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GROWTH PERFORMANCE AND MORPHOLOGY OF IN 28-84 DAY-OLD VIETNAMESE LOCAL NOI CHICKEN

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Abstract: Noi chicken is one of the most popular native breeds in the South of Vietnam because their good meat quality and disease resistance. Therefore, although price of their products (eggs and meat) is always high, they are always preferred. However, there have not been many studies on the morphology of this breed yet. In the current study, a total of 355 Noi chickens (164 males and 191 females) at 28 days old were selected and randomly allotted to individual cages until they reached the market weight at 84 days old. During the experiment, Noi broilers were fed *ad libitum* a diet with 17% crude protein and 3.000 kcal/kg ME produced by GreenFeed Vietnam Joint Stock Company. Average daily gain, feed conversion ratio and some morphological dimensions were recorded at two different stages of age (28-56 and 56-84 days old). Results were demonstrated that *(i)* significant differences in feed intake (P=0.006), body weight (P=0.019), beak length (P=0.014), thigh length (P=0.004), shank length (P=0.003), breast diameter (P=0.000), and thigh diameter (P=0.001) were found between males and females as well as between different stages; and *(ii)* body weight and some dimensions will increase rapidly at the first stage. An understanding on these economic traits helps researchers and producers have a more detailed glance on developing of each part of Noi chicken at different stages of age which they are the basic scientific foundation for further studies on this breed.

Key words: Noi broilers, economic traits, measurements

Introduction

Chicken industry in Vietnam has been developing rapidly and strongly in recent years. Many poultry companies have exported commercial chicken meat and eggs to China, Cambodia, Japan market, etc. However, similar to other countries owing native breeds, Vietnamese customers tend to choose the products of these breeds because of their specific quality (taste, flavor, toughness, stiffness, sweetness, etc.).

Noi is known as one of the native chicken breeds who are easy to raise in different conditions of environment, micro-climate, nutrition, and nursing from rural to urban areas for improving farmers' income and meals quality as well as sometimes for fighting games. Noi chickens have strong tough muscles, good natural disease resistance and produce delicious meat. Thus, this breed is chosen as a potential genetic for the sustainable poultry production system in Vietnam. In earlier studies, *(i)* some performance characteristics (feather color, shank color, eyes color, beak color, comb color) and estimation of allele frequencies of 2 microsatellite markers in chromosome 7 (*Linh, 2013*), *(ii)* genetic association of some candidate genes with eggs performance (*Vu and Ngu, 2016*), *(iii)* effects of garlic on growth performance (*Thuong, 2014*), *(iv)* influence of different ME and CP levels on growth and laying rate (*Quyen, 2008*) in Noi chicken were investigated. Recently, *Khoa et al.* (2019) reported some quantitative genetic traits including body weight, average daily gain, feed intake, feed conversion ratio, and some dimensions in 0-28 day-old Noi chicken. Nowadays, with the increasing demand of domestic customers, Noi chicken breed needs to be studied in many ways/methods to produce high quality products. It is also the reason why this study was subsequently conducted and focused on some indicators of growth performance, feed conversion ratio and morphology, as a basic foundation for further studies on this breed.

Materials and methods

This study was conducted at the Can Tho Center for Breeds of Seed, Livestock and Fish, where it is cooperating with Can Tho University in many scientific research activities, located at O Mon district, Can Tho city, Vietnam.

A total of 355 Noi individuals (164 males and 191 females) at 28 days old were selected from a resource population of 1.200 birds investigated in previous studies (*Vu and Ngu, 2016; Khoa et al., 2019*). All they were kept in private cage with dimensions of 47cm length, 40cm front height, 38cm back height and 40cm

width. Each cage had a separate feeder and drinker. Cages were put inside of the opened housing system.

