



Research Article

Quantitative Traits of Bayang Ducks Raised with Intensive and Extensive Systems in Bayang District, West Sumatra

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ABSTRACT

This study aims to determine the polymorphism of quantitative traits of Bayang ducks raised with intensive and extensive system in Bayang District, West Sumatera. This study used 114 Bayang ducks consisting of 60 males and 54 females. Ducks are raised intensively and extensively or traditionally in Bayang District. This study used the observation method by calculating the mean, standar deviation, and coefficient of variation. Data were analyzed using the t-test to see the effect of sex and rearing system. The variables observed in this study were body weight (BW), chest circumference (CC), beak length (BL), wing bone length (WBL), shank length (SL), shank circumference (SC), femur length (FL), tibia length (TL), and Back Length (BAL). The results showed that sex had a significant effect ($P<0.01$) on FL and ($P<0.05$) on SL and CC. The rearing system had a significant effect ($P<0.05$) on SC and FL in male Bayang ducks. The coefficient of variation (CV) in male Bayang ducks was moderate ($>5-15\%$) except for TL which was small ($<5\%$). While in female Bayang ducks WBL and TL have CV classified as low, CC classified as high and other traits classified as medium. The conclusion of this study is that sex and rearing system affect the quantitative characteristics of Bayang ducks and the CV of Bayang ducks is low to high.

Keywords: Bayang duck, coefficient of variation, quantitative, West Sumatra

INTRODUCTION

Bayang ducks are local Indonesian ducks that must be protected and preserved. Bayang ducks originate from Bayang District, Pesisir Selatan Regency, West Sumatra Province. Bayang ducks have been designated as a clump in accordance with Ministerial Decree No.2835/Kpts/LB.430/8/2012. Bayang ducks have good adaptability and different characteristics from other native or local duck families. Bayang ducks are the result of a cross between Jawa ducks and local ducks in Bayang District. Currently, Bayang ducks have a distribution area in the Pesisir Selatan district, Padang Pariaman, Pasaman and the coastal area of Bengkulu Province (Kepmentan, 2012).

The body weight of adult male Bayang ducks is 1.8 ± 0.3 kg and females are 1.5 ± 0.2 kg. Egg production is 184-215 eggs/year with a high production peak of 85%. Egg weight is 65 ± 6 g. Duration of egg production is 2.5-3 years and age of sexual maturity is 5.5 ± 0.6 months (Kepmentan, 2012). The rearing system affects the productivity of ducks. The rearing system is a critical non-genetic factor that can considerably affect poultry production (Liu *et al.* 2011; Jin *et*

al. 2019; Guo *et al.* 2020; Wan *et al.* 2021), and has remarkable effects on behaviour (El-Edel *et al.* 2015), health (Kolluri *et al.* 2014; Grafl *et al.* 2017; Zhao *et al.* 2019; Pinto da Rosa *et al.* 2021).

To produce high-quality duck meat, the birds must be raised in ecologically and controlled environments that demonstrate the quality of care (Onbaşilar & Yalcin, 2018). The well-being of the ducks is strongly influenced by the environment and the rearing program. (El-Hack *et al.*, 2022). The duck rearing system is divided into three: intensive, semi-intensive and extensive or traditional. The intensive rearing system (IRS) of duck feed is provided by the farmer. semi-intensive rearing system, namely with a cage system and occasional free-range grazing (Tumanggor *et al.*, 2017), while extensive rearing system or traditionally ducks are spread on harvested rice fields and ducks look for feed themselves. The disadvantage of an intensive rearing system is that it requires high feed costs while extensive rearing system do not incur feed costs. It's just that farmers have to carry ducks moving around looking for harvested rice field locations to raise there.

In addition to intensive rearing system, farmers can ensure feeding according to the needs of the ducks, while extensively cannot. Bayang duck farmers in Bayang district generally raise ducks extensively and intensively. The rearing system significantly influences duck production, affecting growth performance, meat quality, and health parameters (Inayat *et al.*, 2024; Wang *et al.*, 2023; Yifan *et al.*, 2021). Therefore, this study aims to see the effect of the rearing system on the quantitative characteristics of Bayang ducks in Bayang District, West Sumatra Indonesia.

