). The butcher business was sometimes

Table 1. Count of pig butchers who were enumerated and voluntarily participated in a cross-sectional observational study in Busia and Kakamega Districts of western Kenya, 2008 to 2009.

	Busia	Kakamega	Total
Enumerated and interviewed in 2008 only	16	20	36
Enumerated and interviewed in 2009 only (in business in 2008 but not enumerated)	4	2	7
Enumerated and interviewed in 2009 only (new to business in 2009)	5	3	8
Enumerated in 2008 but not interviewed in 2008 or 2009	0	1	1
Enumerated and interviewed but excluded from study because inclusion criteria not met	2	0	2
Total butchers enumerated in 2008 or 2009 that met inclusion criteria	25	26	51
Total butchers interviewed in 2008 or 2009 that met inclusion criteria and were included in study	25	25	50

Participating butchers responded to a questionnaire in either English or Swahili. The questionnaire was exploratory in nature, designed to capture information about the butchers, their processes, and their opinions on challenges of pig butcher operations in the areas of procurement, transport, slaughter, marketing and government regulation.

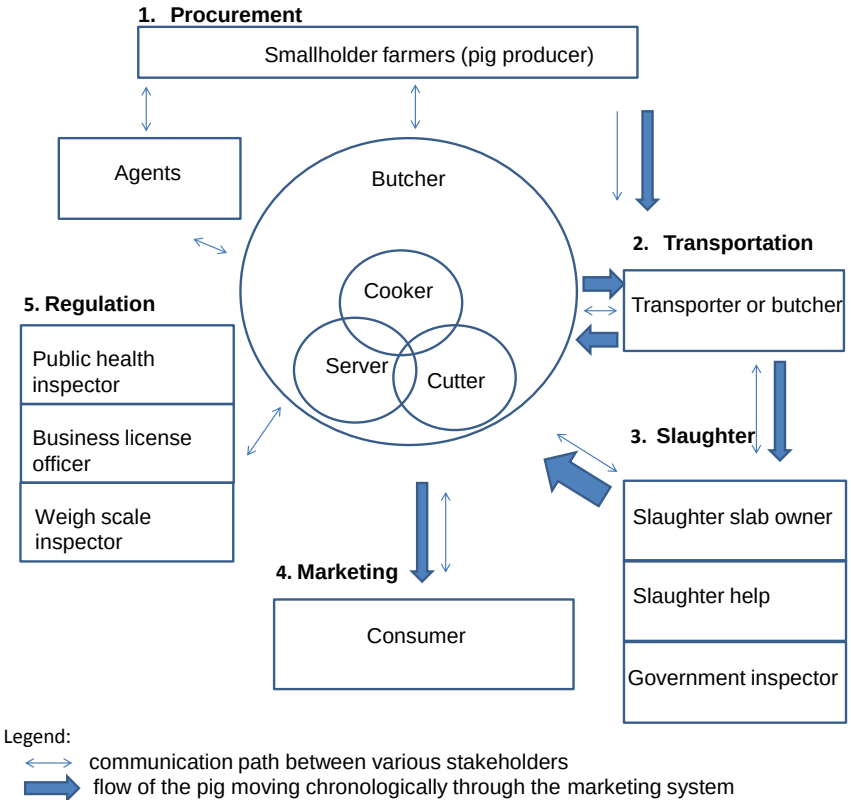

Figure 1. The communication of people, the movement of the pig, and the activities coordinated by pig butchers in getting pigs to local markets in the Busia District (rural) and Kakamega District (peri-urban) of western Kenya.

generational as 30% of the butchers had fathers who butchered either cattle or pigs.

An overview of the pig marketing system

In the indigenous pig-marketing system being described, the pig butcher was responsible for the coordination of activities and people necessary to transform pigs into marketable pork. Figure 1 depicts the interactions, activities and stakeholders linked to the pig-butcher enterprise. The pigs were not purchased in a central market; instead, butchers purchased pigs directly from the smallholder farmer at the farm gate, sometimes using an agent to aid in finding pigs. A purchased pig was transported to the butcher's shop, the butcher's home, or

Table 2. The operating practices of pig butchers found to be significantly different between rural (Busia) and peri-urban (Kakamega) Districts in western Kenya, 2008 to 2009.

