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Growth Efficiency of Local Chickens Using Sweet Potato Vine with Concentration Feed as a Basal Diet

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Abstract: The experiment was conducted at the animal experimental station of the Faculty of Animal Sciences, Royal University of Agriculture, commenced from 10 January to 14 March, 2022. The CRD (Completely Randomized Design) was used with 5 treatments and 4 replications. The 500 chicks at one-day-old, local bread, were purchased from farmers who run their small scale hatchery farm. The chicks were kept together till 21 days old, and then were allocated randomly into in five diets (treatments), 25 chicks per replication. The feed formulas for this study were designed and calculated to maintain a protein content of approximately 17%, dividing into 5 feed formulas (Treatments), such as concentrated feed only (control treatment: T0), plus 10% of fresh sweet potato vine (T1), plus 20% of fresh sweet potato vine (T2), plus 30% of fresh sweet potato vine (T3) and plus 20% of sweet potato vine meal (T4). The results showed that the treatment T1, had a similar final weight with the treatment T4, but was slightly lower than the treatment T0 which used concentrated feed alone. Feed intake and FCR (Feed Conversion Ratio) were not significantly different among those treatments. In conclusion, the average daily weight gain of chickens seemed to decrease with increasing the level of fresh sweet potato vine. Thus, the optimum level of fresh sweet potato vine was 10%, which may have little effect on the growth performance of local chickens. In addition, it was not far different from the positive control treatment and the treatment using sweet potato vine meal. However, the producers can increase the amount of sweet potato vine in feed formula by processing it into meal and mixing with concentrated feed or using as feed ingredients.

Key words: Local breed, final weight, feed intake, FCR.

1. Introduction

The researchers have tried to find the ways to improve the efficiency of chicken production and reduce the cost of raising chickens through the use of locally available raw materials that are cheap and easy to use. Particularly in the low-income countries, there is a need to identify by-products that may be useful for poultry production [1]. Sweet potato (*Ipomoea batatas* L.) is a member of morning glory family (Convolvulaceae), which is considered as one of the most important food crops in the world. It is cultivated in all tropics and subtropics regions, where there is sufficient moisture to support its growth, especially in Asia, Africa and the Pacific [2]. Asia accounts for more than 90% of the production [3], while 85% in China alone [4]. Sweet potato (*Ipomoea batata* L.) is a type of plant whose stems are in the form of vines, creeping plants, and can be grown for tubers and leaves for human and animal consumption. The sweet potato culture produced by-products with animal feeding potential, such as vines were used as feed for livestock. The by-products and wastes are also a source of energy, nutrients, proteins, minerals and vitamins etc. The

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sweet potato vine can be fed cattle (Bangladesh, China, India, Indonesia, and the Philippines), pig (Papua New Guinea and Vietnam) and poultry in China [4]. Sweet potato vines can be used as a protein source for animals, 10%-12% of protein, even lower than cassava leaves, but higher than the grasses commonly grown in tropical climates. In addition, they are safe feed which has no substances that have negative effect on animals [5]. In good management and soil rich nutrients, the chemical composition of the sweet potato vine fresh contained 162 g/kg DM of protein and 298 g/kg DM of NDF (Neutral Detergent Fibre) [6], however, the sun-dried SPVs (Sweet Potato Vines) showed high levels (g/kg DM) of NDF, ash and protein of 364, 100, and 191, respectively [1]. The dried leaves of sweet potato contain high crude protein and energy level, 25% and 2,672.44 ME kcal/kg respectively, which can be considered as good sources of protein [7]. The fresh sweet potato vines can be used for chicken feed, however vine meal can be included in chicken rations at a 3% of ration [5]. Therefore, the use in appropriate level, either fresh or dried, can be a substitute in feed compounds and may not affect the intake and growth performance of chickens. Thus, purpose of this study was to evaluate the growth performance, feeding and the efficiency of FCR (Feed Conversion Ratio) through the use of different levels and types of processed sweet potato vine, either fresh or meal.

2. Research and Methodology

2.1 Location and Duration of Experiment

The experimental study was conducted at the animal experimental station of the Faculty of Animal Sciences, Royal University of Agriculture. The experiment lasted 9 weeks for monitoring and recording data from January 10 to 14 March, 2022.

