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Feeds and feeding dynamics among chicken farmers and feed millers: insights into practices, quality, and challenges in selected districts of Uganda

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Abstract

Adequate chicken feed in terms of quantity and quality are foundations of successful chicken production. A cross sectional survey was conducted in 10 districts of Uganda, with a total of 320 poultry farmers and 59 feed millers participating in this study. Data on socio demographic characteristics, feedstuffs used in chicken feed production, seasonal availability of feedstuffs, mixing of feed stuffs, challenges faced in chicken production and perception of chicken producers and feed millers on feeds quality were analyzed. Results revealed that 54.7% of the farmer respondents were females, while 62.7% of the feed miller respondents were males. Broilers followed by layers and kuroiler were the major types of chickens reared by both groups of respondents. White maize and maize bran were the major energy sources while fishmeal was the main protein feedstuff in chicken diets. About 59.7% of the chicken producers used commercial feeds while 71.4% of the feed millers used self-compounded feeds. Gender significantly influenced methods used to check quality, particularly asking fellow farmers ($X^2 = 4.01$, $P < 0.0045$). Education played a significant role in shaping farmers' understanding of high quality feed. Farmers with higher levels of education primarily defined good feed quality by the absence of foul smell ($X^2 = 9.72$, $P < 0.017$). Price fluctuation and low-quality feeds and feed ingredients were identified as their major challenges. Organoleptic tests and farmer-to-farmer information sharing were the major methods used to check the quality of feeds. Quality chicken feed meant different things to chicken producers and feed millers. Both chicken producers and feed millers were aware of feed and feed ingredient adulteration.

Keywords Poultry farmers, Feed millers, Feed compounding, Feed and ingredient quality, Quality indicators

1 Introduction

Chicken feeds constitute more than 75% of the cost of inputs by most commercial farms [1]. In addition, the quality of feeds determines the productivity of the birds in terms of egg and meat production [2] and this in turn directly affects the profitability of the poultry enterprise. The quality of feeds and feed ingredients need to be improved to protect poultry farmers from the adverse effects of unwholesome feeds. However, there are several unanswered questions to this effect. The feed production industry is mainly unstructured and unregulated and the quality of feeds produced is not known in some circumstances [3].

A survey carried out in 2023 estimated a global feed tonnage of 1.29 billion metric tons and in 2024 the poultry sector is anticipated to continue its growth driven by global market dynamics. The broiler sub sector is expected to grow as a result of expected improvement in consumer disposable income, standard of living, increased industrial margins and changing consumer behavior. Broiler feed at the moment accounts for 29.9% of the worlds' feed tonnage [4].

Feed production is a technical field that requires a certain level of education or training in order to formulate high quality feeds [5]. Feed formulation involves not only mixing different feed ingredients but, the ingredients should be in the right proportions and of an appropriate quality. The objective of feed formulation is to meet the nutritional requirements of an animal to achieve a specific production level [6].

However, it is not known if the people involved in commercial feed production or feed mixing for personal use have been trained in the different aspects of poultry feed production. Feed formulation involves not only mixing different feed ingredients but, the ingredients should be in the right proportions and of an appropriate quality. The objective of feed formulation is to meet the nutritional requirements of an animal to achieve production targets [6]. Persons involved in feed production should have basic knowledge of the same. There is little information available to determine if the people involved in poultry feed manufacturing have the basic knowledge required to produce poultry feeds of adequate standards. Several feed resources are used to produce poultry feeds in Uganda [1]. However, the availability and price of the ingredients are influenced by season and crop yield [7]. Poultry farmers claim that the quality of the feeds is often compromised, thus leading to poor productivity of their flocks [8]. It is not known how feed quality is compromised. Is it the feedstuffs or the mixed feeds that are adulterated? How is the adulteration done? Which feed resources are mainly adulterated? Are the feed manufacturers aware of the adulteration? At what stage of the value chain is adulteration done? Some of these questions are left without answers. Quality feed allows poultry farms to enhance the health and welfare of the flocks, reduces the need to use antimicrobials, reduces production costs and promotes food safety [9]. However in Uganda, sufficient know-how, and adequate awareness among poultry farmers and feed mill operators to ensure feed quality standards are lacking.

