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Effect of Feeding Diet with Paddy (*Oryza sativa*) and Redworm (*Perionyx excavates*) on Growth Performance of Free Range Go Cong Chicken

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Authors' contributions

This work was carried out in collaboration among all authors. Author BTMD conceptualized the study and contributed to the manuscript writing. Author QTTT drafted the initial manuscript and finalized the manuscript and authors VTNB and DTX contributed to the manuscript writing and analyzed the data. All authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Aims: This present study was conducted to evaluate the effect of feeding various levels of paddy with redworms *(Perionyx excavates)* on growth performance of Go Cong chicken under free range system of rearing.
Experimental design: A total of 250 free range Go Cong chicken from 5 to 14 week of age with five treatments including control treatment consists of 100% self-mixed feed and 3 treatments with paddy and redworm levels 20% (TQ20); 25% (TQ25); 30% (TQ30) respectively; and treatment with 100% paddy (LUA) were included in the study.
Place and duration of study: The study was conducted in Thanh My hamlet, Thanh Duc commune, Long Ho district, Vinh Long province.
Methodology: All chickens included were cared under uniform managemental conditions. Every

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morning, cleaning the trough, weighing the leftover food in the trough and feeding the chickens with new food. Food and water was ensured to be enough in the trough.
Growth targets: Body weight, body weight gain, average feed consumption and feed conversion ratio (FCR) were collected for growth targets in each experimental period.
Results: At 14 weeks of age, the heaviest weight was found in the control treatment (1299.40g) similar to TQ25; and the lowest one was LUA treatment (966.00g) ($P<0.05$). There was no significant difference in feed intake between all treatments ($P>0.05$). At 5 to 14 weeks of age stage, the lowest value of FCR was revealed in the control (3.73), similar to TQ25 treatment and was statistically significant different from LUA treatment (5.56)($P <0.05$). The livability of 4 treatments TQ20, TQ25, TQ 30% and control were 100% while LUA was 95% of livability.
Conclusion: In summary, the feeding treatment containing 25% *Perionyx excavatus* and 75% paddy revealed the best results and can be suggested to apply for raising free range chicken

Keywords: FCR; Go Cong native chicken; body weight; paddy; Perionyx excavates.

1. INTRODUCTION

Chicken farming plays an important role in Vietnam's livestock industry, with an average growth rate of about 8% every year. However, backyard chicken farmers in the Mekong Delta are still using commercial feed, they have not yet utilized the potential of locally available byproducts such as paddy, redworms, and earthworms to feed their chickens in order to improve feed efficiency, chicken growth, and profitability. Paddy is an abundant source of raw materials in the Mekong Delta. Redworms (*Perionyx excavates)* are also a very good source of food for chickens because they contain a large amount of protein, amino acids [1,2,3] meeting chickens' nutritional needs for their good growth. It is easy to raise and reproduce redworms quickly [4,5]. Moreover, redworms can also be fed with food waste and leftovers such as vegetables, fruit peels, etc., which can help significantly reduce food waste to the environment [6,7]. Free-range chicken raising households have been tending to make use of paddy and redworms as food for chicken. Currently, the use of paddy and redworms is effective for feeding chickens in practice; however, it has not yet been investigated and scientifically evaluated to have specific recommendations for farmers.

2. MATERIALS AND METHODS

The study was conducted in Thanh My hamlet, Thanh Duc commune, Long Ho district, Vinh Long province.

2.1 Experimental Shed and Chicken

The shed was designed in the Southeast direction (4 x 20 m) and divided into 25 pens with 4 m^2 for each pen for raising 10 chickens. In the pen, there was a roost (cajuput) for chickens to sleep. During the day, the chickens were released in the garden and kept in the pen in the evening. The feeding and drinking troughs were arranged equally in each batch so the chickens can eat and drink freely. The experiment was carried out with 250 Go Cong chicks with an average weight of 32 g.

2.2 Experimental Food

Chicken feed included mixed feed, paddy, and redworms. Paddy was selected with OM4900 variety and redworms were raised by food waste and leftovers such as vegetables, fruit peels, leftovers, etc.

The chemical composition and nutritional value of the ingredients are shown in Table 1.

Experimental chickens were raised according to a process consisting of 2 stages:

Stage 1: from 1 to 28 days of age, all chickens were fed by the same Proconco starter feed, containing 20% CP and ME of 2850 kcal / kg. Gradually, it was switched to experimental feeding food for about 10 days so that the chickens can adapt to the food.

Stage 2 (experimental): Experimental feed was applied to chickens at 5-14 weeks of age (Table 2).

Formula of experiments:

Experiment 1: 100% mixed feed (Control)
Experiment 2: 80% paddy + 20% redworm (TQ20)
Experiment 3: 75% paddy + 25% redworm (TQ25)
Experiment 4: 70% paddy + 30% redworm (TQ30)
Experiment 5: 100% paddy (LUA)

2.3 Experimental Design

Experiments were arranged in a completely randomized format with 5 treatments corresponding to 5 experimental diets, repeated 5 times. Each experimental unit was a pen with 10 chickens (5 male + 5 female), a total of 250 chickens.

