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**Greater Cane Rat Market Survey in Ghana**

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## **Declaration**

I hereby declare I wrote my Master's thesis entitled "Greater Cane Rat Market Survey in Ghana" myself and I have used only sources cited in text and list of references. I agree that my Master's thesis will be accessible for future studying purposes in the library of CULS.

Prague, 27th April 2018

.....

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## **Abstract**

This Master's thesis described the trade of greater cane rats (*Thryonomys swinderianus*) its origin, price and demand and supply on local markets in Greater Accra region in Ghana. Greater cane rats are important source of animal protein in Western Africa and considered as a local delicacy which is also reflected in its price. They are sold on local markets and also frequently bred on farms or in backyards. Data were collected on markets and farms in Greater Accra region in Ghana. For data collection on market I used semi-structured interviews based on scenarios and respondents from markets were randomly selected. On farms were data collected through short interviews with farmers which were selected by the method of snowball sampling. Important part of my research was observation of market and farm environment. Total number of 25 respondents participated in my survey, 10 farmers and 15 market sellers from 8. All greater cane rats sold on market were originated from wild. In 73 % market sellers knew the origin of greater cane rats, which was mostly in Afram plains (46 %), in Dodi (27 %), in Dodwa (18 %) and in Nsawam (9 %). The remaining 23 % of market sellers did not know exact place of origin, but they assumed, that greater cane rats are originated in Eastern region. According to market sellers demand for greater cane rats is high during the all year and especially during the Christmas time. Supply for greater cane rats depends on season – higher supply is during the rainy season, while the lower supply is during the dry season . Price of greater cane rats sold on local markets ranged from 50 to 200 GH¢ per whole body, but market sellers sold also smaller cuts of meat for average price 30 GH¢ ( $\pm 10.32$ ). Price of greater cane rats was slightly lower and ranged from 50 to 150 GH¢ per whole body. Market sellers were predominantly women (93 %) with average age 44.6 years ( $\pm 11.3$ ). Farmers were mostly men (96 %) with average age 55 years ( $\pm 9.47$ ) and had significantly higher education than market sellers.

**Key words:** grasscutter, chain market, food source, local market, origin

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# 1. Introduction and Literature Review

Greater cane rat (*Thryonomys swinderianus*) is currently very demanding meat source and source of animal protein in Western Africa (Fonweban et al. 1990). Greater cane rat meat is well accepted to all social classes in both rural and urban areas (Omole et al. 2005). There is no taboo about consumption, which is huge advantage of greater cane rats and makes meat suitable for all religion (Salau et al. 2017). In Ghana, greater cane rats are the most popular and most common bushmeat animals (Tutu et al. 1996).

Greater cane rats, in Ghana called “Akrantia” (Akinola 2015) or in West Africa called “grasscutters”, “marsh cane-rats” or “ground hogs” (Opara 2012), are very often hunted in the wild as a bushmeat. They are also abundantly breed on privet small scale farms as a source of additional income. Greater cane rats are one of the most popular game species in West Africa (Jori et al. 2005) sold on the local market. Greater cane rat is one of the major non-conventional livestock bred in Ghana (Anonym 2016). Its production is crucial to the development of economic of the country as a result of its impact on food security, povetry palliation and employmnet generation. Utilization and farming of greater cane rats is relevant in improving the living standards of rural, urban and sub-urban households (Salau et al. 2017).

The name “greater cane rat” is based on their raid on sugar-cane plantations (Vink 2014).

## 1.1. Greater Cane Rat (*Thryonomys swinderianus*)

### 1.1.1. Description

Greater Cane Rat (*Thryonomys swinderianus*) belongs to family Thryonomyidae, order Rodentia – according to presence of one pair of chisel-like incisor teeth in each jaw (Adu et al. 2017), class Mammalia. According to IUCN Red List of Threatened Species it is least concern animal species. Greater cane rat, the second largest rodent of Africa (Vink 2014), has heavily built body (Taiwo 2006) which is about 0.35-0.61 m long, and tail is up to 0.26 m long (ADW 2002). Weight of adult individuals can reach up to 9 kg (Vink 2014), but average body mass is from 3.5 kg in females to 4.5 kg in males (Merwe 2000). They have small round ears and round muzzle (Taiwo 2006). The color of their thick coat ranges from brown reddish and grey to black (Jori & Chardonnet 2001; Opara 2010) and the skin is pale and tender (Figure 1). There is no visible sexual dimorphism, only females have a little elongated head in comparison with males (Adu et al. 2017). To determine sex are also used methods of body measurements (Lindenfors et al. 2007).

This species is nocturnal, with sharp eyesight and well developed sense of smell. They are also very strong and smart animals, if they are threatened, they can jump very high or fast run away into nearest dense vegetation or into open water (Aluko et al. 2015). Even though they have blunt snout, they are excellent swimmers (Opara 2012). If they are caught by the tail, they can detach it from the body by rotating (Vink 2014), which makes them very difficult to catch or handle (Opara 2010).



**Figure 1** Greater cane rat (photo by author).

### 1.1.2. Distribution and habitat

Greater cane rat can be found only in Africa (Rosevear 1969; Baptist & Mensah 1986; Opara 2012) and is widely distributed from Senegal to Gambia, Guinea, Central African Republic, north of Democratic Republic of the Congo and south of Sudan. This species is found in savanna grasslands, secondary forests and cultivated lands (Vink 2014) and close to freshwaters, in tall dense grass with thick cane stems. Original habitat was exclusively on river basins and wet habitats (Cocker et al. 2017) latest its range habitat is common in urban areas like edges of large cities (Red List, IUCN 2016). Their distribution is affected by the presence of dense grasses (Rosevear 1969) and appropriate grass species they eat (Opara 2012). In comparison with other rodent species, grater cane rats do not dig holes; they use burrows made by other animals instead (Vink 2014).

### 1.1.3. Reproduction

Sexual maturity at males is in 8 months with minimum body weight 2.5 kg and in females in 6.5 months with minimum body weight 1.8 kg (Akinbobola, Livestocking net). Females are induced or reflexed (Vink 2014) ovulators and are able to breed all year round, usually they are able to litter twice a year. In captivity is female normally transferred into the males cage for mating (Opara 2010). Then is necessary to observe signs of mating and pregnancy signs. Is absolutely necessary to isolate female from male if occurs serious fighting between them (Vink 2014), because there is risk of serious injury (Figure 2).



**Figure 2** Injured female after fight with male (photo by author).

Detect pregnancy is possible with several methods: observation (size of belly is increasing), palpation of abdomen, weight gain monitoring (increasing of weight) or pregnancy test. Pregnancy test is done by inserting a clean end of cotton on wooden skewers half-way into the vagina (Vink 2014). Red, brown or yellow mucus indicates pregnancy in 100 % cases (Jori et al. 2005). After pregnancy confirmation female must be separated from male, because of risk killing the young individuals or pregnant female injury (Vink 2014).

The gestation lasts from 148 to 170 days with average length 152 days. After four months of gestation is good to place clean grass to the cage for making a nest (Vink 2014). Greater cane rats give birth to 2 – 6 young (Addo et al. 2007), in some cases up to 11 young (Vink 2014). Newborns are precocious, which means, that they are fully developed (Vink 2014) – born with full fur, with open eyes and ears and are able to walk (Addo et al. 2007) (Figure 3). Their weight after parturition is 80-150 g. Females are ready to mate again 6 – 8 week after delivery (Vink 2014).



**Figure 3** Few weeks old greater cane rats (photo by author).

## **1.2. Breeding of greater cane rat**

Breeding of greater cane rats has good social acceptability, inexpensive feeds and accessibility to captive breeding (Owen & Dike 2012). Greater cane rats can suffer from

parasites and fatal infectious diseases (Baptist & Mensah 1986), it is necessary to vaccinate animals and de-worming every 3 months.

### **1.2.1. Domestication**

First attempts of domestication have begun in early 1970s. The domestication programme was initiated by Department of Forest Resources Management at University of Ibadan in Nigeria (Ntiamoa-Baidu 1997). Main purpose of domestication was to increase meat availability (Aluko et al. 2015) and maximize meat production (Ntiamoa-Baidu 1997) because of high demand for their meat (Opara 2010). There was also urgent need for the feeding for the malnourished population in developing countries (Ajayi & Tewe 1980).

The studies report that greater cane rats have adapted very well to new captive conditions (Ntiamoa-Baidu 1997). For successful domestication should be provided similar conditions as in the wild environment with a sufficient supply of fresh grasses (Vink 2014). Domesticated cane rats are submissive and able to eat from keepers' hand. In captivity they still have the ability of reproducing and caring of offspring itself (Gatune & Ransom-Ofori 2014).

Greater cane rats are good choice for domestication – require little care every day, little space, easily accessible feeding which can be grow on farm or harvested from wild, and easy integrate into developed farm or in backyard. Approximately 0.2 % of world meat production of greater cane rat comes from domesticated individuals (Gatune & Ransom-Ofori 2014). Domestication may lead to increasing of inbreeding and reduction of genetic variation (Bruford et al. 2003).

### **1.2.2. Farming**

High demand for greater cane rat meat led to over-harvesting and aggressive hunting of animals from wild. It had the consequence in habitat destruction and decreasing of wild greater cane rat population (Salau et al. 2017). It has resulted in domestication and farming bussines of greater cane rats in Ghana (Adu et al. 1999; Coker et al. 2017).

Regardless the intensive reduction of wildlife population, bushmeat and their products are still important in the economy (Tutu et al. 1996). Greater cane rat production is highly supported by the Government of Ghana (Ministry of Food and Agriculture) and NGOs (Non-Governmental Organizations). Farmers are trained by NGOs to gain knowledge, skills and background in breeding of greater cane rats. However, not all trained farmers will produce greater cane rats in the end (Annor & Kusi 2008).

Economic potential of farming greater cane rats is dependent on the placement of the farm, whether is farm near urban areas, where is higher demand for bushmeat and price can be also higher. In these areas can be profitable middle-sized farms (Jori et al. 2005). Small-scale farming is still important for the poor or landless people, since they have their farms in the backyards (Aiyeloja & Ogunjinmi 2013) and is more profitable than large-scale farming (Tutu et al. 1996). However this system of breeding animals requires initial capital investments as fencing, cage materials, etc. (Aiyeloja & Ogunjinmi 2013). Farming of greater cane rats is important income to household and also alternative source of animal protein. In Ghana, majority of greater cane rat farmers is situated at rural communities and villages (Hagan et al. 2016). This farming is also important aspect of organic agriculture (Banjo et al. 2012). Small-scale farming of greater cane rats proves better returns before poultry and rabbits (Bojö 1996).