Table 1. Nutrient component of the experimental feed	
Items	31-84 days old (GF1324)*
Crude protein (min), %	17
Humidity (max), %	14
Crude fiber (max), 5	5
Methionine and cysteine (min), %	0.7
Metabolism energy (min), kcal/kg	3.000
Calcium, %	0.8-1.2
Phosphorus, %	0.6-1.0
Total lysine (min), %	1
*Main ingredients: soybean cake, fish meal, rice bran, broken rice, corn, wheat bran, cassava, amino acids, vitamins and minerals (Source: GreenFeed Vietnam Joint Stock Company)	

Whole flocks were fed *ad libitum* a diet containing 17% crude protein and 3.000 kcal ME (Table 1). During the experiment, multivitamins and beta-glucan were supplied some days at time points of stress (suddenly high temperature, vaccinating, catching, etc.).

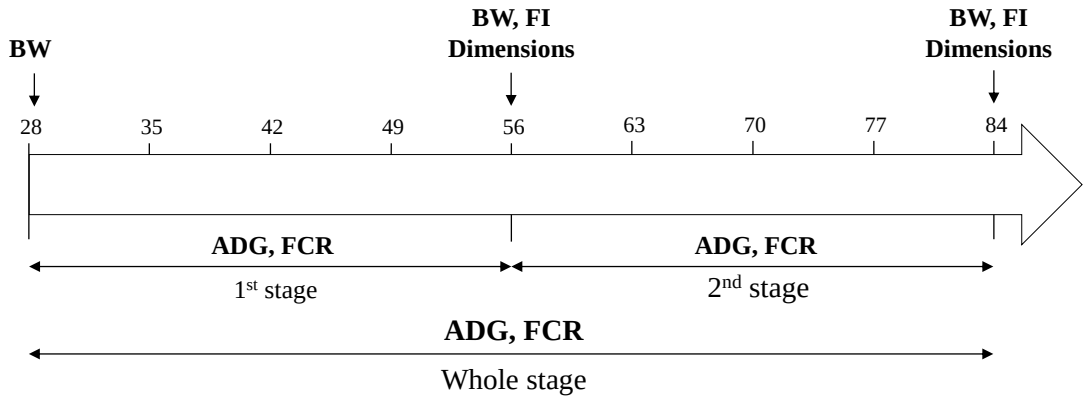

Figure 1. Scheme for sampling

At the end of each month, body weight (BW, g/head), average daily gain (ADG, g/head/day), feed intake (FI, g/head/day), feed conversion ratio (FCR) as well as some parameters such as beak length (BL, mm), skull length (SL, mm), skull width (SW, mm), neck length (NL, mm), back length (BaL, mm), wings length (WL, mm), thigh length (TL, mm), shank length (ShL, mm), keel length (KL, mm), breast diameter (BD, mm), and thigh diameter (TD, mm) (FAO, 2012)

were recorded and calculated. Increasing percentage (IP) of observed traits was calculated as below:

$$IP\ (\%) = \frac{\text{Measurement at the end of the month} - \text{Measurement at the beginning of the month}}{\text{Measurement at the beginning of the month}} \times 100$$

Collected data were statistically analyzed by using R program (ver. 3.4.2). General Linear Model was applied to analyze effects of gender or old stage on observed traits.

Results and discussion

Average daily gain, feed intake and feed conversion ratio

The obtained results revealed that *(i)* there was high significant difference in ADG, FI and FCR between males and females at each various stage of age (P=0.000) (Table 2). It is easy to recognize that BW of males was always higher than that of females. This was probably due to much more feed consumption of males. However, males showed lower FCR than females. This was normal biological development in poultry production industry in which males were used economically to produce meat; *(ii)* significant difference between two stages was found for FI (P=0.006) (Table 2). Feed consumption gradually increased in aging of broilers.

