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The Utilization of Local Feed Ingredients and Moringa Leaf Flour Supplementation in KUB Chickens: Impacts on Growth, Egg Production and Meat Quality

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ABSTRACT

Background: This study aimed to evaluate the effects of local feed ingredients and Moringa leaf flour supplementation on the growth, egg production and meat quality of Balitbangtan Superior Village (KUB) chickens.

Methods: A total of 200 chickens were randomly assigned to four dietary treatments using a completely randomized design (T1: 100% commercial feed; T2: 100% local feed; T3: both commercial and local feed); T4: 50% moringa leaf flour + 50% commercial feed). The parameters were studied to analyze growth performance, egg production, egg and meat quality.

Result: T1 and T3 treatment significantly improved BWG, FCR and HDP compared with T2 and T4 ($P<0.05$). T1 treatment resulted in the highest meat pH, while T2 produced the highest yolk weight. In addition to meat pH, no significant differences were observed in quality of meat and eggs. In conclusion, utilization of local feed up to 50% can provide good growth performance in native chickens.

Key words: Egg quality, KUB chicken, Local feed, Moringa leaf flour, Production performance.

INTRODUCTION

One type of superior native chicken in Indonesia is the superior native chicken of Balitbangtan (KUB). This chicken is a pure native chicken resulting from the selection of female lines for 6 generations developed by the research and development agency. KUB chicken is known to have advantages in meat and egg production. This chicken has a short period rearing for meat production. In a maintenance period of 84 days, the KUB chicken reached a body weight of 1.2 kg (Sinurat *et al.*, 2022). This body weight is higher than that of similar native chickens (Depison *et al.*, 2020). KUB chickens layer their first eggs at the age of 163.7 days, with egg production of 160-180 eggs/head/year. The peak egg production is 60%, with an average egg weight of 29.99 g (Iskandar and Sartika, 2014). Based on these advantages, KUB chicken has spread to several regions in Indonesia, including the province of East Nusa Tenggara.

Currently, the maintenance of native chickens is often carried out traditionally by marginal farmers (Wibowo, 2019). To reduce feed costs, farmers often mix local ingredients for use in native chicken feed. However, farmers still do not know the appropriate feed ratio to ensure good productivity at affordable cost. Based on previous research (Widjastuti *et al.*, 2020), to achieve a high average daily, feed ratio efficiency must be considered. However, until now, information on the use of feed based on local East Nusa Tenggara ingredients has been limited to the performance of KUB chickens from the starter to layer phases.

East Nusa Tenggara has abundant local resources and the potential to develop the livestock sector (Bhae *et al.*, 2022). Local feed ingredients such as sorghum, corn, rice bran, pollard, tofu dregs and coconut meal are widely used. Previous studies have shown that local ingredients improve egg production (Ramadani and Haryuni, 2023). Slaughter weight, carcass weight and nutritional content of KUB chicken meat (Nurhayu *et al.*, 2021). Krishaditersanto *et al.*, (2023). Adding local feed ingredients can balance the productivity of KUB chickens fed commercial feed.

Several studies have demonstrated that crude fibre has a beneficial impact on the development of the digestive tract and physiology of poultry. The use of crude fibre in feed enhances digestion, absorption, intestinal health and immune function (Jha and Mishra, 2021). One of the feed ingredients that contains crude fibre and is often used in feed mixtures is moringa leaves. Moringa leaves contain bioactive components such as saponins, alkaloids, flavonoids and tannins (Kashyap *et al.*, 2022), which can work optimally in the body of poultry because they can help

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the absorption of nutrients (Edeoga *et al.*, 2005). In addition to the absorption of food nutrients, these bioactive components can also reduce the fat content in meat (Chaudhary *et al.*, 2018). Puspita *et al*. (2021) reported that Indonesians prefer chicken, which has a lower fat content. The main objective of this study was to determine the effect of adding moringa leaf flour to KUB chicken feed on increasing the productivity and quality of KUB chicken meat and eggs.