Operational practice being compared	Busia (rural)	Kakamega (peri-urban)	P-value
% of butchers who do repeat business with farmers	81	40	≤ 0.01
% of pigs purchased using an agent	27	47	≤ 0.05
% of butchers that keep pigs on their farm	81	30	≤ 0.01
% of butchers that pay for transport	46	72	≤ 0.01
% of butchers that sell cooked pork	88	26	≤ 0.01
[a]Typical pig purchase weight (kg)	33 (sd = 9.96)	43.4 (SD = 11.51)	≤ 0.01
[a]Typical pig purchase price (Kenyan shilling) per kg	78.2 (sd = 12.3)	85.4 (SD = 12.9)	≤ 0.05

Source: Field data from survey of pig butchers taken in 2008 or 2009 (Table 1).,Differences of proportions (%) across districts were assessed with a chi-squared analysis.,[a] Differences in means across districts were assessed with Student's t-tests.

directly to the slaughter slab (abattoir), depending on the time of day that the pig was purchased. From the butcher's shop or home, the pig was transported to the slaughter slab. Pigs were usually slaughtered in the morning. The pork was inspected at the slaughter slab before being transported back to the butcher shop to be sold to consumers either as raw or cooked pork. The butcher enterprise, slaughter slab and meat inspection were regulated by the government.

Procurement

Most market-weight pigs changed ownership only once between the farmer and the butcher before being sold for pork. Half of the butchers (53%) purchased live pigs and resold an average of 4.8 pigs per month (20% of the pigs they purchased) to other butchers. Butchers found pigs by having farmers coming to their shops to notify them (97% of respondents), using agents to find pigs (75%), going to farms to look (69%), calling a farmer on a cell phone (67%), or getting a call from a farmer on a cell phone (54%). Few butchers reported farmers bringing pigs to the shop (11%). Butchers discouraged people from bringing pigs to the shop to protect themselves from inadvertently purchasing a stolen pig. No butchers from Busia reported purchasing pigs from a supplier on a truck, whereas a small percentage of butchers from Kakamega (20%) did report that as a method for finding pigs. Table 2 presents the operational practices of pig butchers that differed significantly between districts. Busia butchers were 6.1 times ($p \leq 0.05$) more likely to do repeat business with farmers than butchers in Kakamega (Table 2). Few (11%) of butchers said they had an agreement with farmers for purchasing pigs; however none of the agreements were financial in nature. The agreements were only verbal arrangements to do business in the future. Prices were never discussed until time of the transaction. All exchanges were completed using cash. Although, most butchers (75%) reported using agents to find pigs, the proportions of pigs purchased through an agent in rural Busia was significantly lower than that of peri-urban Kakamega (Table 2). Agents were more like informants in that they put the butcher and farmer into contact with one another for a flat fee.

Whether informed by an agent or contacted by a farmer, the butcher always travelled to the farm to see the pig. Butchers reported travelling for 5.4 h (sd = 3.39) or 24.2 km (sd = 28.79) in a day to source pigs. Travel time and distances did not significantly differ between districts. None of the butchers had access to credit for the procurement of pigs. A few butchers explained that they often could not purchase their next pig until they had sold enough pork from the pig currently in their shop. Sometimes a butcher had an opportunity to purchase a pig, but by the time the capital was raised, the pig had been sold to another butcher. Butchers mentioned, informally, a desire to expand their inventory of pigs, seeing opportunity in buying young pigs to feed to market weight or to have pigs as a safety net for when they lacked capital or could not find a pig to purchase. Busia butchers were 11.1 times ($p \leq 0.10$) more likely to keep pigs on their farm than Kakamega butchers (Table 2). Busia butchers also reported significantly lower average pig weights and pig purchase prices (per kg) than Kakamega butchers (Table 2). Butchers classified the factors affecting the price they were willing to pay for pigs on a 5-point Likert scale from most important (5) to least important (1) as follows: size of pig (4.91), health of pig (4.86), time of year (3.86), sex (3.29), breed (3.27) and age (2.73). The size and health of the pig were scored significantly higher than the time of year ($p \leq 0.09$), sex, breed and age ($p \leq 0.0002$). All butchers estimated the weight of the pigs without use of a weight scale.

