

Response of Egg Number to Selection of Different Genotypes of 24-bp Insertion-Deletion Locus in the Promoter of Prolactin Gene of Papua Local Chickens

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Abstract. This study aims to estimate the response of the number of eggs produced up to 240 days of age (EN₂₄₀) to the selection of Papua local chickens (PLC) with different genotypes from the 24-bp Indel cPRLp locus. A total of 68 PLCs were taken randomly from several breeders in Manokwari as the basic population for selection (G0). Genotype identification of the 24-bp Indel cPRLp locus was performed G0. Based on the distribution of these genotypes, mating pairs were randomly formed G0-II, G0-DD and G0-ID to produce G1-II, G1-DD, and G1-Control (G0-ID offspring). Heritability of EN₂₄₀ in G1-II and G1-DD populations were estimated in full-sib (single pairs mating). Individual selection based on breeding value EN₂₄₀ was carried out on G1-II (♀) and G1-DD (♀) to form the selection generation (GS): GS-II (♀) and GS-DD (♀). Selection was also carried out on G1-II (♂) and G1-DD (♂) based on body weight at 240 days (BW₂₄₀) to become selected GS-II (♀) and GS-DD (♀) mating partners. GS-Control was also formed through 25% random sampling from G1-Control (♂ and ♀). GS mating resulted in the second generation (G2): G2-II, G2-DD, and G2-Control. Age at first laying (AFL), EN₂₄₀, and mean egg weight (EWA) in hens of G1, GS, and G2 were recorded. Response to selection for EN₂₄₀ was calculated by two methods predicted selection response (Rp) and actual selection response (Rr). Both methods of calculation yield positive and high values. In actual response (Rr), PLC in II genotypes group are more responsive to the selection treatment than DD genotype group. Selection increase EN₂₄₀ impact accelerate of AFL and lower the EWA, because of their negative genetic correlation.

Keywords: Papua local chickens, a 24-bp Indel/cPRLp locus, egg number, response to selection

Abstract. Penelitian ini bertujuan untuk memperkirakan respon jumlah telur yang dihasilkan hingga umur 240 hari (EN₂₄₀) terhadap seleksi ayam lokal Papua (PLC) dengan genotipe yang berbeda dari lokus cPRLp Indel 24-bp. Sebanyak 68 PLC diambil secara acak dari beberapa *breeder* di Manokwari sebagai populasi dasar seleksi (G0). Identifikasi genotipe lokus cPRLp Indel 24-bp ditunjukkan sebagai G0. Berdasarkan sebaran genotipe tersebut, pasangan kawin secara acak membentuk G0-II, G0-DD dan G0-ID untuk menghasilkan G1-II, G1-DD, dan G1-Control (keturunan G0-ID). Heritability of EN₂₄₀ in G1-II and G1-DD populations were estimated in full-sib (single pairs mating). Heritabilitas EN₂₄₀ pada populasi G1-II dan G1-DD diperkirakan bersaudara penuh (kawin berpasangan tunggal). Seleksi individu berdasarkan nilai pemuliaan EN₂₄₀ dilakukan pada G1-II (♀) dan G1-DD (♀) untuk membentuk generasi seleksi (GS): GS-II (♀) dan GS-DD (♀). Seleksi juga dilakukan pada G1-II (♂) dan G1-DD (♂) berdasarkan berat badan pada 240 hari (BW₂₄₀) untuk menjadi pasangan kawin terpilih GS-II (♀) dan GS-DD (♀). GS-Control juga dibentuk melalui 25% *random sampling* dari G1-Control (♂ dan ♀). Hasil perkawinan GS menghasilkan generasi kedua (G2): G2-II, G2-DD, dan G2-Control. Usia saat pertama bertelur (AFL), EN₂₄₀, dan rata-rata berat telur (EWA) pada ayam G1, GS, dan G2 dicatat. Respon terhadap seleksi untuk EN₂₄₀ dihitung dengan dua metode respon seleksi prediksi (Rp) dan respon seleksi aktual (Rr). Kedua metode perhitungan tersebut menghasilkan nilai positif dan tinggi. Pada respon aktual (Rr), PLC pada kelompok genotipe II lebih responsif terhadap perlakuan seleksi dibandingkan dengan kelompok genotipe DD. Seleksi meningkatkan EN₂₄₀ berdampak mempercepat AFL dan menurunkan EWA, karena korelasi genetik yang negatif.

