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Characterization of Feeding Management Practices of Quails in Urban Areas of Uganda

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Abstract: The early 2010's witnessed increased interest in quail farming in urban areas of Uganda; particularly in regard to quail eggs which were claimed to have better health benefits compared to chicken eggs. However, being a new venture in Uganda's poultry industry, there is a paucity of information on quail feeding management practices. Therefore, this study identified and characterized the feeding management practices used in quail farming in Kampala, Mukono and Wakiso Districts. A total of 90 quail farmers were interviewed using structured questionnaires. Among, the cited quail species kept, Japanese quail (73.3%) was the most commonly kept species and flock size was generally small (between 100 and 500 birds). Almost all the respondents (94.4%) used commercially-mixed quail feeds as opposed to home-mixed feeds (5.6%). The most probable non-conventional protein feed resources cited in the feeding of quails were all plant protein sources, namely cocoyam, sweet potato, cassava, Amaranthus, *Brassica oleracea* (traditionally known as Sukuma wiki) and *Hoslundia opposita* (locally known as Kamunye) leaves. About 13% of the respondents continued with the starter diet beyond the recommended 4 weeks of age. Over 35% of the respondents offered the grower diet to quail chicks while 34.5% continued with the grower diet to the laying stage. Nearly 40% of the respondents offered the layer diets to chicks and growing quails. Thus, results of the present study revealed the existence of some inappropriate feeding practices which may translate into inadequate dietary nutrient supply, consequently reducing the performance of quails.

Key words: Feeding practices, quail farming, quail products, Uganda, protein, consequently

INTRODUCTION

Quail production is steadily gaining importance in many developed countries for meat (Spain, France, China and the United States of America) and egg production (China, Japan, Brazil and France) (Bertechini, 2012) as well as for use as animal models for biological studies (Minvielle, 2004). Besides, a large number of quail birds can be raised in a very small space. This growth has seen an increase in the consumption of quail products in these countries. A per capital consumption of about 30 eggs per year by 2020 was predicted by Bertechini (2012). However, in Africa, the commercialization of game bird farming is a recent development (Moreki and Seabo, 2012; Moreki and Radikara, 2013) and as such there is limited information on the contribution of quails to the region's poultry industry. In Uganda, quail birds attracted interest in urban areas (in early 2010's) for their eggs which were claimed to have better health benefits compared to chicken eggs (Tobiko, 2015). These claims stimulated consumer demand for quail eggs in urban areas of Uganda to the extent that the market price of quail eggs was about 70% higher than the price of chicken eggs. Consequently, this high price motivated many farmers into quail farming.

Besides, quails have a short generation interval which gives them a competitive advantage compared with other poultry species. They are ready for market as table birds at 5 weeks of age and start laying from the 7th week (Priti and Satish, 2014). However, for quails to thrive and reproduce efficiently they must be provided with optimal environmental conditions particularly nutrition and feeding (quality and quantity of dietary nutrients). Therefore, ensuring sound feeding management practices is a very important aspect in quail farming. Being a new venture in Uganda's poultry production, there is still a paucity of information on what and how farmers feed quails. Such information would be necessary to help develop strategies for improvement. What is true for

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feeding other game birds and chickens is not always true for feeding quails (El-Katcha *et al*., 2015). Therefore this study was conducted to identify and characterize the feeding management practices of quails in Uganda.

MATERIALS AND METHODS

Study area: The study was conducted in 3 Districts of Central Uganda (Wakiso, Mukono and Kampala). The districts were selected for this study on the basis of the degree of commercialization of domesticated quail production. In each district, four sub-counties were purposively selected (based on the existence of production activities) with the help of district extension officers.

Sample selection: The selected sub-counties were Entebbe municipality, Kira, Kakiri and Makindye municipality for Wakiso District, Goma, Mukono Town Council, Seeta-Namuganga and Namanve for Mukono District as well as Kawempe, Makindye, Lubaga and Nakawa divisions for Kampala District. For each sub-county, a list of farmers known to have quails was obtained from the district extension offices. Snowball sampling was then used to identify prospective respondents; where by quail farmers on the provided lists were asked to provide contact information of fellow farmers in the area actively involved in quail farming. These identified farmers were contacted in advance if they were willing to participate in the study as respondents. In all, a total of 90 households were interviewed with 36 respondents from Kampala, 38 from Wakiso and 16 from Mukono.