### **1.2.3. Feeding**

Greater cane rats are monogastric (Jori et al. 2005) herbivorous rodents (Akinola 2015), which are easy to feed (Baptist & Mensah 1986). 70 – 80 % of their feeding should consist of forage (Vink 2014). Proper nutrition is necessary for efficient production of greater cane rats and their high productivity (Karikari & Nyameasem 2009), because they have ability of conversion of cellulosic material into precious animal protein (Salau et al. 2017). As forage can serve variety of grasses – mostly elephant grass (*Pennisetum purpureum*) (Figure 26) and guinea grass (*Panicum maximum*) (Adu et al. 1999), leaves, legumes and crop residues. Annor et al. (2008) found, that portion of elephant grass leaves is more nutritious than stem and meat from animals fed on stems is less fat. Forage can be fed dry (hay) or conserved (silage), which is appropriate feeding during the dry season (Vink 2014). Study of Edoror &

Okoruwa (2017) revealed that cocoa bean shell with cocoyam peel can serve as an alternative for forage grass due the lack of feeding during the dry season.

Further they also consume bark, nuts, fruit, vegetable, cassava, yam, maize and sugar cane (Aluko et al. 2015) (Table 1). Although this animal species is herbivorous, they consume in small amount insect and small rodents. Vink (2014) states that cannibalism is not unusual, while Ajayi & Tewe (1980) states there occur no cannibalism among greater cane rats.

In captivity, they are often fed by kitchen wastes (Banjo et al. 2012), bread or wheat bran (Adu et al. 2017), but they need minerals, vitamins and proteins as well. Minerals and proteins can be provided in form of the concentrates and vitamins can be provided by fruit and vegetables (Vink 2014). Kusi et al. (2012) found, that greater cane rats can be raised only on concentrate diet; however Etchu et al. (2012) found, that for sustainable production of greater cane rats is possible to feed them with mixture of maize and rodent pellets.

Greater cane rats are wasteful feeders, because they are able to eat more the more nutritious, succulent inter-nodes and leave only pieces of stem. This behavior helps hunters to find greater cane rats in the bush – they follow scattered pieces of stem (Ntiamao-Baidu 1997). Greater cane rats have been reported as serious pests (Ajayi & Tewe 1980) on local fields. They can damage sugar cane, maize, pineapple, egg plant and cassava fields. A lot of plantations are protected by predators as pythons, which are used to prey on greater cane rats. They also can cause damage of corn, millet, sweet potato and cassava fields (Nowark 1991).

Special form of their feeding is coprophagy, which is process of eating their own faeces. Intestinal bacteria recycle faeces and this cause breakdown of cellulose, protein synthesis and provide vitamin B (Vink 2014). Since they prefer grass species with higher moisture and with thick stem (Akinola 2015), they need only a little water (Vink 2014).

**Table 1** List of greater cane rat feedstuff (Vink 2014; Adu et al. 2017)

English name	Scientific name	Part of plant
Cassava	<i>Manihot</i> spp.	Tuber, leaves
Elephant grass	<i>Pennisetum purpureum</i>	Leaves
Guinea grass	<i>Panicum maximum</i>	Leaves
Maize	<i>Zea mays</i>	Leaves, cob, husk
Sugar cane	<i>Saccharum officinarum</i>	Leaves
Banana, plantain	<i>Musa</i> spp.	Leaves, stem
Oil palm	<i>Eleis guineensis</i>	Young shoots
Mango	<i>Mangifera indica</i>	Fruit
Paw paw (papaya)	<i>Carica papaya</i>	Fruit
Pineapple	<i>Ananas</i> spp.	Leaves, peels, crowns
Sweet potato	<i>Ipomoea batatas</i>	Tuber
Taro	<i>Xanthosoma sagittifolia</i>	Tuber
Yam	<i>Dioscorea</i> spp.	Tuber
Sandpaper tree	<i>Ficus exasperata</i>	Leaves
African marigold	<i>Tagetes erecta</i>	Leaves
Job's tears	<i>Coix lacryma-jobi</i>	Leaves
African giant star grass	<i>Cynodon</i> spp.	Leaves
Bamboo	<i>Bambusa</i> spp.	Leaves
Wild sorghum	<i>Sorghum bicolor</i>	Leaves
Rottboellia	<i>Rottboellia</i> spp.	Leaves
Gamba grass	<i>Andropogon gayanus</i>	Leaves

Since greater cane rats are mostly active early morning and in the evening (Schrange & Yéwadan 1999), they eat mostly in the mornings and evenings, therefore it is should be available enough feeding in these times (Adu et al. 2017).

Aluko et al. (2015) refers that greater can rats sit on hind legs during feeding, hold the grass in the forepaws and feed the grass into the mouth. For cutting the grass they use the incisors.



#### 1.2.4. Housing conditions

Breeding of greater cane rat require less space and less capital, it is possible to breed them in backyards where is limited space (Aqwunobi et al. 2009). In captivity can be greater cane rat kept in boxes, in wooden or metal (wired) cages (Figure 4 and Figure 5) or even in open areas within walls or fences (Vink 2014) where can be males and females kept together (Ntiamoa-Baidu 1997). According to Adu et al. (2002) is also possible to keep greater cane rats in empty drums or pipes of Poly Vinyl Chloride material. In proper housing conditions can greater cane rat live up to four years (Jori & Chardonnet 2001; Opara 2012).



**Figure 4** Wooden cage for greater cane rats (photo by author).



**Figure 5** Cages for greater cane rats from wire mesh (photo by author).

### **1.3. Hunting**

In Africa, there is long tradition in hunting a bushmeat as a food source. It was symbol of cultural identity and ethnic origin or source of alternative medicine (Tutu et al. 1996). Ghanaian rural population is dependent on protein from bushmeat and fish (Tutu et al. 1996). Hunting of bushmeat is one of the important sources of income for people in rural and urban areas. Animals are both actively hunted and trapped, not only for meat, but also for a reduction of population, since they can be pests for agricultural plants. However, hunting is not sustainable and can lead to rapid decrease of population (Bennet & Robinson 2000). However, there is needed permission for hunting (Tutu et al. 1996), since the hunting is regulated and controlled by legal instruments (Lindsey et al. 2013). Hunting of bushmeat significantly contributes to the income of rural households living in acute poverty (Cowlshaw et al. 2004).

### **1.4. Nutritional value of meat and quality**

Meat of greater cane rats has higher nutritional value (Opara 2010) and can provide alternative high quality animal protein with less fat than beef, goat or sheep meat. Beside high quality of protein contain also high level of calcium, phosphorus and several types of lipids includes triglycerides, phospholipids and cholesterol (Adu et al. 2017). All these characteristics make this meat suitable for cardiac patients (Opara 2010).

There is significant difference in protein, fat and moisture content in meat of captive and wild greater cane rat. Meat of wild greater cane rats consist higher percentage of crude protein, higher level of Ca, P and Fe (Table 2). Wild greater cane rats also reach higher slaughter weight of 3.12 kg, while the captive greater cane rats reach mean weight of 2.95 kg. There is also difference in organoleptic properties of meat such as aroma, texture and color. Because of these parameters consumers prefer meat of wild greater cane rats (Asuk et al. 2017).

Despite smaller body weight, the yield of meat is higher in comparison to cattle (Clottey 1981, Omole et al. 2005; Adu et al. 2017). Fur must be removed before further processing of meat. There are two methods of removing the fur: flaming and scalding.

Flaming is traditional method, where are slaughtered animals placed on fire wood or straw and the fire is burning. This method improves the taste and flavour of meat. Scalding is method where is dead body of animal dipped into hot water (60-80°C) and fur is scraped with the knife (Omole et al. 2005).

**Table 2** Proximate composition (%) and mineral content of the meat in relation to other domestic animal meat (Opara 2010).

<b>Meat</b>	<b>Moisture</b>	<b>Ash</b>	<b>Protein</b>	<b>Fat</b>	<b>Fe</b>	<b>Ca</b>	<b>P</b>
Beef	73.8	1.0	19.6	6.6	5.1	3.9	57
Mutton	78.5	1.0	17.2	2.9	3.1	9.0	80
Pork	64.8	0.8	19.4	13.4	1.0	3.0	72
Greater cane rat	72.3	0.9	22.7	4.2	2.8	8.3	111

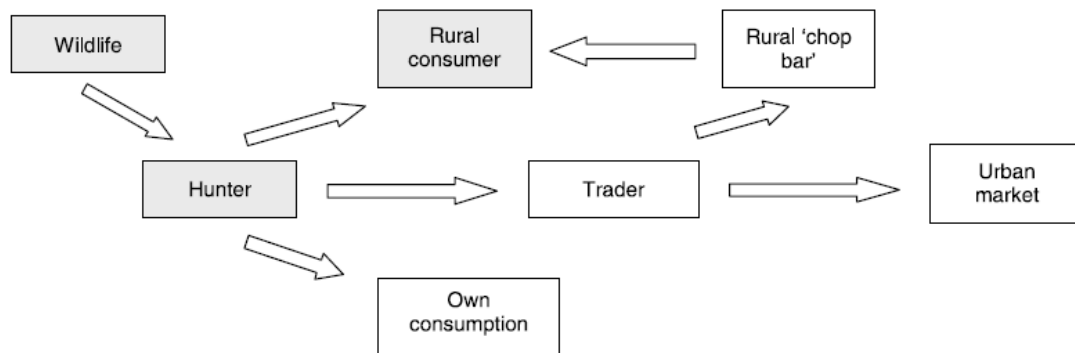
### 1.5. Bushmeat trade market in Ghana

Bushmeat is used for “meat of wildlife”, which is able substitute domestic animals’ meat protein (Okiwelu et al. 2009) and serve as a source of protein from wildlife (Asibey 1974; Cowlshaw et al. 2004). Bushmeat is the most valuable product from tropical forest after timber (Cowlshaw et al. 2004).

Range of trading of bushmeat in West and Central Africa is estimated about 42 – 205 million USD (Cowlshaw et al. 2004). In the 1960s, 70 – 80 % of animal protein had origin in bushmeat, while in 1996 only 5 % of animal protein came from bushmeat (Bowen-Jones et al. 2003).

According to Cowlshaw et al. (2004) there are five main groups in the structure of bushmeat trade market: farmers, hunters, wholesalers, market vendors and operators in chop bar – roadside bars or restaurants. Hunters are mostly men, work in rural areas and also live there. Livelihood fully depends on bushmeat hunting. People who are both hunters and farmers have sale of bushmeat as a supplementary income while main income comes from farming. Hunters have highest profits per kilogram of live weight

since their costs are quite low. In comparison with market vendors and chop bars, hunters do not need much equipment. For hunting they use snares and shotguns and hunt mostly during the night. Chop bars need more equipment such as cookers and freezers and also need to pay for their employees. Wholesalers live and work in urban areas. Their main job is to buy amount of bushmeat from hunters and after that sell it to the market vendors and to the chop bars (Figure 6).



