



RESEARCH ARTICLE

THE STATE OF GUINEA FOWL PRODUCTION AND CHALLENGES FACED BY THE INDUSTRY IN GHANA

Bonsu Fritz Ramseyer Karikari^{1, 2, *}, Asenso Richard Adomako^{1, 3}, Afrifa Prince¹, Donkoh Armstrong² and Hamidu Jacob Alhassan²

¹Department of Animal Science Education, Akenten Appiah-Menka University of skills Training and Entrepreneurial Development, Kumasi, Ghana; ²Department of Animal Science, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana; ³Institute of Animal Breeding and Genetics, Justus Liebig University, Giessen, Ludwigstrasse 21b, 35390 Giessen, Germany

ARTICLE INFO

Article History:

Received 14th December, 2023
Received in revised form
20th January, 2024
Accepted 24th February, 2024
Published online 30th March, 2024

Key words:

Guinea fowl, Challenges, farming system, production, Disease management, Poultry product, Hatchability

*Corresponding author:

Bonsu Fritz Ramseyer Karikari

ABSTRACT

The study assessed Guinea fowl (*Numida meleagris*) production in Ghana's middle belt and northern regions, aiming to identify challenges and propose strategies for sustainable production. Using a survey, 159 farmers were sampled through purposive snowball sampling technique and randomised methods. Results indicated male dominance (97 %) in the industry. Challenges included housing, low hatchability, accessibility, availability and affordability of quality feed, limited education on Guinea fowl production, animal health control gaps, and inadequate support. Operations were small-scale (average <1,000 fowls), adopting semi-intensive practices. Earlier research integration was lacking, highlighting the need for feed and hygiene programmes through extension services. Addressing these challenges could elevate the role of Guinea fowl farming in protein provision and job creation. Economic considerations drove production, mostly small-scale production with semi-intensive management. The study unveiled a range of hurdles highlighting production constraints notably feed-related problems, while addressing possible causes of reproduction challenges, primarily keets mortality and less incidence of diseases cases. Appropriate platform for sharing research outcomes with Guinea fowl farmers, encouraging female participation for poverty alleviation and feed subsidies are recommended to boost production. Overall, the study underscores the potential to transform Guinea fowl farming for economic and nutritional gains while advocating strategic interventions to address present challenges.

Copyright©2024, Bonsu Fritz Ramseyer Karikari et al. 2024. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Bonsu Fritz Ramseyer Karikari, Asenso Richard Adomako, Afrifa Prince, Donkoh Armstrong and Hamidu Jacob Alhassan, 2024. "The state of Guinea fowl production and challenges faced by the industry in Ghana.". International Journal of Current Research, 16, (03), 27535-27542.

INTRODUCTION

Guinea fowl (*Numida meleagris*) originates from West Africa (Annor et al., 2012; Abdul-Rahman, 2017), however, its commercial viability has primarily been realised in Europe and United States of America, where successful commercialisation endeavours have been accomplished (Cassius and Radikara, 2013; Bhogoju et al., 2018). In its original geographical area, *N. meleagris* continues to be reared as unconfined scavenging avian species, often lacking proper feeding and genetic enhancements, which have consequently impacted their egg and meat production (Dougnon et al., 2012; Issaka and Yeboah, 2016). Nevertheless, Guinea fowls exhibit inherent resistance against a broad spectrum of poultry diseases, rendering them a promising option for smallholder farmers without access to formal veterinary services. The prominent production of Guinea fowls predominantly occurs in the northern savannah zones, contributing to 7 % of overall poultry production in Ghana (FAO, 2014).

In this context, they hold significant importance within the local farming system, serving as alternative means of livelihood, particularly for women and children, aimed at poverty alleviation (Ahiagbe et al., 2021). In addition to their primary function as a source of income and dietary protein, Guinea fowls fulfil other significant roles in the social customs of various tribes. Specifically, the Dagomba and Gonja tribes hold them very high in cultural significance during the annual Guinea fowl festival (Majeed, 2020). The pure white Guinea fowl strain is utilised for ceremonial purposes and specific funeral rituals (Odutsa, 2021). Customarily, the Frafras, Dagabas, and Bulsas communities employ Guinea fowls to welcome their mothers-in-laws' (Teye and Adams, 2000; Molina-Flores et al., 2020). Guinea fowls are known to exhibit lower susceptibility to a majority of avian diseases (Anderson et al., 2022). Researchers have documented that the meat of Guinea fowl possesses superior taste and texture compared to chicken (Teye and Adam, 2000; Soara et al., 2020).

Additionally, owing to its streamlined skeletal framework, Guinea fowl generates a higher proportion of consumable meat compared to chicken (Koney, 1993; Teye and Adams, 2000). During the months spanning from May to July, Guinea fowl eggs enjoy substantial popularity and market availability (Kokoszyński, 2017). Particularly noteworthy is their eggshells' enhanced thickness, conferring a distinct edge in terms of extended storage and handling, thereby mitigating breakage (Farkas, 1965; Amoah *et al.*, 2018). Nonetheless, the pressing pursuit of sustainable strategies to combat escalating household food insecurity in numerous Ghanaian households underscores the need for the effective harnessing of locally accessible resources to augment meat production. The burgeoning popularity of Guinea fowl production in Ghana is increasingly evident. This industry not only ensures consistent profitability for farmers involved but also holds promise as a significant contributor to national GDP and benefiting over 50,000 individuals (Francis *et al.*, 2015). Guinea fowl meat has gained considerable popularity among local consumers, prompting a shift towards its preference over imported meat varieties in numerous Ghanaian restaurants. This consumer preference consequently aids the country's economic growth. However, Guinea fowl production in developing nations, Ghana included, encounters certain challenges that impede its progress. Numerous research studies have been conducted over the years with the ultimate goal of providing solutions to the challenges of the industry. There is big knowledge gap, adversely affecting the birds' productivity, consequently posing a threat to national food security especially in the Northern part of Ghana. The objective of this study was to determine the present status of Guinea fowl production and the difficulties encountered by Guinea fowl farmers in Ghana and recommend solutions to increase productivity.

