HEALTHIER HENS

Feed Testing Report

March 2023

Introduction

Egg-laying hen productivity, health and welfare are highly dependent, among other factors, on the quality of their feed. Adequate levels of calcium, phosphorus, protein, and vitamin D3 are essential, and deficiencies in these nutrients can lead to a range of problems, such as poor bone density and increased risk of fractures, reduced egg production, and lower egg quality. Ensuring that egg-laying hen feed meets appropriate standards for these nutrients is, therefore, crucial for maintaining the health and welfare of hens reared for their eggs.

Through Key Informant Interviews (KIIs) and market research, we found that there is a risk of inadequate feed quality in Kenya, our country of operations. Examples include farmers experiencing feed quality issues, high-quality feed ingredient shortages in the market and a struggle to regulate the enforcement of quality standards. We developed a sample collection protocol to aid volunteers and farmers in collecting an adequate sample for testing.

Figure 1: A picture showing the sampling of a commercial feed.

In Kenya, as in many other countries, there are established standards for the composition of egg-laying hen feed, including minimum and maximum levels of calcium, phosphorus, protein, and vitamin D3. However, there is a lack of information on whether these standards are being met in practice. In order to address this gap in knowledge, we sampled feeds in several counties and had them analyzed at certified laboratories to assess the dietary levels of these key nutrients. The aim of this study was to evaluate whether egg-laying hen feed in Kenya met the established standards for key nutrients for hen bone development and health, and to provide information on how prevalent these issues might be, recommending what improvements should be made.

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Methodology

A total of 32 samples were collected, 27 of which were adult hen mash. These samples were collected opportunistically when connecting with various stakeholders in the egg industry, including farmers, universities, feed mills, and agrovets. The samples were collected from 7 counties from December 2021 to December 2022, with high egg production rates, mainly consisting of commercial feeds, but also including some self-formulated feeds as a significant fraction of the farmers, especially larger ones, choose to produce their own feeds.

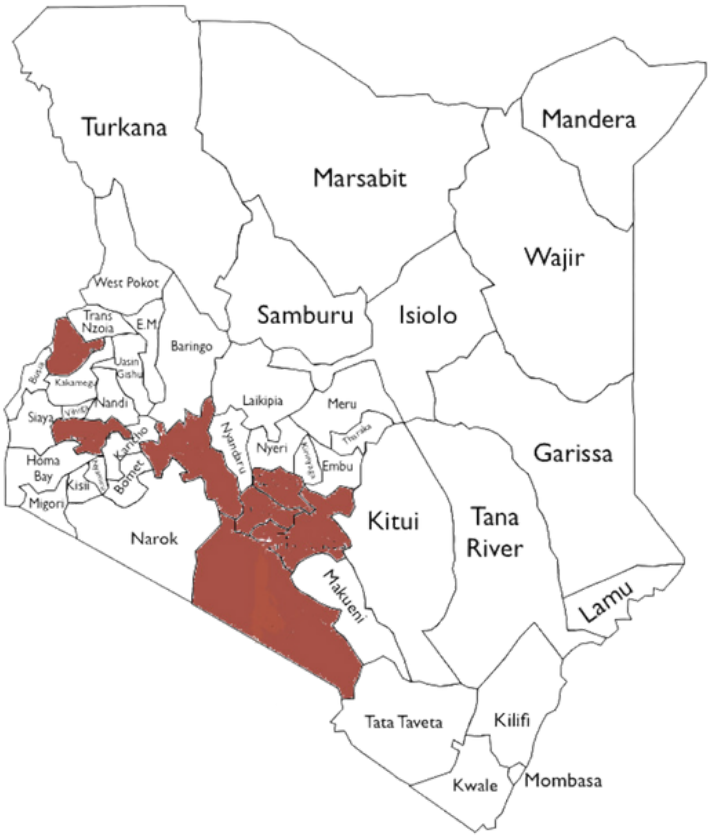
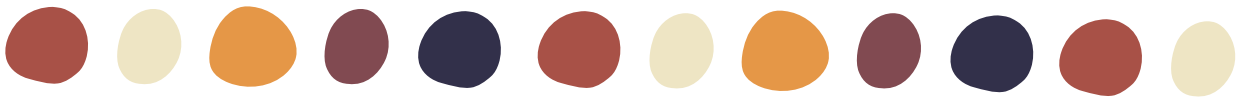


Figure 2: Map depicting the locations where the feed samples were collected.