Kata kunci: ayam lokal papua, lokus 24-bp Indel/cPRLp, jumlah telur, respon seleksi

Introduction

Papua local chickens (PLC) are phenotypically no different from native chickens found in various regions in Indonesia. However, the

genetic constitution of the PLC population is thought to contain genes derived from superior laying hens from the Australorp and Barred Plymouth Rock breeds that were ever cultivated by a research institute in Manokwari during the

Dutch colonial period (Kilmaskossu, 2010: Personal Communication).

In general, PLC is the same as other native chickens, which has broodiness behaviour. Broodiness or incubation behaviour occurs when the secretion of the hormone prolactin in the body increases (Alipanah et al., 2011), which causes ovary regression (Sharp et al., 1984) and ends egg-laying activity (Sockman et al., 2000), which in turn decreases egg production (Reddy et al., 2002). According to the observations of Tri-Yuwanta et al. (2002), breeders usually bathe hens that show incubation behaviour and then dry them in the sun for 3-5 consecutive days, and 10-15 days later, the hen will lay eggs again. Such practice allows the hens to lay more eggs in about 9-10 egg production cycles per year (Tri-Yuwanta et al., 2002).

With the development of molecular biology techniques today, it is very possible that the brooding behavior of PLC can be permanently eliminated. Genetically, chicken prolactin (cPRL) is encoded by a gene (Miao et al., 1999; Au and Leung, 2000). The 24-bp InDel (Insertion-Deletion) mutation that occurs at the -358 site in the prolactin gene promoter region causes the cPRL gene to be unable to express its products and results in absence of the brooding behavior, causing the number of eggs produced to increase (Cui et al., 2006; Begli et al., 2010; Rashidi et al., 2012).

With the PCR technique using a pair of primers: forward, 5'-ttt-aat-att-ggt-ggg-tga-aga-gac-a-3', and reverse, 5'-atg-cca-ctg-atc-ctc-gaa-aac-tc-3' (Cui et al., 2006) in PCR conditions: initial denaturation of 94°C 5 minutes, continued with 35 cycles of amplification (denaturation of 94°C 30 seconds, annealing 54°C 30 seconds, extension 72°C 30 seconds), and final extension 72°C 5 minutes, three genotypes of the 24-bp InDel/cPRLp locus were found on PLC: II (Insertion Insertion), ID (Insertion-Deletion), and DD (Deletion-Deletion) (Mu'in and Lumatauw, 2018). The II genotype