Butchers reported that 29% of the farmers knew the weight of their pig. Butchers negotiated the price of the pig directly with the farmer. Negotiations began with a farmer stating the price. The gender of the farmer who bartered with the butcher was approximately evenly distributed between males (54%) and females (46%). Purchases were cash sales, so once a butcher

Table 3. Proportion of butchers using various modes of transportation to locate and transport pigs to the butcher shop and slaughter slab in Busia (Bus) and Kakamega (Kak) Districts of western Kenya, 2008 to 2009.

Parameter	Travel to farm to buy pig				Transport pig from farm				Transport pig to slaughter slab			
	Bus % (n = 16)	Kak % (n = 20)	OR	P value	Bus % (n = 16)	Kak % (n = 20)	OR	P value	Bus % (n = 16)	Kak % (n = 20)	OR	P value
Walk	15	35	-	-	40	57	-	-	30	79	8.5	(≤ 0.05)
Bike	95	35	0.029	(≤ 0.01)	95	0	0.011	(≤ 0.01)	70	7	0.03	(≤ 0.01)
Motor bike	10	71	22.5	(≤ 0.01)	15	29	-	-	5	7	-	-
Motor car	0	7	-	-	0	7	-	-	0	0	-	-
Hire a person	n/a	n/a	n/a	n/a	0	21.4	-	-	5	0	-	-

Source: Field data from survey of pig butchers taken in 2008 or 2009 (Table 1). Odds ratio (OR) based on Fisher's exact test (Davis, 2007). n/a: Not applicable, -: not significantly different.

purchased the pig, he bore the cost of the pig if the carcass was condemned at the time of inspection, if the pig was stolen, or if the pig died during transport.

Transportation

Butchers required transportation in several situations; to get to farms to look at the pigs, to move the pig back to a temporary holding space such as the butcher shop or the butcher's home, to move the pig to the slaughter slab, and to transport the pork carcass in a transport box from the slaughter to the butcher shop. Butchers purchased 62% of their pigs from outside of their own village. The main reason cited by 97% of the butchers was that the farmers wanted too much money in their village. One butcher commented that neighbors could see him making progress and therefore thought they expected a higher price due to jealousy. Other reasons included; not enough pigs in their own village (83%), pigs too small in their own village (81%), and pigs not healthy in their own village (81%). Table 3 lists the methods of transport that butchers used for getting to farms to see pigs, transporting pigs from the farm, and transporting pork from the slaughter to the shop. A butcher walked to a farm to see a pig if the farm was close enough. However, pig butchers in Busia were more likely to use bicycles, whereas Kakamega butchers were more likely to use rented motorcycles for farms that were not within walking distance (Table 3). Purchased pigs were most often walked from the farm, but might have been tied to a bicycle in Busia or to a motorbike in Kakamega (Table 3). Some butchers mentioned that transporting a pig on a bicycle was illegal. If butchers found pigs close enough to their business, they did not incur transportation costs because they could walk the pigs. Butchers less frequently paid for transport in Busia than butchers in Kakamega (Table 2).

Some problems associated with transport that were mentioned informally by the butchers included; during transport, authorities asked the butcher for a letter from the person who sold him the pig, pigs were too far away, cycling through rough terrain was very difficult, bicycles got damaged while looking for pigs, butchers were fined for allegedly purchasing a stolen pig. Some problems with travel that were mentioned informally by the butchers included; farmers not being at the farm when they arrived to purchase the pig (and therefore the butcher needing to make another visit), farmer had sold the pig by the time the butcher got to the farm, or the butcher got to the farm but the pig was not large enough to be slaughtered.