MATERIALS AND METHODS

Balitbangtan Superior Kampung Chicken (KUB) were unsexed on one day (Day Old Chicken) about 200 chickens were raised for 32 weeks. The maintenance was carried out in the laboratory cage of Balitbangtan, East Nusa Tenggara Province and the Central Laboratory of the Faculty of Agriculture, University of North Sumatra from January 2022 to March 2023. In the starter to grower phase, the chickens were raised in 20 cages with each cage containing 10 chickens. Each cage measures 300 × 150 cm and is equipped with a place to feed, drink and light. In the layer phase (21-24 weeks), the chickens were transferred to individual cages with 50×50×45 cm.

This study used an experimental design based on completely randomized design (CRD) with 4 treatments and 5 replications. The treatments given were (T1: 100% commercial feed; T2: 100% local feed; T3: both commercial and local feed); T4: 50% moringa leaf flour + 50% commercial Feed). The local feed consists of corn, fish flour, fine bran, coconut cake, tofu dregs, pollard, sorghum and coconut oil. Each treatment consisted of 10 native chickens. The feed was developed based on the consumption needs of KUB chickens (Balai Pengkajian Teknologi Pertanian, 2020). The nutritional composition of the feed used in this study is presented in (Table 1).

Feed intake (FI), body weight gain (BWG) and feed conversion ratio (FCR) were measured in the starter phase (0-4 weeks), grower (5-20 weeks) and layer (21-24 weeks). At 20 weeks of age, meat quality was analyzed using parameters such as pH, water holding capacity and cooking loss. The chemical properties of meat include its protein, fat and water content. The meat samples were analyzed using the proximate analysis method based on the Association of Official Agricultural Chemists (AOAC, 2005). Hen day production (HDP) and egg production data were collected from laying hens at 24-32 weeks of age by recording the number of eggs produced per hen per day. Age at first egg laying, body weight and egg weight at first laying were recorded for analysis. The physical qualities such as egg weight, egg shell weight, egg index, weight of egg yolk and white and Haugh unit of eggs were measured.

The data were subjected to an analysis of variance based on the CRD (complete random design) and Duncan's test using SPSS software version 22.0. Prior to analysis, data normality was assessed using the Shapiro-Wilk test and homogeneity of variance was evaluated using Levene's test. All tests were considered significant when the p-value was less than 0.05

RESULTS AND DISCUSSION

Growth performances

Based on the results of the study, the type of feed did not have a significant effect on the feed consumption of native chickens in the starter, grower and layer phases. The treatment had a significant effect ($P<0.05$) on BWG and FCR. T1 and T3 exhibited higher BWG and FCR compared to T2 and T4. This is because the crude fibre content of the grower phase feed in T1 and T3 is lower than T2 and T4. The crude fibre content of feed affects nutrient absorption. High crude fibre content is difficult for poultry digestive enzymes to digest, thereby reducing nutrient absorption in the small intestine. In addition, high fibre content has an impact on the faster movement of feed in the digestive tract, resulting in shorter contact time for nutrients with enzymes. This results in less energy being utilized, resulting in a lower body weight (Singh and Kim, 2021). However, in the layer phase, the effect of feed, on BWG was not observed, because the chickens had started laying eggs and their growth had stopped. In this phase, the consumed feed was more focused on egg production than BWG (Prananda *et al*., 2021). The BWG in this study was lower than the BWG of KUB chickens, which had different nutritional levels during the grower phase. The FCR in this study was lower than that reported by Tirajoh *et al.* (2020), who obtained an FCR of 5.15 in KUB chickens fed with 5% moringa leaves for maintenance from 6-18 weeks. Sijung *et al.* (2023) also reported that giving 15% moringa leaves in the layer phase for 3 months resulted in an average feed conversion of 6.53.

Egg production

The results showed significant effects ($P<0.05$) of treatment on age at first laying, body weight at first laying, egg production and HDP. TI and T3 had the highest body weight. Chicken body weight is correlated with the ability to lay eggs

Table 1: Nutritional composition of the experimental diets.

