Buletin Peternakan 46 (4): 248-256, November 2022

ISSTAP
Indonesian Society for Sustainable Tropical Animal Production

Bulletin of Animal Science

ISSN-0126-4400/E-ISSN-2407-876X Accredited: 36a/E/KPT/2016
http://buletinpeternakan.fapet.ugm.ac.id/

Doi: 10.21059/buletinpeternak.v46i4.75810

Association of Quantitative Characteristics with Growth Hormone Gene (GH Gene) in Kerinci Duck Using PCR-RFLP Method

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Article history
Submitted: 28 June 2022
Accepted: 20 October 2022

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ABSTRACT

This study aims to determine the association of quantitative characteristics with growth hormone gene (GH gene) in kerinci duck using PCR-RFLP method. Samples total used was 96 Kerinci ducks consisting of 43 males and 53 females and 96 blood samples. DNA was extracted using the protocol Genomic DNA Purification Kit from Promega and then amplified by PCR using a pair of primers5'-CAA GGA ACA GAG GGT TTC CA-3' and Revers : 3'-GGG AGA TAG GGC AAA CAT CA-5', with a length of product 855 bp. The amplification product was cut using restriction enzyme AluI with the AG↓CT cutting site. Growth hormone/AluI fragments of Kerinci duck were electrophoresed using 1.5% agarose gel and visualized using doc gel. Data collected includes body weight, weight gain, body measurements, and blood of Kerinci ducks. The differences in body weight, body weight gain, and body measurements, as well as differences in body weight between genotypes were tested by T-test. The determinants of the size and shape of Kerinci duck were analyzed using PCA. This study showed that the body weight, weight gain, and body sizes of male Kerinci ducks were significantly different ($P<0.05$) than female Kerinci ducks. The Kerinci duck GH|AluI gene is polymorphic with three genotypes, i.e, +/+ of (49%), +/- of (39.6%), and -/- of (11.5%), and two alleles, namely (+) by 69% and (–) by 31%. Conclusion: body weight, weight gain, and body sizes of male Kerinci ducks were higher than female. The size identifier of male and female Kerinci ducks were sternum, shank lengh, and shank circumference, while shape identifier was wing length. GH Genes|AluI in Kerinci duck is polymorphic. GH gene |AluI of Kerinci ducks was associated with body weight, weight gain, and body measurements, and the best is the genotype (+/+).

Keywords: Association, Growth hormone, Kerinci duck, PCR-RFLP

Introduction

Indonesia is a country that has diverse genetic resources. The diversity of genetic resources owned by Indonesia is a germplasm that needs to be maintained. One of the germplasm that has the potential to be developed is ducks. Duck is a poultry that produces eggs and meat that can be consumed by the public. One of the efforts to preserve the Kerinci duck is to characterize the quantitative characteristics.

Quantitative characteristics can be used to determine the level of livestock productivity, identify, and determine the size and shape of chickens (Puteri *et al.*, 2020), as basic information on the genetic ability of livestock (Gultom *et al.*, 2021), in the context of sustainable genetic improvement (Assefa and Melesse, 2018). The quantitative characteristic parameters include body weight, weight gain, and body size (Sari *et al.*, 2021; Rahayu *et al.*, 2021; Wahyuni *et al.*, 2022). However, quantitative characterization for selection purposes to improve the genetic quality of livestock requires a longer time and a larger number of livestock.

Recent advances in molecular science have opened opportunities for effective, accurate and efficient selection programs because they are directly related to functional genes that play a role in meat growth and production. Molecular characterization can be used as an alternative in the selection program (Hasan *et al.*, 2021: Yang *et al.*, 2022). Selection can be made on characteristics that have economic value such as body weight, body weight gain and body measurements on structural genes. One of the genes that is the main and decisive gene in controlling growth and skeleton is the GH gene (Nova and Yurnalis, 2016).