Slaughter

Slaughter slabs were privately run enterprises, and butchers were charged a fee for each pig slaughtered. A government inspector examined the carcass at the slaughter slab and condemned unsafe meat. After inspections, the butcher was provided with a ticket to display alongside the pork in the shop to show the inspection date. All but one butcher said that 100% of their pigs were slaughtered at the slab. However, some butchers (14%) admitted that not all pigs were inspected, especially in very busy seasons such as Christmas. Government inspectors were to be available at each slaughter slab for a short time each day, usually in the mornings. Two butchers mentioned informally that government inspectors did not come every day, or came later than expected on some days, resulting in some missed pork inspections. Overall, butchers reported that

Table 4. Challenges in operating a pig butcher enterprise as scored by the relative importance by butchers, illustrated by the mean value of a score from 1 (low) to 5 (high) challenges in Busia and Kakamega Districts, western Kenya, 2008 to 2009.

Busia			Kakamega		
Challenge	**Mean**	**Median**	**Challenge**	**Mean**	**Median**
Seasonal variation	4.3	4	Pig prices	4.4	4
Capital	4.3	4.5	Finding pigs	4.4	5
Licenses	4.2	5	Licenses	4.2	4
Pig prices	4.2	4.5	Travel	4.2	4
Transport	3.6	4	Capital	4.2	4
Travel	3.4	3.5	Transport	4.1	4
Competition	3.0	2	Profit	3.4	3
Profit	2.9	3	Seasonal variation	3.3	3
Finding pigs	2.8	3	Competition	2.9	3
Selling pork	2.8	3	Selling pork	2.6	2

Source: Field data from survey of pig butchers taken in 2008 or 2009 (Table 1).,The Busia butchers scored seasonal variation higher than Kakamega butchers ($p \leq 0.05$). Kakamega butchers scored finding pigs higher than Busia butchers ($p \leq 0.05$).

93% of the pigs they slaughtered were inspected. This did not differ by district.

Marketing

Pork was sold in local shops either as raw pork or as a plate of cooked pork, served optionally with ugali which was sold separately. Ugali, the staple food in the area, is maize flour cooked with water into a dough-like consistency. Butchers in rural Busia were 20 times ($p \leq 0.05$) more likely to sell cooked pork than butchers in peri-urban Kakamega (Table 2). For butchers that sold cooked pork, less than half (41%) of the pork they sold was cooked, while 59% was sold raw. Butchers hired 2.8 employees (sd = 1.38) to help run their operations. Employees served many functions, including cutting pork, serving customers, cleaning, cooking and helping with slaughter (Figure 1). Some butchers relied on employees to look for and transport pigs.

Government regulation

Butchers were required to have health certificates for each employee who handled pork in their shops. A local business license was also a prerequisite for keeping a shop. One butcher admitted he was operating part-time without a license. Business licenses, health certificates and weigh-scale inspections were charged to butchers on an annual or semi-annual basis.

Butchers' perspectives on their challenges

Table 4 lists the challenges scored by butchers (using a Likert scale) in each district from highest (5) to lowest (1). Busia butchers scored seasonal variation and access to capital as their highest challenges (Table 4). The Busia butchers scored seasonal variation higher than butchers in Kakamega ($p \leq 0.05$). Seasonality reduced sales and forced butchers to lower prices. The reasons cited for lower sales were that people needed money for school fees, farm inputs, and planting, and therefore did not have extra money to buy pork. Kakamega butchers scored pig prices and finding pigs as their highest challenges. Kakamega butchers scored finding pigs as a higher challenge than butchers in Busia ($p \leq 0.05$). Selling the pork was the lowest scored challenge for butchers in Busia and Kakamega (Table 4). Figure 2 illustrates the seasonal variation of pig purchases by month.

From August through September, pig purchases increase, after the biggest harvest and the sale of crops which gave farmers disposable income to purchase pork. November and December were very busy months, attributed to people having money available from the second harvest. Also, family members came back to the villages for the December holidays, bringing money from their city jobs, and families were more likely to eat pork during the holidays. No significant differences in pig purchase counts were found between Busia and Kakamega butchers for any given month.