Intervention node	Intervention	Possible unintended consequences
Wildlife	Increased exclusion	Demand not reduced so hunting likely to continue with increased conflict and increased enforcement costs, and less chance to monitor offtake
Hunters	Offer alternative livelihoods	Some hunters may take up alternatives but demand for bushmeat not reduced, returns to hunting not reduced, and so new hunters may enter
Rural consumers	Provide cheap alternative protein	Hunters who supply rural consumers are worse off, may increase hunting to maintain level of income, or hunt higher value (possibly rarer) species, no impact on urban areas where consumers pay a premium for bushmeat
Urban consumers	Influence preferences	Urban demand for common species may increase as demand for scarce species diminishes, but without differential hunting, hunters will supply rural areas and own families with rare species that are caught, so overall impact low
Urban consumers	Introduce farmed game meat	Urban consumers demand less wild bushmeat, depressing price, hunters may increase own consumption and increase supply to rural consumers to maintain income levels

**Figure 6** Bushmeat trade chain and unintended consequences (Bowen-Jones et al. 2003).

### 1.6. Economic aspects of breeding greater cane rat

Bushmeat trade for human consumption is major contributor to local economies in developing countries (Bennet & Robinson 2000; Brashares et al. 2004) and the meat sale is major industry in Ghana (Adu et al. 2017). According to Adu et al. (1999), in Africa is consumed over 80 % of protein from bushmeat (Opara 2010). 25 % of meat protein in West Africa comes from bushmeat, since wildlife is an essential source of

animal protein (Bennet & Robinson 2000). There is sold more than 73 tons of greater cane rat meat (15 000 animals) per year at local markets, which makes them dominant bush meat trade (Opara 2010).

Economic analysis has revealed that internal trade in greater cane rat meat contributes to the Ghanaian economy more than 54.7 – 59.7 million USD per annum (Adu et al. 1999). Due to 40 000 tonnes of annual consumption of greater cane rat meat in West Africa (Salau et al. 2017) is greater cane rat meat reported as the most expensive and the most preferred in majority of West African countries (Akinola 2005). Meat is more expensive than meat of domestic animals (Aluko et al. 2015).

Greater cane rats can not provide cheap source of animal protein, since it is the most expensive meat in West Africa (Karikari & Nyameasem 2009, Adu et al. 2017). Higher price is caused by urbanization leading to urbanization of game animal species in hunting areas. If the price of greater cane rat meat were as same as price of eg. poultry, it could replace any other meat (Baptist and Mensah 1986). The economic return of greater cane rat is equal to cow, but lower than the pig and considerably higher than most of livestock species (Table 3). A significant advantage of breeding greater cane rat is requiring a minimal space (Adu et al. 2017).

**Table 3** Productivity and gross return product per breeding greater cane rat female in comparison to other livestock and poultry (Adu et al. 2017)

<b>Species</b>	<b>Productivity per breeding female per year</b>	<b>Gross return per breeding female (USD)</b>
Cow	0.95 – 1	183.87 – 193.55
Sheep	1.24	13.82
Rabbit	29	187.10
Guinea pig	4.4	9.46
Greater cane rat	6	193.55
Pig	8.1	260.34
Duck	6.7	12.05
Chicken	7.1	13.29

## 1.7. Description of Ghana

The Republic of Ghana is presidential republic situated in Western Africa (Figure 7), on the Gulf of Guinea. In east is bounded with Togo, with Burkina Faso in the north and with Côte d'Ivoire (Ivory Coast) in the west. Southern border is lined with Atlantic Ocean and the Gulf of Guinea. Ghana covers 238 533 m<sup>2</sup> with 560 km of coastline (Figure 8).

Ghana has 10 districts - Northern, Eastern, Western, Central, Upper East, Upper West, Volta, Ashanti, Brong-Ahafo, Greater Accra. Ghana has 26 908 262 inhabitants with annual population growth rate 2.17 % (2017). Official language is English, but there are widely used many of local languages (eg. Asante, Ewe, Fante, Twi etc.). Ghana is mostly Christian (71.2 %) country, with 17.6 % of Muslims, 5.2 % of traditionals, 0.8 % of other types of religion and about 5.2 % people with no religion (CIA World Factbook 2018).



**Figure 8** Map of Africa.

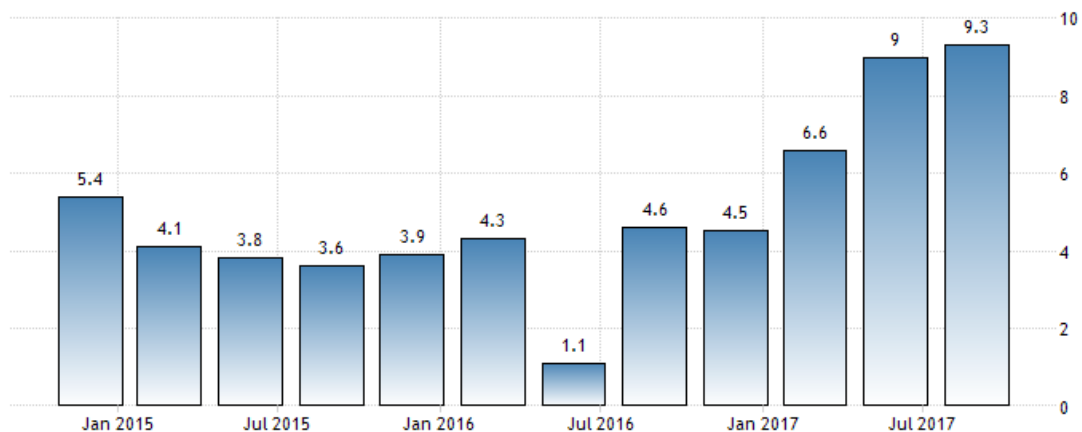


**Figure 7** Map of Ghana.

(source: <https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html>)

The economy of Ghana was strengthened in last 25 years which helped to reduce poverty – population living below poverty line is 24.2 % (2013). Gold and cocoa are important commodities for export and major source for foreign exchange. Other exported commodities are oil, tuna, timber, horticultural products, bauxite, aluminum, manganese ore and diamonds. Most important export partners are Switzerland 17.6 % and India 14.7 % (2016) (CIA World Factbook 2018).

GDP (purchasing power parity) is 130.2 billion USD (2017) and real growth rate of GDP is 5.9 % (2017) (Figure 9). Gross national savings are 7.9 % of GDP (2017). Agriculture contributes 18.3 % to GDP, industry contributes 24.5 % and services contributes 57.2 % to GDP (2017) (CIA World Factbook 2017). Main products in agriculture are cocoa, rice, cassava, peanuts, corn, bananas and timber and most important products of industry are mining, lumbering, food processing, petroleum and commercial ship building (CIA World Factbook 2018).



**Figure 9** Ghana GDP annual growth rate 2015-2017 (source: tradingeconomics.com).

### 1.7.1. History of Ghana

Ghana, previously called Gold Coast, used to produce 10% of world gold production. During past, European traders - Portuguese, Swedish, Danish, and British - build castles and forts on the coastline of Gold Coast to trade gold, ivory and slaves. In 1874 Great Britain took control over country and became a crown colony of Great Britain. 6<sup>th</sup> of March 1957 country became independent and was named Ghana (Anonym 2017).

## **2. Aims of the Thesis**

Main aim of my Master's thesis was to determine the origin of greater cane rats (*Thryonomys swinderianus*) and their products sold on markets in Greater Accra region in Ghana. Further aim was determine how market sellers and farmers assess demand and supply for greater cane rat meat.

### **2.1. Specific objectives**

- Determine whether the greater cane rats sold on local markets are originated from farms or from wild
- Determine seasonality in selling greater cane rats and seasonal demand for its meat.
- Create trade chain of greater cane rat meat sold on local markets and farms.
- Define motivation for being a greater cane rat market seller or farmer.
- Define socio characteristics including gender, age, marital status and education level.



### 3. Methodology

#### 3.1. Study site description

My research was done in Greater Accra Region in Ghana (Figure 10). Greater Accra Region is one of the administrative regions, divided into 16 districts and is located on the south of the country (Table 4). The capital city of this region is Accra. On the south is lined with Gulf of Guinea of Atlantic Ocean, on the west borders with Central region, on the north borders with Eastern region and on the east borders with Volta region. The area of Greater Accra Region is 3 245 km<sup>2</sup> and according the census from 2010 is there 4 010 054 inhabitants – 1 938 225 males and 2 071 829 females (Ghana Districts 2006).



**Figure 10** Map of districts in Greater Accra Region  
([https://commons.wikimedia.org/wiki/File:Districts\\_of\\_the\\_Greater\\_Accra\\_Region\\_\(2012\).svg#filelinks](https://commons.wikimedia.org/wiki/File:Districts_of_the_Greater_Accra_Region_(2012).svg#filelinks)).

**Table 4** Districts in Greater Accra Region

	<b>District</b>	<b>Capital town of district</b>
<b>1</b>	Accra Metropolitan	Accra
<b>2</b>	Ada East	Ada Foah
<b>3</b>	Ada West	Sege
<b>4</b>	Adentan Municipal	Adenta
<b>5</b>	Ashaiman Municipal	Ashaiman
<b>6</b>	Ga Central Municipal	Sowutuom
<b>7</b>	Ga East Municipal	Abokobi
<b>8</b>	Ga South Municipal	Weija
<b>9</b>	Ga West Municipal	Amasaman
<b>10</b>	Kpone Katamanso	Kpone
<b>11</b>	La Dade Kotopon Municipal	La
<b>12</b>	La Nkwantanang Madina Municipal	Madina
<b>13</b>	Ledzokuku-Krowor Municipal	Nunga
<b>14</b>	Ningo Prampram	Prampram
<b>15</b>	Shai Osudoku	Dodowa
<b>16</b>	Tema Metropolitan	Tema

