



Socioeconomic Characteristics of Guinea Pig (*Cavia porcellus*) Farmers in the Middle Belt of Ghana

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ABSTRACT

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The study was conducted to assess the socioeconomic characteristics of Guinea pig farmers in the middle belt of Ghana. The study was carried out in two phases. With phase one, 54 Guinea pig farmers were selected using snowball sampling procedure to obtain their demographic characteristics. In the second phase however, Fifty four (54) Guinea pig approximately four (4) weeks old were procured from the farmers and reared intensively for four months to access the production cost of Guinea pig through on-farm study. Data analysis was carried out using R statistical software version 4.2.1 and SPSS version 21.0. Majority of Guinea pig producers were males (88.89%) whilst female were (11.11%). Again, most (62.96%) farmers had received some form of formal education. A lot of the respondents (83.33%) purchased their breed stock from their neighbors. Over 85.48% of the household respondents interviewed had the herd size between 1 and 9. Several (66.66%) respondents received below GH¢32.79 (US\$5.74) as revenue from the sales of one Guinea pig. On-farm study indicated that the production cost of raising one cavy from birth to maturity (90 days) was GH¢32.16 (US\$5.63). Basically, the overall revenue from the sales of one Guinea pig yielded GH¢66.04 (US\$11.57) with GH¢33.88 (US\$5.93) as the profit on each animal. Hence, in conclusion the local Guinea pig in the middle belt of Ghana are prolific, easy to produce by all classes of people, which provide valuable food and income, require small capital to start and have an appreciable return on investment.

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INTRODUCTION

Animal production in general plays a vital socioeconomic role for people living in low-income and advanced countries. Animals are widespread and almost every rural family owns them which provides a valuable source of family protein and income (Tadele et al., 2018).

Recently, micro livestock are likely to become increasingly important as a result of the rapid increase in human population and urbanization (Assan, 2014). Moreover, there have been growing interest in the use of mini-livestock, including Guinea pig (*Cavia porcellus*) to increase and diversify livestock production (Manjeli et al., 1998). Domestic cavies are one of the mini livestock which are used in Sub-Saharan Africa to provide food and nutrition security, and thereby generating income (Ayagirwe et al., 2019). There is growing evidence that engaging in micro livestock farming has a potential to address the food insecurity in Sub Saharan Africa (Hardouin, 1995). According to Assan (2014), micro livestock species can be an option to meet the animal protein demand in Sub Saharan Africa. Guinea pig appear to be cheaper and achievable solution that can be used to augment protein insufficiency in some of the rural people (Handlos, 2018). Guinea pig appear to be cheaper and achievable solution that can be used to supplement and compensate for the insufficiency of protein in rural areas for many reasons (Handlos, 2018).

Guinea pig are animals that were first domesticated as early as 5000 BC for food by tribes in the Andean region of South America (the present-day southern part of Colombia, Ecuador, Peru, and Bolivia) (Chauca, 1995). The domestic Guinea pig (*Cavia porcellus*) belongs to monogastric herbivore which comes from the Caviidae, the rodent family (Terril et al., 1998), which belongs to the order of Caviomorpha, or Hystricomorpha (Mancinelli, 2016). Guinea pig have historically contributed to poverty alleviation and minimized protein deficiency issues in the diets of poor people

in South America, the Philippines and Sub-Saharan Africa (Bindelle et al., 2007; Lammers et al., 2009; Handlos, 2018).

Cavies are considered as a promising micro livestock as they require small startup capital and produce high quality meat as compared to other livestock (Lammers et al., 2009; Niba et al., 2012; Assan, 2013). Guinea pig meat contains a high amount of protein (20.3 to 21%), low content of fat (7.8 to 8.0%) and minerals (0.8%) as compared with other animals such as poultry (18.2% protein and 10.2% fat), cattle (18.7% protein and 18.2% fat) and pigs (12.4% protein and 35.8% fat) (Kouakou et al., 2013). Guinea pig mature earlier and are prolific (Dikko et al., 2009; Lammers et al., 2009) with less competition with humans for food as they can be fed with a large variety of wild plants, crop residues, kitchen wastes, forages, vegetables and fruits leftovers (Kouakou et al., 2015; Abossede et al., 2019).