2.2 Experimental Pen

The experimental pen was divided into 20 small blocks, at the size of 1.2 m × 2.8 m, surrounded by a 1-m-high of plastic mesh from the surface of the pen, which had rice husks litter. During the first 3 weeks, the chicks were kept in the flock in the same house. The water and feed trough were used depending on the age of the birds. Pens are very important for animal husbandry because they play a role in protecting the safety of animals, we can keep animals from infecting diseases, as well as help protect chicken from other potential dangers. It eventually protects the animal from the heat, rain, and wind, which endangers the animal's life.

2.3 Experimental Layout

The experiment was conducted according to the CRD (Completely Randomized Design) model, in which there were 5 treatments and 4 replications in each treatment. The experimental layout was shown in Table 1.

Table 1 Experimental lay out.

T0	T2	T3	T0
T1	T0	T4	T1
T2	T3	T2	T4
T3	T4	T1	T3
T4	T1	T0	T2

where:

T0: Concentrated feed only, which was the control treatment "Positive control";

T1: Concentrated feed plus with 10% of fresh sweet potato vines;

T2: Concentrated feed plus with 20% of fresh sweet potato vine;

T3: Concentrated feed plus with 30% of fresh sweet potato vine and;

T4: Concentrated feed plus with 20% of sweet potato vine meal.

2.4 Experimental Animal

In this experiment, 500 local chickens at one-day-old were purchased from farmers who had run small scale hatchery farm in Tram Kak district, Takeo province. The chicks were raised and fed together

until they were 21 days old, then were allocated into experimental treatments randomly into 20 experimental units or replications, including 25 chicks per replication.

2.5 Experimental Feed

Sweet potatoes were grown at the animal experimental station of the Faculty of Animal Sciences, Royal University of Agriculture. The sweet potato vines were cut to a length of 20 cm from the top with a paring knife and chopped into small pieces, 0.03 to 0.05 cm size, before feeding in the fresh. The amount of fresh sweet potato vine fed the chicken based on the growth rate of chicken. For feeding we used two separated feed troughs, one with fresh sweet potato vine and the other with concentrated feed. While, for making sweet potato vine meal, we needed drying it, then grinding it thoroughly into a powder and mixing it with the feed.

The feed ingredients were analyzed for CP (Crude Protein), DM (Dry Matter), OM (Organic Matter) and ASH (Ash) according to the analysis method of AOAC (Association of Official Analytical Chemist) [8] in the laboratory of the Faculty of Animal Sciences, Royal University of Agriculture.

2.6 Data Collection

2.6.1 Daily Feed Weighing

In this experiment, chicken were fed ad libitum, but were provided three times a day: 7:00 AM, 12:00 noon and 5:00 PM. The amount of offered feed was weighed and recorded, and refusal feed was also collected, weighed and recorded daily.

2.6.2 Weighing Chickens

Chickens were weighed every week at 7 AM, by weighing one by one of all chickens in each replication with a scale of 2 kg (measuring in grams), we do this until the end of the experiment.

2.7 Data Analysis

The data were recorded in the Excell program and analyzed for mean, variance, and significance within the statistical method. There were many parameters which will be analyzed including, body weight gain, feed intake and FCR.

Average daily weight gain was calculated using the SLOPE equation:

$$b = \frac{n\sum xy - \sum x \sum y}{n\sum x^2 - (\sum x)^2}$$

where:

b: Average daily weight gain;

x: Date of weighing;

y: Weight of chicken.

3. Result

3.1 Chemical Composition of Feed

According to Table 2, the protein of sweet potato vine, both in fresh and meal, contained high protein from 20.40 to 22.00, respectively, while OM was the same level.

While the feed formula was shown in Table 3, the requirement of protein contained met the growing stage and all treatments contained the same level.

Table 2 Chemical composition of feed.

Ingredients	CP (%)	DM (%)	Ash (%)	OM (%)
Fresh sweet potato vine	20.40	17.96	18.00	82.00
Sweet potato vine meal	22.00	96.90	18.00	82.00
Rice brand	6.27	93.26	5.65	94.35
Soyabean meal	35.00	86.85	9.14	90.86
Concentrate feed	16.83	92.80	5.36	94.64

Table 3 Feed formula (in DM basis).