DISCUSSION

The butcher and the role of butcher enterprise in pork marketing

The butchers in the local pig-marketing system are central to the coordination of activities required to connect pig farmers to pork consumers in their communities. The butchers provide smallholder farmers

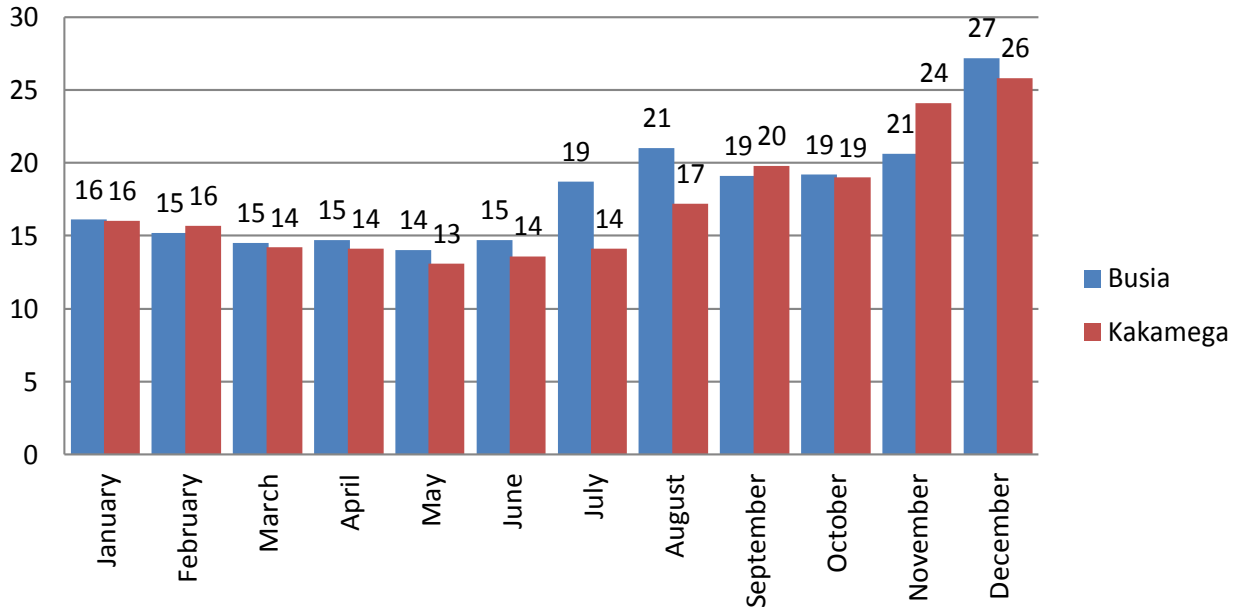

Figure 2. Mean number of pigs purchased per month by butchers in Busia and Kakamega Districts, western Kenya, 2008 to 2009. Source: Field data from survey of pig butchers taken in 2008 or 2009 (Table 1). No significant differences in pig purchase counts were found between Busia and Kakamega butchers for any given month.

the only legal marketing outlet for inspected pork, as they are required to have health and business licenses to handle and sell pork. Butchers invest their own capital and assume the risks associated with purchasing pigs, transporting them, having them inspected, and selling the pork. They also create employment opportunities in their communities. Employment creation is an important benefit of local markets (Puskur et al., 2011). Many butchers, particularly in rural locations also cook the pork. Consumers rely on the butchers to have the pork inspected and to safely handle and cook the pork. It is important that butchers appreciate the need to have pigs inspected and to ensure that pork is properly cooked. Infection from zoonotic pathogens such as porcine cysticercosis, trichinellosis and toxoplasmosis can occur from the consumption of infected and undercooked pork (Thomas et al., 2012). Estimates on the prevalence of porcine cysticercosis in the study locations has been reported to be between 4 and 4.5% at the pig level, and between 9 and 15% at the farm level depending on the testing method and the study (Kagira et al., 2010c; Mutua et al., 2011). The outreach and training on prevention of zoonotic pathogens has tended to focus on farmers (Flisser et al., 2003; Ngowi et al., 2009; Wohlgemut et al., 2010). Educating butchers is also important as results from this research show that butchers do not have all their pork inspected and the butchers that sell cooked pork are the last prevention point before pork is consumed.

