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Correlation Between Body Weight and Carcass Weight in the Selection of Village Chicken Three-Generation

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ABSTRACT

This study aims to estimate the correlation between body weight and carcass weight in selected native chickens in the third generation (G3). The material used in this study was 200 DOC managed with a free-range system. The samples used to obtain carcass weight were determined by purposive sampling, consisting of 38 male chickens and 26 female chickens. The data obtained were analyzed using correlation and regression analysis. The observed variables were body weight (BW) at 2, 4, 6, 8, and 10 weeks of age (independent variable) and carcass weight (CW) at 10 weeks of age (dependent variable). The results showed that the average body weight (BW) of male and female chickens up to 6 weeks of age showed no significant difference ($P>0.05$). After eight weeks of age, the male free-range body weights were significantly different ($P<0.05$) higher than female chickens, while at the period of 10 weeks, the body weights of male chickens were significantly different ($P<0.01$) and showed higher than female chickens. Male chickens' average free-range carcass weight was significantly higher ($P<0.01$) than the carcass weight (CW) of female chickens. The correlation between body weight at 2, 4, 6, 8, and 10 weeks and carcass weight showed a close correlation, ranging from 0.71 to 0.97. The highest correlation coefficient values were found in male and female native chickens at ten weeks of age, with 0.94 and 0.97. It can be concluded that BW at 2, 4, 6, 8, and 10 weeks of age in male and female chickens strongly correlated with carcass weight (CW). Hence, body weight (BW) could be used as a selection criterion to increase chickens' carcass weight (CW) under study.

Keywords: native chicken, correlation, body weight and carcass weight

INTRODUCTION

Free-range chicken is native to Indonesia and has adapted to a tropical environment. Free-range chicken has several advantages, including a relatively easy maintenance system, disease resistance, and high selling value. Free-range chicken is highly adaptable, so it easily adapts to the environment. Free-range chickens have weaknesses, namely slow growth and low productivity. It is due to their traditional rearing system. The population and productivity of free-range chickens are decreasing due to uncontrolled mating patterns. No improvement has been made to the environment or the genetic quality of free-range chickens. In general, increasing the productivity of native chickens can be done by improving the environment and genetic quality. Improvement of gene quality can be made by selection and or crossing. Free-range chicken has a high level of phenotypic diversity caused by genetic and environmental diversity. Increased diversity is also advantageous because it improves genetic quality, such as selection.

Free-range chicken productivity can be assessed from several variables, including body weight at 2, 4, 6, 8, and 10 weeks of age and carcass weight. Live weight is the chicken's body weight, which is weighed after the chicken has fasted for 8 hours. Live weight is closely related to growth. Good growth produces a good life weight as well. High body weight indicates good growth because the nutrients in the ration can be used optimally for bone, meat, and fat gain.

The carcass is a part of the chicken body that is decisive in production. The carcass is the chicken's body weight after slaughter minus the head, legs, blood, feathers, and internal organs. High carcass weight indicates good carcass quality. Factors influence carcass quality before slaughter, including genetics, species, nation, type of livestock, sex, age, and feed (Fijana et al., 2012). Carcass production is related to body weight. According to Immamudin et al. (2012), a higher live weight causes higher carcass weight and vice versa, so body weight can be used as a selection criterion to estimate carcass weight. Selection can be made directly or indirectly on the selection criteria variables. Natural selection can be made on chicken body weight, while indirect selection can be made, for example, on carcass weight. Therefore, to increase carcass weight, it is necessary to look for characteristics

closely related to carcass weight, one of which is body weight.

Correlation is a method to determine the closeness of the relationship between two or more variables described by the magnitude of the correlation coefficient. The correlation coefficient is a coefficient that describes the degree of similarity of the relationship between two or more variables. The correlations between variables are given the values of the correlation coefficients (Djego et al., 2020)

This study aimed to estimate the correlation between body weight and carcass weight in native chickens from the third-generation selection.