MATERIALS AND METHODS

Study location: The study was conducted in the Republic of Ghana, located in West Africa. The terrain is mainly low relief, with elevations below 914.4 metres. Ghana's climate is influenced by a hot, arid air mass from the Sahara and a warm, humid air mass from the South Atlantic. Figure 1 provides a study area map.



Figure 1. Map showing the survey area (<https://www.ghanamissionun.org/map-regions-in-ghana>)

Study design and sample size: A total of 159 Guinea fowl farmers constituted the sample size for data collection. The study focused on farmers involved in Guinea fowl farming in Ghana and employed purposive sampling and snowball sampling technique. This descriptive cross-sectional investigation aimed to assess Guinea fowl production status and challenges faced by Ghanaian farmers. These designs were adopted aiming for comprehensive insights through a structured series of inquiries.

The participants responded to a well-structured questionnaire that covered the current state of Guinea fowl production and associated difficulties. For participants with basic literacy, the questionnaires were self-administered, with clear instructions for closed-ended questions and opportunities to elaborate for open-ended questions. Illiterate respondents received oral explanations of the questionnaire in their native language, enabling them to provide choices for closed-ended inquiries and express their thoughts for open-ended queries.

Data analysis: All collected field questionnaires underwent a thorough review to verify question completion and subsequent coding. Data entry was performed using Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics were applied to examine variable characteristics, including frequency and percentage calculations. The outcomes of this analysis were presented in a cohesive narrative form. For enhanced clarity, numerical summaries, charts, and tables were utilised to effectively communicate the descriptive results of the study.

RESULTS

Demographic Characteristics of Respondents: Analysis of the demographic characteristics of individuals involved in Guinea fowl production is presented in Tables 1. According to the survey, 5 respondents (3 %) were women, whereas 154 respondents (97%) were men (Table 1). Among the respondents, the largest proportion, comprising 68 individuals (43%), fell within the age group of 41-50 years (Table 1). More than half of the respondents, totalling 93 individuals (59%), had gone through a tertiary level of education (Table 1). In terms of marital status, the majority of respondents, 134 individuals (84 %), were married (Table 1).

The religious affiliation of the respondents revealed that Christians constituted the majority, with 104 individuals (65 %) as compared to 35 % of Muslims (55 individuals) (Table 1). Additionally, it was observed that a significant proportion of the respondents, 115 individuals (72.3%), cited financial gain as the primary drivers for Guinea fowl production (Table 1). A significant number of respondents, specifically 74 individuals (47 % of the total), reported having 1-5 years of experience in Guinea fowl farming. Additionally, 35 respondents (22 % of the total) indicated having over 10 years of farming experience (Fig. 2). These findings indicate that while farmers in the surveyed area possess substantial overall farming experience, their expertise in Guinea fowl production is relatively limited (Table 1)

Table 1. Biodata of respondents

Study Variable	Frequency	Percentage (%)
Sex		
Male	154	96.9
Female	5	3.1
Age		
Less than 20 years	15	9.4
20-30 years	15	9.4
31-40 years	48	30.2
41-50 years	68	42.8
51-60 years	5	3.1
Above 60 years	8	5.0
Educational Background		
Non-formal	14	8.8
Basic	27	17.0
Secondary	25	15.7
Tertiary	93	58.5
Marital status		
Single	25	15.7
Married	134	84.3
Religion		
Christian	104	65.4
Muslim	55	34.6
Purpose of Guinea fowl production		
Money	115	72.3
Employment	32	20.1
Others	12	7.6

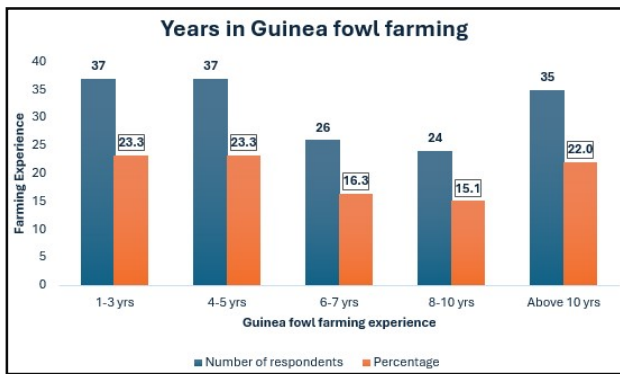


Figure 2. Farming experience of respondents

State of the Guinea fowl industry

Breed, management practices, and health concerns in the Guinea fowl industry: The data reveals that 80 farmers (approximately 50 %) reported raising Pearl Guinea fowl as compared to 50 (31 %), 21 (13 %) and 8 (5 %) respondents for lavender, mixed culture of Lavender and Pearl and that of Lavender and white respectively (Table 2). Most farmers (approximate 53 %) prefer to raise Guinea fowl for their meat while others (approximately 28 %) find peculiar interest in both their meat and eggs, expressing no interest in solely eggs (Supplemental table 1). These types of productions are driven by the meat and consumer preference with a cumulative percentage of approximately 62.9 % (supplemental table 1). A considerable majority of respondents (approximately 87 %) claimed knowledge of other farming enterprises, indicating a robust network of Guinea fowl farmers in Ghana (Table 2). The study identified that most farmers (approximately 71 %) feed their Guinea fowl a diet consisting of mixed feed, grains and waste, a cost-effective feeding practice commonly employed in Ghana (Table 2). However, it is important to note that such a diet may not provide all the necessary nutrients for Guinea fowl. Additionally, 144 individuals (approximately 91 %) reported diseases prevalence on their farms, which is not surprising considering the susceptibility of Guinea fowl to various diseases (Table 2).