Data collection: The data was collected in two phases. Firstly, the selected households (total of 90) were interviewed using a structured pretested questionnaire. For each of the selected households (N = 90), the key person involved in the daily management of quails was interviewed from their farms used structured pre-tested questionnaires. The data collected included questions related to: respondent characteristics (age, sex, education level and farming experience), farm characteristics (size of total landholding, flock size and breed composition), feed resources used for feeding quails and their sources, potential non-conventional protein feed resources, frequency of feeding quails, training in livestock production (feeding, health, etc.) reasons for rearing quails as well as challenges faced. Information on gender responsibilities in quail production (ownership, division of labour, contribution of women and children, etc.) was also collected.

Secondly, Focused Group Discussions (FDGs) were conducted. The 2 FGDs were conducted in each of the three districts. This resulted into a total of 6 FDGs. Each focus group comprised of 6-10 participants (males and females farmers and an extension worker). The discussions were held in both English and Luganda (the two most commonly used languages in the study area). The FGDs were used to corroborate the individual farmer interviews on the questions related to: the potential non-conventional protein feed resources, history of rearing quails in the area, general important feeding practices of quail rearing in Uganda and the challenges faced.

Data analysis: The questionnaire data was analyzed using the SPSS 22.0 statistical package. The analysis included descriptive statistics (percentages and means), cross-tabulations and Chi-square tests of association. Weighted rank indices as used by Katongole *et al.* (2013) were computed to obtain the most pressing challenges faced by quail farmers.

RESULTS

Respondent characteristics: Of the 90 respondents interviewed, 55.6% were females. Over 50% of the females respondents owned the quail farms they were interviewed at while 41.1% of male respondents owned the quail farms interviewed at Table 1. Majority of the respondents (83.3%) were above 30 years of age. Over 70% of the respondents had acquired some kind of training in livestock keeping activities. All the respondents had some kind of formal education. More than half (52.2%) of the respondents had attained above secondary education level. The majority of the respondents (95.6%) had been involved in quail farming for a period of 3 years or less at the time of the study and this observation was not dependent upon the respondent's district ($\chi^2 = 39.22$; $p = 0.247$). Although, all household members were reported to take part in the feeding of quails, wives (39.1%) and hired laborers (34.5%) undertook most of the routine work.

Farm characteristics: The majority of respondents (80%) operated on less than one acre of land (Table 2). Pearson Chi-square tests of association indicated that there was no significant relationship ($\chi^2 = 6.577$; $p = 0.362$) between land size and the respondent's district. Flock size was generally small: 54.4% kept between 100 and 500 birds; 16.7% kept between 50 and 99 bird and 16.7% kept <50 birds. Only 11.1% kept more than 500 birds. Of the quail species mentioned, Japanese quail (73.3%) were the

Table 1: Characteristics of quail farmers in Kampala, Mukono and Wakiso Districts of Central Uganda

		Chi-square test of association with respondent's district	
Variables	Responses (%)	Chi-square test values	p-values
Gender			
Male	44.4	0.833	0.659
Female	55.6		
Age (years)			
<30	16.7	6.239	0.397
31-40	28.9		
41-50	24.4		
More than 50	30.0		
Training in livestock production			
Trained	72.4	3.323	0.190
Never trained	27.6		
Highest level of education			
Primary level	12.2	12.906	0.115
Lower secondary	22.2		
Upper secondary	13.3		
Tertiary institution	20.0		
University level	32.2		
Experience in quail farming (years)			
<1	39.5	39.217	0.247
1-3	56.1		
More than 3	4.4		
Stakes in Quail farming (ownership)			
Wife	54.4	0.2679	0.444
Husband	41.1		
Hired laborer	3.3		
Relative	1.1		
Participation of household members in the feeding of quails			
Husband	11.5	8.205	0.609
Wife	39.1		
Both husband and wife	5.7		
Children/Other relatives	9.2		
Hired laborers	34.5		

Table 2: Characteristics of quail farms in Kampala, Mukono and Wakiso Districts of Central Uganda