The growth hormone gene is one of the genes associated with economically valuable traits (Asiamah *et al.*, 2020). Growth hormone genes control growth and play a role in body metabolism, which can be seen from body weight, body weight gain, and body measurements (Mazurowski *et al.*, 2015; Hidayati, *et al.*, 2016; Pagala *et al.*, 2018).

Growth hormone gene characterization can be used to determine livestock productivity. Identification of growth hormone gene is important to obtain initial information in knowing the properties of genes that affect livestock productivity (Yurnalis *et al.*, 2019). Identification and characterization of GH gene can be done by PCR-RFLP method.

PCR-RFLP is one of the methods developed to visualize differences in DNA levels based on the use of restriction enzymes which are enzymes that are able to cut DNA sequences at a certain point, where the diversity that appears is displayed through the bands formed by electrophoresis (Hidayati *et al.*, 2016; Mardiah *et al.*, 2021). However, the relationship between the diversity of the GH gene and body weight, body weight gain and body size is not widely known, even though the diversity of GH genes is indicated by the presence of polymorphisms at certain sites associated with GH gene expression in production traits. If the diversity of GH genes is related to the nature of production, this can certainly be used as a Marker Assisted Selection (MAS) tool (Kazemi *et al.*, 2018; Hosnedlova *et al.*, 2020).

Materials and Methods

The material in the field research used was 96 Kerinci ducks consisting of 43 male and 53 female as well as 96 bloods sample. The data collected included body weight at 3 and 4 months of age, body weight gain at 3-4 months of age, body size measurements at 4 months of age and genotype. Commercial feed produced by PT. Japfa Comfeed Indonesia Tbk, namely BR 1 for 0-1 months of age with an energy composition of 3020-3120 Kcal/kg, protein 22-23%, fat min 5%, Calcium min 0.9% and phosphor min. 0.6% and BR 2 for 1-4 months of age composition 4100 Kcal/kg, 20-21% protein, 5% fat min, 0.9% min calcium, and 0.6% min phosphorus. The equipment used is stationery instruments, digital calipers, digital scales with 4 kg capacity with 0.1 g accuracy, digital camera, tape measure, incandescent lamp, places to eat and drink, penoject tube, and syringe.

In laboratory research, the materials used are blood samples taken from Kerinci ducks aged four months, totalling 96 samples consisting 43 male and 53 female. The equipment used were 70% alcohol, cotton, protocol Genomic DNA Purification Kit from Promega, isopropanol, 70% ethanol, agarose powder, TBE Buffer solution, aquades, ethidium bromide (EtBr) staining, loading dye, DNA ladder, forward and reverse primers. Nuclease Free Water, Gotaq Green Mastermix, and the restriction Thermoscientific brand AluI. The equipment used is a digital scale, EDTA K3 vaculab, tube holder, disposable syringe size 3 ml, cool box, stationery, freezer for blood storage, oven, autoclave, micropipette 200 µl, 1000 µl, 100 µl, 20 µl, pipette tip Eppendorf (yellow, blue, white), Eppendorf microtube, microtube rack, centrifuge, Vortec, analytical balance, Erlenmeyer, measuring cup, gel doc, electrophoresis power supply, electrophoretic gel system, gel printer, well comb, mini spin centrifuge, electric heater, PCR machines, analytical balances, and water baths.