The study revealed that most farmers (76 %) rarely experienced diseases on their farms, indicating that Guinea fowls are less susceptible to disease risks in Ghana (Table 2). Nonetheless, farmers exhibited the awareness and vigilance on preventive measures of disease. Farmers (approximately 40 %) sought the assistance of veterinary officers when faced with a disease outbreak, highlighting their awareness of the importance of veterinary care for Guinea fowl, however some farmers (approximately 37 %) prefer to provide self-treatment with drugs (Table 2). Furthermore, the study found that a significant majority of farmers (approximately 96 %) had a ready market for their Guinea fowls, with the open market being the primary source for most farmers (approximately 64 %) (Table 3). Others (approximately 12 %) indicated that prospective buyers come around farms with motor bikes to buy the bird. Majority of respondents (96 %) reported facing challenges in Guinea fowl production, with high mortality (29.4 %) and brooding problems (28.8 %) being the most significant challenge (Table 3). A high portion of the respondents (32.8 %) out of the farmers practicing brooding (84 %) indicated that they experienced keets mortality rates exceeding 10 % during the brooding stage (Table 3).

Table 2. Breed, management practices, and health concerns in the Guinea fowl industry

Study Variable	Frequency	Percentage (%)
Breed of Guinea fowl kept		
Pearl	80	50.3
Lavender	50	31.5
Lavender and Pearl	21	13.2
Lavender and white	8	5.0
Rear other birds apart from Guinea Fowl		
Diverse Farming Expertise Among Respondents	144	90.6
Farmers operating Solely Guinea fowl	15	9.4
Knowledge of other Guinea fowl farms		
Yes	139	87.4
No	20	12.6
Feeding of Guinea fowls		
Concentrates	25	16.0
Mixed feeds	62	38.7
Grains and waste	65	40.6
Concentrates and grains	7	4.7
Occurrence of Guinea fowl diseases at the farm		
Prevalence of diseases	144	90.6
Absence of diseases	15	9.4
If yes, how often		
Weekly	5	3.1
Monthly	33	20.8
Others	121	76.0
How do you treat diseased animals		
Call veterinarian	63	39.6
Buy drugs	59	36.8
Call veterinarian and buy drugs	23	14.2
Call veterinarian and use herbs	8	5.7
Buy drugs and use herbs	6	3.8

Table 3. Disease, market dynamics and problems in the Guinea fowl Industry

Study Variable	Frequency	Percentage (%)
Ready market for products		
Readily available	153	96.2
Lack of market	6	3.8
Market outlet for products		
Babique operators	4	2.5
Food vendors	6	3.8
Restaurant	16	10.1
Open markets	101	63.5
Individuals	19	12.0
Food vendors and restaurant	8	5.0
Open market and restaurant	5	3.1
Face problems with Guinea fowl		

production		
Presence of challenges	153	96.2
Absence of challenges	6	3.8
What are the problems		
Unavailability of Guinea keets	7	4.6
Brooding problems	44	28.8
High mortality	45	29.4
Feed problems	28	18.3
Poor hatchability	17	11.1
Disease	5	3.3
Unavailability of Guinea keets and high mortality	7	4.6
Do you brood keets		
Brood keets	134	84.0
No brooding of keets	25	16.0
If brooding done, what is the mortality rate		
Less than 5 %	45	28.4
Greater than 5 %	30	18.7
Less than 10 %	32	20.1
Greater than 10 %	52	32.8

Farming Systems: The farming system adopted by most farmers is the free-range system of farming, with elements of extensive farming practices constituted 40 % of the respondents (Fig. 3). Small minority of farmers (35 %) adopts semi-intensive system of Guinea fowl rearing with the intensive system accounting for 25 %. The survey results also showed that 25 % of the respondents practiced the intensive system of Guinea fowl rearing. In this system, farmers typically provide a high level of input and control over the production environment. This may include providing controlled housing or confinement, feeding commercial poultry feeds, and closely monitoring the health and growth of the Guinea fowl.

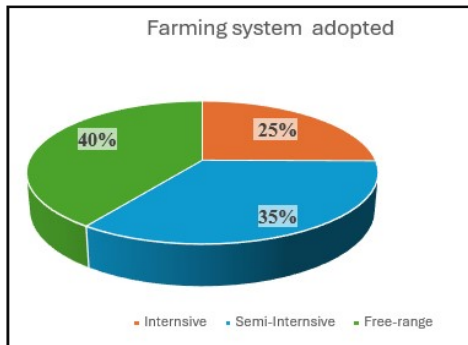


Figure 3. Farming system adopted by Guinea fowl farmers

Sources of Guinea fowls: A significant portion of the respondents, 33 % (53 individuals), sourced their Guinea fowls from the open market, while 35 % (59 individuals) obtained them from their own farms (Figure 4). Guinea Fowls sourced from the hatchery was preferred by 25 % (40 individuals). Gifts and other sources were the least preferred sources for Guinea fowl representing 9 % (Figure 4)

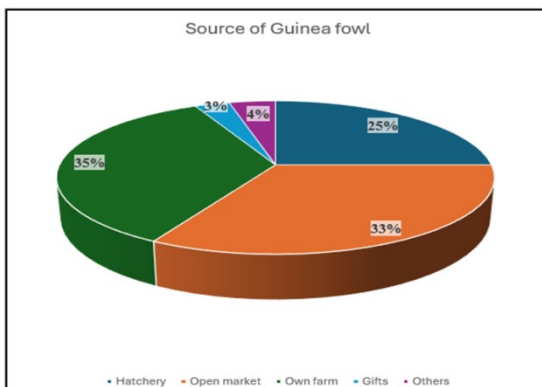


Figure 4. Source of Guinea fowl

Challenges associated with feed and hatching in the Guinea fowl industry: Farmers (87 %) reported hatching their own Guinea fowl eggs, with 49 % of the respondents experienced a hatchability percentage between 60-80 % (Table 4). Faced with feed-related challenges (approximately 71 %), out of the farmers surveyed, 29 % reported no feed problems (Table 4). The high cost of feed was highlighted as the primary challenge by most respondents (76 %) (Table 4). Nevertheless, the financial rewarding aspect (approximately 42 %) of Guinea fowl farming was geared towards a large majority of respondents (93 %) expressing their willingness to recommend Guinea fowl farming to others (Table 4). Most respondents (91 %) relied on the open market, while a significant portion (61 %) prepared their own feed for their animals (Table 4). The primary source of water for the birds was boreholes, as indicated by the majority (64 %) of respondents (Supplemental Table 2).