2.4 Managemental Practices

All experimental chickens were reared under uniform managemental conditions. Every morning, cleaning the trough, weighing the leftover food in the trough, and feeding the chickens with new food were done. Food and water were ensured to be enough in the trough. The chickens were provided compact lights hanging along the pen and each bulb was spaced 6 m apart. All chickens were vaccinated according to the recommendation of Vinh Long Animal Husbandry and Veterinary Sub-Department .

2.5 Tracking Indicators

Growth parameter included body weight, body weight gain, average feed consumption and feed conversion ratio (FCR) for each experimental period.

2.6 Statistical Analysis

Raw data was preliminarily processed by Excel program, then analyzing variance by the General Linear Model of Minitab 16.0 program, when F calculates the difference, then conducting a comparison. Data was compared by the Tukey test at the 5% significant level.

3. RESULTS AND DISCUSSION

3.1 Body Weight and Weight Gain at 10 Weeks and 14 Weeks of Age

Redworms had an effect on body weight of chicken at 10 and 14 weeks of age between treatments ($P<0.05$). Chicken raised with diets in the control treatment had the highest weight and lowest weight was in LUA treatment (100% paddy) at 10 and 14 weeks of age. The body weight of chickens in TQ25 treatment was the same as chickens in the control treatment according to the Tukey test. Due to the differences in body weight, the weight gain of chickens over the period 5–10, 10–14 and the period 5-14 weeks of age, were also significantly different ($P<0.05$), the highest weight gain was in chickens of the control treatment and lowest in the LUA treatment. The weight gain of chickens raised in TQ25 treatment was similar to chickens of the control treatment with the Tukey test.

Table 1. Chemical composition of the ingredients used in the experiment

Ingredients	DM	CP	TRO	EE	CF	Ca	P	ME, kcal/kg	Lys	Met
Corn	86.72	8.41	3.37	2.55	0.84	0.36	0.31	3218	0.26	0.18
Broken rice	86.43	7.88	0.27	1.38	0.42	0.42	0.39	2865	0.43	0.22
Bran	88.72	14.43	17.71	5.83	1.15	0.57	1.69	3025	0.59	0.56
Soybean	89.14	44.7	1.75	3.79	3.01	0.36	0.38	2213	2.61	0.59
Fish meal	90.19	54.77	13.05	0.3	2.52	5.91	1.82	3018	2.52	1.23
Redworm (*Perionyx excavates)*	83.6	18.2	0.6	1.6	0.9	0.44	1.59	3012	0.66	0.71
Paddy	86.7	10.4	2.9	2.2	8.6	0.1	0.23	2638	0.53	0.46
Dicalci Phosphat	97.75	0	0	0	0	23.96	8.78	0	0	0
L-Lysine HCl	100	0	0	0	0	0	0	0	79	0
DL-Methionine	100	0	0	0	0	0	0	0	0	98
Salt	100	0	0	0	0	0	0	0	0	0
Premix vitamin	100	0	0	0	0	0	0	0	0	0

Note: DM: dry matter, CP: crude protein, EE: crude fat; CF: Crude Fiber, Lys: Lysine, Met: Methionine. ME: Metabolizable Energy was calculated according to Jansen (1989) quoted from NRC (1994). Data are based on analysis results at the Department of Nutrition, Faculty of Agriculture and Applied Biology, Can Tho University.

Table 2. Feed formula, chemical composition, and nutritional value of experimental diets for chickens at 5-14 weeks of age

Ingredients,%	Control	TQ 20	TQ 25	TQ 30	LUA
Corn	68.50	0	0	0	0
Broken rice	11.50	0	0	0	0
Bran	0.30	0	0	0	0
Soybean	12.80	0	0	0	0
Fish meal	5.00	0	0	0	0
Redworm (*Perionyx excavates)*	0	20	25	30	0
Paddy	0	80	75	70	100
Dicalcium Phosphat	0.50	0	0	0	0
L-Lysine HCl	0.30	0	0	0	0
DL-Methionine	0.35	0	0	0	0
Salt	0.20	0	0	0	0
Premix vitamin	0.55	0	0	0	0
Total	**100**	**100**	**100**	**100**	**100**
Crude Protein	15	12	13	13	10
Ash	3.27	2.33	2.26	2.21	2.9
Crude fat	2.42	2.05	2.03	2.02	2.2
Crude fiber	1.14	6.68	6.44	6.29	8.6
Calcium	0.76	0.19	0.20	0.20	0.1
Phosphorus	0.45	0.57	0.61	0.64	0.23
Lysine	0.93	0.56	0.57	0.57	0.53
Methionine	0.63	0.52	0.53	0.54	0.46
ME(Kcal/kg)	2977	2732	2743	2750	2638