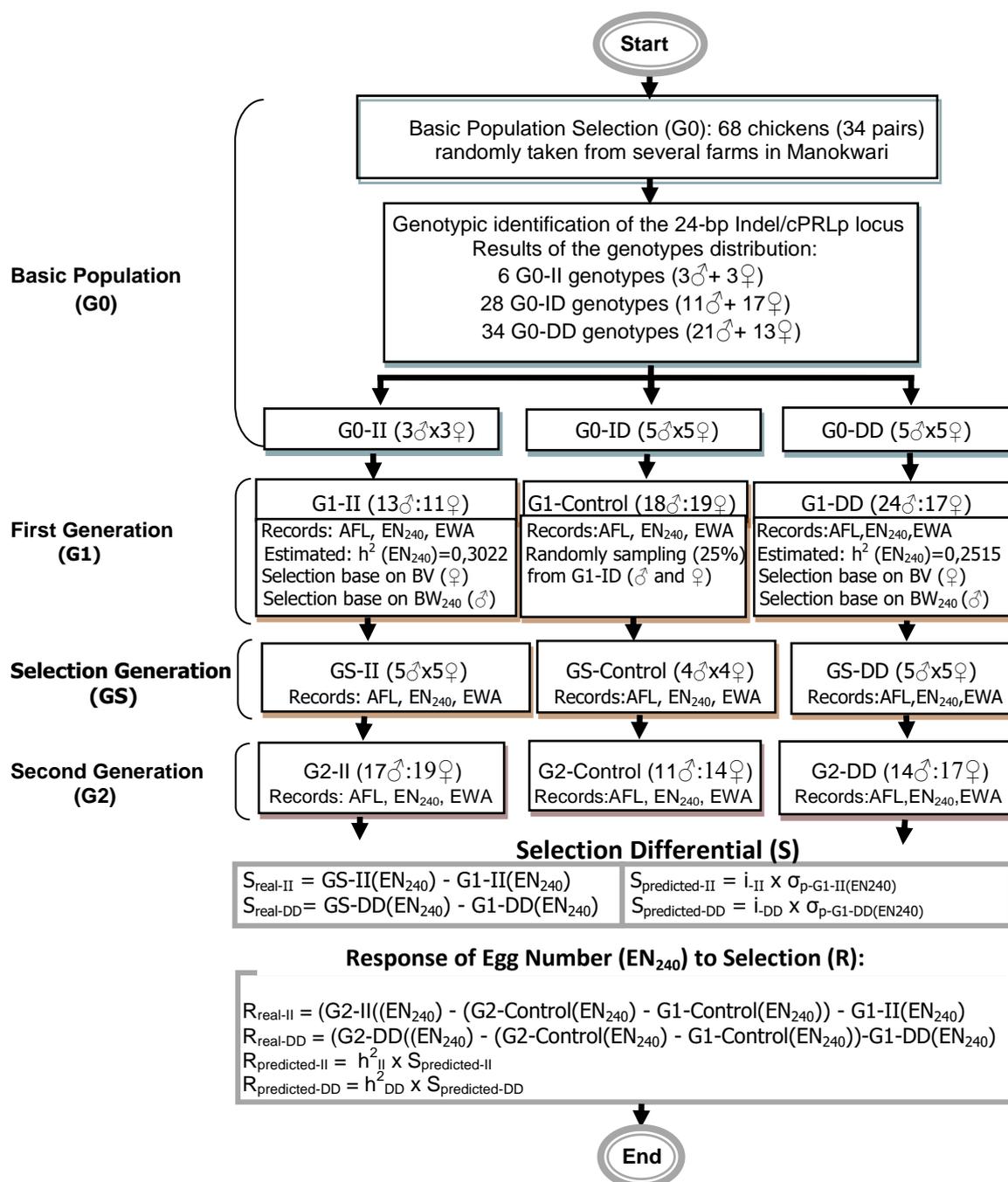
chickens can reduce cPRL expression so that it does not have incubation behavior (Jiang et al. 2005), and the presence of the I-allele in chickens has a positive impact on the number of eggs produced (Cui et al., 2006; Begli et al., 2010; Rashidi et al., 2012).

This finding raises the hope that the problem of incubation behavior in PLC can be eliminated permanently, and that superior PLC in laying eggs can be realized in the future through the selection of increased egg numbers on PLC based on the 24-bp InDel marker in the promoter region of prolactin gene. The selection method is the right method to be applied to local chickens because it can improve the desired traits while maintaining the purity of the local chickens. Application of "Marker Assisted Selection (MAS)" can accelerate genetic improvement, because this selection method is free from environmental effects, can be applied to livestock as early as possible, and is not limited to specific sex (Smith and Brascamp, 1990). This study aims to determine the differences in the response of the egg number to the selection treatment on PLC of II and DD genotypes from the 24-bp InDel locus in the promoter region of prolactin gene.

Materials and Methods

This research was conducted at the Experimental Farm, Faculty of Animal Science, University of Papua, Manokwari, West Papua Province, Indonesia. The study lasted from Maret 2018 to November 2020. The flow chart of research activities is presented in Figure 1.

A total of 68 (34 pairs) Papua local chickens were taken randomly from several farms in the Manokwari region, West Papua Province, Indonesia, and were used in this study as the baseline population for selection (G0). Identification of the 24-bp InDel cPRLp locus genotype by PCR technique on G0 has been carried out in previous studies (Mu'in and Lumatauw, 2018).



Information:

AFL = Age of first egg laying (day); EN₂₄₀ = Egg number to 240 days of age (egg); EWA = Egg weight average to 240 days of age (g/egg); BV = Breeding value; BW₂₄₀ = Body weight at 240 days; S_{realized-II} = realized differential selection of II-genotype group; S_{realized-DD} = realized differential selection of DD-genotype group; S_{predicted-II} = predicted differential selection of II-genotype group; S_{predicted-DD} = predicted differential selection of DD-genotype group; i_{II} = selection intensity of II-genotype group; i_{DD} = selection intensity of DD-genotype group; $\sigma_{p\text{-G1-II}}(EN_{240})$ = deviation standard of EN₂₄₀ in G1-II group; $\sigma_{p\text{-G1-DD}}(EN_{240})$ = deviation standard of EN₂₄₀ in G1-DD group; R_{realized-II} = realized response of egg number (EN₂₄₀) to selection in II-genotype group; R_{realized-DD} = realized response of egg number (EN₂₄₀) to selection in DD-genotype group; R_{predicted-II} = predicted response of egg number (EN₂₄₀) to selection in II-genotype group; R_{predicted-DD} = predicted response of egg number (EN₂₄₀) to selection in DD-genotype group; h²_{II} = heritability of EN₂₄₀ trait of II-genotype group; h²_{DD} = heritability of EN₂₄₀ trait of DD-genotype group.