Table 4. Challenges associated with feed and hatching in the Guinea fowl industry

Study Variable	Frequency	Percentage
Hatch Guinea fowl eggs		
Hatching	138	86.8
No hatching	21	13.2
If hatching, what is the % hatchability?		
Less than 30 %	28	20.39
30-50 %	32	23.2
60 -80 %	68	49.3
Above 80 %	9	6.5
Feed problems		
Presence of problems	113	71.1
No problems	46	28.9
If problems are present, what are they?		
High feed cost	86	76.0
Unavailability of feed	14	12.0
Poor feed quality	13	11.5
Recommend Guinea fowl farming to others		
Will recommend	147	92.5
Will not recommend	12	7.5
If you will recommend, why		
Financially rewarding	61	41.5
Readily available market	51	34.7
Both	35	23.8
Sources of poultry feed		
Market	145	91.2
Feed mills	10	6.3
Friends	4	2.5
How do you prepare feed for your birds		
Prepare feed with a formula	97	61.0
Buy already prepared feed	62	39.0

Mode of Disease Treatment in Guinea fowl: Based on the survey results, Significant majority of farmers surveyed (73 %) indicated the use of antibiotics in treat Guinea fowl diseases on their farms (Figure 5). Additionally, 18 % of the farmers mentioned the use of drugs, while 9 % indicated the use of local herbs for disease treatment.

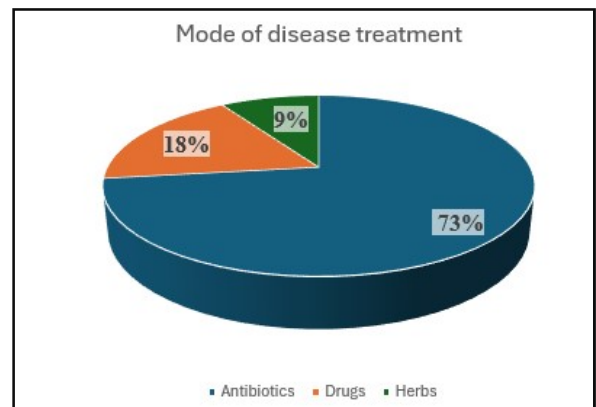


Figure 5. Medications used in the treatment of Guinea fowl disease

DISCUSSION

Demographic Characteristics of Respondents: Findings from the present study indicate that males with formal education predominantly engage in Guinea fowl production in Ghana. Moreover, married couples were clearly involved in the production of Guinea fowl. Financial considerations were identified as a major driving force for farmers to venture into Guinea fowl production, as they derive income from the sale of meat and eggs (Table 1). The results of the present study align with previous research that has emphasized the gender disparity in livestock production, including poultry farming (Kitalyi, 1998; Ochieng *et al.*, 2015). Additionally, the finding that educated individuals are more likely to participate in Guinea fowl production is consistent with studies that have highlighted the importance of education in improving agricultural practices and productivity (Akudugu *et al.*, 2010; Asfaw *et al.*, 2012). The inclination towards married individuals in Guinea fowl production could be linked to the stability and increased resources commonly available to those who are married, enabling them to make greater investments in agricultural pursuits (Asfaw *et al.*, 2012). Furthermore, the financial motivation behind Guinea fowl production is supported by studies that emphasize the economic aspect of livestock farming and the potential for income generation (Turvey *et al.*, 2013; Nyoni *et al.*, 2017).

Farming experience: Teye and Adam (2000) reported a smaller minority (43 %) of farmers having over 10 years of experience in rearing Guinea fowl, while reports from the present study decipher that most farmers (51 %) had between 3 to 10 years of experience (Fig. 2). These findings have several implications that warrant further investigation. On one hand, the respondents' general farming background may provide a solid foundation for transitioning to Guinea fowl farming. However, the data also highlights the specific knowledge gap in Guinea fowl production, indicating the need for targeted interventions to enhance farmers' expertise in this area. To better understand the significance of these findings, it is valuable to consider previous research findings. The study conducted by Issaka and Yeboah (2016) found that 55 % of Guinea fowl keepers in the Northern region had more than 10 years of rearing experience. This indicates the prevalence of Guinea fowl rearing among the populace in Northern Ghana, serving as a means of subsistence for peasant farmers. The higher geographical distribution of Guinea fowl and farmers' experience in the Northern region compared to other regions in Ghana may contribute to this trend observed in their study. Given the potential economic benefits and nutritional value associated with Guinea fowl farming, addressing this knowledge gap becomes crucial. Implementing training programs, workshops, and extension services that specifically focus on Guinea fowl production can provide farmers with targeted guidance, ensuring the acquisition of essential skills and knowledge in this field.

State of the Guinea fowl industry: The preferential pattern for pearl Guinea fowl strain (Table 2) may be primarily driven by consumer preference for their popularity, meat flavour and eggs as corroborated by Tlhong (2008). Contrary to this finding, lavender Guinea fowl strain was reported to be the most preferred meat due to high-quality meat and eggs (Baimbill-Johnson *et al.*, 2021). A significant majority of respondents (96 %) indicated a flock size fewer than 1000 birds (Supplemental Table 1), indicating that Guinea fowl farming is predominantly a small-scale enterprise in Ghana and mostly practiced in the Northern part on subsistent basis where majority of peasant farmers are geographically located. Furthermore, 144 individuals (91 %) mentioned raising other bird species alongside Guinea fowl (Table 2), which is a common practice due to the benefits of mixed-species flocks, such as enhanced pest control and reduced disease risk (Teye and Adams, 2000; Baimbill-Johnson *et al.*, 2021). The robust network of Guinea fowl farmers through their awareness of the presence other Guinea fowl farms in Ghana (Table 2) provides access to information, resources, and support for farmers (Baimbill-Johnson *et al.*, 2021). Guinea fowl are susceptible to various diseases (Supplemental Table

2), including Newcastle disease, coccidiosis, and fowl pox (Ayim-Akonor *et al.*, 2018). This authenticates the observations made by Baimbill-Johnson *et al.* (2021), on the relevance of veterinary care for Guinea fowl however, contradicts their observation made in their study on the constraints faced by Guinea fowl farmers and reported that the second group of constraints, listed in descending order of significance, included the unavailability of day-old chicks, adverse weather conditions, lack of ready markets for produce, incidents of theft, and high transportation costs. Readily availability of market from the present study (Table 3) indicates a strong demand for Guinea fowl meat and eggs in Ghana. The study provides key findings that can be utilised to enhance the productivity and profitability of Guinea fowl farming in the country. Additionally, ready market for the Guinea fowl is a clear indication that the present level of production of the bird is relatively low and can be increased through encouraging people for more production with some incentives as motivation.