MATERIALS AND METHODS

The material used in this study was 200 DOC of third-generation managed with a free-range system. The sample used to obtain carcass weight was determined by purposive sampling of 38 male and 26 female chickens. The research materials used were feed ingredients (Novo brand complete feed produced by Charoen Phokpand), medicines, and drinking water. The tools used in the study were cages, feeders, drinking bowls, incubators, knives, plastic, basins, digital scales, buckets, wood shavings (litter cages), and 25-watt lamps.

The method used in this study is the direct observation method, which is carried out by raising 200 free-range chickens. Maintenance starts from DOC until 10 weeks old. DOC is marked or numbered as an identity for observation during the study. Chickens are kept in battery cages with a wire base measuring 1 x 1 x 0.5 m 3, which are used to raise as many as 8 chickens. Feed and drinking water are provided as ad libitum. The feed given is the complete Novo brand feed produced by Charoen Phokpand.

Data was collected by weighing the chickens at 2, 4, 6, 8, and 10 weeks of age before considering the chickens fasted for 8 hours. This follows the opinion of Immamudin et al. (2012) that chickens fast for 8 hours to empty their digestive tract. Data was collected by weighing using a digital scale with an accuracy of 0.1 grams. Carcass weight was obtained by slaughtering the chickens at 10 weeks.

Observed Variables

The variables observed in this study were body weight aged 2, 4, 6, 8, and 10 weeks measured using digital scales with an accuracy of 0.1 gram and carcass weight aged 10 weeks.

Data analysis

The mean difference test (t-test) was used to see the average difference between body weight at 2, 4, 6, 8, and 10 weeks of age and carcass weight in male and female native chickens. The regression analysis used was multiple and partial linear regression analysis to see the relationship between body weight at 2, 4, 6, 8, and 10 weeks with carcass weight. Numerous and partial linear regression formulas according to (Gaspersz, 2001):

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 + \ldots\ldots + bn\,Xn$$

Information:
Y = Carcass Weight
b_0 = Constant
b_1 = The regression coefficient of body weight (X2)
$b_{2,3,4}$ = …….($X_{2,3,4}$)

Correlation analysis was used to see how close the relationship between body weight and carcass weight was. To estimate the value of the correlation coefficient (*r)* between the dependent variable (*Y)* and the independent variable (*X),* the formula is used:

$$r = \frac{n\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{\{n\Sigma x^2 - (\Sigma x)^2\}\ \{n\Sigma y^2 - (\Sigma y)^2\}}}$$

Information:
n = Number of X and Y data pairs
Σx = Total of Variable X
Σy = Total of Variable Y
Σx^2 = Total sum of the squares of Variable X
Σy^2 = Total sum of the courts of Y variables
Σxy= Total of the Multiplication of X and Y Variables
$(\Sigma x)^2$ = Square of the total number of variables X
$(\Sigma y)^2$ = Square of the total number of variables Y

RESULTS AND DISCUSSION

Body Weight and Carcass Weight

Average body weight and carcass weight of native chickens. The results of this study can be seen in Table 1.

Table 1. Average body weight and carcass weight of native chickens of various ages (Sunday)

Variable	Male	Female	combined
BB 2 Weeks (gr)	89.43±25.41	96.55±23.80	92.32±24.82
BB 4 Weeks (gr)	226.87±60.60	231.27±51.30	228.66±56.62
BB 6 Weeks (gr)	435.57±83.61	401.73±83.47	421.82±84.56
BB 8 Weeks (gr)	689.74±129.30^{a}	604.69 ± 124.29^{b}	655.19 ± 133.12^{c}
BB 10 Weeks (gr)	959.42±156.68^{A}	816.7±150.23^{B}	901.45±168.41^{C}
BK 10 Weeks (gr)	694.55±129.12^{A}	593.85±116.93^{B}	653.64±133.05^{C}

Note: BB = Body Weight, BK = Carcass Weight, and lowercase superscripts that are different in the same row mean significantly different (P<0.05) , and Superscripts that are different in uppercase letters are other in the same line very quite different (P<0.01)

Table 1 shows that the average body weight of native chickens in this study is higher than the results of several other studies. The average body weight of native chickens aged 4 and 8 weeks was 224.68 ± 41.09 grams and 605.53 ± 80.01 grams, respectively (Putri et al., 2021). The average body weight of native chickens 4 and 8 weeks of age, respectively, 224.68 ± 33.17 grams and 605.53 ± 60.98 grams (Irmaya et al., 2021). The average body weight of native chickens eight weeks old of 658.38 grams (Depison et al., 2022). The difference in body weight is thought to be due to environmental and genetic influences. This follows the opinion of Lapihu et al. (2019), which states that genetics and adaptability influence body weight.