This study was therefore conducted to assess the adherence to quality enhancing measures along the poultry feed value chain as perceived by the farmers and feed manufacturers. It specifically sought to (1) Determine the sociodemographic characteristics of the farmers and feed manufacturers, (2) Determine the poultry feeds and feed resources used in feed production and (3) Determine the quality of feeds and feedstuffs as perceived by the poultry farmers and feed manufacturers.

2 Materials and methods

2.1 Study area

The study was conducted across all the four regions of Uganda in ten districts, known to be the highest in poultry production according to 2008 census data, including Lira and Gulu (Northern region), Iganga, Bugiri and Mbale (Eastern region), Mbarara and Bushenyi (Western region) and Kampala, Wakiso and Mukono (Central region), Fig. 1.

2.2 Methodology

At the start of the study, discussions were held with local administrators and extension officers to explain the objectives, seek permission to access the study areas, and request local leaders to sensitize farmers. The leaders also identified interpreters to assist during the study. Poultry farming data from the 2008 Uganda Livestock Census were used to determine sample sizes, focusing on the proportion of households involved in poultry farming, chicken flock size, and the number of households with exotic chickens. Only chicken data were used, as they are the predominant poultry type in Uganda. Sample size was calculated using Cochran's formula, $n = Z^2p(1\text{-}p)/e^2$. where, n = Sample size; Z = Z-score (1.96 for 95% confidence level), p = Estimated proportion of yoghurt producers with the characteristic of interest (if unknown, use 0.5), e = Margin of error (commonly 5% or 0.05). Respondents were purposively selected based on flock size, with only those rearing at least 50 birds eligible for interviews. For the purpose of this study,

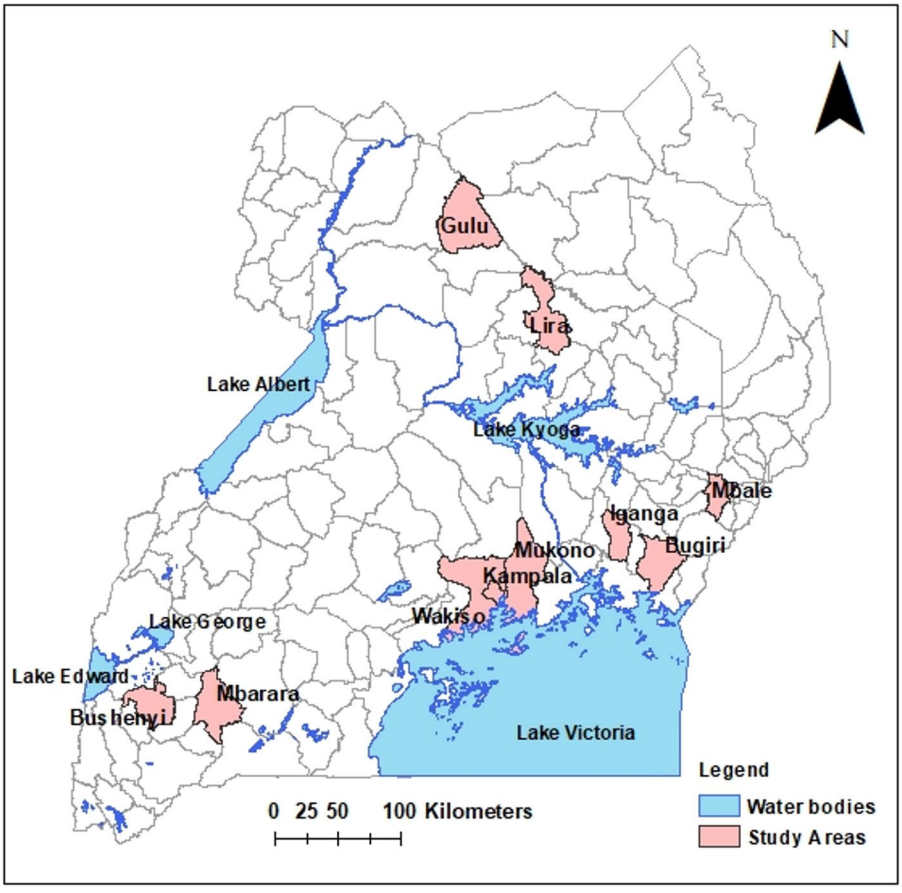

Fig. 1 Map of Uganda showing the study districts: adapted from [10]

commercial poultry production was defined as rearing chickens with the aim of income generation. A total of 320 poultry farmers and 59 feed millers volunteered participation in this study.