Ingredients	T0	T1	T2	T3	T4
Fresh sweet potato vine	-	10	20	30	-
Sweet potato vine meal	-	-	-	-	20
Rice brand	30	25	20	15	21
Soyabean meal	20	15	10	5	9
Concentrate feed	50	50	50	50	50
Total	100	100	100	100	100
Total protein	17.30	17.27	17.25	17.23	17.28

3.2 Growth Performance of Chicken

According to the Fig. 1, we found that the starting weight of the chicks in the five treatments was not significantly different, indicating that the weight factor at the beginning did not affect the result of study.

The T0 treatment (control treatment) and the T4 treatment (sweet potato meal treatment) had faster growth rate than the other three treatments which used fresh sweet potato vine. The growth performance of both treatments, T0 and T4, remains high growth until the end of the study, which is the final age for the market. This means that the average weekly weight of chickens per treatment of T0 treatment (control treatment) and treatment T4 (treatment using sweet potato meal) was similar weight, in generally was not significantly different. In particular, they are higher than the other three treatments, especially in the last week "W9", where the treatments of T0 and T4 were still remaining the highest. But for the treatment that added fresh sweet potato vine, there seemed to be decreasing with increasing its level in the feed formula (Fig. 1).

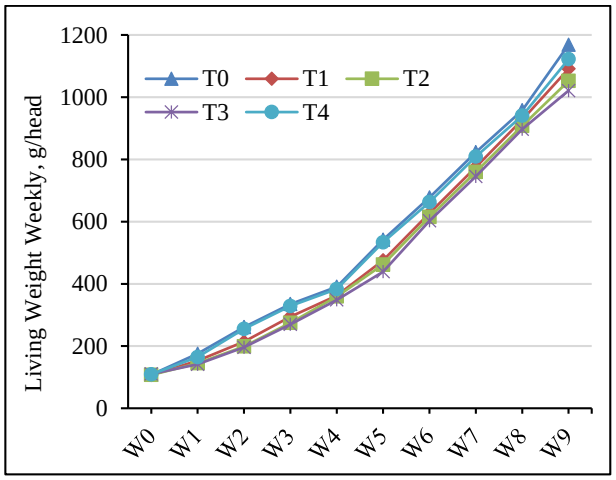

Fig. 1 The variation of living weight.

3.3 Daily Weight Gain

According to Fig. 2, the average daily weight gain of the five treatments was significantly different ($p < 0.01$). Among those treatments, the treatment using concentrated feed alone (T0) and the treatment using concentrated feed plus sweet potato meal (T4) had the highest growth rate, accounting for of 16.46 g/head/day and 15.99 g/head/day, respectively, followed by the treatment using concentrated feed plus fresh sweet potato vine 10%, 20% and 30%. At the same time, we found that the average daily weight gain of chickens seemed to decrease with increasing the level of fresh sweet potato vine.

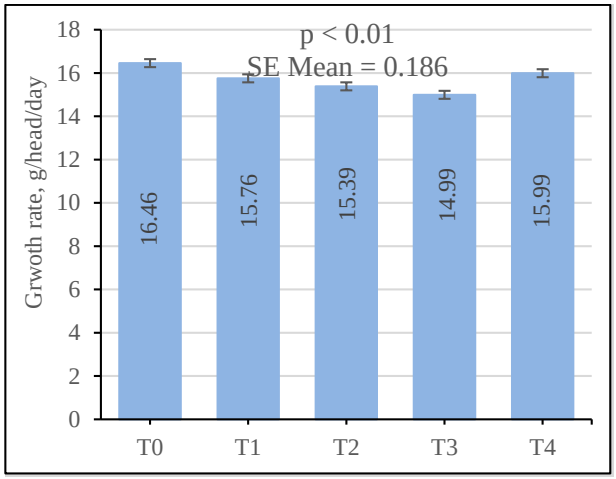

Fig. 2 Average daily weight gain.