Kagira et al. (2010b) reported that the District Veterinary Officer felt there was insufficient staffing and transport capacity to support the number of slaughter slabs in Busia District. The government should equip inspectors with the resources to travel to each slaughter slab more frequently than once a day during high seasons and ensure visits are consistent during lower seasons. In our study, the one unlicensed butcher that operated part-time did not use slaughter slab facilities, or have pork inspected, or have a license to handle and sell pork. Un-inspected pork increases the health risk to the community as discussed earlier and may compromise the reputation of the industry if people fall ill to un-inspected pork. Butchers that do not pay for slaughter, inspection or licenses have fewer expenses which make for illegal and unmerited competition. Further research should be completed to understand community perceptions of illegal pig slaughtering, and the impact unlicensed butchers have on the pork industry.

Procurement

Butchers spent a considerable time searching for pigs. The travel time and expense of travelling to farms only to find the pigs were not market weight, the farmer was not present at the farm to negotiate a price, or the pig had already been sold was challenging for butchers. It is also costly to have to visit each farm and negotiate each pig purchase given the distances that butchers must cover. The cash-only exchange of goods without any pre-arranged agreements or warranties has been characterized as a “flea market economy” by Fafchamps (2004). In the absence of weigh scales, grading systems, and contracts, butchers will not risk a pig acquisition

without seeing the pig despite doing repeat business with farmers, and farmers will not allow the butcher to take the pig without cash payment. The lack of contractual enforcement (and therefore use of contracts) and grading systems has been recognized as costly to marketing systems in SSA (Poulton et al., 2010; Coulter et al., 2002; Kyeyamwa et al., 2008). The pig weight was the most important criteria for butchers in evaluating pig prices. Without weigh scales, butchers and farmers had to estimate the weight of the pig to negotiate the price. Since butchers reported that only 29% of farmers were able to estimate the weight of pigs, there was likely inequality of abilities and to estimate pig weights during price negotiations. Farmers who under-estimate their pigs' weight, may under-value the pig and consequently receive a poor pig price. Smallholder farmers generally only sell 1 pig per year (Kagira et al., 2010b) so low revenue from a poorly negotiated pig sale could have a substantial impact on annual income, and lower farmers' incentive to raise pigs.

Kyeyamwa et al. (2008) identified a similar scenario in Ugandan cattle markets, where traders had the experience of negotiation, could better estimate cattle weights and knew prices in the various markets available to them. Busia farmers reported receiving low prices in the study by Kagira et al. (2010). To reduce a butcher's advantage of being able to better estimate pig weights, the use of tape measures should be encouraged. Weight charts have been produced for pigs in the area of study (Mutua et al., 2011). Tape measures have been used in the absence of weigh scales for sheep and other ruminants (Kunene et al., 2009). Better estimated weights could also improve communication with the butcher to further reduce search costs and increase information flow. Producer groups could also help increase the efficiency of pig exchanges between butchers and farmers by producing a set of standards for pricing pigs, and tracking the prices of pigs sold based on the standards applied. These pig sales could be shared on local marketing boards (Kyeyamwa et al., 2008; Shiferaw et al., 2011). Lack of market information was a reported challenge by pig farmers in Busia (Kagira et al., 2010). Shiferaw et al. (2011) suggested that collective action is not as important for local markets as it would be for upstream markets. However, farmer groups could help to reduce the transaction costs associated with the local marketing system described and could benefit and promote cooperation between all stakeholders in the market.