The results of this study were lower than the body weights of several other chicken lines. The average body weight of Sentul chickens aged 4 and 8 weeks was 400.63 ± 37.37 grams and 781.63 ± 44.89 grams, respectively (Abdu et al., 2021). The body weight of Bangkok chickens aged 4 weeks was 387.43 ± 14.03 grams and 8 weeks 816.86 ± 8.59 grams (Wahyudi et al., 2022), the body weight of super free range chickens aged 4 weeks 349.47 ± 35.38 grams and 8 weeks 837.98 ± 68.97, the body weight of KUB chickens at 4 weeks of age was 235.64 ± 38.63 grams (Putri et al., 2021) and 8 weeks of age 755.39 ± 30.11 grams (Utama et al., 2021). Merawang chickens at the age of 4 weeks had a body weight of 291.65 ± 35.42 grams, and at 8 weeks, 647.78 ± 63.46 grams (Sari et al., 2021). The difference in body weight is thought to be due to genetic and environmental influences. This follows the opinion of Arianto et al. (2019) that several factors, including genetic and environmental factors, influence livestock growth.

The t-test results on the body weight of male and female native chickens at 2, 4, and 6 weeks of age showed no significant difference (P>0.05). After 8 weeks of age, the body weight of male native chickens was significantly different (P<0.05) higher than native chicken females, each of 689.74 ± 129.30 grams and 604.69 ± 124.29 grams, while at 10 weeks of age, the body weight of male free-range chickens was significantly different (P<0.01) higher than that of female native chickens, each of 959.42 ± 156.68 grams and 816.73 ± 150.23 grams. Average body weight Male native chickens in this study were higher than female native chickens due to hormonal differences, where male chickens have androgen hormones, namely testosterone, which plays a role in accelerating growth in male chickens (Pagala et al., 2018). There is a tendency for the weight of male DOC to be greater than female DOC or male chicken embryos to be heavier than female chicken embryos because male embryos have heavier skeletal muscles than females (Cheng et al., 2004).

The average carcass weight of male and female native chickens in this study was more significant when compared to that of Marsetyo et al. (2015), with an average carcass weight of 603.9 grams. Compared with the research of Ramdani et al. (2016), with an average weight of 647.95 ± 90.07, the results of this study are more significant. Differences in the environment, cage system, genetics, and the type of feed can cause these differences.

The t-test results on the carcass weight of male native chickens were significantly different (P<0.01) higher than the carcass weights of female native chickens, each of 694.55 ± 129.12 grams and 593.85 ± 116.93 grams. Live weight affects carcass weight, so a significant carcass weight, and vice versa, will also follow a sizeable live weight. This follows the opinion of Wahju (2015)that the final weight supports the high carcass weight as a result of the increase in the live weight of livestock. This is supported by the opinion of Daud et al. (2017) that if the body

weight gain is high, the final body weight and carcass weight will be greater.

Relationship Between Body Weight and Carcass Weight

Regression values between body weight and carcass weight of male and female native chickens and corrections at various ages can be seen in Table 2.

