# CHARACTERIZATION PHENOTYPE AND GENETIC DISTANCE SOME OF THE NATIVE CHICKEN STRAINS IN JAMBI PROVINCE INDONESIA

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**ABSTRACT**

**Characterization is used to determine genetic quality which is used as a basis for consideration in selection and crossing. The research materials were Super Chicken, Bangkok, KUB, Sentul, Kampung and Merawang. Data including qualitative and quantitative. Descriptive and quantitative qualitative data used t-test, T2-Hotelling test and principal component analysis. Data processing using Minitab and MEGA-X program. The results showed that body weight, weight gain and body size of Super chickens were significantly different (P<0.05) higher than the other chickens. The closest genetic distance between the lines is Kampung dan Sentul chicken, then between Bangkok and Super chicken. Sentul and Kampung chicken have a close relationship with KUB, compared to Bangkok, Super and Merawang. Conclusion: Qualitative criteria for Super, Bangkok, KUB, Sentul, and Kampung are still very diverse, while Merawang chickens are more uniform. The highest body weight up to the age of 4 months is Super chicken, followed by Bangkok, KUB, Sentul, Kampung and Merawang. The increase in the body weight of chickens is achieved at the age of 2-3 months.**

**Key words: principal component analysis, qualitative characteristic, quantitative characteristic**

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# الصفات الظاهرية والمسافة الجينية لبعض سلالات الدجاج المحلية في مقاطعة جامبي في إندونيسيا

دِيفِيْسُونْ غُسْهَيْرِيَنْطَا دِيْكَ اِرْمَايَا
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**المستخلص**

**يستعمل التوصيف لتحديد الجودة الجينية كأساس للنظر في الاختيار والعبور. كانت مواد البحث عبارة عن سوبر تشيكن وبانكوك وكيه يو بي وسينتول وكامبونج وميراوانج. البيانات بما في ذلك النوعية والكمية. استعملت البيانات النوعية الوصفية والكمية اختبار tواختبار ميني تاب وتحليل المكون الرئيسي. معالجة البيانات باستعمال برنامج ت ٢ فندق وميجا إيكس. أظهرت النتائج أن وزن الجسم وزيادة الوزن وحجم جسم الدجاج السوبر كانت مختلفة معنوياً (P < 0.05)(أعلى من الدجاجات الأخرى. أقرب مسافة وراثية بين السطور هي دجاج كامبونج دان سينتول ، ثم بين بانكوك وسوبر تشيكن. دجاج سنتول وكامبونغ لهما علاقة وثيقة بقرية أنجول بالتناك، مقارنة ببانكوك، ممتاز وميراوانج. الخلاصة: لا تزال المعايير النوعية لقرية سوبر، بانكوك، قرية أنجول بالتناك، سينتول، وقرية متنوعة للغاية، في حين أن دجاج ميراوانج أكثر اتساقًا. أعلى وزن للجسم حتى عمر 4 أشهر هو سوبر تشيكن، يليه بانكوك، وكوب، وسينتول، وكامبونغ، وميراوانج. تتحقق الزيادة في وزن جسم الدجاج في العمر**

**الكلمات المفتاحية: الدجاج الأصلي الإندونيسي، تحليل المكونات الرئيسية، الصفات النوعية، الصفات الكمية**

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## INTRODUCTION

In Indonesia, it has a diversity of local chicken clumps and currently, there are 31 families, including Super chickens, Balitnak Superior Village chickens KUB-1), Bangkok chickens, Sentul chickens, Merawang chickens and Kampung chickens. Super Chicken is the result of a cross between native chickens and laying hens which have faster growth than native chickens. Chicken KUB-1 is the result of selection from the clumps of native chickens for 6 years based on the Minister of Agriculture Decree No. 274 / Kpts / SR.120 / 2/2014. (15) Bangkok chickens originate from the Ayutthaya area, North Bangkok, which has been developed by the people of Indonesia for a long time, both as broilers, layers and as fighting chickens (32). Sentul Chicken is a local chicken originating from Ciamis Regency, West Java Province and has claimed to be Ciamis Regency's germplasm based on Ministerial Decree No. 689 / Kpts.PD410 / 2/2013. Ayam Merawang has claimed to be Indonesian germplasm through the Decree of the Minister of Agriculture of the Republic of Indonesia No. 2846 / Kpts. / LB.4301812012 and is a genetic source and community assets of the Bangka Belitung Islands Province. Kampung Chickens are local chickens that are mostly kept by Indonesians but do not yet have special characteristics compared to other local chickens. However, until now there is relatively little information regarding the phenotype. Efforts can be made to obtain phenotypic information, it is necessary to characterize both qualitatively and quantitatively. Qualitative characteristics are descriptive characteristics in which individuals can be classified into one, two or more groups and distinct groupings from one another. Qualitative characters are controlled by one or more genes and little or no environment. Several qualitative studies have been conducted, such as the Burgo chicken (38). Bekwaara local chickens (8), Kampung chickens in Nabire Indonesia (9), Pelung chickens, Indonesia (5), chicken in Kampung Lombok Island, Indonesia (17). Characteristics are properties that can be measured, valued economically, can be seen by many people, can be used by environmental factors which can be used for early selection. Sayings that can also be used to measure productivity, measure and mark the size and shape of livestock (4). Quantitative parameters include body weight, body weight gain, and body linear size (9; 30). Genetic diversity, which includes qualitative and quantitative traits, is needed in carrying out breeding programs (2) and sustainable genetic improvement (6) as a consideration in selection and crossing. One of the basic studies to find out genetic information is genetic information (18 ,26; 31). Quantitative characteristics can also be use to analyze genetic distances. The genetic distance of a gene in a population is measured using a numerical quantity of tree use derived from phylogenetics. A phylogenetic tree is a branching diagram depicting an arrangement of genetic relationships in a population. On the other hand, until now, the quantitative characterization and genetic distance of Super, Bangkok, KUB, Sentul, Kampung and Merawang chickens have not been widely known, therefore research was carried out on "characterization and genetic relationships of several local chicken lines in Jambi Province, Indonesia.