Leveraging technology such as SMS messaging for cell phones or other cellular communication protocols could also improve the information flow for pig exchange. Not all farmers have cell phones, but the results from this study have shown that farmers and butchers do communicate about potential pig exchanges using cell phones. Use of electronic media has been acknowledged as a potential solution for increasing information access (Kyeyamwa et al., 2008; Poulton et al., 2010). Electronic solutions have already seen traction in larger markets. Kenya does have an electronic commodity exchange board called Kenya Agricultural Commodity Exchange (KACE), which is a privately operated and facilitates commodity exchanges. A simplified, localized messaging system (either electronic or a simple bulletin board) could effectively service rural markets as well if it could be made cost effective and sustainable. A lack of sustainable financing has hindered the potential benefit that could be achieved with market information systems in SSA (Tollens, 2006).

Slaughter and transport

The challenges associated with slaughter and transport included condemned carcasses and death or loss of the pig in transit. Butchers assumed the risks of loss of the pig from the moment the cash was exchanged with the farmer. Loss of one pig could result in a complete depletion of capital, which could force the butcher out of business. The risk of purchasing a pig and not being able to receive revenue from it due to loss is amplified in a marketplace where butchers are constrained by capital. Insurance programs to protect butchers from losses due to condemned carcasses or transport should be researched for feasibility and discussed with butchers to evaluate uptake of such programs. Currently, if a butcher has the carcass condemned, he may not have enough capital to purchase another pig for his shop, so we feel that butchers would take an interest in insurance products to back their pig purchases. Targeting butchers for insurance programs could reduce the costs associated with monitoring, moral hazard, and adverse weather conditions that have disrupted farmer insurance programs in the past (Poulton et al., 2010).

Marketing

Selling the pork was not a highly scored challenge for the butchers. An evaluation of cost structures, and marketing margins was beyond the scope of this paper; however, detailed net income statements should be assessed to understand the efficiency of butchers in rural and peri-urban settings, and the potential profitability of pigs for farmers and pig butchers in these markets.

Challenges and rural and peri-urban differences

Butchers faced a myriad of challenges in the day-to-day functioning of their enterprises. The rural Busia butchers scored seasonal variation and capital as their highest challenges (Table 4). The two challenges are likely related. In Busia, farmers are more dependent on farm

income, so their disposable income fluctuates with harvest or wet and dry seasons. The dry seasons are difficult for marketing pigs, so butchers buy and market fewer pigs and lower their pork price, which negatively impacts their income, and working capital. The effect of seasonal market fluctuations is not unique to pork demand and reflects the seasonal pricing challenges of many commodities in SSA (Williams et al., 2006; Michelson, 2012). Suggested approaches to consumption smoothing include the use of warehouse receipt systems (Coulter and Onumah, 2002), and better infrastructure to promote distance trading (Poulton, 2010). However, warehousing pork requires electricity and freezers, neither of which is available to these butchers. Kakamega butchers' greatest challenges were high pig prices and finding pigs. In turn, they relied more on agents to find pigs. Butchers used agents to find pigs, rather than middlemen, likely because it was less expensive to pay a search fee to an agent, than a mark-up fee to a middleman. Generally, as the number of exchanges increase, the farmer's share of the retail price tends to decrease and deters participation (Kyeyamwa et al., 2008). Researchers did not get the sense from butchers that there were many pig middlemen in the market, and only encountered and interviewed one middleman (excluded from the study), who claimed to purchase most of his pigs in Uganda (Busia boarders Uganda). However, Kagira et al. (2010) suggested that in Busia, "amorphous" middlemen did purchase pigs to resell them to butchers but these researchers could not quantify margins or numbers of pigs. The Kenyan Pig Industry Act discourages the activities of middlemen, as it is legal for a farmer to sell pigs only to other farmers, a licensed pig butcher, or a licensee of a bacon factory (Anonymous, 2006).