2.3 Data collection

Data was collected using a mixed open and close-ended questionnaire in face-to face interviews. The interviews were conducted in the dominant local language spoken in the study area. The questionnaire covered the following broad themes: Poultry feeds and feeding characteristics, feed ingredient mixing, challenges faced in chicken feed production, storage of feeds and understanding of high quality chicken feed.

2.4 Data analysis

The data was sorted, and summarized into percentages using STATA statistical package (version 15). Chi-square tests were conducted to evaluate the relationships between socio demographic characteristics and knowledge of feed quality parameters, understanding of attributes of high quality feed and methods used to check for quality feeds. A probability (p) value of ≤ 0.05 was considered statistically significant.

3 Results

3.1 Socio–demographic characteristics of respondents

Both farmers and feed millers were interviewed during the study as shown in Table 1. More than half of the farmers interviewed for this study were female (54.7%), aged between 30 and 49 years (54%).The majority of the farmers interviewed had attained tertiary education (45.3%) and their main source of income was poultry production. When asked about the main type of chicken reared, they mentioned broilers (37.2%), followed by layers (21.6%) and Kuroilers (28.5%) as shown in Table 1 below.

Majority of the feed millers interviewed were males (62.7%) and were aged between 20 and 39 years (78.9%). Most of the respondents had attained secondary education (47.4%) and a good number of them had attained tertiary (43.9%) education. Broilers (38.5%), Kuroilers (30.8%), and Layers (23.1%) were the main types of chicken reared, Table 1.

Over half of the respondents, both farmers (56%) and feed manufacturers (67.8%) mentioned having been trained. The main provider of the training was the concentrate distributors for both farmers (28%) and feed manufacturers (34%). However, farmers also received trainings from local government extension workers (21%) and NGOs (15%). The main content of the trainings for all respondents were mixing feeds and storage of feeds.

3.2 Feeds and feeding characteristics

Farmers (88.3%) and feed millers (62.5%) reared chickens on deep litter system. Majority of the farmers (59.7%) used commercial feeds for chickens while the feed millers (71.4%) mixed feed for their chickens. Feed ingredients commonly employed in feed mixing include white maize, maize bran, fish meal, and soya bean meal (Table 2).

Farmers mentioned that majority of the feed resources were seasonally available and their availability through the year is indicated in Fig. 2. Maize and maize bran were more available in August, followed by March, April, July, December and January. November and October were the months of least availability of maize and maize bran.

Table 1 Socio-demographic characteristics of respondents presented as percentages

Characteristic	Farmers(n=320)	Feed manufacturers(n=59)
Sex		
Female	54.7	37.3
Male	45.3	62.7
Age		
16-19	2.6	12.3
20-29	18.9	49.1
30-39	29.1	29.8
40-49	24.9	7.0
50+	24.6	1.8
Education		
None	1.3	
Primary	18.9	8.8
Secondary	34.6	47.4
Tertiary	45.3	43.9
Duration engaged in poultry farming		
Less than 1 year	7.6	
1-4 years	45.7	75.0
5+ years	46.7	25.0
Type of chicken reared		
Broilers	37.2	38.5
Layers	21.6	23.1
Kuroilers	28.5	30.8
Other[a]	12.6	7.7
Duration engaged in feed manufacturing		
Less than 1 year	9.1	3.5
1-5 years	68.2	54.4
Over 5 years	22.7	42.1

[a]Local, Sasso

3.3 Feed ingredient mixing

Majority of farmers (67.8) and feed manufacturers (81.3%) employ floor mixing of feeds. Major tool used for feed mixing was spade (farmers: 73.5%; and feed manufacturers: 86.7%). 8% (8%) of the farmers mixed their feeds in machine mixers, while none of the feed manufacturers used a mixer. A higher percentage of farmers (33.6%) obtained formulae for feed formulation from workshops, 15.6% from fellow farmers while 11.5% engaged in trial and error to arrive at a feed formular. For feed manufacturers, concentrate distributors (53.3%), workshop (13.3%) and fellow farmers (13.3%) were the major sources of feed formulation guides.