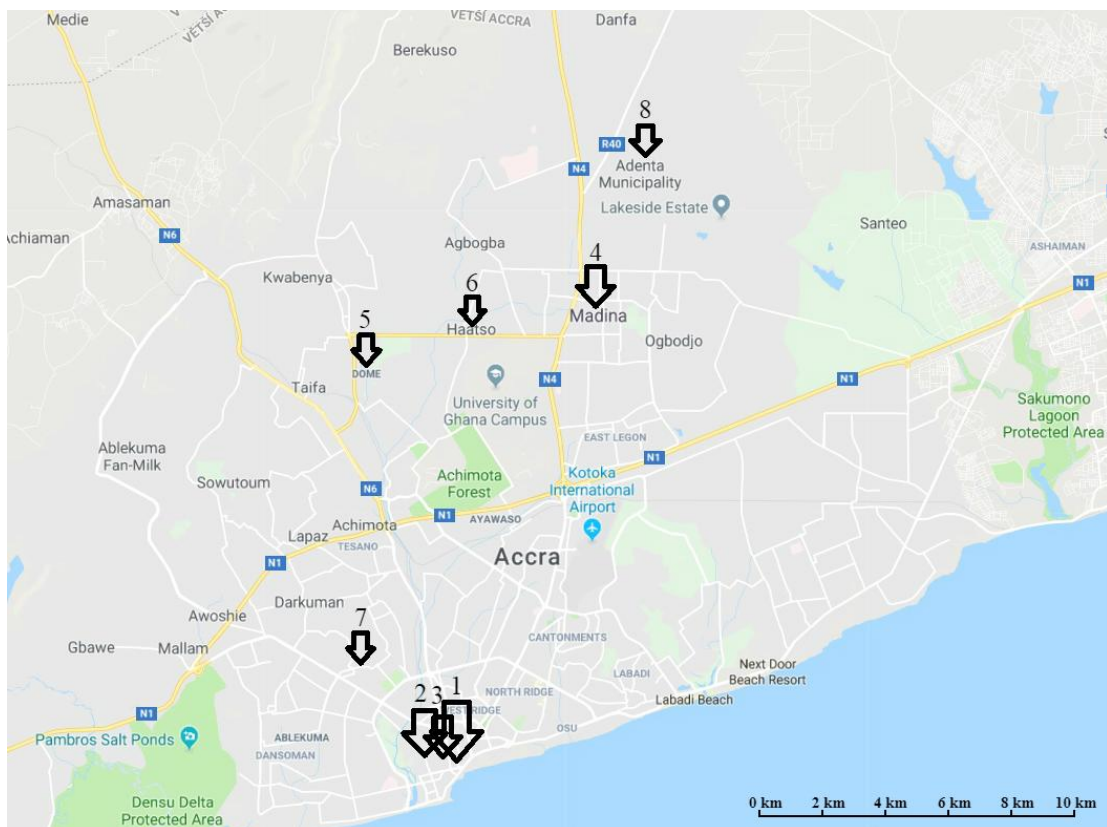
According the Köppen climate classification, Greater Accra Region belongs to category Aw – tropical savanna climate. For this type of climate are typical two seasons – wet and dry. Annual rainfall is 109.00 mm and highest precipitations occur from May to June. The warmest months are February, March, April and May with average temperature 29°C and maximum temperature 32°C. The coldest month is August with average temperature 26°C. Average humidity per year is about 79 % with highest relative humidity in June (Time and date 2018).

### **3.1.1. Markets**

My main research was done on markets in Greater Accra Region in Ghana. Specifically at Madina market, Makola market, Dome market, Haatso market, Kaneshie

market, Adenta market, Okaishie market and Kantamanto market. Markets are situated in urban areas.

Makola market (1) is located in the Accra Metropolitan district, city of Accra on the south of the Greater Accra Region. It is the largest market in Accra. Kantamanto (2) and Okaishie (3) markets are just next to Makola market, it is difficult to distinguish these three markets, since they intersect together. Madina market (4) is in La Nkwantanang Madina Municipal district, town Madina in northern part of Greater Accra Region, it is also very large market and vendors usually sell goods by the highway near the market. Dome market (5) is located in Ga East district, town Dome and it is smaller local market, mostly situate in halls. In Ga East district is also located market in town Haatso (6). Kaneshie market (7) is in Accra Metropolitan district, in the city of Accra. Market in town Adenta (8) belongs to Adentan Municipal district. It is not possible to determine exact area of each market, since there are no records about size. Locations of markets see in Figure 11, where the size of arrows represents numbers of respondents.



**Figure 11** Location of selected markets in Greater Accra Region.

### 3.1.2. Farms

Farms were situated in urban and semi-urban areas of Greater Accra Region. I visited 6 farms in Ga East district in towns Abokobi (1), Agbogba (2) and Haatso (3). Two farms in Tema metropolitan district (4) and two farms in Adentan Municipal district (5). All these farms were small scaled and mostly bred greater cane rats and other animal species in the backyards (Figure 12).



**Figure 12** Location of selected farms in Greater Accra Region.

### 3.2. Data collection

Literature review, a theoretical part of my thesis, was focused on greater cane rat (*Thryonomys swinderianus*) description, habitat, feeding, breeding and farming and its meat quality. Furthermore I was focused on bushmeat trade market in Ghana, economic aspects of breeding this animal species and in the end on description of Ghana and its brief history. All information were obtained from scientific sources as a journals, articles, books or websites.

My research was based on semi-structured interviews based on scenarios. Scenarios were in English language. Important part of interviews was improvisation based on the answers of respondents.

Primary data were collected at markets. Initially I wanted to record the interviews on a voice recorder, but in the vast majority of cases, market sellers did not allow me to use a recorder. In consequence I wrote down all interviews by hand. Supplementary data were collected on farms. To obtain more comprehensive information about the issue of greater cane rat breeding, I decided to visit several farms. I had opportunity to see organization of greater cane rat breeding and to speak with farmers about their experiences.

During my research, from July to August 2017, I obtained data from the total of 25 respondents were 15 respondents from 8 markets (market sellers) and 10 respondents from farms (farmers). Since the majority of respondents did not speak English I used local interpreter during interviews.

### **3.2.1. Markets**

I collected data on markets using interviews based on semi-structured scenarios. Markets were randomly selected as well as the market sellers. I tried to visit most of markets in Greater Accra Region and obtain data from all market vendors from each market. Not all market vendors were willing to cooperate with me. The main reason was probably their distrust and fear. In total I obtained data from 15 market sellers from 8 markets (Table 5).

The survey was made mostly during the weekdays, because on Saturdays were main market days and there were too many people and vendors were too busy and thus unwilling to give an interview. I did research usually in the forenoon. One interview usually took approximately 10 to 15 minutes, in some cases 20 minutes. Interviews were recorded on paper, because in most cases we were not allowed to use a voice recorder. I used local interpreter during interviews, since the majority of respondents did not speak English.

Semi-structured interview scenario (see Appendix 1) was divided into two main parts. First part of scenario was “Identification questions”. I asked respondents questions about gender, age, marital status, education level, and type of meat sold, price of meat or other sold products. However, this part was always asked at the end of interview. Second part included following questions. Questions were distinguished into three sections based on main questions: “Origin of greater cane rats”, where I was looking for an answer about origin of greater cane rat meat and some more information about the place of origin – location, size of area, who hunt the animals or how often. In the part “Market” I asked about the demand and supply, who is regular customer and difference in seasons. In the last part “Sell” I talked with respondents about what motivates them to do this kind of business, how long are they market vendors, I asked about profits and benefits or about problems and regulations. It was necessary to react to their answers and modify following questions due to their responds.

**Table 5** Respondents from markets

<b>Market</b>	<b>Number of respondents</b>
Makola	4
Kantamanto	3
Okaishie	2
Madina	2
Dome	1
Haatso	1
Kaneshie	1
Adenta	1
<b>Total number</b>	<b>15</b>

### **3.2.2. Farms**

Interviews with farmers were mostly based on questions about motivation of breeding, number of animals, breeding and housing conditions and also feeding. I also tried to get some information about prices of live animals, benefits of being a greater cane rat farmer or about current demand for greater cane rat meat.

Survey on farms was usually made during the weekdays in the afternoon. Farmers were selected by the method of snowball sampling. Interviews usually took more than 30 minutes, since farmers show us their farms. Willingness to cooperate with us was much better than during the research on markets, farmers wanted to share their experiences and show us their farms. We were also allowed to use a voice recorder in most of cases of interviews. Majority of farmers also spoke English. I obtained data from 10 farmers; 6 farmers in Ga East district, 2 farmers in Tema Metropolitan district and 2 farmers in Adenta Municipal district (Table 6).

**Table 6** Respondents from farms

<b>Location of farm</b>	<b>Number of respondents</b>
Abokobi (Ga East Municipal district)	2
Agbogba (Ga East Municipal district)	2
Haatso (Ga East Municipal district)	2
Tema (Tema Metropolitan district)	2
Adenta (Adenta Municipal district)	2
<b>Total number</b>	<b>10</b>

### **3.3. Observation**

No fewer important part of research was observation. Observations served for better understanding of the market or farm environment. I observed placement of the stall on the market, whole environment and all organization on the markets and farms. During the observation I made field notes.

### **3.4. Data analysis**

Qualitative data were analysed by sorting the answers of respondents and subsequently coded. Quantitative data were analysed with descriptive statistic – mean,

standard deviation and percentage and with Mann-Whitney U test and Pearson & M-L Chi-square test.

For descriptive statistic and sorting the answers was used Microsoft Excel 2007. For quantitative analysis was used Statistica 13 software.



## **4. Results**

In this chapter I present results of my research such as origin of greater cane rat meat sold on local markets in Ghana, market situation and sell of greater cane rat meat. Furthermore I present situation on farms and organization of breeding. In the end I compare the socio characteristic and situation on markets and farms.

### **4.1. Markets**

#### **4.1.1. Characteristic of markets**

African markets are very crowded and noisy places with typical strong odor and narrow aisles. Markets interfere to close streets, roads and cross roads. Some vendors trying to draw attention, sometimes only verbally, but in many cases also with touching to stop the potential customer. Is no exception to see sleeping children on the bare ground between two stalls or goats and sheep tied to stall.

For the first sight markets might seem chaotic and untidy. After few more visits customers may see some system of stall placement with a certain type of goods. At the edges of the markets were situated stalls with vegetables and fruits (mostly pineapples, bananas and coconuts), take away food, clothes and electronic. Choice of goods is diverse; from meat, fish, fresh vegetable and fruit to clothing and electronics. Stalls of greater cane rat vendors were mostly situated in the deep of market and it is not easy to find them – only local people exactly know where to find them. Their stalls are usually in part of market where are gathered together almost exclusively food vendors. In this part of market is possible to find smoked and dried fish, beef and bush meat. This is also place where they sell *Achatina* snails, which is considered as local delicacy (Figure 13).

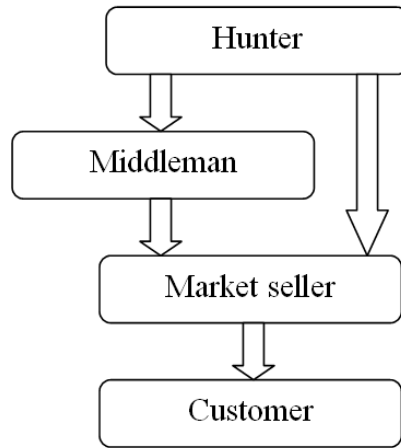


**Figure 13** Snails on Madina market (photo by author).

#### **4.1.2. Origin of greater cane rats**

In all cases were greater cane rats originated from bush. Market vendors buy fresh greater cane rats from hunters or from middlemen. All market sellers respondents agreed, that greater cane rat meat from bush has better taste and thus is more required from customers. Market seller from Kaneshie market states: “In bush, greater cane rats can eat variety of grass. Their meat is much better. More delicious. Better than meat from farms.”

Most of respondents (73 %) know place of origin. In 46 % cases they referred meat comes from Afram Plains (Eastern region), in 27 % meat comes from Dodi (Volta region), in 18% from Dodowa (Greater Accra region) and in 9 % meat origin of meat is in Nsawam (Eastern region). 27 % of sellers respondents do not know the place of origin, but they assume that meat comes from Eastern region (Figure 15). Trade chain (Figure 14) of greater cane rat meat sold on markets starts at hunters. From hunter fresh meat goes to the middleman who sell the meat to the market seller. Sometimes hunter directly sell the meat to the market seller. Market sellers directly sell the meat to the customers. Market sellers buy fresh and unsmoked greater cane rat for 40-60 GH¢ (9 – 13 USD).