This research method is experimental. This research was carried out in two stages: in the field and the laboratory. Research in the area includes data collection of body weight, body weight gain, and body measurements of Kerinci ducks and taking blood samples of Kerinci ducks using a syringe in the axillary vein of the wing as much as 2-3 ml then put into a 3 ml EDTA tube. Blood samples were stored in a cool box for a while, after which the blood was held in a freezer before further processing. Research in the laboratory includes DNA extraction using the Genomic DNA Purification Kit from Promega. Electrophoresis using agarose 1.5% Ethidium Bromide at 100 volts for 60 minutes. The DNA extraction results will be visualized through UV light using Gel Doc. The primer used is 855 bp in length on Exon 4 with no access to GenBank AB158760.2. Primer Forward : 5'-CAA GGA ACA GAG GGT TTC CA-3' and Revers : 3'-GGG AGA TAG GGC AAA CAT CA-5'. PCR amplification using the BIO-RAD brand PCR machine. The amplification results can be seen by electrophoresis using 1.5% agarose, stained with Ethidium Bromide (EtBr) with a voltage of 100 volts for 60 minutes. The amplified PCR product was then cut with the AluI (*Arthrobacter luteus* I) restriction enzyme with the AG↓CT cutting site according to the gene locus. GH|. Gene restriction results AluI can be seen after electrophoresis using agarose stained with Ethidium Bromide (EtBr) at a voltage of 200 for 120 minutes. The genotype identification of each sample was determined based on the band cut's size and pattern, namely the band's length compared to the 1000 bp (DNA ladder) marker.

Data analysis

T-test, T2-*Hotelling*, and principal component analysis (PCA). The differences in body weight, body weight gain, and body size, as well as differences in body weight between genotypes were tested by t-test (Gaspersz, 2006). The vector of the mean body size of male and female Kerinci ducks was used T2-*Hotelling*. If the results were significantly different ($P<0.05$), then continued with Principal Component Analysis to determine the determinants of body size and shape of Kerinci ducks (Gaspersz, 2006).

Genotype and allele frequency. Frequency and alleles were calculated using the formula of Nei and Kumar (2000). Hardy-Weinberg principle (HW) is calculated by chi-square test (X^2)using the formula (Kaps and Lamberson, 2004), heterozygosity value was calculated using the formula Nei (1987), PIC was calculated using the formula Botstein *et al.* (1980).

Association of quantitative characteristics with the growth hormone gene. Associations of quantitative characteristics include

body weight, body weight gain and body size measurements with growth hormone gene obtained by grouping body weight, PBB, body size according to each genotype. Furthermore, it is analyzed using the average difference test (T test) (Gaspersz, 2006).

Results and Discussion

Average body weight and body weight gain of Kerinci ducks

Average body weight at ages 3 and 4 and body weight gain at 3-4 months of age for male and female Kerinci ducks can be seen in Table 2.

Based on Table 1 the average body weight of male and female Kerinci ducks aged three months was 1647.6±55.00 g and 1443.29±37.21 g, while the average body weight of male and female Kerinci ducks aged 4 months was 1761.10±60.49 g and 1523.37±55.12 g. The results of this study are higher than some other studies. The average body weight of male and female Leizhou Black ducks aged 3 months was 1.188.64±33.59 g and 1100.33±36.29 g, while the average body weight of male and female Leizhou Black ducks aged 4 months was 1258.69±34.61 g and 1235.00±37.00 g (Asiamah *et al.*, 2020). The average body weight of Alabio ducks aged 3 and 4 months was 1347.92±97.53 g and 1474.17±82.40 g (Setiyono and Bekti, 2019). The average body weight of male Domyati ducks aged 4 months was 1684.0 g (El-Deghadi *et al.*, 2022). This condition indicated that male and female Kerinci ducks aged 3 and 4 months had a relatively higher average body weight than several other duck lines.

The average body weight gain of male and female Kerinci ducks aged 3-4 months, respectively, was 132.10±72.36 g and 80.08±55.12 g. The results of this study are higher than several other studies, which state that the body weight gain of male and female Leizhou Black ducks aged 3-4 months, respectively, is 70.05 g and 134.67 g (Asiamah *et al.,* 2020), body weight gain in ducks Layers aged four months is 88.63±1.6 g (Daud *et al.*, 2019) Thus it can be stated that male and female Kerinci ducks aged 3-4 months have a relatively high body weight gain compared to other duck lines.