Figure 1. Flowchart of Research Activities

The results of genotypic identification were found 6 chickens (3♂: 3♀) G0-II, 34 chickens (21♂: 13♀) G0-DD, and 28 chickens (11♂: 17♀) G0-ID. Based on the distribution of the G0 genotypes found, done formation randomly 3 pairs of G0-II mated group, 5 pairs of G0-DD mated group, and 5 pairs of G0-ID mated group.

The mating of G0 produced the first generation (G1): the G1-II (13♂: 11♀), G1-DD (24♂: 17♀), and G1-control (18♂: 19♀). G1-control is the offspring of G0-ID. The G1 chicks were kept in a brooder for 30 days, then kept in a rearing cage for 90 days, wing tagged and sexed. Furthermore, females reared in individual cages, recorded the age at first laying eggs (days), the number of eggs produced (eggs) to the age of 240 days (EN₂₄₀), and the average egg weight (g) of EN₂₄₀. Meanwhile, males are kept in limited yards and weighed at age 240 days (BW₂₄₀). During the maintenance of chickens are given commercial chicken feed with a protein content of 20%.

In population G1 (♀), the heritability of EN240 was estimated based on full-sib data analysis. The variance component to estimate the h² value was obtained from analysis of variance (unidirectional pattern) and the separation of variance components for single pair mating (Becker, 1975). The estimation results of h² ± SE (EN240) for G1-II, G1-DD, and G1-control were 0.3022 ± 0.2002; 0.2515 ± 0.1180; and 0.3429 ± 0.1233, respectively. Furthermore, individual selection was carried out based on breeding values (EN240) above the average, both in G1-II (♀) and G1-DD (♀), to form the selection generation: GS-II (♀) and GS-DD (♀). The breeding value (BV) of EN240 in individual G1 (♀) was calculated using the formula (Hardjubroto, 1994):

$$BV = hj2 (P_{ij} - Pr_j)$$

Where:

P_{ij}: EN240 the i-th individual in the j-th genotype group;

Pr_j: mean EN240 r-th in the j-th genotype group;

h_j²: heritability of EN240 in the j-th genotype group.

Meanwhile, the selection of G1 (♂) to become a mated partner G1 (♀) was selected in a certain genotype group based on body weight at 240 days (BW₂₄₀) above the average of the genotype group. In addition, GS-control was also formed by taking 25% of chickens randomly on G1-control (♂ and ♀).

Based on the individual selection method above, GS-II (5 pairs) and GS-DD (5 pairs), as well as GS-control (4 pairs) were formed. The selection generation (GS) is formed to produce the second generation (G2). The GS that is formed is placed in a mated cage. The resulting eggs were collected for 2 x 10 days, then hatched. The eggs that hatch are G2, which consists of G2-II (17♂: 19♀), G2-DD (14♂: 17♀), and G2-Control (11♂: 14♀). The G2 chickens were reared in a brooder for 30 days, then kept in a rearing cage for 90 days, given an identity (wing tag) and were sexed. Furthermore, for females reared in individual cages, the age at first laying eggs (days), EN240 (eggs), and the average egg weight (g) was recorded from EN240. Commercial chicken feed with a protein content of 20% is provided during maintenance.

In this study, actual and predicted of response of egg number (EN240) to selection were calculated (Hardjubroto, 1994).