		Chi-square test of association with respondent's district	
Criteria	Responses (%)	Chi-square test values	p-values
Land size (acres)			
<1	80.0	6.577	0.362
1-2	15.5		
More than 2	4.4		
Size of quail stock			
Less than 50 birds	16.7	3.935	0.685
50-99 birds	16.7		
100-500 birds	54.4		
More than 500 birds	11.1		
Quail species kept*			
Japanese quail	73.3	24.870	0.015
Bobwhite quail	8.9		
Chinese quail	2.2		
Texas quail	15.6		
Main reason for quail ownership			
Sale of eggs/meat	95.6	1.883	0.757
Home consumption	4.4		
Quail farming system			
Intensive (cage)	96.6	0.586	0.746
Semi-intensive	3.4		
Extensive	0.0		
Other livestock types kept			
Cattle	10.0	5.331	0.070
Goats	12.2	1.024	0.599
Sheep	2.2	5.076	0.280
Pigs	7.8	2.152	0.341
Chickens	62.2	0.299	0.861
Guinea fowls	5.7	1.112	0.573
Turkeys or ducks	15.9	1.920	0.382

*As mentioned by respondents

Table 3: Quail feeding management practices in Kampala, Mukono and Wakiso Districts of Central Uganda

		Chi-square test of association with respondent's district	
Feeds	Responses (%)	Chi-square test values	p-values
Feed type given to quails			
Commercially-mixed feeds	94.4	20.184	0.028
Home-mixed feeds	5.6		
Feed form given to quails			
Pelleted	22.2	4.356	0.113
Mash	77.8		
Frequency of feeding quails			
One time per day	12.2	6.276	0.393
Two times per day	54.4		
Ad libitum access	43.4		
Age at which quail starter diet is offered			
From 0-4 (weeks)	87.0	4.660	0.324
From 0-6 (weeks)	7.2		
Beyond 6 (weeks)	5.8		
Age at which quail grower diet is offered			
Before 4 (weeks)	39.5	4.821	0.306
Between 4-6 (weeks)	25.9		
Beyond 6 (weeks)	34.5		
Age at which quail layer diet is offered			
From 0-4 (weeks)	26.2	5.940	0.430
From 0-5 (weeks)	8.2		
From 0-6 (weeks)	4.9		
Beyond 6 (weeks)	60.7		
Quail feed storage length			
1 (week)	51.2	4.661	0.588
2 (weeks)	18.6		
3-4 (weeks)	27.9		
More than 4 (weeks)	2.3		
Means of transporting quail feeds			
Personal vehicle	24.7	11.456	0.177
Commuter/hired vehicle	10.6		
Personal motorcycle/bicycle	61.2		
Commuter motorcycle/bicycle	1.2		
Carry on foot	2.4		

most commonly kept species. However, there was a significant relationship (χ^2 = 24.870; p = 0.015) between quail species kept and the respondent's district (Table 2). The rearing of Japanese quail was significantly more common in Wakiso (41.2%) and Kampala (41%) districts than in Mukono district (17.8%). Respondents kept quails for sale (95.6%) and occasional home consumption (4.4%). The quails were primarily fed and managed under two systems: intensive (under total confinement) (96.9%) and semi-intensive (confinement combined with free-ranging) (3.4%). Although, other livestock types (cattle, goats, sheep, pigs, etc.) were kept by the respondents there was a tendency towards more respondents having chickens (62.2%) across the three study districts.

Quail feeding management practices: The majority of respondents (94.4%) used commercially-mixed feeds as opposed to home-mixed feeds (Table 3). However, this observation was dependent on the respondent's District (χ^2 = 20.18; p = 0.028). The use of commercially-mixed feeds was significantly more common in Wakiso (42.2%) and Kampala (40%) districts than in Mukono district (17.8%). Most of the respondents offered mash diets to quails (77.8%). Irrespective of the district, the most common feeding frequency was "twice a day" (54.4%) followed by "*ad libitum*" access (43.4%) and "once a day" (12.2%). Although, feed requirements change as birds pass through the starting, growing and laying phases, some respondents fed quails without considering these 3 Phases. The results showed that 13% of the respondents continued with the starter diet beyond the recommended 4 weeks of age. Over 35% of the respondents offered the grower diet to quail chicks while 34.5% continued with the grower diet to the laying stage. Nearly 40% of the respondents offered the layer diets to the chicks and growing quails. The duration of feed storage time ranged from 1 week (51.2%) to more than 4 weeks (2.3%). Use of personal motorcycles/bicycles (61.2%) was the most common means of transporting quail feeds. Personal vehicles (24.7%), commuter/hired vehicles (10.6%), carrying the feed on foot (2.4%) and commuter motorcycles/bicycles (1.2%) were the other transport means mentioned.