Farming Systems: The free-range system typically involves a minimal level of input and management. Farmers practicing this system may provide some level of housing or shelter for their Guinea fowls, others may live on trees along with some supplementary feed, while allowing them freedom to roam and forage for food in an unrestricted area. This result obtained in this study (Fig. 3) is contrary to that of Kouassi *et al.* (2019) who asserted that the most popular management method for Guinea fowls is the semi-intensive system (86.2 %) but consistent with report of Annor *et al.* (2012) and Teye and Adam (2000). While the free-range system allows for a more natural and less controlled environment, it may also expose Guinea fowl to various risks such as predators, disease transmission, lower production efficiency and theft as compared to intensive or semi-intensive systems as highlighted by Soar *et al.* (2020). The survey indicated that a smaller proportion of farmers adopted the semi-intensive (55 %) and intensive (40 %) system of Guinea fowl rearing (Fig. 3). In the semi-intensive system, small level of input and management is given. This system involves a balanced approach to farming, combining elements of intensive and free-range systems with restricted access to space and natural forages. The intensive system often requires more investment and management expertise but can result in higher productivity and faster growth rates (Gržinić *et al.*, 2023). The result obtained is consistent with those reported by Teye and Adam (2000) and Teye and Gyawu (2002). The survey results provide insights into the prevailing farming systems adopted by Guinea fowl farmers in the middle belt and Northern regions of Ghana. The high prevalence of the free-range system highlights the importance of considering traditional and cultural practices in Guinea fowl production. The importance of the free-range system is observed for traditional and cultural festivities where it is believed that the true Guinea fowl is the one raised on the free-range system than the other systems which does not allow the Guinea fowl to exhibit natural behaviours. The adoption of the semi-intensive system by farmers in these areas also indicates preference for a balanced approach that combines some level of input and management. The adoption of the intensive system by a smaller proportion of farmers may indicate a desire for higher productivity and more controlled production environments for an increased production output and profitability. However, intensive system of Guinea fowl rearing is yet to dominate in the industry due to high feed cost (Mnisi *et al.*, 2022) which has been identified as the major hindrance.

Sources of Guinea fowls: Guinea fowl production involves breeding and rearing these birds for various purposes, including meat, eggs, and feathers. The high percentage of respondents acquiring Guinea fowls from the open market (Fig. 4) suggests that it is a readily accessible source, as confirmed by Kwesisi *et al.* (2022) in their pursuit of factors affecting the production and market performance of Guinea fowls and quails. The open market likely offers a range of options, allowing farmers to select from different breeds or ages based on their specific requirements. However, it should be noted that acquiring Guinea fowls from the open market may expose farmers to potential disease risks, as the birds could come from various sources and may not undergo rigorous health screening implemented by

farmers or be bred under controlled conditions to mitigate the chances of introducing diseases to the farm. Guinea fowls obtained from the open market may possess diverse genetic backgrounds, potentially contributing to genetic variability within the farming population (Babarinde *et al.*, 2023). This variability can have both positive and negative implications on traits such as growth rate, disease resistance, and productivity. Farmers who source Guinea fowls from their own farms can maintain better bio-security measures and disease control (Olawuyi *et al.*, 2023). They have control over the health and management practices of their flock, reducing the risk of introducing or spreading diseases. By breeding and rearing Guinea fowls sourced from their own farms, farmers can implement selective breeding programs to improve specific traits of interest. This approach allows for the development of a more homogeneous flock with desirable characteristics, such as higher meat yield or improved egg production. While owning a farm, breeding Guinea fowls may require an initial investment and ongoing maintenance, it can potentially reduce long-term costs compared to purchasing birds from the open market (Kwesisi *et al.*, 2022). Additionally, owning a breeding flock allows farmers to generate revenue through the sale of birds or their products. It is important to note that the specific dynamics of Guinea fowl production may vary among individual farmers or regions. Additionally, factors such as cultural practices, market demand, and available resources can influence the choice of sourcing Guinea fowls.

Challenges associated with the Guinea fowl industry: The results obtained in the study are consistent with the previous studies conducted by Kouassi *et al.* (2019) and Baimbill-Johnson *et al.* (2021). This observation of persistent high keets mortality (Table 3) indicates that the industry is yet to realise the much-needed improvement from research outcomes of the numerous studies on improving keets mortality. This could be due probably to challenges from full knowledge transfer and integration in the production process. Guinea keets are vulnerable to various diseases, predators, and environmental stressors, which contribute to high mortality rates at the early stage. However, more than half of the respondents (77 %) practiced keets vaccination (Supplementary Table 2) against diseases such as Gumboro, Newcastle, fowl pox, and coccidiosis (Butler, 2016). Among those who did not vaccinate, 42 % mentioned the unavailability of vaccines (Supplementary Table 2) as the reason which was previously observed by Patel and Heldens (2009). The observation made during the administration of the questionnaire indicated a higher number of farmers not vaccinating keets contrary to the figure reported. Many farmers who rear keets on free range and semi-intensive system had no idea of how the vaccination was done and yet indicated their keets were vaccinated. Most farmers (87 %) reported hatching their own Guinea fowl eggs (Table 4), which aligns with the findings of Gono *et al.* (2013) who attributed this to careless Guinea hens. Regarding feed problems, farmers (71 %) indicated that they faced feed-related challenges (Table 4) conforming to the observation made by Teye and Adams (2000) while a small percentage (29 %) reported no feed problems.