Besides, keeping Guinea pig for income generation and they also provide good manure that support crop production. Cavies meat is best served on important occasions such as weddings; and is also used in traditional medicine to treat anemia (Ngoupayou et al., 1995; Maass et al., 2014; Simtowe et al., 2017).

Global poverty and food insecurity continue to remain as critical issues, especially in rural areas (Lammers *et al.*, 2009). Cavy production is geared towards contributing significantly to nutritional security, especially catering for animal protein deficits, and income generation of more than a hundred of thousands of poor rural and urban households in the world (Maass et al., 2013).

Despite many significant benefits obtained from Guinea pig as pet and laboratory animals, to the best of the authors knowledge no research work and publication have been done on local Guinea pig in Ghana. However, Ghana Animal Genetic Diversity must conserve indigenous breeds and improve upon their sustainability (APD, 2003).

Now, it is imperative to identify these wonderful animals (Guinea pig) for food, income, multiplication and research.

The objective of the study was to assess the socioeconomic characteristics of Guinea pig farmers in the middle belt of Ghana namely; Ahafo, Ashanti, Bono and Bono East regions.

MATERIALS and METHODS

Study area

The research was carried out in the middle belt of Ghana namely; Ahafo, Ashanti, Bono and Bono East regions. The research data collection was obtained from September 2019 to February, 2021. Ashanti region is found between longitudes 0.15 – 2.25 °W and latitudes 5.50 – 7.46 °N. Bono Ahafo region is within longitude 0.15 °E and latitudes 8.45 °N and 7.30 °S of Ghana. These regions have an average rainfall of 1,088 mm – 1,800 mm in a year which start from early March to the latter part of September and October. The atmospheric temperature falls within 23.9 °C to 32 °C and humidity is between 65 % - 85 % throughout the whole year (MoFA, 2021ab).

Data collection and design

A twelve months study was conducted. The study was carried out in two phases. About phase one, fifty four (54) Guinea pig farmers were interviewed using a semi-structured interview and questionnaire on Guinea pig sampled in middle belt of Ghana using snowball sampling method. Data obtained from the survey were farmers' educational background, age, sex, income, sources of Guinea pig, herd number and production cost of cavies in the three regions (Figure 1). In phase two, fifty four (54) Guinea pig approximately four (4) weeks old were procured from the farmers and reared intensively for four months to compare the economics of Guinea pig farmers with that of the monies that go into the production and monies received from on-farm

study that took place at Goaso, Ahafo region. Wooden pen with iron sheets roof was used to house the cavies. Each chamber was 86 cm x 81 cm x 58 cm and it was raised 30 cm above the ground. The animals were confined in a pen partitioned into 12 compartments with two (2) males and four (4) females in each compartment to give a total of 20 males and 34 females. Wood shavings were spread in the corrals as a bedding material to absorb their urine, faeces and water spills. Animals were fed with forages (basal feed) such as Guinea grass (*Panicum maximum*), etc. Kitchen scraps and supplementation of concentrate (15 % crude protein) were given as well. Water was offered *ad libitum*. Feeding and watering troughs were washed every two days. Drinking water was changed every twelve (12) hours to make sure the Guinea pig had clean cool water to drink. The production cost of Guinea pig was calculated as how much goes into the production and how much is received from their sales or revenue.



Figure 1. Obtaining data on social characteristics of Guinea pig farmers in the middle belt of Ghana

Primary characterization and cross-sectional type of design were used for this study.

Determination of production costs of Guinea pig

Guinea pig costs were determined by how much goes into the inputs such as their pen construction (standard pen), nutrition, purchase of starter stock, transportation and the sales or revenue. The operative stage entailed proper management in which an index of productivity and cost of production was calculated;

$P = I - C$, where; **P** is the profit margin, **I** is the income from cavies production and **C** is the cost of production.