Actual Selection Response (see Figure 1)

$$S_{\text{actual-II}} = EN_{240}(\text{GS-II}) - EN_{240}(\text{G1-II})$$

$$S_{\text{actual-DD}} = EN_{240}(\text{GS-DD}) - EN_{240}(\text{G1-DD})$$

$$R_{\text{actual-II}} = (EN_{240}(\text{G2-II}) - (EN_{240}(\text{G2-Control}) - EN_{240}(\text{G1-Control}))) - EN_{240}(\text{G1-II})$$

$$R_{\text{actual-DD}} = (EN_{240}(\text{G2-DD}) - (EN_{240}(\text{G2-Control}) - EN_{240}(\text{G1-Control}))) - EN_{240}(\text{G1-DD})$$

Where:

$S_{\text{actual-II}}$ = actual differential selection of II-genotype group;

$S_{\text{actual-DD}}$ = actual differential selection of DD-genotype group;

EN_{240} (GS-II)= egg number to 240 days of age (egg) of GS-II group;

EN_{240} (G1-II)= egg number to 240 days of age (egg) of G1-II group;

EN_{240} (GS-DD)= egg number to 240 days of age (egg) of GS-DD group;

EN_{240} (G1-DD)= egg number to 240 days of age (egg) of G1-DD group;

$R_{\text{actual-II}}$ = actual selection response of egg number (EN_{240}) of II-genotype group;

$R_{\text{actual-DD}}$ = actual selection response of egg number (EN_{240}) of DD-genotype group;

EN_{240} (G2-II)= egg number to 240 days of age (egg) of G2-II group;

EN_{240} (G2-DD)= egg number to 240 days of age (egg) of G2-DD group;

EN_{240} (G2-Control)= egg number to 240 days of age (egg) of G2-Control group;

EN_{240} (G1-Control)= egg number to 240 days of age (egg) in G1-Control group;

EN_{240} (G1-II)= egg number to 240 days of age (egg) of G1-II group;

EN_{240} (G1-DD)= egg number to 240 days of age (egg) of G1-DD group;

Predicted Selection Response

$$S_{\text{predicted-II}} = i_{\text{II}} \times \sigma_{p(\text{G1-II})}$$

$$S_{\text{predicted-DD}} = i_{\text{DD}} \times \sigma_{p(\text{G1-DD})}$$

$$R_{\text{predicted-II}} = h_{\text{II}}^2 \times S_{\text{predicted-II}}$$

$$R_{\text{predicted-DD}} = h_{\text{DD}}^2 \times S_{\text{predicted-DD}}$$

Where:

$S_{\text{predicted-II}}$ = predicted of differential selection of the II-genotype group;

$S_{\text{predicted-DD}}$ = predicted of differential selection of the DD-genotype group;

i_{II} = selection intensity of the II-genotype group;

i_{DD} = selection intensity of the DD-genotype group;

$\sigma_{p(\text{G1-II})}$ = deviation standard of EN_{240} in G1-II group;

$\sigma_{p(\text{G1-DD})}$ = deviation standard of EN_{240} in G1-DD group;

$R_{\text{predicted-II}}$ = predicted of response of egg number (EN_{240}) to selection in II-genotype group;

$R_{\text{predicted-DD}}$ = predicted of response of egg number (EN_{240}) to selection in DD-genotype group;

h_{II}^2 = heritability of EN_{240} trait of the II-genotype group;

h_{DD}^2 = heritability of EN_{240} trait of the DD-genotype group.

Results and Discussion

The results of recording the age at first laying eggs (days), egg number to 240 days of age (eggs) and egg weight average (g/egg) produced during the period from first laying to the age of 240 days in the first generation (G1), the selection generation (GS), and the second generation (G2), are shown in Table 1.

The results of statistical analysis showed that the differences in the genotype group of the research chickens in G1 and G2 had a significant effect ($P < 0.05$) on AFL, EN_{240} , and EWA. In G2, it was found that EN_{240} on G2-II was higher ($P < 0.05$) than EN_{240} on G2-DD and EN_{240} on G2-control. However, EN_{240} on G2-DD was not different ($P > 0.05$) with G2-control. This shows that the selection for increasing the number of eggs in chicken II-genotype have a higher response than the same selection applied to chicken DD-genotype. This is in accordance with the opinion of Sartika (2005) who states that if the genotype selection of the prolactin promoter as a genetic marker (MAS) is carried out in native chickens in the basic population, the response to egg production selection will be faster and more accurate.