3.4 Feed Intake

The utilization of sweet potato vine, both fresh and meal in different levels, had no effect on the feed intake of chicken. In particular, the average daily feed intake of all experimental treatments throughout the study period was not significantly different, ranging from 84.08 g/head/day to 90.42 g/head/day ($p > 0.05$) (Fig. 3).

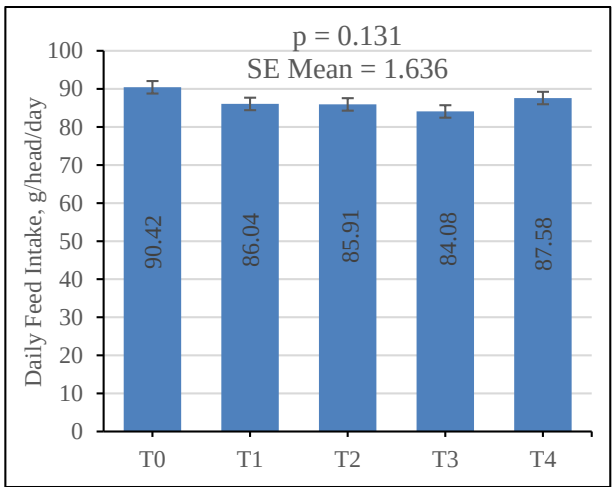

Fig. 3 Average daily feed intake.

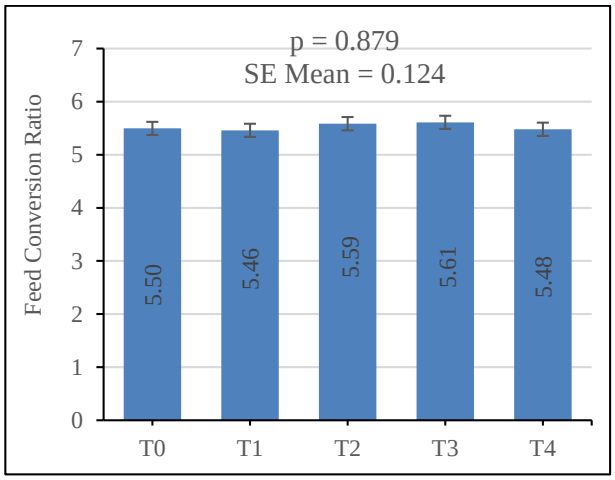

Fig. 4 Mean of FCR.

3.5 FCR

Based on Fig. 4 it is shown that the average of FCR of all treatments was not statistically different ($p > 0.05$), ranging from 5.46 to 5.61.

4. Discussion

In the first 3 weeks, the feed intakes of the five treatments were significantly different, in which the control treatment (T0) had the highest feed intakes, however there were no differences for the rest of weeks. This finding was similar to other researchers who reported that at the young age, the birds were unable to digest the feed containing more than 10% of fiber because their digestive tract was still too weak to metabolize nor release enzymes for digestion [9-11]. In particular, this amount of feed intake decreased with increasing levels of fresh sweet potato vine in feed formula.

The final weight of chicken obtained from this study, both with and without the sweet potato vine, was approximately 1,100 g, which was lower than some finding [12, 13]. This difference might be due to the difference of chicken breed, since both of these researchers used broiler breed with high growth performance.

For the final weight, there seemed to decrease with increasing the level of fresh sweet potato vine from 10% to 30%, which is similar to the previous researcher's findings [14] which indicated that the weight loss occurred when using sweet potato vine up to 11.25% and 15%. However, the amount of sweet potato vine could be increased up to 20%, if it was processed into meal, without any effect on weight gain compared with the control treatment, which was similar to some finding suggesting that the sweet potato vine meal could be used up to more than 10% without affecting the normal growth of chicken [15].

5. Conclusion

According to our finding, we could conclude that the average daily weight gain of chickens seemed to decrease with increasing the level of fresh sweet potato vine. Thus, the optimum level of fresh sweet potato was 10%, which may have little effect on the growth performance of local chickens. In addition, it was not far different from the positive control treatment and the treatment using sweet potato vine meal. However, the producers can increase the amount of sweet potato vine in feed formula by processing it into meal and mixing with concentrate feed or using as feed ingredients.

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