## MATERIALS AND METHODS

The materials of this research were Super Kampung Chickens, Balitnak Superior Village (BSV), Bangkok, Sentul, Kampung and Merawang. The equipment used, namely; stationery, a digital scale with a capacity of 3 kg with an accuracy of 0.1 g, digital calipers, measuring tape, and a digital camera. Experimental research method with direct observation of qualitative and quantitative characteristics. Chickens are raised from DOC to 4 months of age. Chicken rearing system in colony cages with commercial feeding and drinking continuously (ad libitum). Each line is placed in a different cage from the other lines. The size of the cage used is 4 x 3 m, which is equipped with a place for feeding, a place for drinking, and a lamp for lighting. Each chicken is tagged with a number on the wing (wing-tag). Qualitative characteristics data collected include; beak color, lobe color/ear, wattle color, shank color. The quantitative characteristics data collected include; Body Weight (BB), Body Weight Gain (WG), Head Length (HL), Beak Length (BeL), Beak Width (BWd), Head

Circumference (HC), Head Height (HH), Neck Length (NL), Neck Circumference (NC), Wing Length (WL), Back Length (BL), Back Height (BH), Chest Length (CL), Chest Width (CW), Shank Length (SL), Shank Circumference (SC), Tibia Length (TL), Tibia Circumference (TC), Longest Finger Length (LFL) and Pubic Bone Distance (PBD). The data of qualitative characteristics between chicken breeds were analyzed descriptively. Variable differences between lines include; BWg, HL, BL, BWd, HC, HH, NL NC, WL, BaL, BH, CL, CW, SL, SC, TL, TC, LFL, and PBD, were analyzed using the t-test. Vector mean values of HL, BL, BWd, HC, HH, NL NC, WL, BaL, BH, CL, CW, SL, SC, TL, TC, LFL, and PBD between groups of native chicken lines were analyzed using the T2 statistical test -Hotelling. Determinants of the size and shape of the Super Kampung Chickens, Balitnak Superior Village Chickens (KUB-1), Bangkok Chickens, Sentul Chickens, Merawang Chickens and Kampung Chickens were analyzed using principal component analysis (PCA) (11). The Mahalanobis distance approach with the correlation matrix between variables based on the Chicken line group is arranged into a matrix used to determine the discriminant function. The discriminant function can be used to determine the percentage of genetic similarity and distance between chicken lines. Dendograms of genetic distance between chicken lines were analyzed using the UPGMA (Unweight Pair Group Method with Arithmetic) method with the help of the MEGA X application (37). Minimum statistical distance according to (22).

## RESULTS AND DISCUSSION

**Qualitative characteristics of native chickens:** Qualitative traits are descriptive traits in which individuals can be classified into one, two, or more groups and the groupings differ markedly from one another. The results of observations on the qualitative properties of Super chickens, Bangkok chickens, Kampung chickens, Sentul chickens, KUB chickens and Merawang chickens including comb shape, beak color, lobe color and shank color are shows in Table 1 and Figure 1. Super chicken's comb forms include a single comb, ros comb, pea comb and walnut comb, with the highest form in male Super chickens being single comb (73.17%), while female Super chickens are walnut comb (60.98%). This is following the opinion of (3) stated that most male Super cock's comb is single. Bangkok's cock has a single comb and a pea's comb with the most forms in males is a single comb (60.98%) and females are pea's comb (90.24%). Male and female KUB combs have various forms of a comb, including single comb, pea comb and walnut comb, with the most forms being single comb in males and walnut comb in females with a frequency of 46.34% and 56.1% respectively. The shape of the male Sentul's comb is a single comb with a frequency of 75.61% and the female is walnut (68.29%). This is following the opinion of (21) that Sentul chickens generally have a single comb. The form of Kampung chicken's comb includes single's comb, ros's comb, pea's comb and walnut's comb with the most forms in males being single comb (60.98%) and females being pea's comb (65.85%). The results of this study are following the statement of (2) which states that the form of the male Kampung chicken's comb is a single comb, while the female Kampung chicken is a pea comb. Merawang chickens, both male and female, mostly form a single comb with a frequency of 100% and 81.82%, respectively. This is following the research results of (14), which states that Merawang chickens have a single comb form with a phenotypic frequency of 100%. Super chicken’s beak color, namely 80.49% yellow in males and 58.54% black in females. The largest beak color in male Bangkok chickens is black with a frequency of 60.98% and the female is yellow with a frequency of 85.37%. The largest beak color in KUB chickens, both male and female, is black with a frequency of 90.24% and 90.24%. Most of the beak color in Sentul chickens is yellow with a frequency of 100% in males and black with a frequency of 100% in females. Kampung Chickens, both male and female, mostly have a black beak with a frequency of 65.85% for males and 85.37% for females. Merawang chickens, both male and female, have a yellow beak with a frequency of 100% in males and 100% in females. This beak color is caused by the pigment color of the skin. This is following the opinion of (34)