**Figure 14** Trade chain diagram of greater cane rat meat on market in Greater Accra region.



**Figure 15** Map of meat origin according to market respondents.

### **4.1.3. Demand and supply**

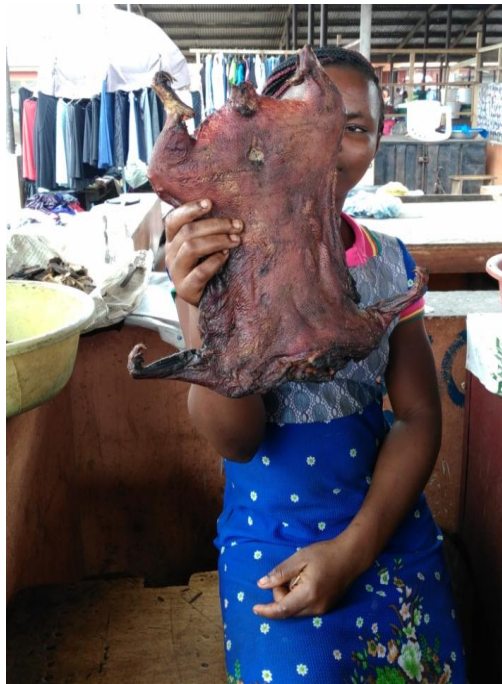
Market was changing during the times and along with it was changing demand for greater cane rat meat. Since the market sellers keep no records about sales, it is hard to form the exact picture of demand for greater cane rat in recent years. Majority of respondents referred, that demand for meat is all year long and especially during the Christmas time, nevertheless respondents also referred lower supply between December and January. In this time occurs in Ghana higher temperature with low precipitation, which affect grass growth and feed stuff for greater cane rats.

Even though Ebola virus diseases (EVD) between years 2013 and 2016 was never widespread in Ghana, people were affected by this situation. Since the wild animal can be infected by the EVD, people were afraid to buy bushmeat. During this time were sales low and many of greater cane rat sellers quit. The business is “picking up” now. Anyway, there is still apparent fear from EVD and market sellers are very suspicious about presence of strange people. As some of respondents referred, in past occurred bushmeat controls from government and they are still afraid about their business. Market women were not much willing to speak with me. They were very suspicious and afraid, that I am control from government even they saw my International Student Identity Card (ISIC). Only in one case I was allowed to take a audio record of interview.

Very inconsistent answers were about competition. On bigger markets respondents referred there was big competition among greater cane rat sellers, since there was usually bigger amount of greater cane rats. On small markets there is almost no competition, since there was only one or two sellers. Seller from Dome market described the situation as follows: “There is no competition now. Two of sellers quit during the Ebola epidemic and now there is only me.” On the other side, seller from Makola markets said: “There is very big competition. I always must have enough greater cane rats on stock. If I would be out of stock, customer can easily go somewhere else.” Another seller referred she get fresh meat every day.

#### 4.1.4. Sell

Majority of respondents grew up at the market and being a vendor is long lasting family business, which they inherit after mothers. Women start selling at the market in early age and spend there all life. My respondents aged over 50 years, sell at the market more than 30 years. It is no exception to see daughters (Figure 16.) selling with their mothers. In many cases, the vendors live right at the markets or in close surroundings.

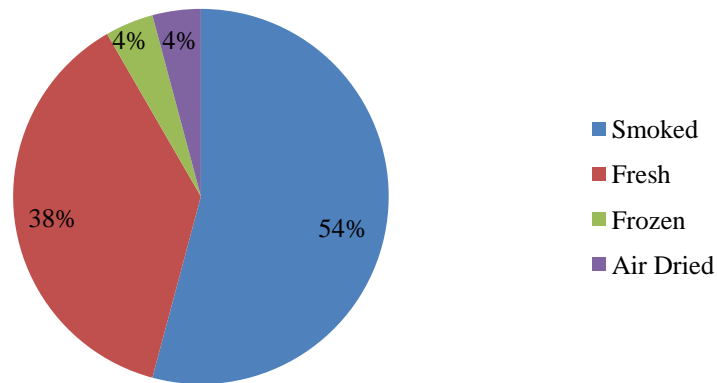


**Figure 16** Daughter of market vendor with smoked greater cane rat at Dome market (photo by author).

Women usually sell at the markets every day with exception of Sundays – the day they visit church, since the religion is very important part of their lives. There are also exceptions when market woman sell also on Sundays. Market women do not have any tricks to lure customers, they almost do not even care about people passing their market stall. They stand around, talking with other market women or even sleep. Their stalls are in the middle of the market, surrounded by other sellers.

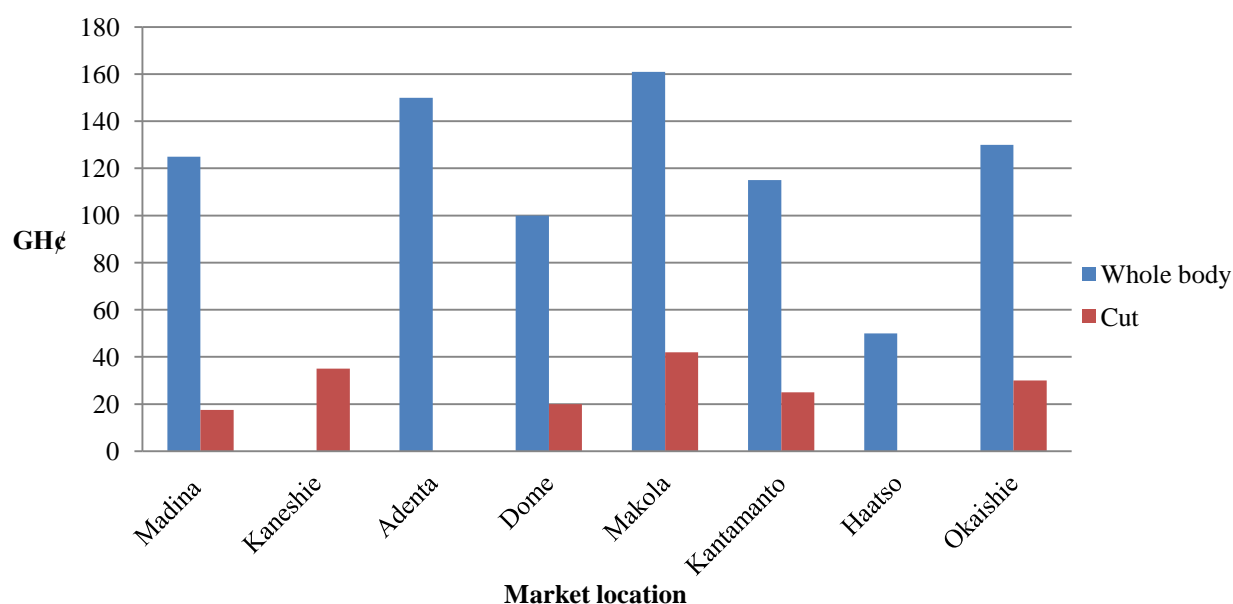
Since they do not keep any records about sales, they do not know their exact profits from selling. All respondents repeated that “business is good” and it is “very profitable”. Some of them were able to say how much of greater cane rats sell per day or per week. Profits from markets are not main income into their households. Market sellers usually buy greater cane rats fresh and smoke them themselves. Smoking helps to

extend the durability of meat. Raw meat become dry after long time at the market. It change meat quality and it leads to price reduction. In 54 % cases was meat sold smoked, in 38 % fresh, frozen in 4 % of cases and air dried in 4 % (Figure 17).



**Figure 17** Form of meat sold on markets.

Price of the whole body of greater cane rat (smoked, fresh or frozen) ranges from 50 to 200 GH¢ (11 - 44 USD). Sellers are also willing to cut certain part of greater cane rat (ribs, head and chest or leg) and the average price is 30 GH¢ ( $\pm 10.32$ ) (7 USD) (Figure 18). It makes meat more available for everyone. As respondents referred, “anyone can come and buy a greater cane rat meat”. Price of meat is reflected in location and size of the market. Makola market is the biggest market from all visited markets and is located in the Accra metropolitan district, the capital district of Greater Accra region. On the other side, meat price for whole body of greater cane rat on small market such as Haatso is lowest. Respondents were not strictly concern on greater cane rat meat. Beside it, they sell another bushmeat – smoked and dried fish, beef products or snails.



**Figure 18** Average price of greater cane rat meat sold on markets according the location.

## 4.2. Farms

### 4.2.1. Characteristic of farm environment

All farms were characterised as small scaled - livestock production on a small size of land with no using of advanced or expensive technology (Kutya 2012). Number of greater cane rats ranged from 1 to 40 individuals (Table 7). Beside greater cane rats farmers bred another animals – ducks, guinea fowls, turkeys, layers, broilers, goats, sheep, pigs and rabbits. Farmers who bred less than 5 greater cane rats were small farmers keeping animals in their backyards. Their main profits come from breeding of other animals, such as rabbits or turkeys. Animals were kept close to farmers’ houses or in backyards of their houses.

**Table 7** Number of bred greater cane rats on farms and other bred animals

Farm	Number of greater cane rats	Other bred animals
1	40	ducks, geese, goats, sheep, turkeys, guinea fowls
2	8	guinea fowls, rabbits, layers, ducks, goats
3	20	broilers, layers, snails, sheep, goats

4	35	-
5	3	layers, broilers, turkeys
6	1	sheep, pigs, ducks, guinea fowl, rabbits
7	8	-
8	14	-
9	4	layers, turkeys, guinea fowls
10	3	-

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Greater cane rats were kept in wooden cages similar to rabbit hutch. Farmers usually make the cages themselves from wood and wire mesh. Some farmers preferred only wire cages, since the greater cane rats can browse the wood and damage the cage. Water was supplied by drinkers placed outside the cages or was in the bowls inside the cages. Feed stuff was provided twice a day. As a feed stuff farmers mostly referred cassava, maize, elephant grass and sugar cane. As a less common or supplementary feeding were mentioned pineapple crowns, water melone peels, tomatoes, old bread or peppers. Farmers do not buy any feed stuff for greater cane rats, they grow plants for feeding purpose on their private lands. They also use “kitchen waste” as a feeding during the dry season.

Farmers were more willing to cooperate with us. They wanted to share their knowledge about farming with us, showed us their animals and farms. They were not suspicious or nervous about our presence at all. Most of them agreed with audio recording of interview and only in two cases they rejected to take a photos.