Note: ME: Metabolizable energy was calculated according to Jansen (1989) quoted from NRC (1994)

Table 3. Effects of experimental feed on body weight and weight gain of Go Cong chickens

Growth Targets	Control	TQ20	TQ25	TQ30	LUA	SEM	P
Body weight (g/head)							
5 weeks old	281.00	280.80	286.00	281.00	281.29	6.15	0.969
10 weeks old	807.20^{a}	783.40^{ab}	797.60^{a}	734.60^{b}	668.00^{c}	14.65	<0.05
14 weeks old	1299.40^{a}	1236.20^{b}	1271.20^{ab}	1166.20^{c}	966.00^{d}	24.71	<0.05
Body weight gain (g/head/day)							
5-10 weeks old	12.53^{a}	11.97^{ab}	12.18^{a}	10.80^{b}	9.21^{c}	0.32	<0.05
11-14 weeks old	17.58^{a}	16.17^{bc}	16.91^{ab}	15.41^{c}	10.64^{d}	0.30	<0.05
5-14 weeks old	14.55^{a}	13.65^{b}	14.07^{ab}	12.65^{c}	9.78^{d}	0.19	<0.05
Food consumption (g/head/day)							
5 – 10 weeks old	51.35	50.73	51.03	51.03	50.66	0.42	0.79
11-14 weeks old	61.77	63.53	61.68	63.11	62.08	0.46	0.11
5 – 14 weeks old	54.20	54.82	54.57	54.56	54.33	0.99	0.99
Feed conversion ratio (FCR) (g food/ g weight gain)							
5 – 10 weeks old	4.11^{c}	4.29^{bc}	4.16^{c}	4.76^{b}	5.51^{a}	0.15	<0.05
11 – 14 weeks old	3.51^{c}	3.93^{bc}	3.65^{bc}	4.10^{b}	5.88^{a}	0.13	<0.05
5 – 14 weeks old	3.73^{c}	4.02^{bc}	3.82^{c}	4.33^{b}	5.56^{a}	0.11	<0.05

^{a,b,c} mean numbers in the same row carry different exponents, and the differences are statistically significant (P <0.05) according to the Tukey test

3.2 Feed Consumption and Feed Conversion Ratio of Go Cong Chickens

This result indicated that supplementation of redworms to the backyard chicken improved growth performance and this might be due to presence of high protein in the worm [5,8]. Similar finding was reported by Vu Dinh Ton et al. [2] in broiler chicken fed with redworms. Prayogi [9], recorded improved weight gain and FCR in Japanese quails fed with fresh earthworm meals.

The ratio of redworm supplementation in the diet did not affect the amount of feed consumed by chickens (P> 0.05) over the experimental

periods, chickens raised on redworm diets still consumed the same amount of feed as the control treatment. However, due to the statistically significant difference in weight gain, chickens in the control treatment had the improved FCR over both 5–10 weeks of age (4.11) and 11-14 weeks of age (3.51) and the whole period (3.73), while FCR of chickens in LUA treatment were always higher such as 5.51 (5–10 weeks of age) respectively 5.88 (11-14 weeks of age) and 5.56 (the whole period). However, according to the pair comparison of Tukey, chickens in TQ25, and TQ20 treatment had the similar FCR as the control treatment. Similar finding was reported by Yi et al. [10] in broiler chicken supplemented with earthworm powder in the diet.

3.3 Survival Rate

The survival rate of experimental chickens was very high**.** The survival rates in the control treatment, TQ20, TQ25 and TQ30 treatment all reach 100%, in LUA treatment the livability of chickens was 95%. In particular, chickens in 3 treatments of TQ20, TQ25 and TQ30 were healthy during the experimental process.

Popovic et al. [6] noted that redworms contained a mixture of glycolipoprotein (G-90) including active antibiotic killed a lot of bacteria such as *Staphylococcus sp.* better than commercial antibiotics such as gentamycin and enrofloxacin. Redworms contained more than 8% Glutamic acid, which helped the chickens to be healthy, grow well, less infected by diseases and produce a much more delicious meat than chickens raising without redworms. In the study of Govindra et al. [11] also reported that earthworms have the ability to inhibit pathogenic bacteria and such as *Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus* and inhibit pathogenic fungi in chickens: *Candida albicans* and *Aspergillus flavus*, *Aspergillus niger*.

4. CONCLUSION

Go Cong backyard chickens can be raised with fresh redworm supplement for improved performance in growth, and survival rate. The diet fed with 25% redworms and 75% paddy was found to be effective on growth performance of chicken and reduced investment cost on feed. In addition, it may contribute to increase economic efficiency in livestock farming in the local household and very favorable for poor farmers to improve their livelihood. Furthermore, it helps to take advantage and reduce a huge source of organic waste from households to the environment because organic waste is decomposed by redworms.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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