Treatment	Nutritional composition					
	ME (kcal/kg)	CP (%)	CF (%)	CFr (%)	Ca (%)	P (%)
T1	3,000	22.72	6.28	2.57	1.10	0.90
T2	2,642	16.78	4.34	7.42	1.34	0.59
T3	2,821	19.75	5.31	5.00	1.12	0.75
T4	3,081	21.00	4.27	6.31	1.78	0.93

ME: Metabolic energy; CP: Crude protein; CF: Crude fat; Crude fibre (CFr); Ca: Calcium; P: Phosphorus.

for the first time. An optimal first-lay body weight will have an impact on ideal sexual maturation and reaching peak production (Guo *et al*., 2023), which explains why TI and T3 produce eggs at a faster rate. Achieving optimal sexual maturation will encourage hormonal synchronization. Optimal levels of follicle-stimulating hormone (FSH) and luteinizing hormone (LH) stimulate follicle development and increased ovulation, thereby rapidly increasing egg production (Prastiya *et al*., 2022).

The observation results (Table 2) showed that the highest egg production and HDP occurred in T1. This indicates that local feed and moringa leaf flour cannot match the egg production from commercial feed. The significantly lower HDP in T2 and T4 compared to T1 is likely due to the higher crude fibre content in diets containing local feed ingredients and moringa leaf flour. The crude fibre levels in T2, T3 and T4 were 8.58%, 7.29% and 8.03%, respectively, whereas T1 contained only 6%. Increased crude fibre content in poultry feed is known to reduce nutrient digestibility and absorption in the intestine, thereby decreasing the availability of essential nutrients for egg production. As a result, hens that received these treatments exhibited lower egg production. Andrade *et al.* (2022) reported that a fibre content higher than 2.5% in feed will disrupt the process of nutrient absorption in the intestines, resulting in decreased nutrient availability for egg production and a decreased number of eggs produced. However, Guzmán *et al.* (2016) reported that chickens fed up to 4% crude fibre during the grower and layer periods did not affect digestive tract development and egg production. Egg production and HDP of KUB chickens treated with T1 in this study were comparable to those reported by Alfiyanto *et al.* (2023) KUB chickens raised from 20-32 weeks have egg production and HDP of 37-40 eggs and 45-47%. Similar to the findings of Shastri *et al.* (2020), the hen-housed egg production was around 49-50%.

Meat and egg quality

The results of the analysis showed (Table 3) that there was no significant difference in the water holding capacity and cooking loss variables, but there was a significant difference ($P<0.05$) in meat pH. T4 produced the lowest pH value. This is thought to be due to the higher glycogen content of meat in T4 because it contains more crude fibre than other treatments. Crude fibre in feed affects the glycogen content of meat in the formation of lactic acid, which affects the pH content of meat (Mahfudz and Piao, 2019). Moreover, antioxidant activity in feed supplemented with moringa leaf flour contributes to modulating glycolysis in chicken energy metabolism (Chandran *et al*., 2022). In addition to physical analysis, chemical analysis was also performed on the meat. The results of the study showed that treatment did not result in significant differences ($P>0.05$) in water, fat and protein content. This is because the feed content does not affect the chemical content of the meat (Infante *et al*., 2016). According to Lonkar *et al.* (2022), egg quality is influenced by dietary protein content. An increase in crude protein levels up to 18% in the diet significantly improved egg weight and the albumen index.

Egg quality consisting of egg weight, egg white and yolk weight, egg shell weight, egg index and Haugh Unit value (Table 3) in this study did not show significant differences ($P>0.05$) between treatment groups in this study. This performed that the use of local feed and moringa leaf flour did not affect egg quality. The breed and genetic

Table 2: Effect of dietary treatment on growth performance and egg production.