that the color of the beak and the color of the feet is determined by the color of the skin pigment, namely the lipochrome pigment. The color of the lobe in super male chickens is red with a frequency of 51.22% and the female is white with a frequency of 65.85%. Bangkok chickens, both male and female, have the reddest lobe with a frequency of 100% for males and 97.56% for females. KUB chickens, both male and female, were mostly white with a frequency of 58.54% for males and 97.56% for females. The color of the lobe in Sentul, both male and female, is red with a frequency of 51.22% and 87.8%. The color of the most lobe of native chickens is 56.1% red in males and 65.85% in white in females. According to (17) that the color of the largest Kampung chicken lobe is red. Merawang chickens, both male and female, have the most lobe white with a frequency of 100% for males and 63.41% for females. The results of observations on the qualitative properties of the most shank color in super chickens, both male and female, were white with a frequency of 80.49% and 63.41%. Bangkok chickens, both male and female, are mostly white with a frequency of 100% for males and 90.24% for females. The most shank color of KUB chickens is black with a frequency of 78.05% in males and 80.49% in females. The shank color of both male and female Sentul chickens is yellow and gray with a frequency of 75.61% and 68.29%, respectively. The most shank color in Kampung chickens is black, for males it is 63.41%, while females are 73.17%. The shank color of Merawang chickens, both male and female, is gray with a frequency of 100% and 78.05%. The different color of the shank is caused by the presence of different pigments. According to (2) stated that the black shank color in chickens is caused by the high melanin content in the dermis layer while the yellow shank color is caused by the lack of melanin content in the dermis (albino) layer.


**Figure 1. Qualitative Characteristics of Native Chickens**

**Table 1. Qualitative Characteristics of Native Chickens**

| Qualitative Characteristic | Super Chicken | | | | Bangkok Chicken | | | | KUB Chicken | | | | Sentul Chicken | | | | Kampung Chicken | | | | Merawang Chicken | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Male | | Female | | Male | | Female | | Male | | Female | | Male | | Female | | Male | | Female | | Male | | Female | |
| | n=41 | % | n=41 | % | n=41 | % | n=41 | % | n=41 | % | n=41 | % | n=41 | % | n=41 | % | n=41 | % | n=41 | % | n=41 | % | n=41 | % |
| **Comb Shape** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Single** | 30 | 73.17 | 6 | 14.63 | 25 | 60.98 | 4 | 9.76 | 19 | 46.34 | 15 | 36.59 | 31 | 75.6 | 13 | 31.71 | 25 | 60.98 | 14 | 34.15 | 41 | 100 | 34 | 81.82 |
| **Rose** | 1 | 2.44 | | | | | | | | | | | | | | | 2 | 4.88 | | | | | | |
| **Pea** | 8 | 19.51 | 10 | 24.39 | 16 | 39.02 | 37 | 90.24 | 6 | 14.63 | 3 | 7.32 | | | | | 12 | 29.27 | 27 | 65.85 | | | | |
| **Walnut** | 2 | 4.88 | 25 | 60.98 | | | | | 16 | 39.02 | 23 | 56.10 | 10 | 24.3 | 28 | 68.29 | 2 | 4.88 | | | | | 7 | 18.18 |
| **Beak Color** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Yellow** | 33 | 80.49 | 17 | 41.46 | 16 | 39.02 | 35 | 85.37 | 4 | 9.76 | 4 | 9.76 | 41 | 100 | | | 14 | 34.15 | 6 | 14.63 | 41 | 100 | 41 | 100 |
| **Blacl** | 8 | 19.51 | 24 | 58.54 | 25 | 60.98 | 6 | 14.63 | 37 | 90.24 | 37 | 90.24 | | | 41 | 100 | 27 | 65.85 | 35 | 85.37 | | | | |
| **Ear Color** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Red** | 21 | 51.22 | 14 | 34.15 | 41 | 100 | 40 | 97.56 | 17 | 41.46 | 1 | 2.44 | 21 | 51.2 | 36 | 87.80 | 23 | 56.10 | 14 | 34.15 | | | 15 | 36.59 |
| **White** | 20 | 48.78 | 27 | 65.85 | | | 1 | 2.44 | 24 | 58.54 | 40 | 97.56 | 20 | 48.7 | 5 | 12.20 | 18 | 43.90 | 27 | 65.85 | 41 | 100 | 26 | 63.41 |
| **Shank Color** | | | | | | | | | | | | | | | | | | | | | | | | |
| **Yellow** | 6 | 14.63 | 13 | 31.71 | | | 37 | 90.24 | 9 | 21.95 | 8 | 19.51 | 31 | 75.6 | | | 11 | 26.83 | 7 | 17.07 | | | | |
| **Black** | | | 1 | 2.44 | | | | | 32 | 78.05 | 33 | 80.49 | | | 13 | 31.71 | 26 | 63.41 | 30 | 73.17 | | | | |
| **White** | 33 | 80.49 | 26 | 63.41 | 41 | 100 | 4 | 9.76 | | | | | | | | | | | | | | | 9 | 21.95 |
| **Grey** | 2 | 4.88 | 1 | 2.44 | | | | | | | | | 10 | 24.3 | 28 | 68.29 | 4 | 9.76 | 4 | 9.76 | 41 | 100 | 32 | 78.05 |