The results of the analysis of the average difference test showed that the average body weight at the age of 3 months and four months and the increase in body weight of male Kerinci ducks aged 3-4 months were significantly different($P<0.05$) higher than female Kerinci ducks. Differences in body weight and body weight gain in male and female Kerinci ducks are influenced by hormones. Pagala *et al.* (2017) stated that hormones affect the increase in body weight of male and female livestock. Furthermore, Syaifudin *et al.* (2015) noted that the body weight of male Alabio ducks is hevier than female because male Alabio ducks has androgen hormones. Soeparno *et al.* (2005) stated that male

Table 1. GH gene sequences in Kerinci Duck which can be accessed at GenBank No. AB158760.2.

Posisi segmen	Panjang (bp)	Nama Primer	Sekuen (5' 3')	Suhu *annealing*
3287-4141	855	GHD2- Fwd.	5' CAAGGAACAGAGGGTTTCCA 3'	60^0C
		GHD2-Rev.	3' GGGAGATAGGGCAAACATCA 5'	60^0C

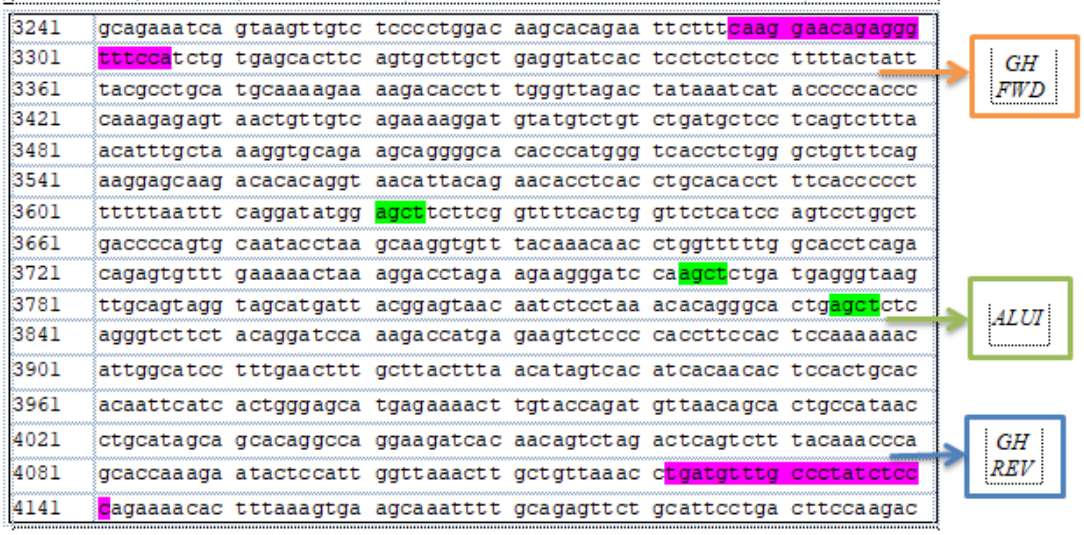

Table 2. Average body weight and body weight gain of male and female Kerinci ducks

Age (g)	Male	Female
Body weight at 3 months	1647.6±55.00[a]	1443.29±37.21[b]
Body weight at 4 months	1761.10±60.49[a]	1523.37±63.17[b]
Body weight gaint at 3- 4 months	132.10±72.36[a]	80.08±55.12[b]

[a,b] Different lowercase superscripts on the same line are significantly different ($P<0.05$).

cattle have testosterone as part of the steroid androgen group, produced in the testes of male cattle, so male livestock grow faster than female Livestock. Average body sizes of male and female Kerinci ducks at the age of 4 months can be seen in Table 3.

Average body measurements of Kerinci ducks, the male is higher than the female Kerinci Duck. The results of this study are not much different from several other studies, which state that male Mojosari ducks are higher in body size than female Mojosari ducks (Brahmantiyo*et al.*, 2003), Bali ducks (Tarigan*et al.,* 2015), Magelang ducks (Fatmarischa*et al.,* 2013). The T-test showed that the body size of male Kerinci ducks was significantly different (P<0.05) than female Kerinci ducks. This means that the body skeleton of male Kerinci ducks is bigger than that of female Kerinci ducks, which is thought to be caused by genetic factors. According to Sitanggang *et al.* (2016), the larger an animal's body frame, the more significant the increase in body size. Furthermore, Hikmawaty*et al.* (2014) stated that the difference in body size of livestock caused by the influence of genetic factors.