The high cost of feed was highlighted as the primary challenge by most respondents (76 %) (Table 4). Availability and affordability of feed were identified as significant challenges by the surveyed farmers. Guinea fowls require a well-balanced and nutritious diet for their growth, development, and overall health, as emphasised by López-Pedrouso *et al.* (2019). The expensive nature of feed and degree of availability can hinder farmers' ability to provide an optimal diet (Saina, 2005). It is paramount to develop cost-effective feeding strategies that utilize locally available feed resources while meeting the nutritional requirements of Guinea fowl for optimal production. This provides clear evidence that the Guinea fowl demand has been met by the current production level. On the issue of sourcing feed, most respondents (91 %) relied on the open market, while a significant portion (61 %) prepared their own feed for their animals (Table 4). The primary source of water for the birds was boreholes, as indicated by the majority (64 %) of respondents (Supplementary Table 2).

The use of antibiotics in veterinary medicine has been a common practice. When Guinea fowls are afflicted with bacterial diseases, such as respiratory infections or certain gastrointestinal disorders, veterinarians may prescribe antibiotics to control and eliminate the bacterial pathogens causing the illnesses, as observed in the present study as the frequent used treatment alternative of Guinea fowl diseases (Fig. 5). However, it is paramount to utilise antibiotics judiciously and responsibly to prevent the emergence of antibiotic resistance (Bonsu *et al.*, 2012; Mak *et al.*, 2022). Antibiotic resistance occurs when bacteria evolve and become resistant to the effects of antibiotics, rendering the drugs ineffective in treating infections (Ventola, 2015). This phenomenon of unguided use of antibiotics poses significant risks to both animal and human health. To mitigate the development of antibiotic resistance, it is recommended to use antibiotics only when necessary and under the guidance of a veterinarian. Regarding the use of drugs and herbs for disease treatment, it is important to note that drugs encompass a broad range of pharmaceutical products specifically formulated for animal use (Craik *et al.*, 2013). These drugs may include antiparasitic agents, anti-inflammatory drugs, or antiviral medications, among others. Since the specific drugs mentioned by the surveyed farmers were not provided, it is difficult to provide further details on their usage. Similarly, the use of herbs in animal health is not uncommon in traditional and alternative veterinary medicine practices. Certain herbs are believed to possess antimicrobial, anti-inflammatory, or immune-boosting properties. However, it is important to acknowledge that the effectiveness and safety of herbal remedies for Guinea fowl diseases have not been extensively studied. This observation corroborates with that of Dillard and German (2000) and Hussain and Hussain (2016). Therefore, caution should be exercised when using herbs, and it is advisable to consult with a veterinarian or animal health expert who is knowledgeable about herbal treatments before administering them.

CONCLUSION

Guinea fowl production in Ghana is predominantly carried out by male individuals who are educated and engaged in production for financial gain. Guinea fowl production is mainly small scale on free range system that are characterized by several challenges including high mortality rate of keets, difficulties in brooding, feed-related issues, poor hatchability, and diseases, an indication that research outputs on Guinea fowl have not been fully integrated. The demand for the Guinea fowl remains high and calls for increased production. It is therefore recommended that appropriate linkage between researchers and Guinea fowl farmers should be established for research output and knowledge transfer while encouraging women participation in the Guinea fowl industry as a source of livelihood for women empowerment and contribute significantly to poverty alleviation.

ACKNOWLEDGEMENTS

The authors are grateful to the Guinea fowl farmers who took time off their busy schedules for the engagement and information sharing. The assistance of the Animal Production Directorate of the Ministry of Agriculture (MoFA) is dully acknowledged.

Conflict of Interests: Authors have declared that no competing interests exist.

Consent: All authors declared that 'written informed consent was obtained from the approved parties. for publication of this article and accompanying images.

Abbreviations

FAO Food and Agricultural Organisation

GDP Gross Domestic Product

SPSS Statistical Package for Social Sciences

SUPPLEMENTARY TABLES

Supplemental Table 1. Production challenges in the Guinea fowl industry

Study Variable	Frequency	Percentage (%)
Reason for the breed kept		
Consumer preference	54	34.0
High egg production	45	28.3
Meat preference	46	28.9
Aesthetic value	9	5.7
Others	5	3.1
Type of Guinea fowl production		
Meat	84	52.8
Eggs	15	9.4
Meat and eggs	60	37.7
Flock size		
Small scale (Less than 1,000 Birds)	153	96.2
Medium flock scale (1,000 to 4,999 Birds)	3	1.9
Large flock scale (5,000 to 9,999 Birds)	2	1.3
Very large scale (10,000 Birds and above)	1	0.6

Supplemental Table 2. Production challenges: Health, marketing and water sources in the Guinea fowl industry

Study Variable	Frequency	Percentage (%)
Practice vaccination of keets		
Vaccination	123	77.4
No vaccination	36	22.6
If vaccination is performed, which disease do you vaccinate against		
Gumboro	12	9.8
Newcastle	32	26
Gumboro and fowl pox	25	20.3
Gumboro and coccidiosis	29	23.6
Newcastle and fowl pox	25	20.3
If No vaccination, why		
Unavailability of vaccines	15	42.1
Drugs are expensive	10	26.3
Others	11	31.6
Problems with Guinea fowl products marketing		
Meat	31	19.5
Eggs	24	15.1
Keets	21	13.2
Others	83	52.2
Source of water for the birds		
Pipe-borne water	49	30.8
Borehole	102	64.2
Others	8	5.0