Motorcycle and bicycle (56.9%) together with vehicle (39.6%) were the major means of conveying feeds by farmers similarly, most feed manufacturers used motor cycle and bicycle (58.3%) together with vehicle (33.9%). Most farmers (45%) obtained feed ingredients from processing industries while 30.4% sourced feed ingredients from feed mills. Most feed manufacturers (69%) grow their own feed ingredients while 24.1% sourced feed ingredients from processing industries. Farmers (43%) and feed millers (75%) submitted that feed ingredient availability was seasonal and that this mainly affected the prices.

Table 2 Ingredients used in chicken feed production as percentage constitution

Ingredient	Farmers	Feed manufacturers
White Maize (broken)	27.2	8.76
Maize bran	21.1	7.3
Wheat bran	0.56	0.73
Rice bran	0.56	0.73
Brewers grain/waste	0.56	0
Sorghum	0.56	0
Millet	0.56	0
Sunflower seeds	0	2.19
Fish meal	12.22	10.22
Blood meal	1.11	0.73
Meat and Bone meal	1.11	1.46
Soya bean full fat (Toasted seeds)	3.33	4.38
Soya bean meal	2.78	5.11
Soya bean cake	0.56	0.73
Sunflower seed cake	5.56	7.3
Cotton seed cake	6.67	13.14
Coco nut cake	0.56	5.84
Limestone	3.33	8.03
Shells grit	6.67	7.3
Bone ash	1.11	1.46
Premix	2.22	6.57
DL-Methionine	0	2.19
Lysine	0.56	2.19
Di-Calcium Phosphate	0.56	2.19
Toxin binder	0.56	1.46

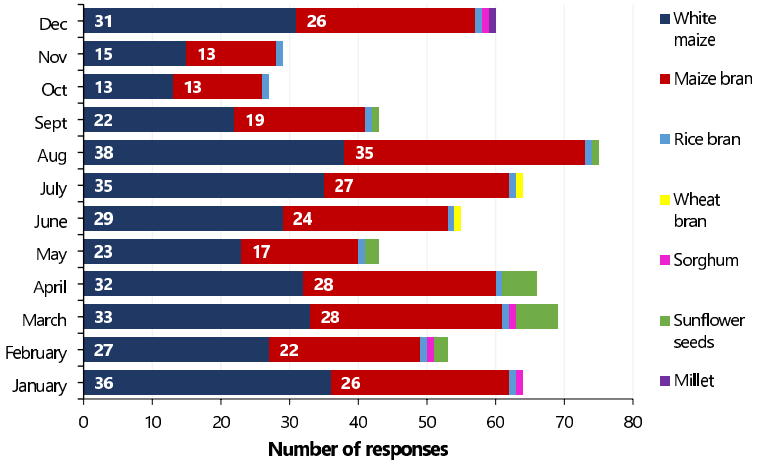

Fig. 2 Seasonal availability of feed resources

3.4 Challenges faced in chicken feed production

Among the several challenges, most farmers (40.5%) identified price fluctuation of feeds and feed ingredients, 24.3% identified poor feed and ingredient quality while 9.6% identified inadequate measurements due to uncalibrated weighing scales as their major

challenges (Fig. 3). On the other hand, feed millers mentioned price fluctuation (35.5%); poor ingredient quality (22.6) and slow business (12.9) as the main challenges faced.