MATERIAL AND METHODS

Ethical Approval

Animal experiments were conducted following the Republic of Indonesia Law No. 18 of 2009 (section 66), which addressed animal keeping, raising, killing and proper treatment and care.

Materials

The number of samples used was 114 sexually mature Bayang ducks. Bayang ducks consisted of 60 males and 54 females. The ducks were raised intensively by 5 farmers and extensively by 5 farmers in Bayang District, West Sumatra. Intensively reared ducks were fed N544 commercial feed from PT Charoend Pokphand, while extensively reared ducks were allowed to forage in harvested rice fields.

Table 1. Nutrient content and metabolic energy of commercial ration N544

Nutrient content	N544
Protein (%)	17.5 – 18.5
Crude Fiber (%)	10
Crude Fat (%)	3
Calcium (%)	2.90 – 4.25
Phospor (%)	0.55
Water Content (%)	14
Ash (%)	14
Metabolic Energy (kcal/kg)	2850

Methods

The equipment used in this study were cameras, stationery, digital scales, measuring tapes, and Vernier calipers. Quantitative trait measurements included body weight (BW), chest circumference (CC), beak length (BL), shank length (SL), shank circumference (SC), wing bone

length (WBL), femur length (FL), tibia length (TL), back length (BAL). Measurements are following FAO (2012) recommendations. The quantitative traits measured were then calculated as mean, standard deviation, coefficient of variation (CV), maximum value, and minimum value. The t-test was conducted to see the effect of the rearing system and sex on the quantitative traits of Bayang ducks.

RESULTS AND DISCUSSION

Quantitative Characteristics of Bayang Ducks

Quantitative characteristic of Bayang duck can be seen in Table 2. Table 2 showed that sex had significant ($P<0.01$) effect on FL and significant ($P<0.05$) effect on SL and CC. Meanwhile, BW, BL, SC, WBL, TL and BAL had no significant ($P>0.05$) effect on sex in Bayang duck. Male and female ducks have different growth patterns that cause differences in body size. Lapik (2016) states that body length, chest circumference, and body weight are influenced by growth curve behavior. Husmaini *et al.* (2024) reported that sex had a significant effect ($P<0.01$) on BW and CC in Peking ducks and BL in Sikumbang Jonti ducks. Male Bayang ducks have a body weight of 1480g, and females are 1448g. Arlina *et al.* (2023) reported that male Bayang ducks weighed 1460g and females 1450g.

Table 2. Quantitative characteristics of male and female Bayang ducks

Variables	Male (60)		Female (54)		Sign.
	Mean	CV	Mean	CV	
BW (g)	1480.80±120.78	8.16	1448.02±145.01	10.01	ns
BL (mm)	60.12±4.05	6.73	55.07±7.72	14.02	ns
SL (mm)	53.11±3.43	6.46	48.52±3.35	6.90	*
SC (mm)	53.27±7.10	13.32	52.09±5.67	10.89	ns
WBL (cm)	32.16±2.29	7.12	30.86±1.44	4.68	ns
TL (mm)	49.42±1.85	3.74	48.70±1.69	3.46	ns
FL (mm)	52.45±2.97	5.67	43.54±6.32	14.52	**
CC (cm)	29.02±3.30	11.36	25.09±4.92	19.62	*
BAL (cm)	32.31±2.29	7.09	30.51±2.37	7.77	ns

Data are presented as min, max, mean±SD or SE. CV=Coefficient of variation; BW= Body Weight, CC = Chest Circumference, BL= Beak Length, SL= Shank Length, SC= Shank Circumference, WBL= Wing Bone Length, FL= Femur Length, TL= Tibia Length, BAL= Back Length

The coefficient of variation (CV) in male Bayang ducks was moderate ($>5-15\%$) except for TL which was small ($<5\%$). While in female Bayang ducks WBL and TL have CV classified as low, CC classified as high and other traits classified as medium. In difference with the study of Arlina *et al.* (2023) that BW, BAL and SL in male Bayang ducks have a high coefficient of variation.