REFERENCES

- Abdul-Rahman I I, & Adu Y E 2017. The role of the rural farmer in guinea fowl *Numida meleagris* value chain, a case study of the Tolon district. *Livestock Research for Rural Development*, 29(4), 1-13.
- Agbolosu A A, Teye, G A, Jebuni, S N, Ansah T & Naandam, J 2012. Comparative study of growth and laying performance of indigenous layer guinea fowls (*Numida meleagris*) from Upper East, Upper West and Northern Regions of Ghana. *Agric. Biol. J. North Am.* 3(9):354-359. ISSN Print:2151-7517. <http://hdl.handle.net/123456789/141>
- Agbolosu A A, Teye G A, Adjete A N A, Addah W & Naandam J 2012. Performance characteristics of growing indigenous guinea fowls from upper east, upper west and Northern regions of Ghana. *Agric. Biol. J. North Am.* <http://www.scribbr.com/ABJNA/PDF/2012/8/ABJNA-3-8-336-339.pdf>
- Ahiagbe K M J, Amuzu-Aweh E N, Bonney P, Nyameasem J K, Avornyo F K, Adenyo C & Kayang B B 2021. Comparison of early growth and survivability in indigenous guinea fowls from Northern Ghana. *Tropical Animal Health and Production*, 53, 1-17. <https://doi.org/10.1007/s11250-020-02510-4>
- Akudugu M A, Guo E, Dadzie S K & Anang B T 2010. The contribution of formal and informal institutions in shaping the well-being of smallholder farmers in Africa. *Journal of sustainable development in Africa*, 12(6), 160-177.
- Amoah K O, Nyameasem J K, Asiedu P, Adu-Aboagye G A, Wallace P, Ahiagbe K M J, & Rhule S W A 2018. Protein and energy requirements for indigenous guinea keets (*Numida meleagris*) in southern Ghana. *Ghana Journal of Agricultural Science*, 52, 105-111. eISSN: 0855-0042
- Anderson A K, Nianogo A J, Some S, Pousga S, & Kisaalita W S 2022. Guinea Fowl Production: The Potential for Nutrition and Income Generation in Rural Households in Burkina Faso. *African Journal of Food, Agriculture, Nutrition & Development*, 22(9). <https://doi.org/10.18697/ajfand.114.21725>
- Annor S Y, Apiiga S Y & Ahiaba J 2012. A Handbook on Guinea Fowl Production in Ghana, 1st Edition. Quality type Limited. Accra. pp. 1-91.
- Asfaw S, Shiferaw B, & Simtowe F 2012. Agricultural technology adoption and rural poverty: Application of an endogenous switching regression for selected East African countries. *Food Policy*, 37(4), 439-451. <https://doi.org/10.22004/ag.econ.97049>
- Ayim-Akonor M, Owusu-Ntumy D D, Ohene-Asa H E, Odoro-Abrokwa A, Hammond P, Appenteng M, & Annan D 2018. Serological and molecular surveillance of infectious bronchitis virus infection in free-range chickens and guinea fowls in the Ga-East District of Ghana. *Journal of Veterinary Medicine*, 2018. <https://doi.org/10.1155/2018/4949580>
- Babarinde I A, Adeola A C, Djagoun C A, Nneji L M, Okeyoyin A O, Niba G & Murphy R W 2023. Population structure and evolutionary history of the greater cane rat (*Thryonomys swinderianus*) from the Guinean Forests of West Africa. *Frontiers in Genetics*, 14. <https://doi.org/10.3389/fgene.2023.1041103>
- Baimbill-Johnson N, Anaman K A, & Amegashie D 2021. Evaluation of the resource efficiency of guinea fowl production in the Savelegu-Nanton District of the Northern Region of Ghana. *Journal of Development and Agricultural Economics*, 13(2), 142-155. <https://doi.org/10.5897/JDAE2020.1223>
- Bonsu F R K, Donkoh A, Osei S A, Okai D B, & Baah J 2012. Effect of direct-fed microbial and antibiotics supplementation on the health status and growth performance of broiler chickens under hot humid environmental conditions. *International Journal of Livestock Production* 3, 67-71. <https://doi.org/10.5897/IJLP12.019> ISSN 2141-2448
- Bhogoju S, Nahashon S, Wang X, Darris C & Kilonzo-Nthenge A 2018. A comparative analysis of microbial profile of Guinea fowl and chicken using metagenomic approach. *PLoS one*, 13(3), e0191029. <https://doi.org/10.1371/journal.pone.0191029>
- Butler J 2016. Prospects and challenges of poultry farming in the Wa Municipality of the Upper West Region of Ghana. *African Journal of Poultry Farming*, 4(1), 103-112.
- Craik, D. J., Fairlie, D. P., Liras, S., & Price, D. (2013). The future of peptide-based drugs. *Chemical biology & drug design*, 81(1), 136-147.
- Dillard C J & German J B 2000. Phytochemicals: nutraceuticals and human health. *Journal of the Science of Food and Agriculture*, 80(12), 1744-1756. <https://doi.org/10.1111/cbdd.12055>
- Doungon T J, Tobada P, Djossa B A, Davito F E & Youssao I 2012. Effects of powdered peanut (*Arachis hypogea*) on the sex reversing in guinea fowl and the parameters of production and reproduction in the fowl "*Numida meleagris*". *International Journal of Advance Biological Research*. 2(2):209-214.
- FAO (2014). Poultry Sector Ghana. FAO Animal Production and Health Livestock Country Reviews. No. 6. Rome. Ghana Statistical Service (2014). District Analytical Report, Population and housing census.
- Francis R, Weston P & Birch J 2015. The social, environmental and economic benefits of Farmer Managed Natural Regeneration. *World Vision Australia*, 6-23.
- Gono R K, Svinurai W & Muzvondiwa J V 2013. Constraints and opportunities to Guinea fowl production in Zimbabwe: A case