**Quantitative characteristics of native chickens**

**Body weight:** The body weight of various native chickens lines aged DOC-4 months are shows in Table 2 and Figure 2. The average body weight of super chickens in this study is not much different from the results of Trisiwi's research (39) which states that the bodyweight of Super chicken aged 2 months range from 618.5 g - 899.5 g. The weight of the Super chicken at 8 weeks of age averaged 862.24g and 16 weeks of age ranged from 1257.4 - 1782.2 g (23). The Bangkok chicken bodyweight of this study was better than that of (28) which states that the bodyweight of chickens resulting from crossing male laying races x Bangkok females and Bangkok male x laying breed females aged 9 weeks is 767.59 ± 30.56 g and 612.42 ± 31.33 g. The bodyweight of KUB chickens from this study was higher than the results of several studies at the age of 8 and 12 weeks, respectively, which were 512 g and 795 g (38), 3 months old KUB chicken weight 750 g (36). The results of the study were not much different from those of (30) which states that the bodyweight of KUB chickens aged 2 months is 713.15 ± 66.7 g and 3 months is 1,108.42 ± 84.52 g. The bodyweight of Sentul chickens from this study is slightly lower, compared to IPB D-1 G4 chickens, which are a cross of Sentul chickens with several chicken lines, with a weight of 3 months 1193.9 ± 142.80 g (12), slightly higher than the study by (30) who got the weight of Sentul chickens aged 2 months of 632.88 ± 85.10 g. The bodyweight of the native chickens from this study was better than that of (35) which states that the weight of free-range chickens aged 10 weeks is 532 g., 3 months old ranges from 943.83-1030.60 g (10). The bodyweight of Merawang chickens from this study was higher than the results of Hardini's research (13) which stated that the bodyweight of Merawang chickens aged 4 weeks was 220.24 g. Table 2 show that the average weight of DOC, 1 month, 2 months, 3 months and 4 months of Kampung Super chickens is significantly different (P <0.05) higher than Bangkok, KUB, Sentul, Kampung, and Merawang chickens, as well as weight. Bangkok chicken bodies at the same age were significantly different (P <0.05) higher than KUB, Sentul, Kampung, and Merawang chickens. KUB chicken body weight at doc age, significantly different (P <0.05) higher than Sentul, Kampung, and Merawang chickens. DOC weight of Merawang chickens was significantly different (P <0.05) higher than Sentul and Kampung chickens, while Sentul chickens were not significantly different (P> 0.05) from Kampung chickens. The bodyweight of KUB chickens aged 1 month and 2 months were not significantly different (P> 0.05) from Sentul chickens and Kampung chickens, but significantly different (P <0.05) higher than that of Merawang chickens. The bodyweight of KUB chickens aged 3 months was not significantly different (P> 0.05) from Sentul chickens, but the body weights of KUB and Sentul chickens aged 3 months were significantly different (P <0.05) higher than Merawang chickens, as well as native chickens. significantly different (P <0.05) with Merawang chicken. All chicken body weights aged 4 months were significantly different between all chicken lines (P <0.05). Based on the results of this average difference test, it can be stated that the bodyweight of the six best chicken lines up to the age of 4 months is Kampung Super chicken followed by Bangkok chicken, KUB chicken, Sentul chicken, Kampung chicken and the lowest is Merawang chicken.

**Tabel 2. The body weights of various native chicken**

| Age | Body Weight (g) | | | | | |
|---|---|---|---|---|---|---|
| | Super | Bangkok | KUB | Sentul | Kampung | Merawang |
| DOC | 39.27[a] | 37.03[b] | 33.57[c] | 29.44[e] | 27.99[e] | 30.56[d] |
| 1 Month | 409.88[a] | 370.89[b] | 321.14[c] | 326.22[c] | 311.82[c] | 289.71[d] |
| 2 Months | 818.73[a] | 750.64[b] | 699.62[c] | 671.38[c] | 658.38[c] | 634.70[d] |
| 3 Months | 1318.51[a] | 1236.41[b] | 1150.20[c] | 1107.02[c] | 1080.47[d] | 992.51[e] |
| 4 Months | 1744.71[a] | 1614.68[b] | 1466.58[c] | 1374.37[d] | 1303.32[e] | 1107.72[f] |