Calculation of production factor of Guinea pig

The production factor of the Guinea pig was expressed by the female determinant (FD) that could be produced by a female Guinea pig annually. Female determinant (FD) was calculated using the following formula;

$$FD = F \times B/A \times LS \times MA \times SR$$

Where; **FD** shows the female determinant, **F** is the birth rate of the female, **B/A** is the rate at which the female gives birth annually, **LS** is the ability of the female to produce at a time, **SR** is the survival rate of the female and **MA** is the mothering ability of the female.

Statistical analysis

The frequencies of socioeconomic characteristics of Guinea pig farmers from the survey and production cost of cavies from the on-farm study were analyzed using the descriptive statistics package of SPSS 21.0 (SPSS, 2021) and R statistical (2021) software version 4.2.1. Relative frequencies of various socioeconomic parameters and production cost results are summarized in tables.

RESULTS and DISCUSSION

Socioeconomic characteristics of Guinea pig farmers

The majority of Guinea pig producers were males (88.89%) with the remaining (11.11%) being females as indicated in Table 1. The present finding agrees with Kouakou et al. (2011) who observed that men were 96.3% more than the women in Guinea pig rearing in the urban and peri-urban areas in central and southern Côte d'Ivoire. The respondents aged between 31 and 49 recorded the highest (51.85%) proportion of individuals involved in raising Guinea pig. Respondents below 17 and between 50 to 75 obtained the same percentage (11.11%). The age 18 to 30 recorded 25.93% as respondents who were into Guinea pig production. The present study contradicts with the findings by Kouakou et al. (2011) who indicated that out of a total of 268 Guinea pig farmers, 102 were children between 7 to 13 years old in Côte d'Ivoire. The reason is that Guinea pig rearing is not restricted by age. Most (62.96%) of the respondents had completed junior high school, as 16.67%, 12.96% and 7.41% represented farmer who had received tertiary, middle school leaving certificate and senior high school education respectively in the middle belt of Ghana.

Mwalukasa (2009) observed that the majority (73.6%) of the respondents in his survey have acquired primary education in Tanzania. Guinea pig production could be raised by both educated and uneducated. The ability to read and write is very paramount in livestock productions since it has great impact on adoption of technology (Zipora et al., 2011).

Most (66.67%) of the farmers mentioned that they rear Guinea pig for food and income whereas 33.33% of farmers produce cavies for many reasons (food, income and multiplication). The majority (66.66%) of the respondents that received below GH¢32.79 (US\$5.74) as revenue from the sales of one Guinea pig as shown in Table 1. The majority (66.67%) of the farmers reared Guinea pig for food and income whereas 33.33% of farmers produced cavies for many reasons (food, income and multiplication). This can be attributed to the fact that the farmers used Guinea pig for

food and surpluses were sold. Cavies production serve as a valuable source of food and income in Sub Sahara Africa (Benin, Côte d'Ivoire, Cameroon, Ghana, Tanzania, etc) (Manjeli et al., 1998 and Komwihangilo et al., 2016). According to Numbela and Valencia (2003); Ngoupayou et al. (1995) stated in their report that Guinea pig meat contributes high protein (20.3 - 21%) and low-fat content (7.8 - 8.0%) and minerals (0.8%) than their counterparts; poultry (18.2% protein and 10.2% fat), cattle (18.7% protein and 18.2% fat) and pigs (12.4% protein and 35.8% fat) respectively which could be used to augment family protein and thereby provide food security for less privileged families.

Moreover, most of the respondents 83.33% purchased their breed stock from their neighbors, or received as gifts (11.11%) while 1.85% acquired their animals through market centres, family members and inheritance respectively. Similar finding has been reported by Komwihangilo et al. (2016) who indicated that 66.7% of farmers obtained their starting stock from friends and neighbors by traditional barter system where they exchange cavies for chicken, dogs, food and sugarcane in Tanzania. The implication is that farmers purchased the starting stock from their acquaintances because of trust and also get the animals relatively cheap. Hence the breed source is a good determinant for breeders to trace the ancestral record and also carry out further investigations on the animals.