Variables	Treatment			
	T1	T2	T3	T4
Starter period (1-4) w				
FI (gr/head/w)	114.68±69.21	112.50±64.57	105.78±71.77	107.78±71.74
BWG (gr/head/w)	3824±9.81^{a}	16.78±6.70^{b}	28.17±6.49^{ab}	23.81±598^{b}
FCR	2.98±070^{a}	4.62±0.97^{b}	3.46±0.59^{ab}	4.38±0.63^{b}
Grower period (5-20) w				
FI (gr/head/w)	477.00±37.18	532.00±45.34	512.50±50	530.12±35.31
BWG (gr/head/w)	114.25±10.90^{a}	97.44±5.36^{b}	107.25±4.57^{ab}	95.75±9.54^{b}
FCR	4.22±062^{a}	5.46±0.34^{b}	4.80±0.70 ab	5.55±0.23^{b}
Layer period (21-24) w				
FI (gr/head/w)	500.00±24.49	557.25±44.78	529.50±342.48	543.75±39.02
BWG (gr/head/w)	104.75±10.18	92.75±18.46	103.00±17.00	91.50±19.12
FCR	4.79±0.28	6.19±1.30	5.23±0.73	6.11±1.14
Body weight at first laying (g/head)	1262.3±21.2^{b}	1045.7±34.8^{a}	1252.9±39.8^{b}	1096.1±60.1^{a}
First egg weight (g/head)	34.2±0.31^{a}	36.7±0.88^{b}	35.5±1.32^{ab}	35.9±1.67^{ab}
Age at first laying (days)	172±1.71^{a}	178±1.71^{b}	172±1.71^{a}	180±1.71^{b}
Egg production (egg/head)	36.25±4.86^{a}	19.50±1.29$_{b}$	26.00±4.23^{c}	15.75±3.30^{b}
HDP (%)	44.00±2.75^{a}	28.22±5.41^{b}	36.47±5.47^{c}	22.22±2.40^{b}

Values bearing different superscript indicates significant differences ($P<0.05$) in row.

Table 3: Effect of dietary treatment on meat and egg quality.

Variables	Treatment			
	T1	T2	T3	T4
		Meat		
pH	6.75±0.22[b]	6.23±0.20 [a]	6.03±0.12[a]	5.93±0.10[a]
Water binding capacity (%)	50.61±8.16	53.26±4.86	53.05±7.66	54.04±5.93
Cooking loss (%)	33.45±0.61	32.88±0.48	30.52±2.15	31.21±2.09
Water content (%)	74.30±1.45	74.94±0.90	76.15±1.29	76.69±0.09
Fat content (%)	1.17±2.06	1.39±1.96	1.37±1.96	1.13±1.09
Protein content (%)	19.97±2.42	22.01±0.47	19.90±2.66	24.34±1.53
		Egg		
Egg weight (g)	46.54±0.72	39.65±2.54	41.23±3.32	40.57±5.95
Yolk weight (g)	12.61±0.34	14.03±1.90	12.10±0.89	11.92±1.85
White weight (g)	25.20±0.45	22.10±1.75	22.36±1.53	22.08±3.20
Shell weight (g)	6.31±0.32	5.09±0.21	5.44±0.24	5.76±0.83
Egg index (mm)	0.78±0.02	0.78±0.05	0.75±0.02	0.81±0.04
Haugh unit value	75.01±6.21	81.40±2.19	71.90±5.47	80.59±2.59

Values bearing different superscript indicates significant differences ($P<0.05$) in row.

response of KUB chicken to local feed and moringa leaf flour were less responsive to egg quality improvement. This agreed with Wolc *et al.* (2012), egg weight, egg shell weight and haugh unit have moderate heritability which means that genetic influence is quite large on egg quality. Abdollahi (2021) research also reported that the addition of up to 6% fibre from wheat bran in feed did not affect egg quality. As stated by Samli (2006) that an increase in fibre sources from rice bran up to 10% did not affect egg yolk weight, albumin weight, shell thickness and shell weight. Monika *et al.* (2021) also reported that egg quality traits generally exhibit moderate to high heritability, except for yolk density.

CONCLUSION

The utilization of local feed up to 50% can provide good growth performance for native chickens.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided. They do not accept any liability for any direct or indirect losses resulting from the use of this content.

Informed consent

All animal procedures for experiments were approved by the Animal Research Ethics Commitee of the Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, Indonesia. (Approval No.0474/KEPH-FMIPA/2022).

Conflict of interest

The authors declared that there is no conflict of interest.

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