**Note: Different superscripts on different lines indicate significantly different between lines (P <0.05).**

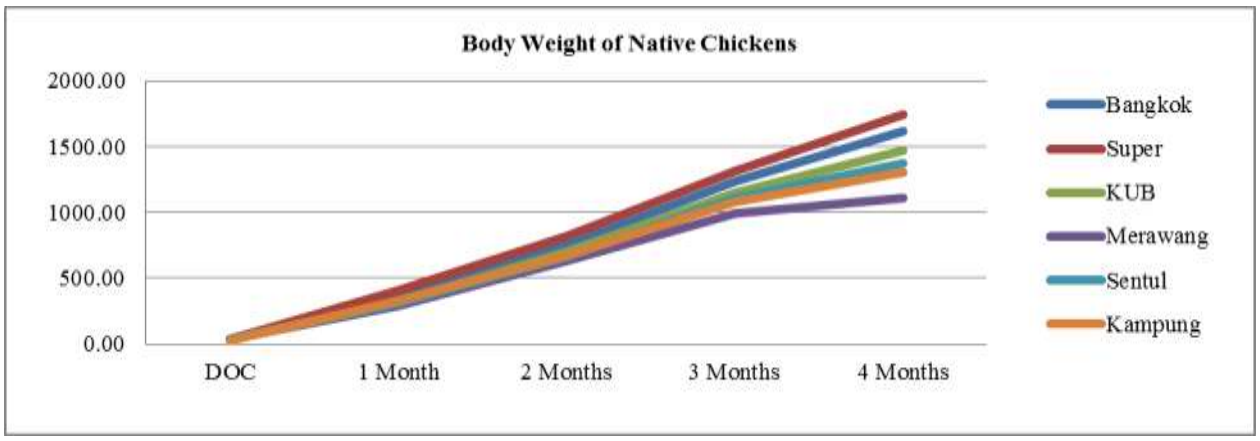


**Figure 2. Graph of body weight of several native chickens**

**Weight gain of native chickens**

The weight gain of several native chicken DOC-1 month, 1-2 months, 2-3 months and 3-4 months are shows in Table 3 and Figure 3. Bodyweight gain is a response to the ability of chickens to digest food. Based on Figure 3, it can be seen that in general Super kampung chickens have the highest body weight gain from DOC to 4 months, while the lowest is Merawang chickens. The highest to the lowest daily body weight gain was the chicken Kampung Super> Bangkok> KUB> Sentul> Kampung and> Merawang. The increase in body weight of Super chickens, Bangkok KUB, Sentul, Kampung, and Merawang, the age period of DOC-1 month, 1 - 2 months and 2- 3 months continues to increase, but in the 3-4 month age period, there is a decrease in body weight gain compared to the age period 2-3 months. It is assumed that at the age of 3-4 months the chickens will experience sexual maturity so that the food consumed is not only used for growth. This is following the opinion of (25) stated that the optimal growth phase of chickens occurs at a maximum age of 12 weeks before entering sexual maturity. The period of accelerated growth generally occurs before the cattle are sexually mature and then there is a slowdown. Growth has a fast and slow stage, the fast stage occurs at birth to sexual maturity (puberty), while the slow stage occurs when the body's maturity has reached (1).

**Tabel 3. Weight Gain**

| Type | | DOC-1 month | 1-2 months | 2-3 months | 3-4 months |
|---|---|---|---|---|---|
| **Super** | **(g)** | **370.60±62.58$^{cA}$** | **408.85±128.56$^{bA}$** | **499.78±184.13$^{aA}$** | **426.20±150.23$^{Aa}$** |
| **Bangkok** | **(g)** | **333.86±45.75$^{cB}$** | **379.75±80.250$^{bA}$** | **485.77±114.21$^{aA}$** | **378.82±207.67$^{aA}$** |
| **KUB** | **(g)** | **287.57±49.35$^{cC}$** | **378.49±110.83$^{bAB}$** | **450.57±140.15$^{aAB}$** | **316.38±132.94$^{bB}$** |
| **Sentul** | **(g)** | **296.78±49.07$^{cC}$** | **345.16±68.680$^{bB}$** | **435.64±133.87$^{aAB}$** | **267.35±174.47$^{cBC}$** |
| **Kampung** | **(g)** | **283.83±49.22$^{cCD}$** | **346.56±91.550$^{bB}$** | **422.09±83.670$^{aB}$** | **222.85±80.380$^{dC}$** |
| **Merawang** | **(g)** | **259.15±41.90$^{bD}$** | **345.00±93.890$^{aB}$** | **357.81±83.450$^{aC}$** | **115.22±83.390$^{cD}$** |

**Note: Different lowercase superscripts on the same row show significantly different body weight gain (P <0.05), different superscripts of capital letters in the same column show significantly different (P <0.05).**

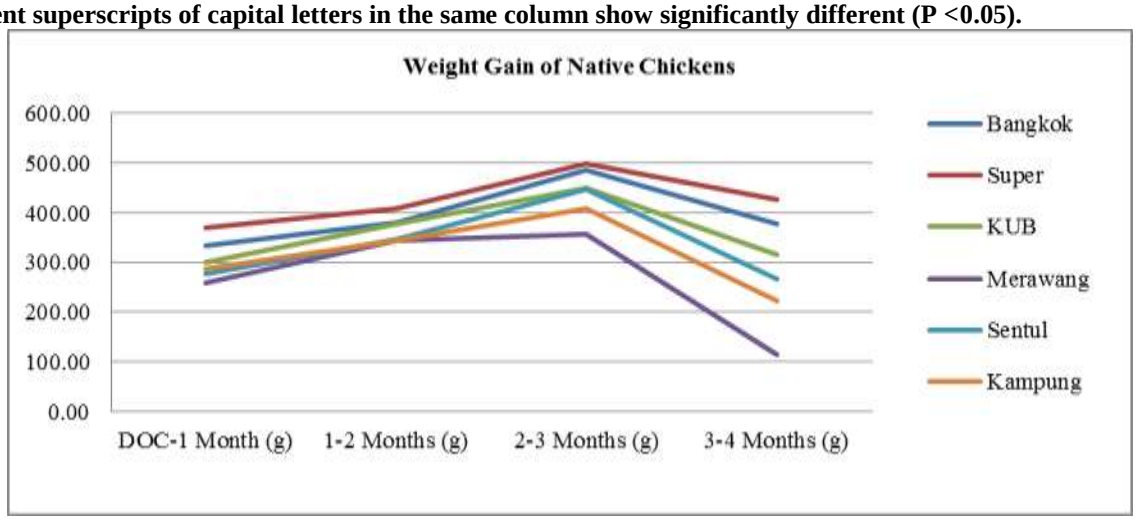


**Figure 3. Graph of the Weight Gain of Native Chickens**

## $T^2$-Hotteling test

The T2-Hotteling statistical test was used to determine the similarities and differences in body sizes between herds of livestock are presented in Table 4. The results of statistical analysis of the T2-Hotteling test (Table 4), body size between all lines were significantly different (P<0.05). This difference is thought to be due to genetic differences between lines because environmental factors have been strived to be so uniform that environmental diversity is almost non-existent. (33) stated that differences in body sizes of chickens can be caused by genetic factors and environmental factors.