#### **4.2.2. Motivation for farming**

According the farmers, being a farmer is stressless job which can be done from home. They like to breed greater cane rats, because it is easy to breed them, since they do not need any special care and is easy to feed them for no costs. Farmers do not buy any feeding for greater cane rats, because they plant grass on their land or feed greater cane rats with waste of fruit and vegetable. As another benefit farmers often referred that greater cane rats do not suffer from serious illness. Another farmer confirm that



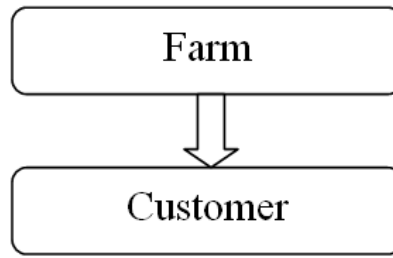
greater cane rats are not disease-sensitive, but only in case they are well treated, vaccinated and dewormed every three months. Furthermore they describe high reproduction rate of greater cane rats as beneficial, since greater cane rats litter twice a year (up to 12 young individuals per year).

Farming is usually long lasting family business, inherited from generation to generation. There are also some farmers who started their own business. Farmers who established their own farms started with own money for which they bought land and during the times expanded. Farmer from Tema described his beginning in farming as follows: “In 1990 I had no money for continue in my education. I decided to quit the school, come back home and become a hunter to earn money to establish my farm. My father had a gun, so I become a hunter and hunted mostly greater cane rats and small antelopes. I bought land of size 70 ft x 100 ft for 15 000 GH¢ (3398 USD). I started my farm with 100 cockerels.”

#### **4.2.3. Sell and demand**

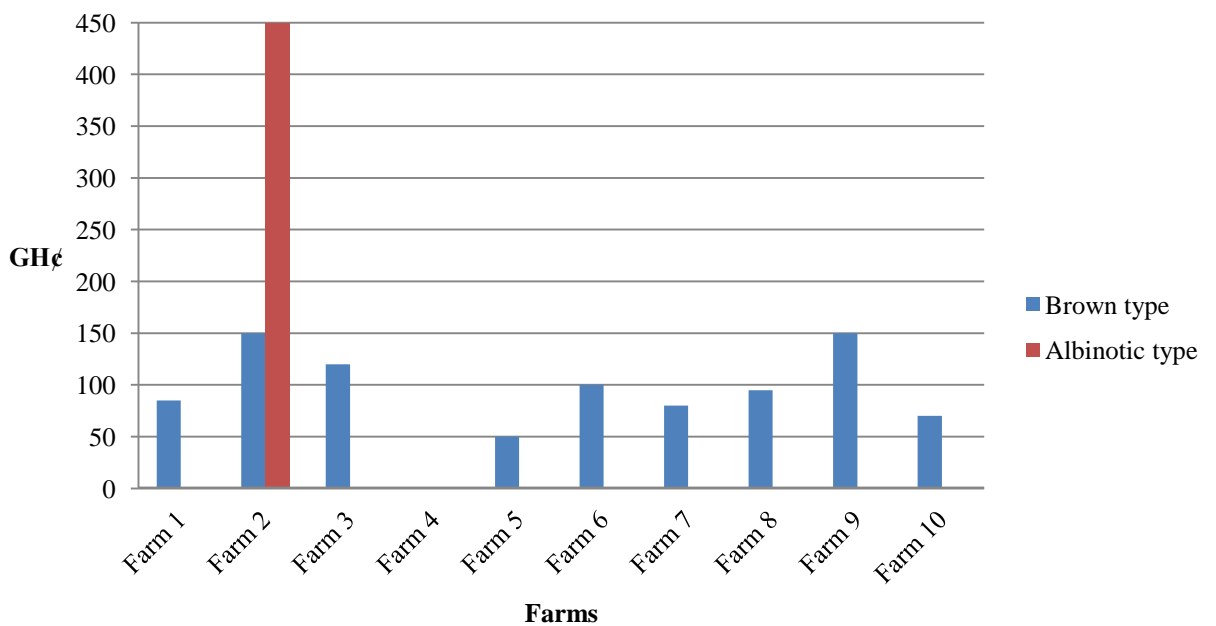
Selling of greater cane rats is not main income of farmers. 67 % of farm respondents also breed other animals which provide higher profits than greater cane rat meat. Farmers who breed also layers referred their biggest income is from eggs. Farmers do not sell greater cane rat on markets. As one farmer stated, it is better to sell greater cane rats right to customer without any middleman. It is not profitable to drive far away to markets and sell meat there. Customers, regularly neighbours, know where to go when they want a fresh greater cane rats. Thus the trade chain is shorter than on markets (Figure 19).

All farmers said they had no problem with Ebola virus diseases in years 2013 – 2016, because they breed greater cane rats on farms and do not keep greater cane rats from wild. One farmer stated: “I never had problem with Ebola epidemic, it did not affected the demand for greater cane rat meat at all.”



**Figure 19** Trade chain diagram of greater cane rat meat on farms in Greater Accra region.

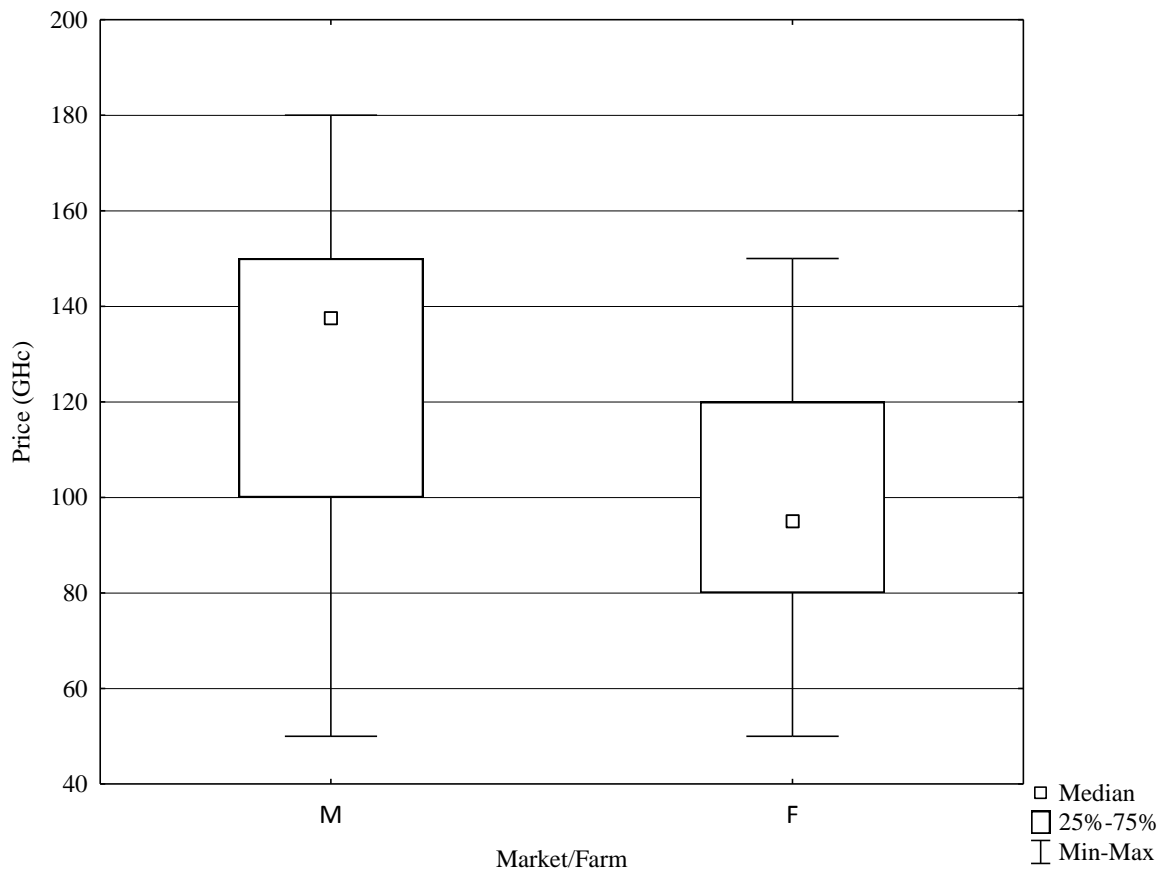
Farmers describe demand for greater cane rat meat as very high. However some of them admitted, they have to sell greater cane rats under price, because demand is not as high as farmers would like. As is visible on the Figure 20, price of meat ranges from 50 GH¢ to 150 GH¢ (11 – 34 USD) per whole body. Exception is farmer number 4 who do not sell greater cane rats only for research purpose in Animal research institute (ARI). ARI shields breed improvement of greater cane rats in Ghana. Beside greater cane rats ARI participates in animal health and food safety, intensive livestock production, ruminants and natural resources and commercialization and technology. Most expensive is meat from albinotic type of greater cane rat (farmer 2), where the average price for whole body is 450 GH¢ (102 USD). According the farmer, taste and quality of meat is equal to brown type, different is only color of fur. Nevertheless some customers want something special and have no problem to pay many times higher price.



**Figure 20** Price of greater cane rat meat sold on farms per whole body.

### 4.3. Price comparison

Mann-Whitney U test showed that the difference in average price of meat sold on markets and farms is on the edge of significance ( $p=0.050842$ ). Can not be clearly said whether is meat on market significantly more expensive. As is visible in Figure 21, average price of meat sold on markets is slightly higher than average price of meat sold on farms.



**Figure 21** Comparison of average price of meat per whole body.

### 4.4. Socio characteristic of respondents

#### 4.4.1. Market sellers socio-characteristic

Major of market vendors were women (93 %), average age 44.6 years ( $\pm 11.3$ ) and with average number of children 3.1 ( $\pm 1.61$ ). Majority (93 %) of respondents from

markets were married. One exception was young girl, who was just 15 years old, single and childless.

Market vendors had lower level of education – 60 % of them had Primary school, followed by Junior secondary school (27 %) and none education occurred in 13 % of respondents. Absence of education caused their inability to speak English. They speak only local languages – in case of markets in Greater Accra Region - mostly Twi language.

The only male respondent was also hunter and income from selling of greater cane rats is just secondary income, since his main income is from taxi driving. He hunt greater cane rats in Dodowa using the traps and gun and meat sell very early in the morning. This market seller from Haatso market states: “My wife sells plantains and cocoyams on the market. We have two children and my wife will gives a birth to the third child soon.”

#### **4.4.2. Characteristic of farmers**

Most of the farmers were men (90 %) with one exception of women. Average age of farmers was 55 years ( $\pm 9.47$ ). In comparison to market vendors, farmers had higher education level - 40 % of farmers had university education, followed by Senior secondary education (30 %), Junior secondary education (20 %), Primary education (10 %) and None education (0 %). It was no problem to speak with them English.