- study of the Midlands Province, Zimbabwe. *International Journal of Science and Research*, 2(3), 236-239. ISSN: 2319-7064
- Gržinić G, Piotrowicz-Cieślak A, Klimkiewicz-Pawlas A, Górny R L, Ławniczek-Wałczyk A, Piechowicz L & Wolska L 2023. Intensive poultry farming: A review of the impact on the environment and human health. *Science of The Total Environment*, 858, 160014. <https://doi.org/10.1016/j.scitotenv.2022.160014>
- Hussain D A & Hussain M M 2016. *Nigella sativa* (black seed) is an effective herbal remedy for every disease except death—a Prophetic statement which modern scientists confirm unanimously: a review. *Advancement in Medicinal Plant Research*, 4(2), 27-57. ISSN: 2354-2152
- Issaka B Y & Yeboah R N 2016. Socio-economic attributes of Guinea fowl production in two districts in Northern Ghana. *African Journal of Agricultural Research*, 11(14), 1209-1217. <https://doi.org/10.5897/AJAR2015.10258>
- Kitalyi A J 1998. Village chicken production systems in rural Africa: Household food security and gender issues (No. 142). Food & Agriculture Organization of the United Nations.
- Kokoszynski D 2017. Guinea Fowl, Goose, Turkey, Ostrich, and Emu Eggs. In *Egg innovations and strategies for improvements* (pp. 33-43). Academic Press. <https://doi.org/10.1016/B978-0-12-800879-9.00004-4>
- Konlan S P & Avornyo F K 2013. The effect of wetland on Guinea fowl (*Numida meleagris*) egg productivity and fertility during the dry season in the guinea savannah ecological zone of Ghana. *Sky J. Agric. Res.* 2(9):126-131. <http://www.skyjournals.org/SJAR>
- Kouassi G F, Koné G A, Good M & Kouba M 2019. Factors impacting Guinea fowl (*Numida meleagris*) production in Ivory Coast. *Journal of Applied Poultry Research*, 28(4), 1382-1388. <https://doi.org/10.3382/japr/pfz079>
- Kwesisi V, Ogada S, Kuria S, Oloko M, Oyier P, Malaki P & Ommeh S 2022. Factors affecting production and market performance of Guinea fowls and Quails in Kenya. *Journal of Agriculture, Science and Technology*, 21(1), 37-42. <https://doi.org/10.4314/jagst.v21i1.4>
- López-Pedrouso M, Cantalapiedra J, Munkata P E, Barba F J, Lorenzo J M & Franco D 2019. Carcass characteristics, meat quality and nutritional profile of pheasant, quail and Guinea fowl. *More than beef, pork and chicken—The production, processing, and quality traits of other sources of meat for human diet*, A review. *Springer Nature* 269-311. https://doi.org/10.1007/978-3-030-05484-7_10 ISBN: 978-3-030-05483-0
- Majeed A 2020. Assessing the Socio-Economic Impact of the Damba Festival on the Lives of the People of Yendi in Ghana. *International Journal of Innovative Research and Development*, 9(12).
- Mak P H, Rehman M A, Kiarie E G, Topp E & Diarra M S 2022. Production systems and important antimicrobial resistant-pathogenic bacteria in poultry: A review. *Journal of Animal Science and Biotechnology*, 13(1), 1-20. <https://doi.org/10.1186/s40104-022-00786-0>
- Mnisi C M, mhlongo G, & Manyeula F 2022. Fruit pomaces as functional ingredients in poultry nutrition: A review. *Frontiers in Animal Science* 3, 883988.
- Molina-Flores B, Manzano-Baena P & Coulibaly M D 2020. *The role of livestock in food security, poverty reduction and wealth creation in West Africa*. FAO. <https://doi.org/10.4060/ca8385en>
- Moreki J C & Radikara M V 2013. Challenges to Commercialization of Guinea Fowl in Africa. *International Journal of Science and Research*. 2(11) :436-440. ISSN (Online):2319-7064
- Nyoni N, Ojango J & Romney D 2017. Income diversification and employment opportunities in smallholder pig farming in Mbeya Region, Tanzania. *Livestock Research for Rural Development*, 29(3).
- Odutsa E N 2021. Chicken Delicacy and Chicken-Related Rituals: A Gateway to Understanding the Luhya. *East African Journal of Arts and Social Sciences*, 3(1), 82-91. <https://doi.org/10.37284/eajass.3.1.325>
- Olawuyi S O, Anjorin A O, Alao O T, Olawuyi T D, Ayinla R A & Ayinla R A 2023. Adoption of Bio-Security Threats Management Practices and Food Security among Arable Farmers in South-West, Nigeria. *Sarhad Journal of Agriculture*, 39(230). <https://doi.org/10.17582/journal.sja/2023/39.2.369.380>
- Patel J R & Heldens J G M 2009. Immunoprophylaxis against important virus diseases of horses, farm animals and birds. *Vaccine*, 27(12), 1797-1810. <https://doi.org/10.1016/j.vaccine.2008.12.063>
- Saina H 2005. Guinea fowl (*Numidia meleagris*) production under smallholder farmer management in Guruve District, Zimbabwe. *Master of Philosophy Thesis*.
- Soara A E, Talaki E & Tona K 2020. Characteristics of indigenous guinea fowl (*Numida meleagris*) family poultry production in northern Togo. *Tropical Animal Health and Production*, 52, 3755-3767. <https://doi.org/10.1007/s11250-020-02413-4>
- Soara A E, Talaki E, Dayo G K, Oke O E, Belem A M G & Tona K 2020. Indigenous Guinea Fowl (*Numida meleagris*) Production in West Africa: Inventory, Performances and Constraints—A review. *European Poultry Science*, 84. <https://doi.org/10.1399/eps.2020.303>
- Tlhong T M 2008. *Meat quality of raw and processed guinea fowl (Numida meleagris)* (Doctoral dissertation, Stellenbosch: Stellenbosch University).
- Teye G A, & Adam M 2000. Constraints to Guinea fowl production in northern Ghana: A case study of the Damongo area. *Ghana Journal of Agricultural Science*, 33(2), 153-157.
- Teye G A, & Gyawu P 2002. A guide to Guinea fowl production in Ghana. University for Development Studies, Tamale. Pg 33-36
- Ventola C L 2015. The antibiotic resistance crisis: part 1: causes and threats. *Pharmacy and therapeutics*, 40(4), 277. PMID: PMC4378521