**Tabel 4. $T^2$-hotteling of Native Chickens**

| Body Measurements | Statistics T2 Hotteling | F Value | P Value | Conclusion |
|---|---|---|---|---|
| Super VS Bangkok | 8211.48 | 413.95 | 0.00 | ** |
| Super VS KUB | 24935.86 | 1257.05 | 0.00 | ** |
| Super VS Sentul | 17714.77 | 893.03 | 0.00 | ** |
| Super VS Kampung | 24765.20 | 1248.45 | 0.00 | ** |
| Super VS Merawang | 15639.48 | 788.41 | 0.00 | ** |
| Bangkok VS KUB | 5581.28 | 281.36 | 0.00 | ** |
| Bangkok VS Sentul | 9132.23 | 460.37 | 0.00 | ** |
| Bangkok VS Kampung | 9399.28 | 473.83 | 0.00 | ** |
| Bangkok VS Merawang | 2763.85 | 139.33 | 0.00 | ** |
| KUB VS Sentul | 6793.09 | 342.45 | 0.00 | ** |
| KUB VS Kampung | 8508.79 | 428.94 | 0.00 | ** |
| KUB VS Merawang | 8841.84 | 445.73 | 0.00 | ** |
| Sentul VS Kampung | 2594.98 | 130.82 | 0.00 | ** |
| Sentul VS Merawang | 15392.44 | 775.96 | 0.00 | ** |
| Kampung VS Merawang | 16180.61 | 815.69 | 0.00 | ** |

**Note: ** very significantly different (P <0.01)**

## Principal component analysis

The similarities in size and body shape of several native chicken lines of native chickens are shows in Table 5.The total diversity of the 1st main component which is equivalent to the body size of Super chickens is 87.6%, Bangkok chicken 78.6%, KUB chicken 90.5%, Sentul chicken 86.3%, Kampung chicken 89.5 %, and Merawang chicken 66.6%. The total diversity of the 2nd main component which is equivalent to the body shape of Super chickens is 2.7%, Bangkok chicken 4.2%, KUB chicken 2.6%, Sentul chicken 2.2%, Kampung chicken 4.1%, dam chicken Merawang 7.4%. Super chicken, Bangkok chicken, KUB chicken, Sentul chicken, Kampung chicken and Merawang chicken have the same main body size component variables, namely breast length, but there are differences in body shape, namely shank length in Super chickens, KUB chickens and Kampung chickens, circumference. tibia on Bangkok and Sentul chickens, and breast length in Merawang chicken. Based on these results, it can be seen that each of the native chicken lines has the same size characteristics, but the shape characteristics are different. This condition is caused by the characteristics of the size is influenced by the environment, while the character of the shape is influenced by genetics. This is following the opinion of (19) that morphometric identification with principal component analysis (PCA) is to determine size traits that are influenced by environmental factors and shape traits are influenced by genetic factors. The main component I is the size factor and the main component II is the shape factor. The scores on the size equation (X-axis) and shape (Y-axis) are visualized in the form of a crowd diagram (24). The complexity diagram is presented in Figure 4. Figure 4 shows that the characteristics of the body size of the Kampung Super and Bangkok chickens are more on the right side of the X-axis and the top of the Y-axis and have a lot of overlapping dendograms. KUB chickens are all at the bottom of the Y-axis and most are the right part of the X-axis. Sentul and Kampung

chickens are mostly at the bottom of the Y-axis and the left part of the X-axis. Sentul chickens have dendograms that are more closely related to KUB chickens than Kampung. Very few KUB chickens have very little dendogram that coincides with free-range chickens. Merawang Chicken is located at the top of the Y-axis and to the left of the X-axis. Merawang Chicken has its dendogram which coincides with the other lines. Based on the dendogram, it can be stated that Kampung Super chickens are closer to Bangkok chickens and Sentul chickens are closer to Kampung chickens. However, free-range chicken and Sentul chicken are closer to KUB chicken than Bangkok, Super, and Merawang chickens.