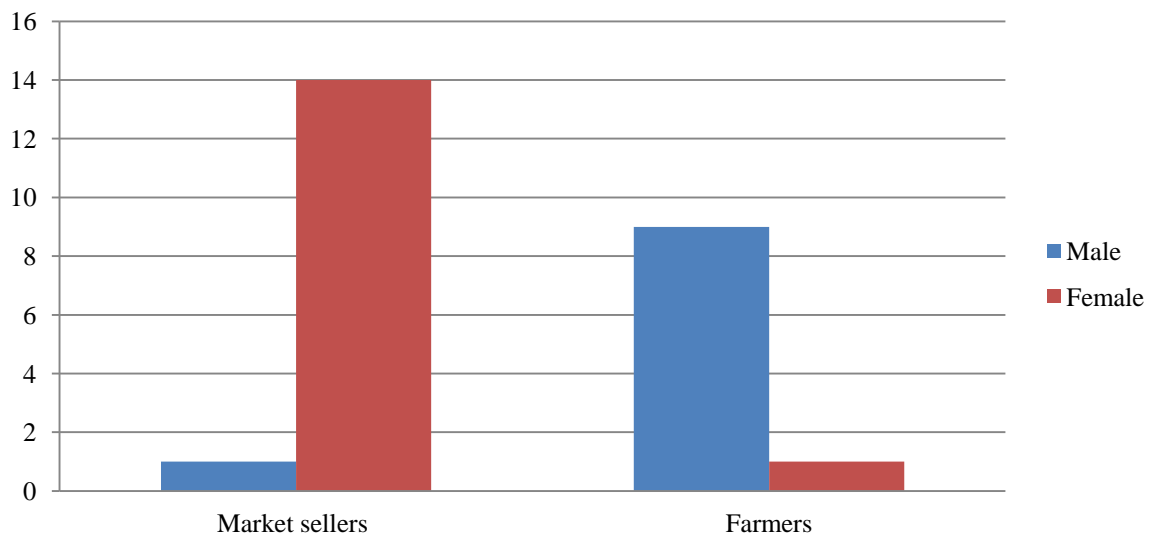
#### **4.4.3. Comparison of socio characteristics**

Socio characteristics of respondents are described in following table (Table 8).

**Table 8** Comparison of socio characterist of market sellers and farmers

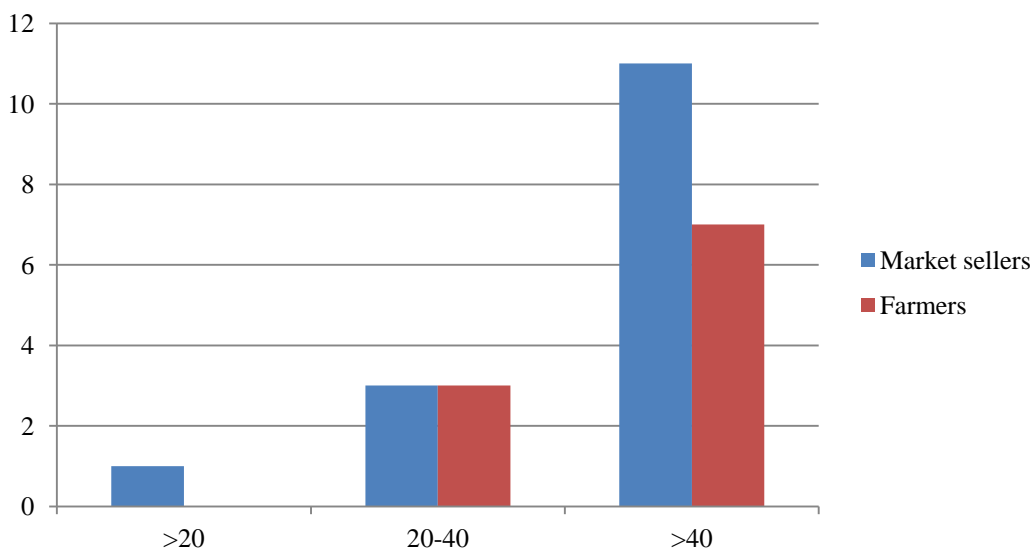
	<b>Markets</b>	<b>%</b>	<b>Farms</b>	<b>%</b>
<b>Number of respondents</b>	15		10	
<b>Gender</b>				
Male	1	7%	9	90%
Female	14	93%	1	10%
<b>Age</b>				
<20	1	7%	0	0%
20-40	3	20%	3	30%
>40	11	73%	7	70%
<b>Marital status</b>				
Single	1	7%	1	10%
Married	14	93%	9	90%
Divorced	0	0%	0	0%
Widow (-er)	0	0%	0	0%
<b>Education level</b>				
Primary school	9	60%	1	10%
Junior Secondary school	4	27%	2	20%
Senior Secondary school	0	0%	3	30%
Higher	0	0%	4	40%
Never gone to school	2	13%	0	0%

As shows following graph, market sellers are almost exclusively women (93 %) and on the other side, farmers are with one exception men (90 %). In total, 60 % of respondents were women and 40 % were men (Figure 22). There is statistical significant difference ( $p=0.00003$ ) in gender between market sellers and farmers. Farms are mostly led by males.



**Figure 22** Comparison of gender.

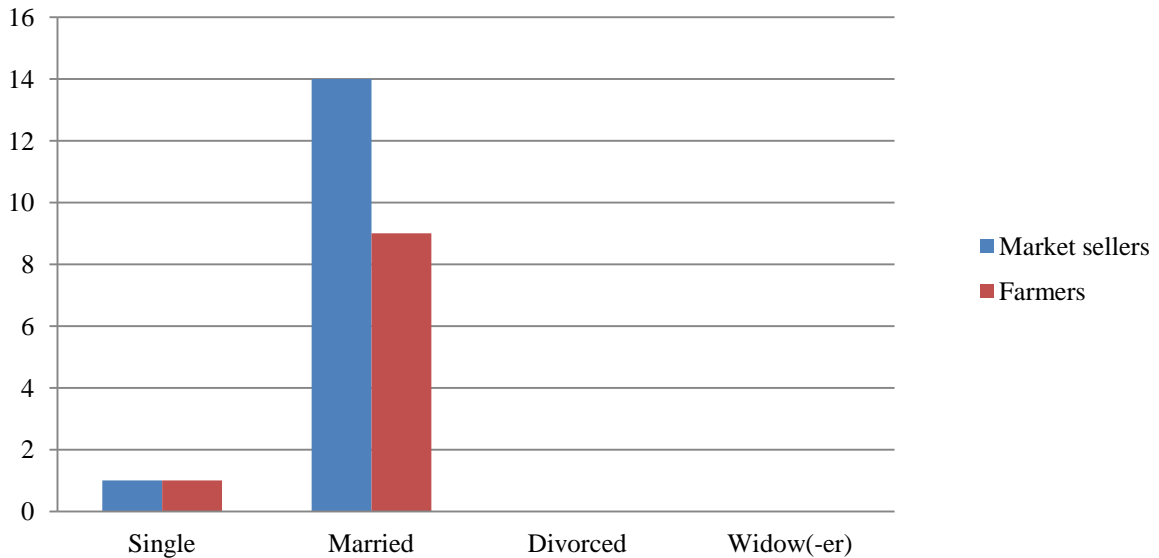
Majority of respondents - market sellers (73 %) and farmers (70 %) were in age category >40. Equal number of respondents (3) were from category 20 - 40. No respondent from farm was from category >20, from market sellers there was only one respondent from this category (Figure 23). There is no statistical significant difference in age ( $p=0.62942$ ) between market sellers and farmers. Higher age in respondents is reflected in experiences. Respondents in the category >40 have more than 20 or 30 years of experiences in their business.



**Figure 23** Comparison of age.

Due to the strong religion, all farmers and market sellers were married. As is visible I Figure 24, only in one case in farmers and in one case in market sellers were

respondents single. In this case, there is no statistical significant difference in marital status ( $p=0.76344$ ) between market sellers and farmers. It was caused by low age of respondents.

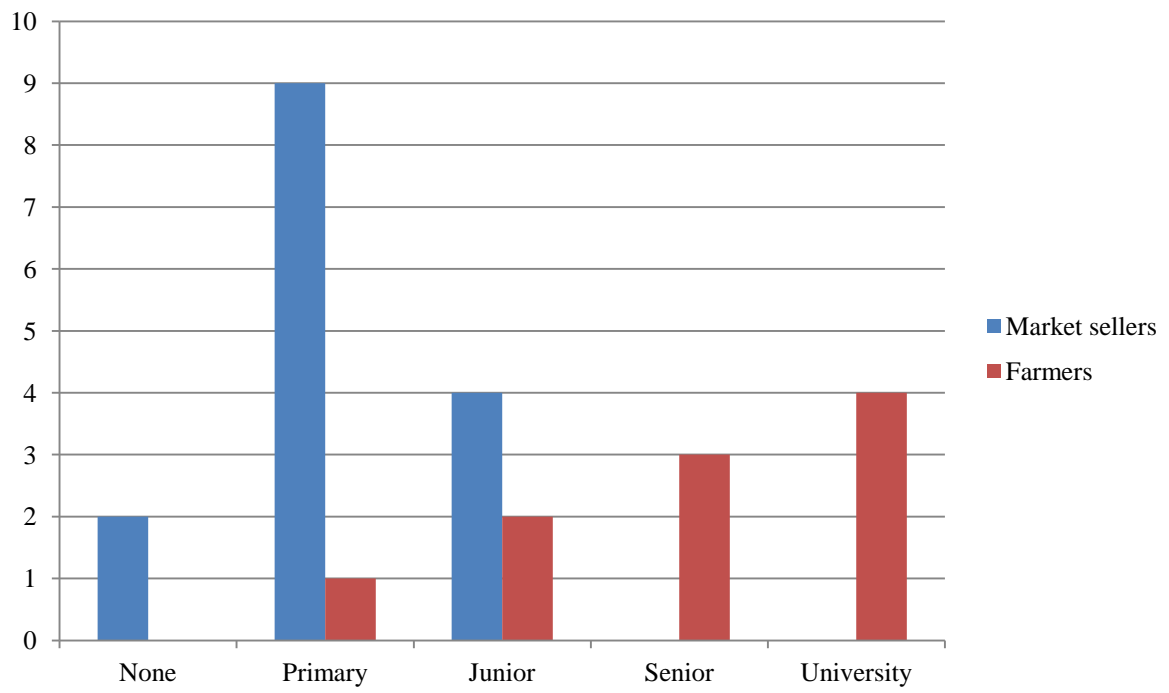


**Figure 24** Comparison of marital status.

Market sellers have significantly lower education than farmers ( $p=0.0034$ ). Education level of sellers ranges from no education to Junior Secondary school, while education level of farmers ranges from Primary school to University (Table 9, Figure 25).