To analyse the collected samples, three accredited laboratories were employed. The choice of laboratories was based on finding the best quality of service to price ratio, until the national body of standards (KEBS) acquired the capacity to determine vitamin D3 levels. Initially, the samples were to be tested for total calcium, phosphorus and vitamin D3 levels, but have been expanded to also include crude protein determination since May 2022, after KIIs uncovered issues, e.g., low availability and quality, surrounding this key macronutrient. The tests were carried out in accordance with international standards, such as AOAC 982.29 and ISO 27085. The regional feed composition standard EAS 90 was also used as a reference for checking compliance. Nutrient deficiency was tested against feed nutrient guidelines scaled for a feed intake rate of 132.5 g feed/hen/day, as

observed through KIIs at commercial Kenyan cage-free farms.

The readers are advised that the preferred laboratory has changed after concerns arose over the quality of the analyses performed. After unexpected results much lower than typical vitamin D3 levels were provided and confirmed internally, another laboratory was recruited (3 samples re-analyzed) and yielded widely varying nutrient levels in the same samples, identifying the issue of reliability. It is therefore recommended to take the results presented here with a grain of salt and rather as indications of possible issues instead of definitive proof thereof.



Results

Table 1 below provides an overview of the tested commercial feed samples. Producers and brands are not revealed as the report is intended to provide a broad overview of typical nutrient levels as sampled in Kenya. The data also includes sample collection dates. Data points highlighted in red represent nutrient levels below the current regional feed composition standard.

Similarly, table 2 below reviews the analyses of self-formulated adult hen and several commercial chick, grower pullet feed samples. These samples were collected during farm visits, after observing that a significant, albeit a seemingly minor, fraction of Kenyan egg farmers chooses to self-formulate. Typically, such farmers voice concerns over commercial feed quality and/or price as the reasons for choosing to produce one's own diet. Our respondents usually consulted with animal nutritionists to inform their formulations in the beginning and, occasionally, subsequently, when, e.g., ingredients became unavailable or compromised on the market. This presented itself as a good opportunity to compare the two sources of feed, i.e., commercial and self-formulated, and see, mainly, which group of producers are able to avoid formulation pitfalls.

Likewise, our team was able to collect several feed samples provided to young hens. As discussed by Wang et al. (2017), early nutrition is key for the overall health and welfare of egg-laying hens. It is, therefore, important to ensure that diets across all feeding phases are formulated well within the standard and, most importantly, provide the necessary nutrients to the hens.

Table 1: Result overview of the tested commercial adult hen feed sample analyses.

Code	Date	Ca (%)	Total P (%)	Vitamin D3 (IU/kg)	Protein (%)
Feed C1	Dec 2021	4.96%	0.65%	975	n.d.
Feed C2	Dec 2021	1.57%	0.77%	1698	n.d.
Feed C2	Dec 2021	2.70%	1.07%	1383	n.d.
Feed C3	Dec 2021	3.74%	0.88%	1148	n.d.
Feed C2	May 2022	4.52%	0.26%	2360	13.7%
Feed C4	May 2022	6.30%	0.44%	1920	9.8%
Feed C2	May 2022	4.18%	0.45%	1770	16.7%
Feed C3	May 2022	2.99%	0.47%	2060	12.5%
Feed C5	May 2022	5.69%	0.54%	2270	12.8%
Feed C6	May 2022	4.88%	0.58%	2210	11.3%
Feed C3	April 2022	5.20%	1.53%	653	12.6%
Feed C7	June 2022	4.70%	0.65%	555	14.4%
Feed C8	June 2022	5.45%	0.71%	766	13.7%
Feed C9	June 2022	5.60%	0.86%	827	13.9%
Feed C10	June 2022	5.73%	0.81%	582	14.0%
Feed C11	June 2022	3.86%	0.61%	2360	14.1%
Feed C12	June 2022	5.87%	1.03%	2990	13.2%
Feed C13	Dec 2022	4.40%	0.76%	<600	16.9%
Feed C14	Dec 2022	2.60%	0.90%	<600	16.9%
Feed C15	Dec 2022	4.00%	0.62%	<600	18.7%
Feed C2	Dec 2022	2.90%	0.51%	<600	17.4%

** Data points in red highlight nutrients that are below the current East Africa Community feed composition standard (EAS 90:2019) levels.*

Table 2: Result overview of the self-formulated adult hen and commercial chick and grower pullet feed sample analyses.