**Tabel 5. Principal Component Analysis of Native chickens**

| Type | | | Equation | TD (%) | Λ |
|---|---|---|---|---|---|
| Super Chicken | Body Size | = | 0.242 BeL + 0.241 BWd + 0.210 HL + 0.236 HH + 0.231 HC + 0.236 NL + 0.243 NC + 0.232 WL + 0.242 BaL + 0.237 BH + 0.244 CL + 0.235 CW + 0.233 SL + 0.239 SC + 0.232 TL + 0.238 TC + 0.236 LFL + 0.233 PBD | 87.6 | 15.76 |
| | Body Shape | = | 0.121 BeL + 0.225 BWd – 0.570 HL – 0.068 HH + 0.061 HC + 0.206 NL – 0.108 NC – 0.379 WL – 0.163 BaL – 0.391 BH + 0.108 CL + 0.028 CW + 0.340 SL – 0.002 SC + 0.208 TL + 0.053 TC + 0.220 LFL + 0.048 PBD | 2.7 | 0.48 |
| Bangkok Chicken | Body Size | = | 0.237 BeL + 0.239 BWd + 0.233 HL + 0239 HH + 0.241 HC + 0.248 NL + 0.243 NC + 0.255 WL + 0.241 BaL + 0.243 BH + 0.249 CL + 0.207 CW + 0.235 SL + 0.225 SC + 0.235 TL + 0.212 TC + 0.246 LFL + 0.241 PBD | 78.6 | 14.14 |
| | Body Shape | = | 0.056 BeL – 0.228 BWd + 0.102 HL + 0.069 HH + 0.010 HC + 0.256 NL + 0.300 NC + 0.343 WL + 0.092 BaL + 0.162 BH – 0.140 CL – 0.437 CW – 0.027 SL – 0.333 SC – 0.180 TL + 0.388 TC – 0.145 LFL – 0.308 PBD | 4.2 | 0.75 |
| KUB Chicken | Body Size | = | 0.233 BeL + 0.240 BWd + 0.235 HL + 0.233 HH + 0.235 HC + 0.242 NL + 0.255 NC + 0.240 WL + 0.240 BaL + 0.241 BH + 0.243 CL + 0.231 CW + 0.232 SL + 0.230 SC + 0.233 TL + 0.237 TC + 0.238 LFL + 0.233 PBD | 90.5 | 16.29 |
| | Body Shape | = | -0.319 BeL + 0.078 BWd – 0.234 HL – 0.332 HH – 0.018 HC – 0.018 NL – 0.001 NC - 0,432 WL + 0.109 BaL – 0.067 BH + 0.090 CL + 0.084 CW + 0.103 SL + 0.369 SC + 0.335 TL – 0.356 TC + 0.095 LFL + 0.273 PBD | 2.6 | 0.47 |
| Sentul Chicken | Body Size | = | 0.235 BeL + 0.232 BWd + 0.236 HL + 0.245 HH + 0.225 HC + 0.227 NL + 0.243 NC + 0.245 WL + 0.242 BaL + 0.233 BH + 0.247 CL + 0.232 CW + 0.217 SL + 0.235 SC + 0.222 TL+ 0.241 TC + 0.244 LFL + 0.238 PBD | 86.3 | 15.53 |
| | Body Shape | = | 0.302 BeL + 0.101 BWd + 0.309 HL + 0.050 HH – 0.264 HC – 0.247 NL – 0.192 NC – 0.184 WL + 0.051 BaL + 0.160 BH – 0.165 CL + 0.010 CW – 0.296 SL + 0.114 SC – 0.418 TL + 0.366 TC – 0.105 LFL + 0.352 PBD | 2.2 | 0.39 |
| Kampung Chicken | Body Size | = | 0.239 BeL + 0.228 BWd + 0.240 HL + 0.235 HH + 0.238 HC + 0.237 NL + 0.230 NC + 0.227 WL + 0.239 BaL + 0.235 BH + 0.241 CL + 0.237 CW + 0.224 SL + 0.238 SC + 0.239 TL + 0.241 TC + 0.239 LFL + 0.235 PBD | 89.5 | 16.12 |
| | Body Shape | = | - 0.235 BeL – 0.275 BWd – 0.226 HL – 0.238 HH – 0.247 HC – 0.253 NL – 0.317 NC – 0.203 WL + 0.079 BaL + 0.026 BH + 0.172 CL + 0.088 CW + 0.360 SL + 0.279 SC + 0.266 TL + 0.225 TC + 0.291 LFL + 0.190 PBD | 4.1 | 0.74 |
| Merawang Chicken | Body Size | = | 0.258 BeL + 0.253 BWd + 0.256 HL + 0.263 HH + 0.240 HC + 0.242 NL + 0.251 NC + 0.273 WL + 0.148 BaL + 0.136 BH + 0.275 CL + 0.244 CW + 0.271 SL + 0.263 SC + 0.272 TL + 0.160 TC – 0.049 LFL + 0.247 PBD | 66.6 | 11.99 |
| | Body Shape | = | 0.019 BeL – 0.028 BWd + 0.029 HL + 0.049 HH + 0.019 HC – 0.210 NL – 0.179 NC – 0.071 WL + 0.555 BaL + 0.503 BH – 0.084 CL + 0.091 CW + 0.062 SL – 0.052 SC – 0.075 TL + 0.183 TC + 0.509 LFL – 0.180 PBD | 7.4 | 1.32 |

**Note: BeL= Beak Length, BWd= Beak Width, HL= Head Length, HH= Head Height, HC= Head Circumference, NL= Neck Length, NC= Neck Circumference, WL= Wings Length, BaL= Back Length, BH= Back Height, CL= Chest Length, CW= Chest Width, SL= Shank Length, SC= Shank Circumference, TL= Tibia Length, TC= Tibia Circumference, LFL= The Longest Finger Length, PBD= Pubis Bone Distance**