Potential non-conventional protein feed resources for quails: Results of the three Focus Group Discussions

Table 4: Potential non-conventional protein feed resources as cited (in order of use) by quail farmers in Kampala, Wakiso and Mukono Districts of central Uganda

Kampala	Wakiso	Mukono
Amaranths leaves	Cassava leaves	Cassava leaves
Cocoyam leaves	Cocoyam leaves	Sweet potato leaves
Sweet potato leaves	Sweet potato leaves	Cocoyam leaves
Brassica oleracea (Sukuma wiki)	Amaranthus leaves	Amaranths leaves
Hoslundia opposita (Kamunye)	*Hoslundia opposita* (Kamunye)	*Brassica oleracea* (Sukuma wiki)
Duck weed	Grain amaranth	*Hoslundia opposita* (Kamunye)
Maggots	Wheat germ	
	Earth worms	

Table 5: Challenges to quail farming in Kampala, Mukono and Wakiso districts of central Uganda

	Rank				
	Number of respondents				
Challenges	1st	2nd	3rd	4th	Weighted index*
Low local consumer demand for quail products	55	7	4	0	0.518
Difficult to brood quails	16	9	1	0	0.193
Low consumer awareness about quail products	6	7	0	0	0.094
High cost of feeds	3	7	3	0	0.081
Poor shelf life of quail eggs	1	5	0	1	0.042
Poor quality feeds	2	3	0	1	0.037
Bureaucratic processes to acquire export permits	2	3	0	0	0.035
Total	85	41	8	2	1.000

*Weighted index = (4×Number of responses for 1st rank+3×Number of responses for 2nd rank+2×Number of responses for 3rd rank+1×Number of responses for 4th)÷(4×Total responses for 1st rank+3×Total responses for 2nd rank+2×Total responses for 3rd rank+1×Total responses for 4th rank)

(FDGs) conducted indicated that there are various potential non-conventional protein feed resources for use in the feeding of quails (Table 4). Some of the feed resources were cited across all the three study districts while others were not. Overall, among the most probable non-conventional protein feed resources were cocoyam leaves, sweet potato leaves, cassava leaves, Amaranthus leaves, *Brassica oleracea* (traditionally known as Sukuma wiki) and *Hoslundia opposita* (locally known as Kamunye) (in that order of importance).

Challenges to quail farming: The respondents were asked to identify and rank four major challenges (1st, 2nd, 3rd and 4th) to quail farming. Low local consumer demand (markets) for quail eggs and meat, poor brooding, low consumer awareness about quail products and high cost of feeds were the top ranked challenges (Table 5). However, some respondents stated that there is a strong consumer demand from neighbouring countries (Southern Sudan, Rwanda and the Democratic Republic of Congo) for quail products.

DISCUSSION

Respondent characteristics: In this study, female respondents were slightly more than male respondents. This shows that quail farming is both a female and male activity. Women were found to have more stakes (ownership) in quail farming than males. This is not surprising since poultry farming in Uganda has previously been reported to be an attractive economic activity for women and the poor populace (FIT-Uganda, 2006; Byarugaba, 2008). In addition, most of the respondents had attained an education level of either lower secondary or above. This finding is not surprising since the study area (Wakiso, Kampala and Mukono Districts) is comprised of more urban than rural residents. According to the 2014 National Population and Housing Census results (UBS, 2016), the literacy rate among urban dwellers is higher than that among rural dwellers by over 18%. This relatively high literacy level of the respondents explains why majority of them reported having attained some kind of livestock training. According to Nambiro *et al*. (2006), literacy level is associated with increased likelihood of seeking and/or receiving extension services. The observation that most respondents had kept quails for a period of three years or less might be due to the fact that quail production is still a recent development in Africa (Minvielle, 2004; Chege, 2014). This study found a conspicuous involvement of women and hired laborers in the day-to-day feeding of quails. The involvement of hired laborers may be due to the fact that urban dwellers have more opportunities for off-farm jobs hence, the likelihood of using hired laborers to attend to farm enterprises.