Analysis T2-*Hotteling* measurements and the main components of the body

Test analysis T2-*Hotteling thiss*tudy obtained a statistical value of 39321.66, an F value of 1835.941, and a P-value (0.01) of 0.047. Test analysisT2-*Hotteling* used to analyze between groups. These results indicate that the overall average body size in male Kerinci ducks was significantly different (P<0.01) than that of female Kerinci ducks. Putra *et al.* (2015) that differences in body size of livestock are caused by differences in genetic factors. Furthermore, according to Muzani*et al.*(2005) that differences in genetic factors cause differences in the body size of livestock. The average size and shape equation for male and female Kerinci ducks aged four months can be seen in Table 4.

Based on Table 4 three equations of body size values for male and female Kerinci ducks aged four months have a total diversity of 82.1% and 85.6%, respectively. This percentage is the highest proportion of diversity among the main components obtained. The highest eigenvectors obtained from the body size equation for male and female Kerinci ducks breastbone length (StL), shank length (SL), and shank circumference (SC).

Table 3. Average body sizes of male and female Kerinci ducks aged 4 months

Body sizes (mm)	Male ducks	Female ducks
BL	69.8±1.54[a]	57.4±2.5[b]
BW	28.2±1.25[a]	24.0±1.7[b]
HL	62.4±1.31[a]	56.9±2.2[b]
HH	47,4±1.30[a]	41.3±2.9[b]
NL	137.2±1.46[a]	128.8±3.1[b]
BL	239.8±6.73[a]	227.7±2.5[b]
StL	143.4±0.96[a]	136.3±2.1[b]
WL	269.3±4.38[a]	248.3±8.0[b]
FL	74.6±0.80[a]	64.0±0.9[b]
TL	85.4±0.94[a]	78.0±3.0[b]
TS	53.2±1.13[a]	47.7±1.4[b]
SC	42.5±0.86[a]	39.5±1.6[b]
TFL	68.1±1.05[a]	65.6±0.6[b]
CC	377.0±3.18[a]	355.2±3.9[b]
BL	521.0±10.72[a]	485.1±3.2[b]
HC	152.2±1.08[a]	146.6±2.1[b]
NC	90.2±1.01[a]	86.5±1.6[b]
TC	67.4±1.75[a]	64.5±0.7[b]

[a,b] Superscripts of different letters in the same line are significantly different (P<0.05).
BL = beak length, BW = beak width, HL = head length, Hh = head height, NL = neck length, BL = back length STL= sternum length, WI = wing length, Fl = femur length,TL = tibia lenght, PS = shank length, SC = shank circumference, TFL = third finger length, CC = chest circumference, BL = body length, HC= head circumference, NC = neck circumference, TC= tibia circumference.

Table 4. The equation of the size and shape of the 4-month-old Kerinci duck

Kerinci duck			Equation	KT (%)	Λ
Male	Body size	=	0,147 BL + 0,236 BW + 0,234 HL + 0,211 HH + 0,253 NL + 0,254 BaL+ **0,255 BrL** + 0,161 WL + 0,234 FL + 0,252 TL + **0,255 SL** + **0,255 SC** + 0,254 TFL + 0,242 CS + 0,238 BdL + 0,247 HC + 0,0,42 NC + 0,237 TC	82,1	14,8
	Body shape	=	-0,759 BL + -0,113 BW + 0,331 HL + -0,096 HH + 0,096 NL + 0,059 BaL + **-0,078 BrL** + **0,390 WL** + -0,012 FL + 0,132 TL + -0,133 SL + -0,137 SC + 0,104 TFL + 0,036 CS + 0,045 BdL + -0,040 HC + -0,168 NC+ 0,156 TC	5,7	1,02
Female	Body size	=	0,223 BL + 0,246 BW + 0,219 HL + 0,249 HH + 0,242 NL + 0,235 BaL+ **0,252 BrL** + 0,152 WL + 0,248 FL + 0,245 TL+ **0,250 SL** + **0,250 SC** + 0,239 TFL + 0,241 CS + 0,214 BdL + 0,239 HC + 0,232 NC + 0,249 TC.	85,6	15,4
	Body shape	=	-0,266 BL + -0,201 BW + -0,068 HL + -0,143HH + -0,258 NL + -0,131 BaL + **-0,100 BrL** + **0,483 WL** + -0,157 FL + 0,151 TL + **0,126 SL** + **0,150 SC** + 0,231 TFL + 0,267 CS + -0,422 BdL + 0,163 HC + 0,346 NC + -0,046 TC.	6,5	1,16