**Table 9** Comparison of education between market sellers and farmers

Summary Frequency Table (Spreadsheet11)				
Table: Education(5) x Location(2)				
	Education	Location Market	Location Farm	Row Totals
Count	Junior Secondary School	4	2	6
Row Percent		66,67%	33,33%	
Total Percent		16,00%	8,00%	24,00%
Count	Primary School	9	1	10
Row Percent		90,00%	10,00%	
Total Percent		36,00%	4,00%	40,00%
Count	Never gone to school	2	0	2
Row Percent		100,00%	0,00%	
Total Percent		8,00%	0,00%	8,00%
Count	University	0	4	4
Row Percent		0,00%	100,00%	
Total Percent		0,00%	16,00%	16,00%
Count	Senior secondary school	0	3	3
Row Percent		0,00%	100,00%	
Total Percent		0,00%	12,00%	12,00%
Count	All Grps	15	10	25
Total Percent		60,00%	40,00%	



**Figure 25** Comparison of education.



## 5. Discussion

Main aim of my thesis was to determine the origin of greater cane rats sold on markets in Greater Accra Region in Ghana. At the beginning of my research I expected, that greater cane rat meat sold on local markets is originated on farms. Nevertheless, in 100 % of cases was meat originated in wild. Market sellers preferred meat from wild because of its better taste. Greater cane rats in wild can eat variety of feed stuff which is reflected in taste of their meat (Economist 2017). Further reason for selling meat exclusively from wild, respectively from hunters, is its price. Market sellers usually buy from hunters whole body of fresh greater cane rat for 40 - 60 GH¢ per whole. Since the average price of greater cane rat is 128.6 GH¢ ( $\pm$  32.86) per whole body, profit from one sold greater cane rat can reach up to 80 GH¢ per whole body. However, market sellers do not keep any records about their sales and profits due to this we cannot assess their real profits or losses. Most of greater cane rats were originated at Afram plains. Since the natural habitat of greater cane rats is in dense grasses close to waters, Afram plains, located around Lake Volta, is suitable location for occurrence of greater cane rats.

Bushmeat hunting is unsustainable and major threat to mammal species in Western Africa (Damania et al. 2005). 21 out of 1854 threatened species of the order Rodentia are threatened by hunting for human consumption in the world (Ripple et al. 2016). Greater cane rats have been established as over hunted in Nigeria due to high demand for their meat and their high price (Okorafor et al. 2012). Increasing price of bush meat increases hunting rates. Open access to hunting the bushmeat can lead to over hunting and depletion of bushmeat sources (Damania et al. 2015). Okorafor et al. 2012 further recommend control hunting by law and also supporting farmers in training of breeding greater cane rats. There are no reports about over hunting of greater cane rats in Ghana, but also farmers are supported and trained with NGOs (Annor & Kusi 2008).

My research was done from the market sellers' point of view, thus I can not tell there is a high demand from customers. Responded market sellers assess current demand for greater cane rat meat as very high, but demand was negatively affected with Ebola virus disease in past. In West Africa outbreak of Ebola virus disease (EVD) began in December 2013 and it was unprecedented in geographical extension, mortality and morbidity (Adokiya et al. 2016; Adongo et al. 2016). The Ebola outbreak dented

demand for bushmeat (Economist 2017) even though there was not recorded or confirmed Ebola case in Ghana (Adongo et al. 2016; Tenkorang 2017). According to Ordaz-Németh et al. (2017) local people changed their dietary behavior and attitudes to bushmeat consumption during the Ebola crisis. Knowledge about the disease had enormous impact on bushmeat consumption. Although the knowledge about Ebola is high among population, there are still misconceptions about the EVD (Adongo et al. 2016). People consumed bushmeat less frequently when they thought the EVD could be transmitted from bushmeat. Especially in poorer households was consumption of bushmeat lower than in wealthier households. This corresponds with statements of market sellers about lower demand for bushmeat during the EVD. Market sellers claimed the demand was low because consumers were afraid that the meat is infected with EVD.

According to Van der Merwe (1999) greater cane rats breed aseasonally with tendency to litter more frequently during the rainy season due to higher availability of food. Nevertheless in captivity is reproduction controlled by farmers. Supply of greater cane rats depends on current season. As responded market sellers claimed, driest months are December with average precipitation 2.54 cm and January with 1.27 cm (Weatherbase, 2017). In these dry months is decreased growth of grasses, the feeding of greater cane rats, and thus the supply of greater cane rats is lower than usually. Okorafor et al. (2012) confirms that supply of greater cane rats is affected by the weather and the highest percentage of hunted animals is during the rainy season and the lowest percentage of hunted animals is during the dry season. Okorafor et al. (2012) further reported that number of hunted animals is also affected with presence of moon in the sky. Hunters prefer absence of moon, because during the hunting they use lights, which greater cane rats can consider as moon light and will not run away. When is the moon present, hunting is reduced, since the greater cane rats can recognize the moon and if they would see two lights, they can feel endangered and run away.

Price of meat is higher on markets than on farms. Higher price on markets can be caused by more difficult meat processing. Meat sold on markets requests more procedures than meat sold on farms. Market sellers buy meat fresh and then process the meat themselves; they remove fur and skin, eviscerate the carcass and then smoke the meat. Farmers on the other hand sold meat fresh and thus they have no extra work with meat, because other meat processing is on the customer. Also farmers have no costs

with transport of meat from farms to markets or from hunter to seller. Nevertheless the price of meat depends also on size or age of the animal. On the market, there were no exact units for greater cane rats; the price is directly proportional to the size of greater cane rat carcass.

The majority of responded market sellers were women (93 %). Markets are mostly created with diverse group of women sellers of various religion and ethnic groups, communicate in different languages (Reddy 2007). Baah-Ennumh & Adom-Asamoah (2012) state the market women play crucial roles on local market. They are important in the development of the local economy and supply the food for the increasing urban population. There is significant difference in level of education between market sellers and farmers. Among responded market sellers education ranges from none to Junior Secondary school. Among responded farmers is wider range of education level and above all, higher education level – from primary school to university. The study of Oduri-Ofori et al. (2014) resulted that education is crucial in improvement of agricultural productivity. Formal education provides knowledge to farmers and is one of the factors that affect agricultural productivity. According the Free Compulsory Universal Basic Education Programme (FCUBE) from 1996 is in Ghana primary and junior secondary education freely accessible and mandatory. In my research were two respondents from market with no level of education. Both of respondents were over 40 years old, thus the FCUBE Programme did not work yet. However there are still many children with no primary education, since there are additional expenses (e.g. uniforms, supplies) and the poorest families cannot afford education for their children. As shows research from 2009 (Otoo et al. 2009) 53.2 % persons eligible to work never gone to school and 32.2 % have only primary education. Absence of formal education is reflected in their language skills. Despite the official language of Ghana is English, some of Ghanaians can not speak English or speak very poor English and speak their local languages. Beside official English there are nine government-sponsored languages in which are provided materials for local people.

My research has its limitations. The main limiting factor were respondents. Since the responded market sellers did not speak English, I needed to use an interpreter to communicate with them. Communication with respondents through interpreter was less continuous, which did not allow to react immediately and thus I could not gain more information. Another limitation was unwillingness of market sellers to cooperate with

us. There was perceptible fear to tell everything and in some cases we had to leave before we finished the interview. I can not guarantee, that all of respondents were true and not distorted any information. Despite these limitations, this study brings new and valuable information.

## **6. Conclusion**

My research provides insight to greater cane rat trade on local markets in Greater Accra region in Ghana. It documented, that all greater cane rats sold on local markets were originated from wild, mostly from Afram plains in Eastern region. Greater cane rats are considered as local delicacy and source of protein. According to market sellers and farmers, demand for their meat is high and customers are willing to pay high prices for their meat. Price for whole greater cane rat is high and can varied from 50 to 200 GH¢ on markets and from 50 to 150 GH¢ on markets. However, greater cane rats are still abundantly hunted in wild and there are not much farmers breeding them and any of responded farmers did not sell their meat on markets. Breeding of greater cane rats could be great opportunity for farmers, since this animal species requires almost no costs and is very easy to breed them with relatively high profits. In past was greater cane rat trade on markets affected by Ebola virus disease and market sellers recorded decline of demand. Farmers did not record demand decline during that times, since customers were convinced that Ebola virus, which never been confirmed in Ghana, affect only bushmeat. Farmers can provide safe greater cane rat meat in times of similar crisis. Supply of greater cane rats is high mostly during the rainy season and lowest is during dry season. Market sellers were typically middle aged women selling on the markets for six days per week. Farmers were middle aged men and sold greater cane rats directly to customers. High profitability is main motivation for their business. Important role plays also family, market selling is family business which is inherited from mother to daughter.

This thesis can serve as preliminary study for future research. I suggest to investigate another locations in Ghana, especially Volta region or Eastern region, because of the habitat around Volta river, which is natural for grater cane rats. I also suggest do another research on markets in Kumasi, the second largest city in Ghana, which is situated approximately 250 km northern from Greater Accra Region. I recommend do a research on markets in region, where is bigger amount of farmers breedig greater cane rats. It could reveal, that in these location are greater cane rats sold on markets originated on farms. Survey among customers could bring new point of view to this problematics and determine whether the demand for greater cane rat meat is as high as referred market sellers.

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## **Appendix 1: Interview scenario for market sellers**

*Introduction – explaining why I need to know all these information. Some brief information about me and my thesis – to gain some trust from respondent.*

*Ask respondent if the interview can be recorded.*

*For greater cane rat is in Ghana use local name “grasscutter”.*

### **IDENTIFICATION QUESTIONS**

Date: \_\_\_\_\_ Market:

\_\_\_\_\_

Type of product: RAW MEAT / COOKED MEAT / LIVE ANIMAL / OTHER

\_\_\_\_\_

Part of meat: WHOLE BODY / A CERTAIN PART – which one

\_\_\_\_\_

Price of the product: \_\_\_\_\_ / \_\_\_\_\_ (price per units)

*This part will be asked at the end of the interview.*

Gender: FEMALE / MALE

Age: \_\_\_\_\_

Home village:

\_\_\_\_\_

Education level: PRIMARY / JUNIOR SECONDARY SCHOOL / SENIOR SECONDARY SCHOOL / HIGHER EDUCATION / NEVER GONE TO SCHOOL

Marital status: SINGLE / MARRIED / DIVORCED / WIDOW(-er)

Children: CHILDLESS / 1 CHILD / 2-4 CHILDREN / MORE THAN 4 CHILDREN

## **1. ORIGIN OF GREATER CANE RATS (GRASSCUTTER)**

- 1.1. Can you tell me where is the meat product (grasscutter) from? (origin)
- 1.2. FARM - Can you tell me more about the farm? Can you describe me the farm? (description of farm – who is breeder, how many of grasscutters do they breed, what do they feed, which other animal do they breed)
- 1.3. WILD - Can you describe me how and where do you hunt the grasscutter? (who, how many, how often, seasonality)

## **2. MARKET**

- 2.1. How do you assess current market situation? (demand, problems, difference in season, who is regular customer)
- 2.2. How the market changed during the time you sell the greater cane rat? (season, commercialization)
- 2.3. Are there any differences in supply/demand for grasscutter during seasons?

## **3. SELL**

- 3.1. Can you tell me what motivates you to sell the grasscutter? (how long, profit, benefits, living standards)
- 3.2. How do you sell grasscutter? (where, tricks, how often, season)
- 3.3. Are there any complications or problems about being a vendor of grasscutter? (competition, laws)

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NOTES:

*Thank you for your time and cooperation.*

## Appendix 2: Pictures from the survey



Frozen greater cane rat – whole body and cut (photo by author)



Air dried greater cane rat – whole body and cuts (photo by author)





Albino greater cane rat (photo by author)



From the market (photo by author)