Farm characteristics: A large number of the farmers in this study operated on less than an acre of land. This is not surprising since Wakiso, Mukono and Kampala are largely urban districts where limited land accessibility

ranks among the top most critical challenges (Sabiiti and Katongole, 2016). Japanese quail was the most kept species (with flock sizes of 100-500 birds). This is attributed to the fact that Ugandan pioneer quail farmers imported chicks and eggs for hatching from Kenya where Japanese quail is one of the most common species (Chege, 2014). The main reason mentioned for keeping quails was the sale of eggs. This finding is not surprising given that quail farming in Uganda (during the early 2010's) was popularized largely by the claims that quail eggs have the potential to combat a number of medicinal conditions (Tobiko, 2015).

Quail feeding management practices: Although, home-feed formulation and mixing has been reported to be an important cost-saving mechanism among urban and peri-urban poultry farmers (Katongole *et al*., 2013; Kasule *et al*., 2014), almost all the respondents (94.4%) used commercially-mixed quail feeds. This was not surprising since quail farming is still a new venture in Uganda's poultry farming (as mentioned earlier) hence, farmer's experience in quail feed formulation is probably still poor. Much as pelleted feeds have been reported to have nutritional superiority over mashes (Jensen, 2000; Murakami *et al*., 2008), most of the respondents in this study used mashed feeds. Probably farmers are not yet aware of the benefits of pelleted feeds as well as the fact that pelleted feeds are more expensive than mashed feeds (Murakami *et al*., 2008). A section of respondents (13%) reported continuing with the starter diet beyond the recommended 4 weeks of age while nearly 40% reported offering the layer diet to chicks and growing quails. This is probably due to the lack of experience as mentioned earlier. According to Leeson and Summers (2005) and Blake and Hess (2009), the starter diet should be offered to quails between 0 and 4 weeks, the grower diet between 4 and 6 weeks and the layer diet beyond 6 weeks of age. Since quail protein requirement decreases with age (Gheisari *et al*., 2011), offering layer diets to quail chicks will definitely retard their growth performance. Quail layer diets contain about 20-30% less protein than the standard quail starter diet.

Potential non-conventional protein feed resources for quails: Non-conventional protein feed resources are increasingly being used in poultry diets in the developing world (Abang *et al*., 2013; Makkar *et al*., 2014; Kperegbeyi and Ikperite, 2015). This is because the major conventional protein ingredients (i.e., soybeans and fish) are also important staple foods for humans hence they are expensive. Results of the Focus Group Discussions (FGDs) conducted in this study indicated that cocoyam leaves, sweet potato leaves, cassava leaves, *Amaranthus* leaves, *Brassica oleracea* leaves (traditionally known as Sukuma wiki) and *Hoslundia opposita* (locally known as Kamunye) as the most probable non-conventional protein feed resources. However, these feed resources were offered to laying birds for purposes of achieving the yellow yolk color preferred by consumers but not as protein sources. The practice of offering sweet potato, cassava and cocoyam leaves was more pronounced in the FGDs of Wakiso and Mukono districts than in Kampala. The major reason being that most of agricultural lands and open access lands in Kampala (where these feed resources can be accessed) are undergoing infrastructural development (Katongole *et al*., 2013). The use of these non-conventional protein feed resources may however be limited by presence of anti-nutritional factors and the high fiber content (being plant protein sources) which limit their inclusion in poultry diets. Cassava leaves contain hydrogen cyanide (Oresegun *et al*., 2016) while Amaranthus and cocoyam leaves contain oxalic acid (Soetan and Oyewole, 2009).

Challenges to quail farming: The challenge of low local consumer demand for quail products (eggs and meat) locally is partly attributed to the low local consumer awareness about quail products. The popularity of quail production witnessed in the in the early 2010's (in urban areas of Uganda) was chiefly due to the claims that quail eggs have better health benefits compared to chicken eggs (Tobiko, 2015). The market price of quail eggs was about 70% higher than the price of chicken eggs. It was this high price which motivated many farmers into quail farming. However, after a while Ugandan consumers started questioning the validity of the claims that quail eggs had medicinal benefits. This uncertainty affected the local consumer demand for quail eggs. In addition, Ugandan consumers were not familiar with quail products (eggs and meat) in their diets since these products are traditionally not part of Uganda's food culture. The many farmers who chose to rear quails were primarily motivated by the high price of their eggs (due to the medicinal claims). The demand for quail eggs in home kitchens or food outlets (hotels, restaurants, etc.) is non-existent locally. Thus, it was not surprising that the challenge of low local consumer demand for quail products is severely affecting quail farming in Uganda. However, there is uncharacteristically high demand from Southern Sudan, Rwanda and the Democratic Republic of Congo. Hence, the foreign market can offer a possible solution to the challenge of low local consumer demand for quail products in Uganda.