Table 1. Average age of first egg laying (AFL), egg number to 240 days of age (EN₂₄₀) and egg weight average (EWA) to 240 days of age in Papua local chickens

Genotype Group/ Generation	n	AFL (day)	CV (%)	EN ₂₄₀ (egg)	CV (%)	EWA (g/egg)	CV (%)
1. 1 st generation (G1)							
G1-II	11	145,2±3,6 ^a	2,5	41,1±3,4 ^a	8,3	35,8±3,6 ^a	10,1
G1-DD	17	149,9±5,6 ^b	3,7	38,2±4,7 ^{ab}	12,3	40,4±3,6 ^b	8,9
G1-control	19	151,0±5,1 ^b	3,4	36,6±4,8 ^b	13,1	41,0±2,9 ^b	7,1
2. Selection generation (GS)							
GS-II	5	143,2±4,3 ^a	3,0	44,0±1,0 ^a	2,3	34,2±1,7 ^a	5,0
GS-DD	5	144,8±3,6 ^a	2,5	43,6±2,7 ^a	6,2	36,2±1,6 ^{ab}	4,4
GS-control	4	151,5±6,9 ^a	4,5	36,0±5,7 ^b	15,8	40,5±4,1 ^b	10,1
3. 2 nd generation (G2)							
G2-II	19	145,3±3,2 ^a	2,2	43,4±2,6 ^a	6,0	35,6±2,3 ^a	6,6
G2-DD	17	147,5±3,2 ^{ab}	6,7	40,0±2,8 ^b	7,0	38,3±3,2 ^{ab}	8,3
G2-control	14	150,9±5,5 ^b	3,6	37,4±4,0 ^b	10,7	40,7±3,9 ^b	9,6

Different superscripts in the same column and serial number indicated a significant difference (P <0.05). G1-II: offspring from the results mating basic population II ♂ x II ♀; G1-DD: offspring from the results mating basic population DD ♂ x DD ♀; G1-control: offspring from the results mating basic population ID ♂ x ID ♀; GS-II: Selected generation from G1-II; GS-DD: Selected generation from G1-DD; GS-control: Papua local chickens group were take 25% random sample of from G1-control; G2-II: GS-II offspring; G2-DD: GS-DD offspring; G2-control: GS-control offspring.

Research by Bagheri et al. (2013) found a significant relationship between the genotype at the 24-bp InDel/cPRLp locus and egg production of local chickens in Iran and supports the results of this study. According to his report, the number of eggs produced (%) of local chickens in Iran with II, ID and DD genotypes were 52.03 ± 1.0^a, 48.78 ± 1.0^a, and 34.38 ± 1.7^b, respectively. The results of the study by Bagheri et al. (2013) put II-genotype chickens in the position of the highest egg producer and chicken with DD-genotype in the lowest position. When compared with the results of this study, it can be seen that the selection of increasing the number of eggs carried out in II and DD-genotypes chickens still positions the genotyped II chickens in a position that produces a higher number of eggs compared to the DD-genotype chickens.

In Table 1, it can be seen that EN₂₄₀ in G2 still has a relatively high coefficient of variation, both in G2-II and G2-DD. However, the coefficient of variation in G2 is lower than G1. The decrease in the coefficient of variation is more contrasted when the two chickens groups (G2-II and G2-DD) are compared to a control

chickens group of the same generation (G2-control). This shows that selection is able to reduce EN₂₄₀ variations in the two selected genotype groups (G2-II and G2-DD).

The high and low of egg number (EN₂₄₀) in the research chickens in all genotype groups in all generations were seen to have an impact on the age at first laying eggs (AFL) and egg weight average (EWA) (Table 1). Both phenotypic and genetic correlations between the three traits are thought to have occurred in this study. This is a common phenomenon in poultry and has been widely reported by researchers. Hu et al. (2004) stated a negative genetic correlation between the age at first laying of eggs and the number of eggs produced on selected Muscovy ducks in Taiwan. Francesch et al. (1997) also reported a negative genetic correlation between egg number and egg weight in three Catalan breeds, namely Penedesenca Negra, Prat Leonada Empordanesa Roja. Realizing this phenomenon, it is important to consider the selection of an increase in egg number at an optimum point where the weight of the eggs produced is still acceptable for consumers.