3.5 Storage of feeds

Majority of the feed millers (88%) and farmers (77%) stored feeds for 1-3weeks. Feeds were sacked and stacked on pallets and on the floor by the feed millers (69% and 19%, respectively) and poultry farmers (73% and 16%, respectively). On challenges faced by feed quality during feed storage, farmers and feed millers (44% and 28.6%, respectively) identified rodent attack, 21.5 and 28.6%, respectively named reduced nutrient density while 15.5 and 14.4%, respectively mentioned pollution by pollutants. Significant chi-square statistics were observed for association between respondent's gender and knowledge of the challenges faced by feed quality during storage (reduced nutrient density: $X^2 = 4.48$, $P < 0.034$; change in colour: $X^2 = 5.93$, $P < 0.017$, and bad smell: $X^2 = 7.74$, $P < 0.008$) (Table 3). Female farmers (54.7%) had better knowledge of the deterioration of feed quality during storage compared to the other respondents.

3.6 Methods used for checking feed quality

Organoleptic tests, such as eyeballing, smell, touching, and feeling were the main methods used for checking feed quality by the farmers (72.6%) and feed millers (85.1%). In addition, farmers also assessed feed quality by seeking the opinion of fellow farmers (13%), feed sellers (7.6%), and from the performance of the birds (6.9%).The other methods identified by feed millers were asking feed sellers (13.4%) or fellow farmers.

Table 4 revealed significant association between respondent's gender and the use of fellow farmer's opinion to ascertain the quality of feeds ($X2 = 4.01$, $P < 0.0045$). Female farmers (54.7%) more than any other group relied on fellow farmers for the assessment of quality of the feeds. There was no significant association between other socio-demographic characteristics and methods used to check feed quality by farmers and feed millers.

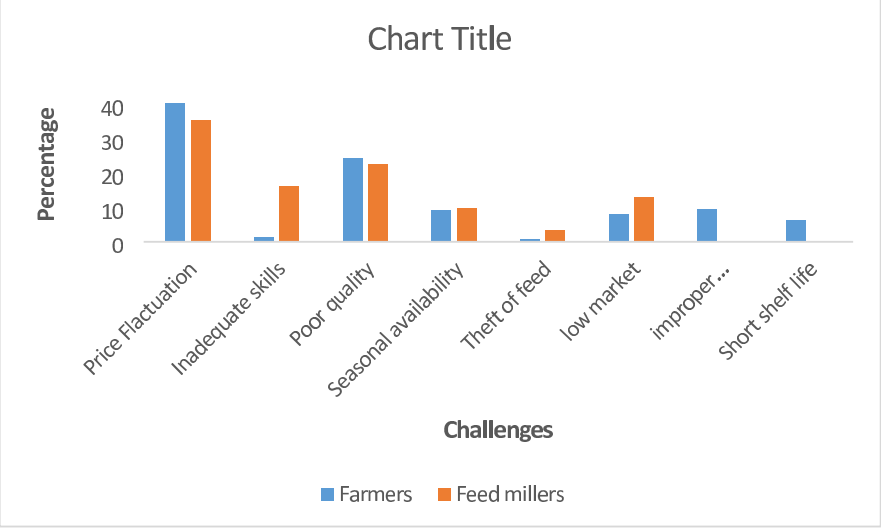

Fig. 3 Challenges faced in chicken feed production

Table 3 Relationship between socio-demographic characteristics and Knowledge on challenges on feed and ingredient quality during storage

Effect	Gender		Education level		Duration of involvement in poultry rearing		Duration of involvement in feed manufacturing	
	X^2	p-value	X^2	p-value	X^2	p-value	X^2	p-value
Farmers								
Reduced/increased moisture content	1.34	0.247	1.42	0.821	5.41	0.056	0.64	1.000
Reduced nutrient density	4.48	*0.034	7.17	0.081	1.87	0.435	4.90	0.143
Rodent attack	0.005	0.947	1.45	0.740	1.90	0.386	3.80	0.194
Pollutants	0.001	0.973	4.13	0.189	2.55	0.311	1.03	0.545
Change in colour	5.93	*0.017	2.5	0.373	0.73	1.000		
Bad smell	7.74	*0.008	0.92	0.792	1.36	0.733	0.49	1.000
Feed Millers								
Reduced/increased moisture content	0.46	0.661	0.81	0.426	3.43	0.25	4.52	0.141
Reduced nutrient density	0.20	0.782	1.07	0.565	0.89	0.464	5.22	0.077
Rodent attack	1.00	0.317	5.99	0.055	0.89	0.464	3.71	0.210
Pollutants	0.58	0.512	2.89	0.193			2.79	0.305