Code	Date	Feed Type	Ca (%)	Total P (%)	Vitamin D3 (IU/kg)	Protein (%)
Feed F1	Dec 2021	Layer	3.64%	0.48%	2223	n.d.
Feed F2	Dec 2021	Layer	5.22%	0.51%	2600	n.d.
Feed F3	Dec 2021	Layer	2.04%	0.45%	1975	n.d.
Feed F4	Dec 2021	Layer	1.86%	0.40%	2258	n.d.
Feed F5	Dec 2021	Layer	1.90%	0.45%	3350	n.d.
Feed F6	June 2022	Layer	4.40%	1.03%	2998	16.9%
Feed F3CM	Dec 2021	Chick	1.61%	0.43%	3600	n.d.
Feed F4CM	Dec 2021	Chick	1.34%	0.48%	4950	n.d.
Feed C3CM	April 2022	Chick	2.34%	1.06%	590	18.7%
Feed C3GM	Apri 2022	Grower	2.10%	0.89%	688	18.3%
Feed C2GM	June 2022	Grower	2.08%	0.91%	636	13.0%

** Data points in red highlight nutrients that are below the current East Africa Community feed composition standard levels.*

Samples not up to scratch

Table 3 below highlights that low feed quality may indeed be a widespread issue in Kenya. Out of the tested 27 feed samples, roughly a third were below minimum calcium, a half below vitamin D3, and two-thirds below each phosphorus and protein levels as regulated by the regional feed composition standard. Interestingly, only one tested sample (F6) appeared to be fully compliant with the standard. Similarly, the table also shows how many of the tested feeds are suspected to provide diets deficient in said key nutrients. Based on an average observed feed intake rate of brown egg-laying hens kept cage-free, a third was deficient in each calcium and phosphorus, two-thirds in protein, and three-fourths - were deficient in vitamin D3. Similarly, just one sample (F6) was free of nutrient deficiencies across the tested range, highlighting how consistent the issue might be.

Table 3: Summary of tested adult hen feed samples that are below standard or contain deficient levels of key nutrients, n = 27.

Fraction of samples below standard:			
Calcium	Phosphorous	Vitamin D3	Protein
29.6%	63.0%	44.4%	66.7%
Fraction of deficient samples:			
Calcium	Phosphorous	Vitamin D3	Protein
29.6%	33.3%	74.1%	66.7%

Sample consistency

Repeat samples were collected of two major feed producer products (C2 and C3). This was done following up on the feed quality consistency concerns expressed by the interviewed farmers. The collected data provides merits to the reported issues, with wide variability in nutrient levels in the same product. While the average C2 feed, for example, fared well in terms of calcium content, in reality, three of the five tested samples were below standard. Although the investigation did not allow for a deeper analysis of the spatial or temporal variance, the results did point to inconsistencies that should be addressed to ensure that hens receive adequate nutrition irrespectively of where in the country they are kept or when in the year the commercial feed is acquired.