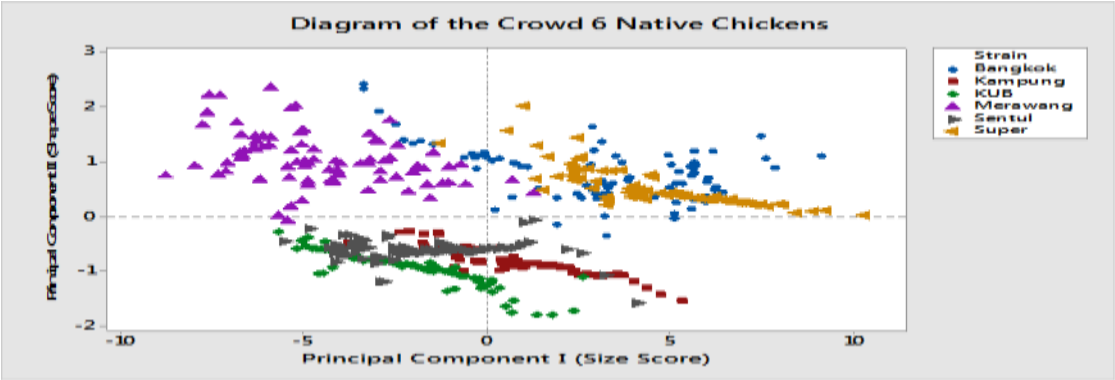


**Figure 4. Crowd Diagram**

## Genetic Distance

Genetic distance are the degree of genes differences (genomic difference) in a population or species as measured by numerical quantities. The results of genetic distance are used to determine the phylogenetic tree. A phylogenetic tree is a branching diagram that describes an arrangement of kinship relationships in a particular population or group. The genetic distance matrix between Super Chicken, Bangkok chicken, KUB chicken, Sentul chicken, Kampung chicken and Merawang chicken is presented in Table 6 and Figure 5. Table 6 shows that the closest genetic distance between chicken lines is between Sentul and Kampung chickens, followed by Bangkok and Super chickens. Sentul chickens and native chickens have a close relationship with KUB chickens, compared to Bangkok, Super and Merawang chickens. The phenogram tree depicts the genetic distance of all chicken lines (Figure 5). Based on the phenogram tree, the results of this study show that Kampung chickens with Sentul chickens have a closer kinship relationship, as well as between Bangkok chickens and Kampung Super chickens so that if you want to crossbreed between Sentul and Kampung chickens as well as Bangkok and Super Kampong, the quality improvement should be improved. genetics is less than optimal. According to (7) that if the crossing is done between clumps that have a close genetic distance, the results of the crossing are less than optimal and good if not accompanied by strict selection. This is because, from the crossover, heterotic traits will not be obtained due to the small diversity in the lines. According to (16) that genetic distances that are relatively close if crossed will not get impressive quantitative measurement progress because the nature of heterosis is mostly derived from diversity within the nation. Furthermore, according to (29). Whereas close genetic distance should not be done by mating, because inbreeding will occur, high intensity of inbreeding will reduce production traits and reduce the diversity level of quantitative traits with increasing homozygous genes. However, if the kinship is not close, then action needs to be taken to increase the quantitative size, namely by crossing.

**Table 6. Genetic Distance**

| Strain | Strain | | | | | |
|---|---|---|---|---|---|---|
| | Super | Bangkok | KUB | Sentul | Kampung | Merawang |
| Super | | | | | | |
| Bangkok | 14.1403 | | | | | |
| KUB | 24.3237 | 11.5838 | | | | |
| Sentul | 16.7940 | 10.9502 | 11.2909 | | | |
| Kampung | 22.1582 | 12.0150 | 12.3951 | 6.3472 | | |
| Merawang | 13.0424 | 6.8879 | 15.6762 | 19.5623 | 19.5643 | 0 |

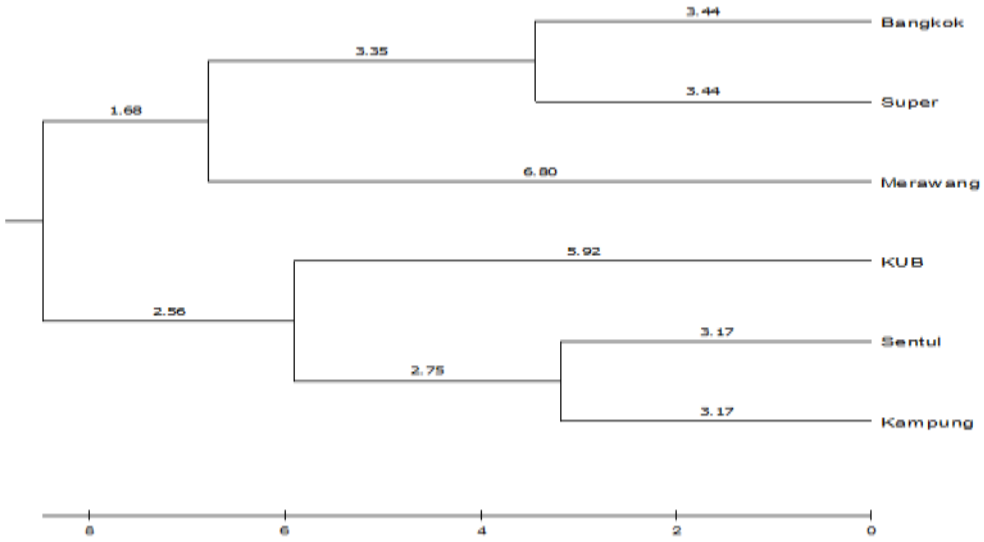


**Figure 5. Genetic distances of several native chickens**

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