Table 4 Relationship between socio-demographic characteristics and Understanding of attributes of high quality feed

Effect	Gender		Education level		Duration of involvement in poultry rearing		Duration of involvement in feed manufacturing	
	X^2	P-value	X^2	P-value	X^2	P-value	X^2	P-value
Farmers								
Absence of contaminants	1.35	0.245	1.42	0.596	1.13	0.570	0.31	1.000
Good Nutrient content	0.3	0.583	3.02	0.354	2.57	0.202	-	-
No Foul smell	0.11	0.741	9.72	*0.017	0.37	0.831	0.42	1.000
Low Moisture content	3.50	0.062	2.38	0.510	3.97	0.137	0.31	1.000
Normal appearance	0.71	0.398	0.62	0.763	1.89	0.465	3.36	0.286
Good performance of birds	2.31	0.128	0.47	0.942	5.45	0.080	0.88	1.000
Feed Millers								
Absence of contaminants	1.85	0.24	2.66	0.245	1.6	0.464	3.52	0.219
Good Nutrient content	0.02	1.000	0.94	0.789	0.89	1.000	7.10	*0.025
No Foul smell	6.62	*0.014	0.7	0.727	0.89	0.464	0.18	0.89
Low Moisture content	1.66	0.198	1.44	0.427	0.89	0.464	4.19	0.112
Normal appearance	0.02	1.000	0.66	1.000	-	-	4.93	0.107
Good performance of birds	0.26	1.000	1.78	0.282	0.89	1.000	0.20	1.000

3.7 Understanding high quality chicken feed

50% (50%) and 38.5% of farmers and feed millers, respectively identified the absence of contaminants as indicative of good feed quality, 25 and 27.9%, respectively considered absence of foul smell, while 10, and 20%, respectively used low moisture content. Chi-square test revealed significant association between the level of education of respondents and the indicator of good quality feed among the farmers (Table 3). Farmers that attained high level of education, understood good feed quality as absence of foul smell ($X^2 = 9.72$, $P < 0.017$). Similarly, a significant association was observed between the gender of feed millers and absence of foul smell as an indicator of good feed quality

Table 5 Relationship between socio-demographic characteristics and Methods used to check for quality of feeds

Effect	Gender		Education level		Duration of involvement in poultry rearing		Duration of involvement in feed manufacturing	
	X^2	P-value	X^2	P-value	X^2	P-value	X^2	P-value
Farmers								
Physical test	0.62	0.433	3.40	0.340	0.30	0.937	0.40	1.000
Productivity	2.73	0.098	1.30	0.712	0.65	0.861	0.38	1.000
Ask farmer	4.01	*0.045	1.25	0.872	4.03	0.159	0.95	1.000
Ask seller	0.02	0.900	2.18	0.637	3.55	0.198	0.38	1.000
Feed Millers								
Physical test	0.58	1.000	1.17	1.000	-	-	1.4	0.456
Ask farmer	1.79	0.362	1.25	0.872	3.43	0.25	0.85	1.000
Ask seller	0.04	1.000	4.34	0.166	0.89	0.464	1.03	0.634

($X^2 = 6.62$, $P < 0.014$) (Table 5). Other socio- demographic characteristics did not have significant association with indicators of feed quality for both farmers and feed millers.

Regarding adulteration, almost all farmers and feed millers were aware of feed adulteration. Commonly adulterated feed ingredients were maize bran (33% and 31% for farmers and feed millers, respectively); fish meal (32% and 35%, respectively); shells (12% and 8%, respectively); and white maize (9% and 15%, respectively). Sand/soil (30% and 27%, respectively); stones (19% and 27%, respectively) and maize cobs (15% and 30%,) were the common adulterants for farmers and feed millers respectively.