Table 2. Body weight and free-range carcass weight regression equation

Description	Variable	Equality
Male	General	$Y = -8.2 + 0.817 X_1 + 0.532 X_2 – 0.192 X_3 – 0.041 X_4 + 0.647 X_5$
	BB 2 MG-BK	Y = 314.0 + 4.255 X
	BB 4 MG-BK	Y = 294.0 + 1.766 X
	BB 6 MG-BK	Y = 119.0 + 1.321 X
	BB 8 MG-BK	Y = 74.8 + 0.8986 X
	BB 10 MG-BK	Y = -48.6 + 0.7746 X
Female	General	$Y = 5.0 + 0.000 X_1 – 0.102 X_2 – 0.096 X_3 + 0.658 X_4 + 0.310 X_5$
	BB 2 MG-BK	Y = 258.0 + 3.479 X
	BB 4 MG-BK	Y = 141.9 + 1.954 X
	BB 6 MG-BK	Y = 76.1 + 1.289 X
	BB 8 MG-BK	Y = 38.8 + 0.9180 X
	BB 10 MG-BK	Y = -20.5 + 0.7522 X
Female to male correction	General	$Y = -17.6 + 0.349 X_1 + 0.483 X_2 – 0.138 X_3 + 0.136 X_4 + 0.5605 X_5$
	BB 2 MG-BK	Y = 309.9 + 4.302 X
	BB 4 MG-BK	Y = 253.3 + 1.945 X
	BB 6 MG-BK	Y = 105.8 + 1.3517 X
	BB 8 MG-BK	Y = 61.6 + 0.9177 X
	BB 10 MG-BK	Y = -37.3 + 0.7628 X

Note: BB = Body Weight, BK = Carcass Weight, MG = Weeks, X 1 = body weight at 2 weeks, X 2 = body weight at 4 weeks, X 3 = body weight at 6 weeks, X 4 = body weight at 8 weeks, X 5 = body weight at 10 weeks

Based on Table 2 shows that in native chickens, male, female, and female-to-male correction have a relationship between body weight and carcass weight in general and partially. The partial regression equation shows a positive relationship between each variable and the response.

The regression analysis showed that free-range chicken body weight significantly affected ($P<0.01$) native chicken carcass weight at several age levels. The regression equation between body weight and carcass weight shows that every 1-gram increase in body weight will affect the growth in carcass weight by the coefficient. The greater the body weight, the greater the native chicken carcass weight. According to Ertina et al. (2021), the regression equation in the treatment without the addition of yellow corn is Y = 248.511+0.536X, which means that if the body weight increases by 1 gram, the carcass weight increases by 0.536 grams.

Table 3. Correlation and Determination of body weight and carcass weight Village Chicken

Description	Variable	Male		Female		combined	
		r	r^2	r	r^2	r	r^2
Free-range chicken	General	0.97	0.94	0.98	0.97	0.97	0.94
	BB 2 MG VS BK	0.84	0.70	0.71	0.50	0.78	0.61
	BB 4 MG VS BK	0.83	0.69	0.86	0.74	0.83	0.69
	BB 6 MG VS BK	0.86	0.73	0.92	0.85	0.88	0.78
	BB 8 MG VS BK	0.90	0.81	0.98	0.95	0.93	0.87
	BB 10 MG VS BK	0.94	0.88	0.97	0.93	0.95	0.91

Information: BB = Body Weight, MG = Week, BK = Carcass Weight

Based on Table 3, the body weight correlation coefficient of male and female native chickens aged 2, 4, 6, 8, and 10 weeks with the carcass weight of native chickens shows a high positive correlation. A high correlation coefficient means that the body weight of male

and female native chickens aged 2, 4, 6, 8, and 10 weeks is closely related to free-range chicken carcass weight. This follows the opinion of Ertina et al. (2021), which states that body weight is closely associated with carcass weight. The correlation coefficient value in this study is higher than that of research by Sari et al. (2021), which stated that the correlation coefficient value of body weight and carcass weight of broiler chickens with commercial feed was 0.673 grams.

The determination value (r2) is in Table 3. Shows that 94% of the variation in male body weight, 97% of the variation in female body weight, and 94% of the variation in body weight of female to male correction in native chickens is influenced by carcass weight. At the same time, the rest is caused by other factors that are not observed. Partially, the highest correlation value between body weight at 2-10 weeks and carcass weight was body weight at 10 weeks of age and carcass weight, with a correlation value of 94% for males, 97% for females, and 95% for females to male correction. This is presumably because, at each age level, there will be an increase in hormones that cause differences in growth. Genetically, development is controlled by several genes, including the growth hormone gene family (Pagala et al., 2018).

CONCLUSION

This study concludes that body weight at 2, 4, 6, 8, and 10 weeks of age in male and female native chickens strongly correlates with carcass weight, so body weight can be used as a selection criterion to increase carcass weight.

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