Table 2. Effects of aging and sex on ADG, FI, and FCR in Noi broilers

Traits	28-56 days old			28-84 days old			56-84 days old			P
	Male	Female	P	Male	Female	P	Male	Female	P	
ADG	21.19±3.22	17.32±3.30	0.000	22.28±3.13	17.88±3.70	0.000	23.38±4.37	18.44±5.09	0.000	0.195
FI	60.68^{b}±8.68	51.15^{a}±8.32	0.000	70.48^{d}±8.91	58.22^{b}±10.65	0.000	80.27^{e}±13.11	65.30^{c}±15.98	0.000	0.006
FCR	2.88±0.23	2.98±0.25	0.000	3.17±0.18	3.28±0.21	0.000	3.46±0.25	3.58±0.29	0.000	0.827

Under intensive management condition in Northwest Ethiopia, ADG, FI and FCR of the native chicken breeds such as Tilili, Gellilia, Debre-Ellias, Mello-Hamusit, Gassay, Guangua, and Mecha from 35-56 days old were 8.8-11.5, 36.4-47.3, and 3.3-4.9, respectively. At 154 days old, they weighed 1,038-1,257 kg/head of BW although during the experiment they were offered a standard starter ration for a period of 56 days and then, a commercial grower ration for an additional period of 84 days *ad libitum* (*Hassen et al., 2006*). In another early study, at the stages of 0-

42 days old and 49-84 days old, Thai native chickens were respectively fed a diet with 15% and 19% of crude protein as well as one ME level of 2,900 kcal/kg for both stages. As a result, *(i)* at the stage of 28-56 days old, ADG (15.46-15.87 vs 17.32-21.19) and FI (33.00-49.76 vs 51.15-60.68) in the Thai showed lower than in the Noi, while FCR was similar between two breeds (2.09-3.24 vs 2.88-2.98); and *(ii)* at the stage of 56-84 days old, FCR (3.89-4.66 vs 3.46-3.58) of the Thai was higher than the Noi (*Jaturasitha et al., 2002*). It was clear that Noi chicken breed had advantages in terms of ADG and FCR compared with some native ones in the world but strategies for developing this breed has not been noticed and focused in national poultry breeding programs yet.

Body weight and morphology

Significant difference for BW and all dimensions were found between two sexes at various time points of age, in which male was always higher than the female for these observed traits ($P<0.05$) (Table 3). At 84 days old, BW of Noi broiler (female 1,196.71 and male 1,424.09) was higher than the Thai native one (1,156.05) (*Jaturasitha et al., 2002*), Chum Long Dau broiler (female 1,095.79 and male 1,298.50) (*Thanh, 2012*) and Ho chicken breed (female 1,124.51 and male 1,297.21) (*Doan and Luu, 2006*), but it was similar to Ninh Hoa Ri breed (female 1,195.65 and male 1,571.79) (*Thinh et al., 2017*) and Long Cam one (female 1,069.41 and male 1,440.34) (*Mui et al., 2012*). These evidence indirectly point to the advantages of carcass traits of Noi chicken and their potential for domestic poultry meat production industry in the future.

Data in Table 4 indicated that *(i)* significant difference between the males and females in the ratio of increasing dimensions such as BW ($P=0.004$), BL ($P=0.030$), TL ($P=0.019$), ShL ($P=0.010$), BD ($P=0.000$), and TD ($P=0.021$) at the first stage (28-56 days old), WL ($P=0.004$), TL ($P=0.000$), ShL ($P=0.001$), BD ($P=0.000$), and TD ($P=0.000$) at the second stage (56-84 days old) as well as BW ($P=0.019$), BL ($P=0.014$), TL ($P=0.004$), ShL ($P=0.003$), BD ($P=0.000$) and TD ($P=0.001$) throughout the whole growing stage (28-84 days old) were found; *(ii)* growth and development of Noi chickens were noticed at the first stage in which dimensions showed double compared with the second stage; moreover *(iii)* a total of 8/12 dimensions (BW, NL, WL, TL, ShL, KL, BD and TD) has an percent increase over 50% (51.70-217.52%) at the first stage.