Table 2. Selection Response of the egg number to 240 days of age (EN₂₄₀) in Papua lokal chickens

Genotype group	h^2 (EN ₂₄₀)	G1 (EN ₂₄₀)	GS (EN ₂₄₀)	G2 (EN ₂₄₀)	i	S _r	S _p	R _r	R _p
II	0.3022	41.1±3.4	44.0±1.0	43.4±2.6	0.880	2.900	2.992	1.500	0.9042
DD	0.2515	38.2±4.7	43.6±2.7	40.0±2.8	1.180	5.400	5.546	1.000	1.3948
Control	-	36.6±4.8	36.0±5.7	37.4±4.0	-	-	-	-	-

h^2 (EN₂₄₀) = heritability of EN₂₄₀ in the first generations; G1(EN₂₄₀) = EN₂₄₀ average in the first generation; GS(EN₂₄₀) = EN₂₄₀ average in the selection generation; G2(EN₂₄₀) = EN₂₄₀ average in the second generation; S_r = actual differential selection (S_{r-II} = GS-II(EN₂₄₀) - G1-II(EN₂₄₀); S_{r-DD} = GS-DD(EN₂₄₀) - G1-DD(EN₂₄₀)); i = selection intensity (i_{-II} = 5/11 = 0.45 = 0.880; i_{-DD} = 5/17 = 0.29 = 1.180); S_p = predicted differential selection (S_{p-II} = i_{-II} × σ_{p-G1-II}; S_{p-DD} = i_{-DD} × σ_{p-G1-DD}); R_r = actual selection response (R_{r-II} = (G2-II(EN₂₄₀) - (G2-Control(EN₂₄₀) - G1-Control(EN₂₄₀)) - G1-II(EN₂₄₀)); R_{r-DD} = (G2-DD(EN₂₄₀) - (G2-Control(EN₂₄₀) - G1-Control(EN₂₄₀)) - G1-DD(EN₂₄₀)); R_p = predict selection response (R_{p-II} = h^2_{II} × S_{p-II}; R_{p-DD} = h^2_{DD} × S_{p-DD}).

In this study, the AFL of G2-II and G2-DD tended to lead to the appearance of Black Kedu chickens, which was 138 days, while in the control group (G2-control) such as native chickens in general, it was 151 days (Creswell and Gunawan, 1982). In addition, the three genotype groups in G2 are in the first age range to lay eggs as shown by KUB chickens, namely the age of 20-22 weeks or around the age of 140-154 days (Iskandar and Sartika, 2014; Hidayat, et al., 2011). The EWA of G2-II and G2-DD tends to be close to the average egg weight during production of 35% (chicken age 29 weeks) in KUB chickens, which weighs 38.56 g/egg (Romjali, et al., 2019).

The results of the selection of increasing the egg number (G2) produced EN₂₄₀ of 43.4 ± 2.6 eggs (± 45.8% Hen Day) in G2-II and 40.0 ± 2.8 eggs (± 43.2% Hen Day) on G2-DD, while in the control group (G2-control) the egg number was 37.4 ± 4.0 eggs (± 41.9% Hen Day). The egg number produced (EN₂₄₀) by G2-II is close to the egg number produced by KUB chickens (45 - 50% Hen Day) as reported by Iskandar and Sartika (2014) and Hidayat, et al. (2011), while the egg number (EN₂₄₀) in G2-DD and the control group (G2-control) was still far below the egg number produced by KUB chickens.

Table 2 shows that the actual selection response (R_r) and predicted (R_p) of EN₂₄₀, both in genotype II and DD groups were still positive. Hardjosubroto (1994) states that a positive

selection response indicates that the genetic variation of the selected trait is still high. This means that the selection in this population can be continued on the next generation to produce the maximum genetic improvement progress or result in the selection minimal response. In other words, the selection increase EN₂₄₀ in local chicken Papua is still effective when performed in the 2nd generation to produce the next generation.

The selection response is an increase in the average phenotype value of the next generation as a result of the selection of the previous population. Hardjosubroto (1994) states that the selection response obtained based on predictions is not always the same as the selection response based on reality. According to him, this situation is due to the influence of environmental factors that cannot be controlled and cannot be taken into account in the analysis. In Table 2, this situation shows, where the estimated selection differential (S_p) obtained is almost the same as the reality selection differential (S_r), but after the influence of the environment, the resulting selection response (R_r) has deviated from the predicted results (R_p). By comparing the actual selection response (R_r) in the two genotype groups (II and DD) (Table 2), it can be concluded that EN₂₄₀ in the II genotype group still has a greater chance of being increased again than EN₂₄₀ in the DD genotype group.

Conclusions

The selection treatment increased egg number to 240 days of age (EN240) in Papua local chickens. This was indicated by the positive and high selection response. The II genotype group was more responsive to this selection treatment than the DD genotype group, it was proven that actual selection response of the II-genotype group was higher. The increase in EN240 as a result of this selection treatment resulted in a decrease in egg weight average (EWA) and an accelerated age at first laying (AFL) due to negative genetic correlation.

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