BL = beak length, BW = beak width, HL = head length, HH = head height, NL = neck length, BaL = back length, BrL = breastbonelength, WL =wing length, FL = femur length, TL = tibia length, SL = shank length, SC = shank lircumference, TFL = third linger length, CS = chest size, BL = body length, HC = head circumference, NC = neck circumference, LC = tibia circumference.

This means that the length of the sternum, shank length, and shank circumference are body size characteristics because they contribute most to the body size equation. The results of this study are different from the research of Muzani*et al.* (2005), which states that as a marker of body size in Cihaieup ducks are neck length, wing length, and chest circumference. The value of this equation is the proportion of the highest diversity among the main components obtained. The highest eigenvector obtained in the body shape equation of male and female Kerinci ducks is wing length (WL) which is a marker of body shape because it has the highest contribution to the equation of body shape. According to Suryana*et al.* (2014), the value of the size and high body shape equation can be used as a differentiating factor in livestock. Mahmudi *et al.* (2019) stated that genetic factors cause the animal size and body shape differences.

DNA extraction and growth hormone gene amplification

Produces clear and clean DNA bands without smears. Results of DNA extraction from Kerinci duck blood were 96 samples using the Genomic DNA Purification Kit from Promega. The DNA quality can be stated to be quite good, meaning that the DNA destruction (lysis) process and the separation between DNA and blood plasma are quite good. According to Hidayati *et al.* (2016), the DNA extraction process consists of three stages: destruction (lysis), separation, and purification of DNA. Fachtiyah *et al.* (2011) stated that the success of the DNA extraction process could be seen in the appearance of DNA bands. More details can be seen in Figure 1.

Remarks: numbers 1, 2, 3, ... 20 = individual samples.

Figure 1 shows that the DNA band extracted from Kerinci ducks looks clear but not too thick. According to Nova and Yurnalis (2016), pure DNA will be obtained if the purification process occurs ideally at the time of DNA extraction so that the DNA bands look clear and clean. Kamagi *et al.* (2017) stated that the primary purpose of DNA extraction is to obtain DNA with a high level of purity for successful experiments, especially in the DNA amplification process.

This primer was designed using primer 3 plus, located in exon 4 with a product length of 855 bp. The PCR method was carried out with an annealing temperature of 60°C for 45 seconds with 35 cycles. The following is the result of the amplification of the PCR product visualized by electrophoresis using 1.5% agarose with a product length of 855 bp and DNA leader 1000 bp. More details can be seen in Figure 1.

Genotype and allele

The results of cutting the growth hormone gene for Kerinci duck using the AluI restriction enzyme, which has been electrophoreticized using 2% agarose and ethidium bromide, can be presented in Figure 2. The results of this restriction obtained three genotypes, namely (+/+), (+/-), and (-/-). The genotype and allele frequencies were identified from genotype identification through PCR-RFLP assay using the AluI with cut-off point (AG↓CT).