Quantitative Traits of Male and Female Bayang Ducks

Quantitative characteristics of extensively and intensively raised male Bayang ducks can be seen in Table 3. Table 3 showed that rearing system had significant ($P<0.05$) effect on SC and FL. Meanwhile, BW, BL, SL, WBL, TL, CC and BAL had no significant ($P>0.05$) effect on rearing system in Bayang duck.

Table 3. Quantitative characteristics of extensively and intensively raised male Bayang ducks

Variables	Extensive			Intensive			Sign
	Min	Max	Mean	Min	Max	Mean	
BW (g)	1301.00	1735.00	1481.97±86.63	1201.00	1710.00	1499.88±134.03	ns
BL (mm)	54.20	70.20	59.33±2.82	55.10	76.00	61.30±5.24	ns
SL (mm)	48.80	56.20	52.56±2.13	48.90	68.00	53.93±4.70	ns
SC (mm)	40.00	60.00	50.86±4.77	40.00	70.00	56.88±8.48	*
WBL (cm)	30.00	38.00	32.16±2.05	30.00	39.00	32.16±2.65	ns
TL (mm)	46.20	53.10	49.49±1.54	45.00	52.80	49.31±2.26	ns
FL (mm)	47.80	54.10	51.42±1.27	49.60	63.20	54.00±4.01	*
CC (cm)	23.00	34.00	29.74±3.23	23.00	34.00	29.73±3.23	ns
BAL (cm)	30.00	37.00	32.38±2.12	30.00	39.00	32.20±2.57	ns

Data are presented as min, max, mean+SD or SE. CV=Coefficient of variation; BW= Body Weight, CC = Chest Circumference, BL= Beak Length , SL= Shank Length , SC= Shank Circumference , WBL= Wing Bone Length, FL= Femur Length , TL= Tibia Length, BAL= Back Length

Quantitative characteristics of extensively and intensively raised female Bayang ducks can be seen in Table 4. Table 4 shows that the maintenance system has no significant effect ($P<0.05$) on all quantitative traits.

Table 4. Quantitative characteristics of extensively and intensively raised female Bayang ducks

Variables	Extensive			Intensive			Sign
	Min	Max	Mean	Min	Max	Mean	
BW (g)	1021.00	1621.00	1414.43±128.21	1141.00	1720.00	1521.12±156.14	ns
BL (mm)	48.20	72.30	55.10±8.58	48.70	68.90	55.01±5.63	ns
SL (mm)	40.10	51.60	47.56±2.96	40.60	57.50	50.59±3.27	ns
SC (mm)	40.00	61.00	50.92±5.58	45.00	60.00	54.65±5.15	ns
WBL (cm)	28.00	35.00	30.76±1.60	30.00	32.50	31.10±1.03	ns
TL (mm)	45.00	50.90	48.34±1.70	45.20	51.80	49.48±1.42	ns
FL (mm)	36.00	54.60	42.70±6.20	38.90	56.20	45.38±6.39	ns
CC (cm)	17.00	30.00	25.97±2.43	25.00	31.50	28.48±2.20	ns
BAL (cm)	26.00	36.10	30.52±2.32	22.10	33.00	30.51±2.54	ns

Data are presented as min, max, mean+SD or SE. CV=Coefficient of variation; BW= Body Weight, CC = Chest Circumference, BL= Beak Length , SL= Shank Length , SC= Shank Circumference , WBL= Wing Bone Length, FL= Femur Length, TL= Tibia Length, BAL= Back Length

The intensive rearing system for ducks resulted in higher levels of triacylglycerol, total lipids, and blood and meat fat. However, ducks in intensive rearing system exhibited poorer growth rates and overall performance compared to those raised in the pool with yard production system (Inayat *et al.*, 2024). The growth performance of ducks in intensive rearing systems generally surpasses that of extensive rearing systems, although each system has distinct advantages. Research indicates that ducks raised in intensive system, such as net rearing systems and closed housing with yards, often achieve higher body weights and better feed conversion ratios compared to their free-range counterparts. However, free-range systems tend to enhance carcass traits and meat quality (Zhang *et al.*, 2018).

CONCLUSION

The conclusion of this study is that sex and rearing system affect the quantitative characteristics of Bayang ducks and the coefficient of variation of Bayang ducks is low to high.

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