In order to ensure good quality feeds, 33% of farmers focused on proper feed hygiene, 37% bought feeds from trusted sources, 18% followed the given mixing formula while 12% engaged in self-mixing of feeds. For feed millers, 40% bought feed ingredients from trusted sources, 40% undertook self-mixing of feeds while 20% grew own major ingredients like maize and soya bean.

4 Discussion

Prior studies [11–14] indicate that consistent availability and production of high-quality poultry feeds are major challenges faced in the sector. This study aimed to analyze the poultry feed ingredient handling and feed compounding on poultry farms and feed mills. This study found that most farmers and feed millers kept broilers, followed by Kuroilers and layers respectively. These results differed from the National Livestock Census Report 2021 [15] which reported that layers were the dominant exotic chicken kept followed by broiler chicken but were broadly consistent with OECD FAO Agriculture outlook 2020–2029 [16]. According to OECD FAO broiler meat is one of the most popular white meat among meat consumers. Compared to other white meats, broiler meat is relatively affordable, low in fat and has no cultural and religious restrictions on its production. Broiler meat production is a source of employment for producers and entrepreneurs. Furthermore, broiler meat production involves a short production cycles, has ready market, low production costs and producer prices and efficient feed conversion rate [17].

The majority of farmers used commercially compounded feeds (CCF) while feed millers used self-compounded feeds (SCF). Currently the majority of chicken farmers use CCF that are unbranded or imported protein concentrates. The increased popularity of

imported concentrates among chicken farmers could be attributed to the fact that local feedstuffs are either of low quality or heavily adulterated by traders [10]. The use of SCF has several limitations. A study by [1] revealed that SCF did not meet the required nutrients levels. Chicken farmers consider SCF to be of higher quality and cheaper than CCF [18]. However, this depends on the quality of feedstuffs used, how the different feedstuffs were mixed, the minimum and maximum inclusion rates, and packaging and storage conditions of the final product [3].

Several small and medium scale feed mills and chicken farmers who self-compound their feeds produce feeds that are not homogenously mixed. Mixing is usually done manually using spades. The chicken feed that is not homogenously mixed may not meet the nutrient requirements of the birds and may lead to poor flock performance [19].

Price fluctuation and poor quality feedstuffs were identified as major challenges in chicken feed production. This is mainly caused by the fact that the majority of feedstuffs used in chicken feed are agricultural or aquaculture based and their availability is affected by season, demand and supply. The business environment is further complicated by the fact that feed millers and chicken farmers work separately with no strong association to bring them together in the chicken feed sector. Forming strong chicken farmer and feed miller cooperatives and associations can mitigate challenges of economies of scale, reduction of operational risks like market competition, engage in bulk purchasing with associated benefits like discounts, have access to affordable financial services and command increased bargaining power. Associations and cooperatives set standards of operation and promote quality products and services [20].

The significant influence of farmers' gender on understanding the challenges associated with feed storage on chicken feed quality may be attributable to most women chicken farmers being personally involved in the farm operations. They participate in the purchasing of feeds or feedstuffs, and supervise the feed storage. On the other hand, men chicken farmers were not always present on their farms, have multiple employments, and do not pay attention to the feed storage conditions in the feed stores.

Using organoleptic tests [smell, touch, taste, sight, and feel] to determine the quality of feed or feedstuffs by chicken producers and feed millers might indicate the dire need for chicken feed analytical services, or where these services are present, the cost might be prohibitive. This situation might reflect that feeds or feedstuffs sold were not labeled or if labeled, producers and feed millers may not trust the credibility of the information provided on the labels. The chicken feed and feedstuff market is not well monitored to ensure that all feeds and feedstuffs are labeled with the correct nutritional values despite the passing of the Animal Feed Law. These results corroborate the findings of [21] who reported that feeds, feed additives, and compound feeds were below standards. In addition, awareness and compliance with animal feed standards might be low as reported by [22]. Chicken farmer peer-to-peer information sharing was another source of information on the quality of feed. Gender significantly influenced peer-to-peer farmer evaluation of chicken feed quality. This may have been attributed to women freely sharing their challenges and experiences with fellow farmers compared to men who often do not open up to their fellow farmers about their experiences and challenges or best practices. These results are consistent with those of [23] who reported that farmer-to-farmer extension (F2FE) was appropriate for women, youth, and the poor. Although F2FE may be appropriate for several innovations, the approach might not be appropriate for high-risk and

very technical fields like chicken nutrition where the cost of an error may be very high, and for permanent decisions.