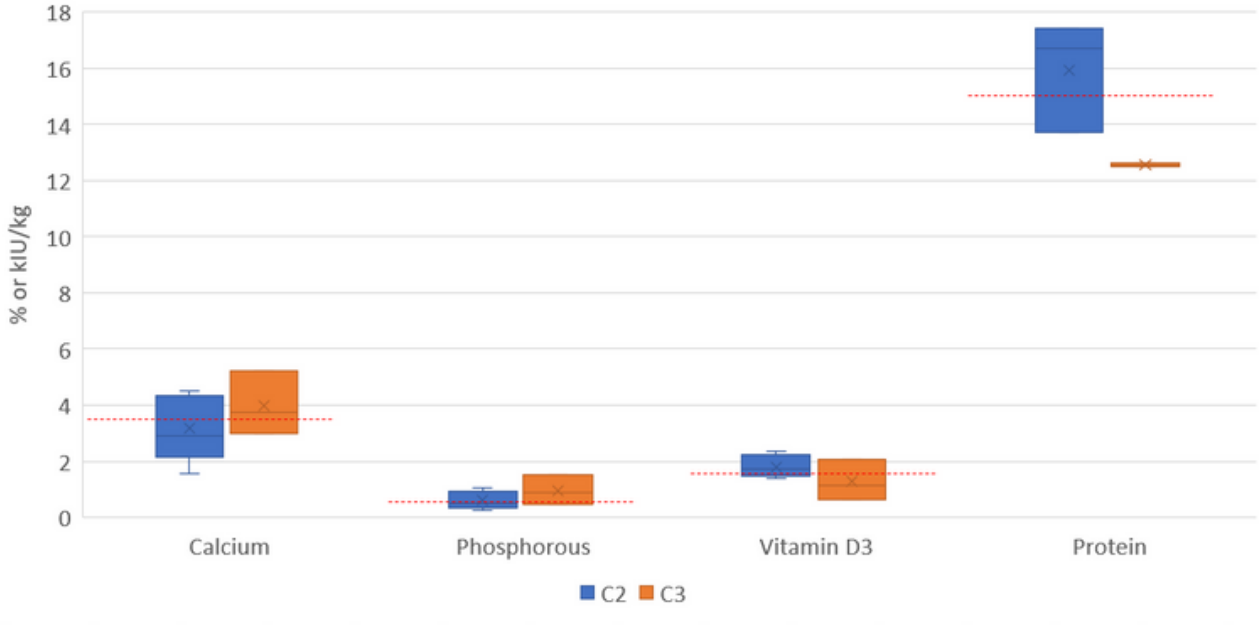


Figure 3: Results of same manufacturer feeds tested across several sampling points. n = 5, n = 3 for C2 and C3, respectively. Red dashed lines indicate minimum levels as set by the current standard.

Commercial vs. self-formulated

A similar initial comparison was made possible by collecting samples of both commercial and self-formulated adult hen feeds. Likewise, there is great variability in terms of the nutritional content of the two feed sources. It is, therefore, recommended not to treat either as blanket statements as there were deficiencies across the board. On average, self-formulated feeds fell below standard with regard to calcium and phosphorous levels but performed significantly better in terms of vitamin D3 content. Ensuring adequate levels of protein seem to have been a common challenge for commercial feed producers. It is noteworthy that several producers voiced concerns over the low quality and scarcity of proteinaceous feed ingredients (e.g. soya, fish meal). Readers are advised to note that only one self-formulated feed was tested for protein content, thus it is not possible to ascertain whether farmers producing their own feed were able to overcome this issue.

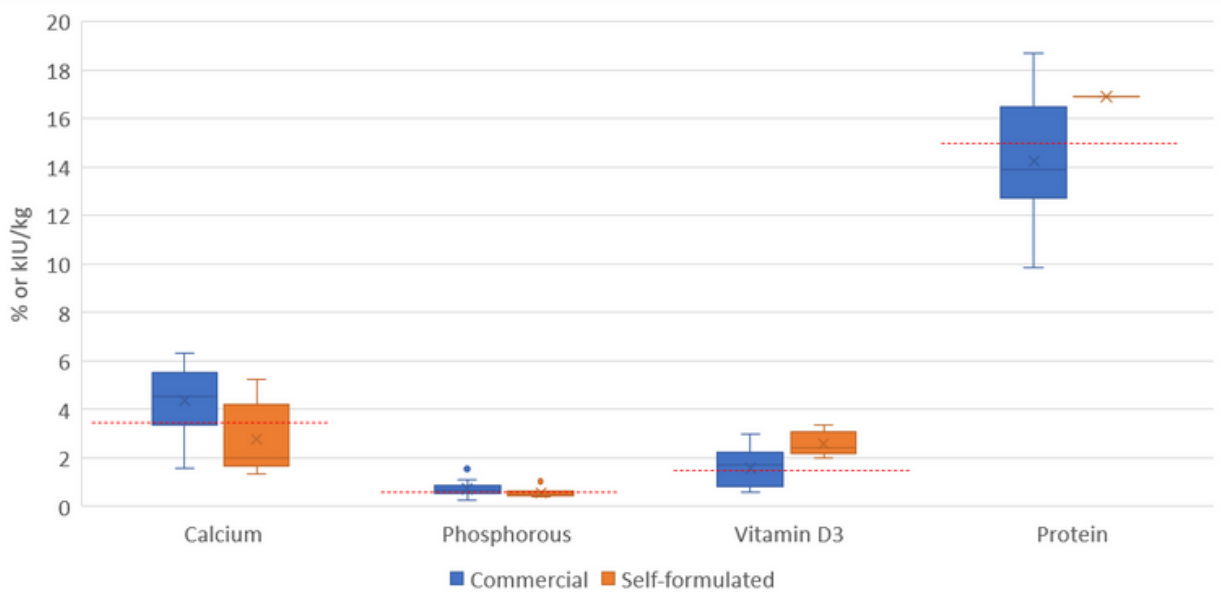


Figure 4: Results of the tested commercial and self-formulated adult hen feeds. n = 21, n = 6 for commercial and self-formulated, respectively. Red dashed lines indicate minimum levels as set by the current standard.