Over 85.48% of the household respondents interviewed have the herd size between 1 and 9. This finding collaborates with the results obtained by Kouakou et al. (2011) who had an average herd size of 1 and 10 Guinea pig per household in the central and southern part of Côte d'Ivoire respectively. The findings disagree with the report by Herman et al. (2014) who pointed out that herd size of Guinea pig per household could range from 1 to 30. Farmers keeping an average number of Guinea pig might have accounted for them to sustain cavies production.

Table 1. Socioeconomic characteristics of Guinea pig farmers

Socioeconomic characteristics	Frequency (n)	Percentage (%)
Sex of Farmers:		
Males	48	88.89
Females	6	11.11
Age of Farmers:		
< 17	6	11.11
18 – 30	14	25.93
31 – 49	28	51.85
50 – 75	6	11.11
Farmers Educational Level:		
Tertiary	9	16.67
Senior High School	4	7.41
Junior High School	34	62.96
Middle School Leaving Certificate	7	12.96
Monies (Gh¢) received from Guinea pig production:		
< 32.79	36	66.66
34.43 - 65.57	7	12.96
67.21 - 98.36	3	5.56
100 - 131.15	2	3.70
132.79 - 163.93	3	5.56
> 163.93	3	5.56
Purpose of Rearing:		
Food and Income	36	66.67
Food, Income and Multiplication	18	33.33
Herd Size		
1 – 9	46.16	85.48
10 – 15	6.09	11.28
> 15	1.74	3.22
Breed Source/Origin:		
Neighbor	45	83.33
Gift	6	11.11
Market	1	1.85
Family	1	1.85
Inherited	1	1.85

Conversion rate of Ghana Cedis (¢) to US Dollar (\$) was GH¢ 5.71 to USD\$ 1.00 as in the time of the study in October 22, 2020 (BoG, 2020).

On-farm study

Production costs of Guinea pig

Knowledge about cavy business (i.e. how much goes into the production and how much is obtained from their investment) would be very imperative for animal producers, breeders and policy makers to know. Table 4 shows the summary of the total cost incurred on Guinea pig for four months. Production costs of cavy covered pen construction (standard pen), nutrition, starter stock, transportation cost and veterinary care and labour cost. The costs of feed for the animals were found to be GH¢350.42 (US\$61.37) which represented 19.46% costs of production for the four (4) months. Other related costs include pen construction, labour, veterinary care and Guinea pig stocks sum up to GH¢ 1,450.46 (US\$254.02), which scored 80.54% of the total cost of production. Total production costs for the animals was GH¢1,801.16 (US\$315.44) for the four (4) months duration. Table 5 presents the revenue/income received from the sales of the Guinea pig in the middle belt of Ghana. Income from Guinea pig production included sale of weaners/young ones and adults and manure. The total income obtained from Guinea pig ventures in four months was GH¢3,698.12 (US\$647.66).

Profit = Income - Expenditure, Profit = GH¢3,698.12 (US\$647.66) – GH¢1,801.16 (US\$315.44) = GH¢1,896.96 (US\$332.22).

The gross revenue or income received from the sale of the animals within the study period was GH¢3,698.12 (US\$647.66) and a profit of GH¢1,896.96 (US\$332.22) was received. The research finding was similar to the observation made by Komwihangilo et al. (2016) reported in the Kongwa and Mpwapa districts of Dodoma region, Central Tanzania that one Guinea pig could be sold for Tshs. 2,000 to 3,000 (US\$1 = Tshs. 2000) and Tshs 100,000 to 225,000 (US\$100 to 150) for those who produced 50 to 75 Guinea pig in a year to support household income. The research findings showed that raising one cavy from birth to reach maturity (90) days was GH¢32.16 (US\$5.63)

for each animal. Also, the study revealed that the overall revenue from the sales of Guinea pig in the middle belt of Ghana yielded GH¢66.04 (US\$11.57). Again, GH¢33.88 (US\$5.93) was recorded as the profit on each animal. The result agrees with Numbela and Valencia (2003), Herman et al. (2014), Nuwanyakpa et al. (1997) and Manjeli et al. (1998) who reported similar findings on the profitability of Guinea pig production. The cost of labour (caretaker of the animals) is presented in Table 2 and The cost of 100 kg of concentrate feed used to feed the animals is presented in Table 3.