Table 3. Length of measured traits at different time points of age

Traits	28 days old				56 days old				84 days old			
	Mean (n= 355)	Male (n= 164)	Female (n=191)	P	Mean (n= 355)	Male (n= 164)	Female (n= 191)	P	Mean (n= 325)	Male (n= 149)	Female (n= 176)	P
BW	253.79±53.25	265.68±54.70	243.591±49.89	0.000	787.94±137.21	857.32±119.21	728.38±123.15	0.000	1300.95±247.20	1424.09±232.88	1196.71±208.41	0.000
CV%	0.21	0.21	0.20		0.17	0.14	0.17		0.19	0.16	0.17	
BL	21.44±1.11	21.57±1.10	21.32±1.10	0.036	29.40±1.70	29.84±1.62	29.02±1.67	0.000	34.19±1.81	35.00±1.71	33.51±1.61	0.000
CV%	0.05	0.05	0.05		0.06	0.05	0.06		0.05	0.05	0.05	
SL	23.24±1.37	23.41±1.47	23.09± 1.26	0.030	28.94±1.47	29.38±1.47	28.55±1.37	0.000	32.03±1.62	32.47±1.59	31.67±1.55	0.000
CV%	0.06	0.06	0.05		0.05	0.05	0.05		0.05	0.05	0.05	
SW	22.06±1.08	22.27±1.17	21.87±0.95	0.000	28.72±1.56	29.46±1.37	28.08±1.44	0.000	32.74±1.86	33.43±1.72	32.16±1.77	0.000
CV%	0.05	0.05	0.04		0.05	0.05	0.05		0.06	0.05	0.06	
NL	81.44±7.93	82.41±8.59	80.60±7.24	0.032	132.99±9.97	136.25±11.32	130.19±7.63	0.000	158.55±14.26	162.19±14.28	155.47±13.53	0.000
CV%	0.10	0.10	0.09		0.07	0.08	0.06		0.09	0.09	0.09	
BaL	115.99±7.32	117.18±7.20	114.97±7.30	0.004	168.76±11.31	171.96±10.66	166.02±11.15	0.000	205.39±16.79	209.84±15.89	201.63±16.65	0.000
CV%	0.06	0.06	0.06		0.07	0.06	0.07		0.08	0.08	0.08	
WL	273.66±20.48	278.32±19.35	269.66±20.62	0.000	413.75±26.31	422.46±26.44	406.27±23.84	0.000	490.72±35.12	497.23±37.27	485.21±32.27	0.002
CV%	0.07	0.07	0.08		0.06	0.06	0.06		0.07	0.07	0.07	
TL	110.29±8.95	111.33±7.94	109.40±9.66	0.042	168.97±11.51	173.66±10.14	164.95±11.11	0.000	199.53±13.63	201.50±13.85	197.86±13.25	0.016
CV%	0.08	0.07	0.09		0.07	0.06	0.07		0.07	0.07	0.07	
ShL	26.13±1.74	26.46±1.61	25.85±1.80	0.001	41.71±3.64	43.46±3.21	40.20±3.30	0.000	52.28±4.99	52.89±5.02	51.77±4.92	0.044
CV%	0.07	0.06	0.07		0.09	0.07	0.08		0.10	0.09	0.09	
KL	71.58±6.52	72.55±6.90	70.75±6.08	0.010	115.27±8.10	118.35±7.69	112.63±7.50	0.000	146.25±11.11	148.21±11.09	144.59±10.89	0.003
CV%	0.09	0.10	0.09		0.07	0.07	0.07		0.08	0.07	0.08	
BD	159.47±10.06	161.32±9.72	157.88±10.11	0.001	241.15±15.52	247.95±13.66	235.32±14.66	0.000	291.63±19.36	295.10±19.27	288.69±19.00	0.003
CV%	0.06	0.06	0.06		0.06	0.06	0.06		0.07	0.07	0.07	
TD	52.48±6.20	53.40±6.07	51.69±6.23	0.009	83.35±6.35	86.14±5.58	80.96±6.00	0.000	101.87±8.69	103.53±8.84	100.47±8.33	0.001
CV%	0.12	0.11	0.12		0.08	0.06	0.07		0.09	0.09	0.08	

BW: body weight (g/head); BL: beak length (mm); SL: skull length (mm); SW: skull width (mm); NL: neck length (mm); BaL: back length (mm); WL: wings length (mm); TL: thigh length (mm); ShL: shank length (mm); KL: keel length (mm); BD: breast diameter (mm); TD: thigh diameter (mm).