Butchers were capital constrained, with no access to credit as is seen with many small enterprises in marketing chains in SSA (Atieno, 2001; Kyeyamwa et al., 2008; Ajala and Adesehinwa, 2007; Jabbar et al., 2008). Some butchers could not purchase their next pig until they had enough revenue from the pork currently being sold in their shop. During low seasons, when butchers are charging less per kg of pork, raising the capital for the next pig becomes even more difficult, and butchers in turn have to lower the price they offer farmers. Busia butchers were more likely to keep pigs as part of their own farm asset mix, likely, to ensure having a steady supply of pork for their shops, or a buffer from short-fall of capital to purchase another pig. It also may indicate that the transaction costs associated with purchasing pigs is higher in Busia, and therefore butchers have more incentive to integrate their operations vertically (Klein et al., 1978; Coase, 1937). The Busia butchers also purchased smaller pigs, which meant they had less marketable pork per pig, requiring them to purchase pigs more often. The challenges described in this paper agree with those presented by Kagira et al. (2010) who identified travel, pig transport and seasonality as challenges in Busia. Their research also mentioned police and authoritative conflicts and outbreaks of African swine fever causing pig shortages. Butchers in the current study were given the opportunity to add to the list of challenges provided by the researchers. However, they did not add the challenges mentioned by Kagira et al. (2010). Other researchers have more broadly attributed credit, transportation, communication and corruption as limitations to the effectiveness of agricultural markets in emerging economies (Barrett and Mutambatsere, 2005; Kydd and Dorward, 2004; Kyeyamwa et al., 2008).

Rural butchers rode bicycles and paid for transport less often, whereas peri-urban butchers relied more on motor transport. Most butchers in rural Busia but only a few butchers in Kakamega sold cooked pork. People in Busia may find it more challenging to cook meat because of firewood scarcity or the additional costs incurred. The demand for cooked pork in Kakamega may have been too low to make cooking pork worthwhile in most market places. Another possible explanation is that in Busia, there were two market days each week. Local farmers converged to the market to sell their wares on these two days. In contrast, Kakamega markets were established marketplaces that were always open. As there are differences between the rural and peri-urban markets, approaches to intervention, educational programming or regulatory policy should consider these differences.

Study limitations and challenges

This study used a convenience sample from 4 sub-locations; Butula and Funyula in Busia, and Shinyalu and Ikolomani in Kakamega. The differences which contrasted Busia and Kakamega butchers were extensive. Our samples are therefore not likely representative of many markets in Kenya which differ in population density, pig rearing systems, infrastructure and consumer demand. Central Kenya and markets around Nairobi for example are much higher density areas, pig-rearing is more intensive, transport conditions are different and commercial pork processors such as 'farmers choice' operate large facilities likely offer a greater marketing opportunity to farmers in those areas (FAO, 2012; Wabacha et al., 2004). Having livestock officers and village elders enumerate and enroll pig butchers likely made butchers feel compelled to participate in the study, and butchers may have been reluctant to discuss some aspects of their business as a result. Un-licensed butchers may have been under represented as livestock officers were likely unaware of their operations to enumerate them. The proportion of pigs that were reported to be slaughtered may have been over-reported as a result. Surveying pig butchers was challenging as they are often in transit as searching for pigs.

Conclusions

Understanding the pig-butcher enterprise and the pork marketing system may lead to innovations, interventions, or education opportunities to increase marketing efficiencies and improve product quality, which ultimately should increase profitability for farmers and butchers and make safe protein sources more accessible to resource-poor people. Several differences between rural and peri-urban market settings were identified in this study including pig sizes, pig prices, agent use, farmer-butcher relationships, methods of travel and transport, and the marketing of pork (cooked or raw), and should be given consideration when addressing policy issues or extension services. Butchers service a large number of smallholder farmers and are key to the marketing of pork. They also add employment opportunities to people in their communities. Further research is required in the areas of public health, innovation, profit margins, value-chain improvements and marketing approaches to ensure a sustainable indigenous pork market. For example, public health can be enhanced by ensuring inspectors are available more frequently during high consumption seasons. Market information can be improved by innovations such as a marketing board. Marketing efficiencies and profitability for farmers and butchers can be improved by promoting the tape measure as a tool to estimate the weight of the pigs. If farmers become more knowledgeable about the weight of the pigs they are selling, the communication between butchers and farmers will be better and the trade of pigs will be more equitable. Farmer groups could aid in reducing transaction costs incurred by both the farmer and the butcher, and should be further explored.

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