The other pressing challenges cited included poor brooding, high costs of feeds, short shelf-life of quail

eggs, poor quality feeds and the bureaucratic processes to acquire export permits. Death during brooding was the other pressing challenge mentioned. This is not surprising because domesticated quails do not brood naturally on their own; hence, their eggs are often incubated using artificial incubators (Idahor *et al*., 2015). The challenge of high cost of feeds is not exclusively limited to quails but a common limiting factor in non-ruminant production. This is due to the fact that the major protein sources in non-ruminant diets (soya bean and fish) in the developing world are also important staple foods for humans which makes them expensive. Owing to the faster growth of quails, their diets are characterized by a higher protein content than diets for growing chickens. Consequently, the proportion of protein ingredients in the average diet for growing quails often ranges between 40 and 52% (Prabakaran, 2003; Leeson and Summers, 2005; Akinola and Sese, 2012) as compared to between 24 and 36% for growing chicken diets (Sahin *et al*., 2002). Consequently, quail feeds tend to be more expensive compared to chicken feeds.

Short shelf-life of quail eggs was also cited among the challenges of considerable importance. This is not surprising considering the on-farm storage conditions and handling practices for quail eggs in Uganda. For example, Dudusola (2009) observed that although quail eggs can be stored for 4 days at room temperature and still maintain desired internal quality parameters, they are best stored at low temperature (refrigerated) without deteriorating. The common practice among Ugandan quail farmers is to keep quail eggs at room temperature until they are sold off. The other important factor that has been reported to influence the shelf-life of quail eggs is the shell thickness. Shell thickness ensures reduced loss of moisture through pores in the egg shell and prevents microorganism invasion, hence prolonging the shelf-life of the eggs. The shell thickness of quail eggs is almost three-fold lower than that of guinea fowl eggs (Song *et al*., 2000) and almost two fold lower than that of chicken eggs (Dukic-Stojcic *et al*., 2012). Shell thickness depends on several factors which include among others feed-related factors. Optimal dietary calcium and protein contents are key in laying birds because calcium carbonate is the main component of the egg shells proper while shell membranes consist of a mixture of protein and glycoprotein (Jonchere *et al*., 2010).

The challenge of poor quality poultry feeds is often a common limiting factor in developing countries. In Uganda, the poor nutritional quality of animal feeds has been attributed to the use of adulterated feed ingredients (Nabukeera, 2011; UNBS, 2012) and the use of improper feed formulae (Kasule *et al*., 2014). According to Katongole *et al*. (2013) much as the National Animal Feeds Policy (which aims at ensuring quality animal feeds on the market) exists, the policy has not been implemented. The animal Feeds Bill which is supposed to operationalize the feed policy has never been passed into law by the parliament of Uganda. Consequently, there are many unqualified actors in the animal feed supply chain.

Finally, the bureaucratic processes resulting from the strict government controls of exportation of game products have often been reported as a limiting factor in game bird farming internationally (Cooper and Rosser, 2002; UEPB, 2016). Quail being wild in nature, the Uganda Wildlife Act considers their domestication as an ex-situ conservation venture. Consequently, according to the Uganda Wildlife Authority-UWA (the body mandated to monitor and regulate the conservation and use of all wildlife in Uganda including that outside protected areas) to raise quails one is required to obtain a wildlife user permit (MTWA, 2014). In addition to wildlife user permits, UWA requires that an environmental impact assessment be obtained before commencement of quail farming. These controls have profoundly affected the quail products export business. However, despite the existence of these various wildlife farming guidelines, most farmers engage in the rearing of quails without UWA's clearance.

CONCLUSION

This study shows that majority of quail farmers in Uganda use commercially-mixed feeds as opposed to home-compounded feeds. The most probable non-conventional protein feed resources are all plant protein sources (namely cassava, sweet potato, cocoyam, Brassicaoleracea and Hoslundia opposite leaves). Despite the fact that nutrient requirements change as birds pass through the starting, growing and laying phases, a substantial percentage of quail farmers use the same type of feed across all the three development phases while others continue with same feed types far beyond the recommended stages. Hence, the need for further research to evaluate the extent to which such inappropriate feeding practices subject the quails to inadequate dietary nutrient supply.

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