The gene in Kerinci ducks, namely: +/+, +/- and -/- with genotype frequency +/+ (49%), +/- (39.6%) and -/- (11.5%) with allele frequency (+) by 69% and (-) by 31%. The results showed that the growth hormone gene of Kerinci duck was polymorphic. According to Allendorf*et al.* (2013) proposes that populations may be classified as polymorphic if there are more than one allele at the locus and if the most common allele frequencies are less than 0.99. Furthermore, Nei and Kumar (2000) stated that a gene will be polymorphic if one of the allele frequencies is less than 0.99. The results of this study are not much different from those of Novaand Yurnalis (2016) that in Sikumbang Janti ducks, the allele frequency (+) is higher than the allele frequency (-).

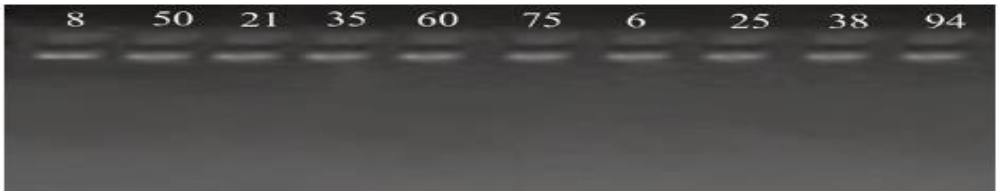

Figure 1. The results of electrophoresis of Kerinci duck DNA.

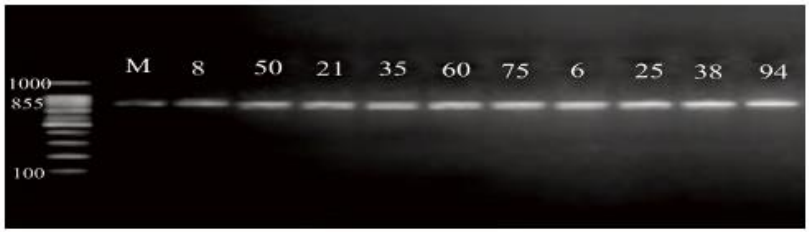

Figure 2. The results of electrophoresis of PCR.

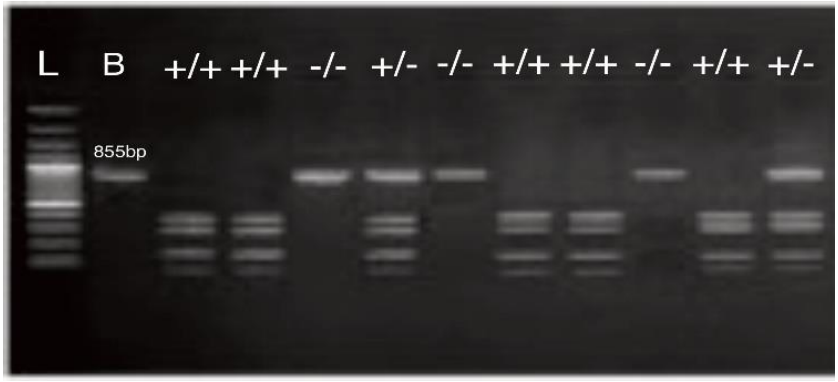

Figure 3. Gene for the AluI GH cutting enzyme AluI.

Hardy-Weinberg principle

Based on the Table. The results of the chi-square test analysis show that X^2count (0.596) > X^2table 0.05 (3.84), Kerinci duck mating in this study occurred randomly, meaning that the Kerinci duck population was in Hardy Weinberg principle. Mulliadi and Arifin (2010) stated that the genetic variation in a population will remain constant from one generation to the next in the absence of disturbing factors.

Mulliadi and Arifin (2010) noted that the balance of the livestock population occurs if the marriage is not regulated or the marriage opportunities between males and females are equal.

Heterozygosity

Heterozygosity is a parameter used to measure the level of genetic diversity in a population-based on allele frequencies at each locus; according to Mulliadi and Arifin (2010), the value of heterozygosity is one of the parameters that can be used to measure the level of genetic diversity in a population. The heterozygosity value of growth hormone genes in Kerinci ducks can be seen in Table 5. Table 5 above shows that the observed value (H0 = 0.395) < the expected value (He = 0.432). This condition indicates that the Kerinci duck population belongs to a relatively moderate level of diversity. This is under the opinion of Wang *et al.* (2015), which states that if the observation value is smaller than the expected value, the population is included in a relatively distant kinship.