Chick and grower mash situation

It is worth noting that out of the 5 non-adult hen feeds tested, all were below standard with at least one nutrient below the regulated concentration. However, the sample size for these types of feeds was very limited, thus the readers are advised against generalizing.

Discussion

This section will include several points of discussion that were recorded in parallel with the ongoing sampling and analysis work. Although the work does not represent a comprehensive study of the quality of Kenyan egg-laying hen feeds, the consistency in which many of the samples were found to be below standard or, in fact, provide inadequate nutrition for the animals is alarming. It is noteworthy that the abrupt changes in the geopolitical landscape might have exacerbated the grim outlook of this snapshot investigation. Indeed, many commercial feed producers voiced concerns over inconsistent and/or low quality raw ingredients and their sporadic availability this past year. Be it as it may, animal health and welfare should not pay the price for supply chain issues.

The animal feed market seems to be saturated with many competing producers, ranging greatly in terms of the product description. For example, many feeds did not contain information about their nutritional contents, in other cases, feed labels were only accessible after purchasing the product (attached inside of the feed bag). It is obvious that better regulation can help direct this competitive landscape towards a consistently higher quality of products. Similarly, it is often difficult to ascertain which products have undergone standardisation and are certified.

Figure 5: Pictures illustrating questionable certification markings on feed bags, lacking certification numbers.

Higher level oversight and support seem to be especially important in a volatile market, challenged by many supply chain intermittences, where many producers are forced to change their formulations often. Similarly, improved regulation could ensure that the compositional differences between the products on the market are less pronounced so

that farmers who end up mixing different feeds to reduce farm input costs do not end up involuntarily compromising on the health and well-being of the hens. Self-formulation, by the way - a practice taken up by many farmers, remains unregulated, posing a serious threat to animal health and welfare.

Feed testing also posed several issues throughout the year. Although many laboratories claim the capacity for analysing animal feed composition, few could actually determine the levels of vitamin D3, a key nutrient for the development and maintenance of bone health in farmed animals. In terms of private service providers, analysis pricing also varied. Finally, through professional engagement and service agreements, we often encountered challenges related to inconsistent quality of reporting, delays and, most critically, questionable reliability of the results. However, given that three separate laboratories were employed in the end, there still is strong reason to believe that hen health and welfare is at risk due to possible substandard feeds being provided. It is of utmost importance that, at the very least, the national standardisation body (Kenya Bureau of Standards (KEBS)) has both the technical and personnel capacity to reliably assess the feeds on the market.

Conclusion

It appears that the quality of egg-laying hen feed in Kenya may not be meeting appropriate standards for key nutrients, including calcium, phosphorus, vitamin D3 and protein. The investigation found that the risk of inadequate feed quality is experienced by farmers, supported by producers via the confirmed high-quality feed ingredient shortages in the market, and an observable struggle to regulate the enforcement of feed composition standards. The study analyzed 32 unique samples of egg-laying hen feed collected from multiple counties with high egg production rates, and found that some samples had nutrient levels below the established regional feed composition standard and some might put hens at risk of receiving inadequate nutrition, contributing to health and welfare issues. However, readers are recommended to take these initial results with a grain of salt, as concerns have been raised over the quality of the analyses performed. Nonetheless, the results provide indications of possible issues with feed quality and consistency for the Kenyan egg industry. Ensuring that egg-laying hen feed meets appropriate standards and, most importantly, contains adequate levels of key nutrients is crucial for maintaining the health and welfare of hens reared for their eggs. It is recommended that improvements are sought immediately to address the potential issues identified.

References

Healthier Hens literature review volume I

Healthier Hens literature review volume II

Healthier Hens literature review volume III

Kenyan standard

Wang, J., Yue, H., Wu, S., Zhang, H. and Qi, G., 2017. Nutritional modulation of health, egg quality and environmental pollution of the layers. Animal Nutrition, 3(2), pp.91-96.