Table 4. Percent increase of measured traits

Traits	28-56 days old				56-84 days old				28-84 days old				P (period *sex
	Mean (n=355)	Male (n=164)	Female (n=191)	P	Mean (n=325)	Male (n=149)	Female (n=176)	P	Mean (n=325)	Male (n=149)	Female (n=176)	P	
BW	534.15±107.34	577.57±99.94	496.87±99.37		511.39±152.93	560.54±157.17	469.54±136.28		1045.95±217.87	1153.04±203.72	955.28±186.43	0.008	0.019
%	217.52±55.61	226.62±56.75	209.71±53.53	0.004	64.83±17.13	64.95±16.24	64.73±17.91	0.906	420.68±96.98	436.20±94.95	407.54±96.99		
BL	7.96±1.62	8.23±1.70	7.73±1.51		4.89±1.51	5.12±1.52	4.70±1.48		12.82±1.84	13.50±1.71	12.26±1.75	0.000	0.014
%	37.33±8.21	38.35±8.57	36.45±7.79	0.030	16.77±6.39	17.24±6.18	16.39±6.55	0.247	60.11±9.88	62.63±9.35	58.03±9.84		
SL	5.71±1.48	5.83±1.54	5.60±1.43		3.25±1.59	3.14±1.72	3.34±1.48		8.72±1.84	8.97±1.89	8.53±1.78	0.330	0.238
%	24.78±7.26	25.17±7.71	24.45±6.85	0.348	11.37±5.94	10.83±6.25	11.81±5.66	0.182	37.87±9.20	38.47±9.54	37.40±8.91		
SW	6.66±1.48	6.90±1.54	6.46±1.40		4.11±1.71	4.19±1.75	4.04±1.68		10.68±1.92	11.22±1.99	10.25±1.74	0.005	0.056
%	30.34±7.25	31.14±7.60	29.65±6.88	0.054	14.41±6.51	14.41±6.67	14.41±6.40	0.997	48.64±9.65	50.39±10.23	47.22±8.94		
NL	51.55±11.88	52.27±10.75	50.93±12.77		27.24±14.81	29.33±15.27	25.45±14.21		76.84±15.64	79.84±16.23	74.33±14.72	0.191	0.614
%	64.67±18.83	65.08±18.49	64.33±19.17	0.711	20.86±11.91	22.12±12.18	19.78±11.61	0.103	95.76±24.09	97.78±25.42	94.06±22.86		
BaL	52.77±11.02	54.10±10.97	51.64±10.97		36.56±17.36	37.55±16.29	35.74±18.21		89.34±18.30	93.33±17.07	86.04±18.68	0.064	0.203
%	45.86±10.86	46.60±10.64	45.23±11.03	0.239	21.93±11.12	21.93±10.00	21.93±12.01	0.994	77.77±18.21	79.96±16.69	75.96±19.24		
WL	140.08±23.81	143.40±23.56	137.24±23.71		78.41±38.62	72.65±41.99	83.35±34.87		216.54±40.34	217.52±41.45	215.73±39.52	0.115	0.058
%	51.70±11.06	52.21±10.41	51.27±11.59	0.422	19.22±10.09	17.35±10.52	20.82±9.45	0.004	79.90±18.92	77.95±17.28	81.51±20.07		
TL	58.80±10.50	60.91±10.44	56.99±10.23		30.96±15.30	27.93±15.58	33.46±14.64		88.89±16.04	89.77±15.21	88.18±16.70	0.467	0.004
%	53.79±11.54	55.34±11.22	52.46±11.68	0.019	18.65±10.07	16.28±9.37	20.60±10.23	0.000	81.42±18.26	80.54±16.37	82.14±19.68		
ShL	15.57±3.50	16.34±3.69	14.92±3.19		10.89±5.38	9.92±5.60	11.68±5.08		26.28±5.39	26.74±5.42	25.90±5.35	0.878	0.003
%	60.00±14.55	62.15±15.06	58.15±13.87	0.010	26.71±14.45	23.43±13.85	29.36±14.42	0.001	101.88±23.90	102.12±22.98	101.68±24.68		
KL	43.69±8.40	44.74±8.19	42.79±8.49		31.23±12.77	30.82±13.23	31.58±12.40		74.62±12.76	75.53±13.45	73.89±12.16	0.437	0.369
%	62.00±15.24	62.75±15.33	61.37±15.17	0.395	27.48±12.19	26.53±12.06	28.25±12.29	0.243	105.38±23.52	104.17±24.52	106.37±22.71		
BD	81.93±12.66	85.70±12.00	78.67±12.34		51.94±23.99	46.94±21.20	56.08±25.41		131.89±20.95	133.35±20.11	130.71±21.61	0.487	0.000
%	51.70±9.72	53.67±10.14	50.00±9.03	0.000	21.57±9.88	19.07±9.01	23.64±10.12	0.000	83.06±16.02	82.32±14.45	83.65±17.22		
TD	30.88±7.42	32.74±7.40	29.28±7.07	0.000	19.93±10.52	17.67±10.90	21.78±9.84	0.000	49.35±11.61	48.55±12.29	50.04±10.99	0.047	0.001
%	60.65^{b}±19.31	63.20^{b}±19.61	58.45^{b}±18.82	0.021	24.67^{a}±13.96	21.12^{a}±13.82	27.57^{a}±13.43	0.000	96.82^{c}±30.61	93.62^{c}±31.19	99.58^{c}± 29.91		