Polymorphic information content (PIC)

The PIC value of the GH|AluI. Gene AluI is shown in Table 4. The PIC value of the growth hormone gene is 0.383; this value is included in the medium category. This value is quite informative as a marker for the GH|AluI. Gene fragment AluI. Estimation of the PIC value is one of the parameters to determine the level of information of an identifier used with criteria if the PIC value is 0.25 in the low category, 0.25 – 0.50 in the medium category, and > 0.5 in the high class (Botstein *et al.,*1980). Furthermore, Puja *et al.* (2013) stated that a reasonably high PIC value indicated that the sample population was very heterogeneous and indicated that there was little selection for specific characteristics, while a small PIC value suggested that the sample population was very homogeneous and indicated a choice for particular traits.

Association of growth hormone genes with a BW4, BWG3-4 months, and BM determining and determining the shape

Average body weight, body weight gain and breastbone length, shank length, shank circumference, and wing length. Various genotypes in Kerinci ducks aged four months and growth hormone genes using the PCR-RFLP method can be seen in Table 5.

Based on Table 5, the average body weight at the age of 3 and 4 months, the increase in body weight during 3-4 months, and the body measurements at the period of 4 months with the +/+ genotype were higher than the +/- and -/- genotypes. The results of this study are not much different from the research of Nova and Yurnalis (2016) that the body weight of Sikumbang Janti duck with the (+/+) genotype is higher than the +/- and -/- genotypes. The results of the analysis of the average difference test showed that the average body weight, body measurements, and body weight gain of 3-4-month-old Kerinci ducks on the GH growth hormone gene |AluI genotype +/+ significantly different (P<0.05) higher than genotype +/- and -/-. This means that the GH gene genotype ++ has body weight, body measurements, and body weight gain than other

Table 5. Frequency, allele, Hardy-Weinberg (HW) balance test, and PIC (*polymorphic information content*)

Line Locus	N	Genotype	Frequency genotype	Allele frequency	X^2 count	H_0	H_e	PIC value
Kerinci Ducks - AliExpress GH AluI	96	+/+	0.490	69%	0.596	0.395	0.432	0.383
		+/-	0.396					
		-/-	0.115	31%				

Based on the Table 3 there are three genotypes that arise from the growth hormone.

genotypes. Research resulted by Yurnalis *et al.* (2019) in Bayang ducks showing a link or association between the gene TSCA with body weight, body weight gain, and body measurements, with body weight. The GH gene in Poland in Pekin and Mulard ducks is associated with body sizes, and the GH gene in Pekin ducks is associated with body weight gain (Mazurowski *et al.,* 2015). These results indicate an association between the GH|AluI with body weight, body weight gain, and body sizes of male and female Kerinci ducks, so that it can be used as a basis for selection in the framework of the Kerinci duck breeding program in the future.

Conclusions

Based on the results and discussion, it can be concluded that: 1) Body weight, body weight gain, and body size of male kerinci ducks were higher than female kerinci ducks. 2) Characteristics of the size of the male and female Kerinci ducks were the length of the sternum, the length of the shank, and the circumference of the shank, while the identifier of the shape was the length of the wings. 3) GH genes | AluI in Kerinci duck is polymorphic. 4) GH gene |AluI of Kerinci ducks was associated with body weight, weight gain, and body measurements, and the best is the genotype (+/+).

Acknowledgment

Thank you to the Faculty of Animal Husbandry, Jambi University, and the Faculty of Animal Husbandry, Andalas University, who have facilitated the research. Thanks to the Kerinci Duck Breeders in Koto Majidin, who have helped facilitate the collection of duck blood in the field. The authors would like also to thank the teammates who helped complete this research.

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