Table 2. Cost of labour (caretaker of the animals)

Caretaker of the animals	Number	Unit cost	Total amount (GH¢)
Motivation for Labour (four months)	1	190.84 × 1 = 190.84	190.84
Total			190.84

Conversion rate of Ghana Cedis (¢) to US Dollar (\$) was GH¢ 5.71 to USD\$ 1.00 as in the time of the study in October 22, 2020 (BoG, 2020).

Table 3. The cost of 100 kg of concentrate feed used to feed the animals

Concentrate feed	Quantity	Unit price	Total amount (GH¢)
Normal/reproduction formula			
Wheat Bran	24 kg	25.78 × 1 = 25.78	25.78
Maize	50 kg	47.72 × 1 = 47.72	47.72
Soya Bean	25 kg	76.53 × 1 = 76.53	76.53
Premix (Minerals and Vitamins)	1 kg	4.77 × 2 = 9.54	9.54
Total			159.57

Conversion rate of Ghana Cedis (¢) to US Dollar (\$) was GH¢ 5.71 to USD\$ 1.00 as in the time of the study in October 22, 2020 (BoG, 2020).

Table 4. Summary of the total costs incurred on Guinea pig for four months

Cost description	Quantity	Unit price (GH¢)	Total amount (GH¢)
Construction of Guinea pig pen	1	858.68	858.68
Purchase of starter stocks of Guinea pig (Weaners)	54	9.55 × 54	515.70
Feed (Concentrate)		159.58	159.58
Veterinary care cost		76.36	76.36
Labour (Caretaker of the Animals)	1	190.84 × 1	190.84
Total Cost			1,801.16

Conversion rate of Ghana Cedis (¢) to US Dollar (\$) was GH¢ 5.71 to USD\$ 1.00 as in the time of the study in October 22, 2020 (BoG, 2020).

Table 5. Revenue/income from sales of Guinea pig

Revenue/income detail	Quantity	Unit price (GH¢)	Total amount (GH¢)
Sale of Guinea pig (Weaners/young ones)	40	14.32 × 40	572.80
Breeders			
Sale of Guinea pig (adults)	74	38.18 × 74	2,825.32
Manure (organic fertilizer)	50 kg	300 × 1	300.00
Total Income			3,698.12

Conversion rate of Ghana Cedis (¢) to US Dollar (\$) was GH¢ 5.71 to USD\$ 1.00 as in the time of the study in October 22, 2020 (BoG, 2020).

CONCLUSIONS

The cavies production in the middle belt of Ghana were mainly small scale household production and the breeds were the indigenous type. Guinea pig rearing have improved the livelihoods of rural poor farmers (in terms of socioeconomic, nutritional and food security). Some farmers and children kept cavies as a prestige. Primarily Guinea pig were kept by all classes of people; males and females, young and aged and also educated and uneducated. Many cavies producers had a herd size between 1 to 9 animals in their pens. Guinea pig production provides valuable food security and income for the rural farmers and their families. Knowledge about cavies business (i.e. how much goes into the production and how much is obtained from their investment)

would be very imperative for animal producers, breeders and policy makers to know. The production expenses of caviae covered pen construction (standard pen), nutrition, starter stock, transportation cost and many others. The production cost of raising one cavy from birth to reach maturity (90) days was GH¢32.16 (US\$5.63) for each animal. However, the overall revenue from the sales of Guinea pig yielded GH¢66.04 (US\$11.57). Again, GH¢33.88 (US\$5.93) was realized as the profit on each animal. Hence, Guinea pig production is a lucrative venture that requires small capital to start.

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Conflict of Interest

The authors have declared that there are no competing interests.

Authors Contribution

All the authors contributed significantly to the development of this paper.

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