The measurement of weight and some dimensions on body helps us predict the development of muscle and skeleton, which they may be important data for setting up healthy diets and appropriate nursing modes to maximize genetic potential at different growing stages of Noi chickens.

Conclusion

It can included that growth rate and feed conversion ratio in Noi chicken were better that some other native chicken breeds in Vietnam and other countries. Furthermore, reasonable high nutritional diets as well as most appropriate nursing should be noted during the stage of 28-56 days old to maximize genetic potential for meat and skeleton traits in Noi chicken in the future.

Porast i morfologija pilića vijetnamske lokalne noi rase starosti od 28-84 dana

Do Vo Anh Khoa, Nguyen Thi Hong Tuoi, Nguyen Thi Dieu Thuy, Shin Okamoto, Kataro Kawabe, Nguyen Thi Kim Khang, Nguyen Tuyet Giang, Takeshi Shimogigri

Rezime

Noi rasa živine je jedna od najpopularnijih autohtonih rasa na jugu Vijetnama, zbog njihovog dobrog kvaliteta mesa i otpornosti na bolesti. Stoga, iako je cena njihovih proizvoda (jaja i mesa) uvek visoka, ovi proizvodi se preferiraju od strane krajnjih ptrošača. U ovom istraživanju, ukupno 355 noi pilića (164 muških i 191 ženski) u starosti 28 dana su odabrani i nasumično smešteni u pojedinačnim kavezima dok nisu dostigli tržišnu težinu u uzrastu od 84 dana. U toku eksperimenta, noi brojleri su hranjeni ad libitum obrokom sa 17% sirovih proteina i 3.000 kcal/kg ME proizvođača GreenFeed Vietnam a.d. Prosečni dnevni prirast, konverzija hrane i neke morfološke dimenzije evidentirani su u dva različita uzrasta (28-56 i 56-84 dana starosti). Rezultati su pokazali (*i*) značajne razlike u unosu hrane (P = 0,006), telesnoj težini (P = 0,019), dužini kljuna (P = 0,014), dužini bataka (P = 0,004), dužini tarzusa (P = 0,003), obimu grudi (P = 0,000), i obimu bataka (P = 0,001) između muških i ženskih pilića, kao i između različitih uzrasta; i *(ii*) telesna težina i neke dimenzije se ubrzano povećavaju u prvoj fazi. Razumevanje ovih ekonomskih osobina pomaže istraživačima i proizvođačima da detaljnije sagledaju razvoj svakog dela noi pilića u različitim fazama starosti koje su osnovna naučna osnova za daljnje studije o ovoj rasi.

Ključne reči: Noi brojleri, ekonomske osobine, merenja

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