The divergent views of what quality chicken feeds meant to farmers and feed millers may reflect the multifaceted nature of feed quality and the need to develop a composite definition. Quality may hence mean different things to different people. Quality may be defined as the degree to which a set of inherent characteristics fulfills a requirement. The requirements may be set by the customers of the products or services and by regulatory authorities [24]. The customers of poultry feeds are the chicken farmers who in the case of Uganda may not be aware of the chicken feeding standards despite that the standards are well documented [25]. In the case of Uganda, the existence of multiple regulatory bodies in the chicken feed subsector creates gaps in enforcing quality management systems in the sector. The multiple regulatory bodies include the Ministry of Agriculture (MAAIF), the Ministry of Trade (MTIC), the Ugandan National Bureau of Standards (UNBS), District Local governments, and National Research Institutes (NARO-NALRI). These regulatory agencies work independently instead of complementing each other with the ultimate goal of improving the quality of chicken feed and feedstuffs on the market. Feed quality do not happen by accident. The initial step may involve identifying the chicken farmers' nutritional needs, then planning for processes and resources, and finally applying monitoring controls in the sector. The three steps may culminate into an efficient and effective quality management system. Establishing a quality management system can direct and control the chicken feed sector concerning quality by putting in place standard operating procedures (SOPs) to which all stakeholders operate consistently. This in combination with regular surveillance and monitoring, investigating problems in the sector, and regularly identifying opportunities for improvement may reduce substandard chicken feed and feedstuffs on the market.

Adulteration of feedstuffs and unbranded compound feeds continues to occur unabated despite the enactment of the animal feed law [26]. Adulterated feeds and feedstuffs are of low quality, and affect the health, productivity, and efficient utilization of nutrients by the birds. Furthermore, adulteration makes chicken farming less competitive pushing chicken producers to excessively use growth promoters and productivity enhancements to improve the production of their flocks. The absence of feed analytical services further exacerbates chicken feed and feedstuff adulteration.

5 Conclusion

This study identified broiler chicken as the main type of chicken reared. White Maize (broken), Maize bran, and fish meal were the major ingredients used in chicken feed production. The research also showed that organoleptic tests and farmer-farmer information sharing were the major methods used to check the quality of feeds. The study found that generally price fluctuations and poor quality of feedstuffs were the main challenges in chicken feed compounding. The results of this study showed that quality chicken feed means different things to farmers and feed millers.

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Author contributions

DK, SO, D KN and JI conceived the study. DK, SO, DKN, JI, MN, IN WA and VK developed study protocol including data collection tool, data collection strategy. DK, JI, IN, WA. DN were involved in field data collection activities. DK, SO, JI

and DN conducted data analysis and interpretation. DK, SO, DN, SN, JI, RT and SN were involved in preparation of the manuscript. All authors contributed to the article and approved the submitted article.

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Data availability
The dataset(s) supporting the conclusions of this article is (are) available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
All methods were carried out in accordance with relevant guidelines and regulations. The protocol was approved by Makerere University School of Veterinary Medicine Animal Resources (SVAR) higher degrees, SVAR research and ethics committees (SVAR-IACUC/90/2021) and certify that the study was performed in accordance with the ethical standard as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable standards. Free, prior and informed consent was obtained from each participant of the study at the beginning of the interview. Participants were informed about the objectives of the study and informed that results from the study will be used for research purposes strictly. Participants were further informed that they had a right to withdraw at any time. All data was handled with the confidentiality.

Human and animal rights
This study did not involve animal handling.

Competing interests
Authors declare no conflict of interest.

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