



UNIVERSITI PUTRA MALAYSIA

**VARIABILITY OF PHENOTYPIC CHARACTERISTICS OF VILLAGE
CHICKENS AND THEIR RELATIONSHIP WITH DIFFERENT FARM
MANAGEMENT PRACTICES.**

NOOR SYUHADAQ BINTI ABDUL RASID

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FPV 2023 32**

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MANAGEMENT PRACTICES.**

BY

NOOR SYUHADAQ BINTI ABDUL RASID

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CERTIFICATION

It is hereby certified that we have read this project paper entitled “Variability of phenotypic characteristics of village chickens and their relationship with different farm management practices”, by Noor Syuhadaq Abdul Rasid and in our opinion it is satisfactory in terms of scope, quality and presentation as partial fulfilment of the requirement for the course VPD 4999 - Project.

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Specially dedicated to my family

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LIST OF ABBREVIATION

Abbreviations	Caption
%	Percent
>	More than
kg	Kilogram
cm	Centimetre



ABSTRAK

Abstrak daripada kertas projek dikemukakan kepada fakulti perubatan veterinar bagi memenuhi sebahagian daripada keperluan kursus VPD 4999 - Projek

VARIABILITI CIRI FENOTIPIK AYAM KAMPUNG DAN KAITANNYA DENGAN AMALAN PENGURUSAN LADANG YANG BERBEZA

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DISEMBER 2023

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Ciri fenotip telah digunakan untuk mengenal pasti jenis ayam berdasarkan pelbagai ciri fizikal mereka seperti warna, bentuk badan, jenis bulu, warna bulu dan lain-lain.

Walau bagaimanapun, masih terdapat maklumat yang tidak mencukupi mengenai fenotip ayam kampung dari pelbagai ladang ayam kampung di Malaysia. Oleh itu, kajian ini dilakukan untuk menentukan keragaman ciri fenotip dalam ayam kampung dari pelbagai amalan pengurusan ladang ayam kampung. Hubungan antara ciri-ciri

fenotip dan amalan pengurusan ladang ayam kampung turut dinilai dalam kajian ini. Sejumlah 116 sampel ayam kampung, merangkumi jantan dan betina, dipilih secara rawak dari tiga ladang ayam kampung di Selangor. Pengukuran kuantitatif, termasuk berat badan, panjang badan, lingkar dada, dan panjang kaki, diambil menggunakan pita pengukur (dalam sentimeter), dan berat mereka direkodkan menggunakan timbangan (dalam kilogram). Selain itu, penilaian kualitatif terhadap ciri-ciri seperti warna bulu dan jenis silet dijalankan melalui teknik pemerhatian. Hasil menunjukkan bahawa jenis silet dominan untuk ayam kampung jantan adalah carnation (75.41%) diikuti oleh single (24.59%) manakala 36.36% ayam kampung betina memiliki silet carnation diikuti oleh cushion (34.55%) dan single (29.10%). Pada jantan, warna bulu merah dan hitam (26.23%) adalah ciri fenotip dominan berbanding ayam kampung betina yang kebanyakannya ditandai dengan warna spot (18.19%). Jumlah purata berat badan ayam kampung (kg), panjang badan (cm), lingkar dada (cm) dan panjang kaki (cm) adalah 2.04kg, 41.61cm, 33.27cm dan 8.53cm, masing-masing. Nilai semua ciri pengukuran badan linear berbeza secara signifikan ($P < 0.05$) di antara tiga ladang ayam kampung. Dari segi amalan pengurusan ladang, diperhatikan bahawa ketiga-tiga ladang ayam kampung ini menjalankan penternakan semi-intensif dengan sistem rumah terbuka dan diberi makan dengan makanan komersial. Walau bagaimanapun, perbezaannya terletak pada punca air, pembekal makanan, dan punca ubat. Kesimpulannya, terdapat perbezaan yang signifikan dalam ciri-ciri fenotip ayam kampung dari tiga ladang ayam kampung, yang mungkin disebabkan oleh pelbagai amalan pengurusan.

Kata kunci: Ayam kampung, ciri-ciri fenotipik, amalan pengurusan ladang, variasi

ABSTRACT

An abstract of the project paper presented to Faculty of Veterinary Medicine in partial fulfillment of the course VPD 4999 - Project.

VARIABILITY OF PHENOTYPIC CHARACTERISTICS OF VILLAGE CHICKENS AND THEIR RELATIONSHIP WITH DIFFERENT FARM MANAGEMENT PRACTICES

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DECEMBER 2023

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Phenotypic traits have been used to identify the type of chicken based on their various physical characteristics such as colour, body conformation, feather type, plumage colour and others. However, there is still inadequate information on village chicken phenotypes from various village chicken farms in Malaysia. Thus, this study was

carried out to determine the variability of phenotypic characteristics in village chickens from different village chicken farm management practices. The relationship between phenotypic characteristics and farm management practices of village chickens was further assessed in this study. A total of 116 samples of village chickens, encompassing both males and females, were selected randomly from three village chicken farms in Selangor. Quantitative measurements, including body weight, body length, chest circumference, and shank length, were taken using measuring tape (in centimetres), and their weight was recorded using a scale (in kilograms). Additionally, qualitative assessments of characteristics such as feather colour and comb type were conducted through observation techniques. The results indicated that predominant comb types for male village chickens were carnation (75.41%) followed by single (24.59%) while 36.36% of female village chickens were carnation combed followed by cushion (34.55%) and single combed (29.10%). In males, red, black colour of feathers (26.23%) were the dominant phenotypic traits in comparison to female village chickens, which mostly characterised by spot colour (18.19%). Overall mean body weight of village chickens (kg), body length (cm), chest circumference (cm) and shank length (cm) were 2.04kg, 41.61cm, 33.27cm and 8.53cm, respectively. The values of all linear body measurement traits were significantly differ ($P < 0.05$) across the three village chicken farms. In terms of the farm management practice, it was observed that these three village chicken farms were practising semi-intensive farming with an open house system and fed with commercial feed. However, the differences lie in water sources, food suppliers and sources of medication. In conclusion, there were significant differences in phenotypic characteristics of village chickens from the three village chicken farms, which may be due to various management practices.

Keywords: Village chickens, phenotypic characteristics, farm management practices, variability



1.0 INTRODUCTION

Poultry production is an important and viable subset of animal industries in Asia, where livestock industries are crucial for economic growth. In addition, one of the biggest and fastest-growing agriculture-based sectors in the world is the poultry business due to the rising demand for poultry meat due to its high nutritious content. Malaysia is one of the countries that consumes the most poultry worldwide, and the country's meat supply primarily comes from the poultry business. With an annual per capita consumption of around 50 kg, Asia leads the globe in chicken eating. Malaysia's primary livestock industry has always been poultry farming, with the country's industrial poultry business beginning with the production of broilers and layers. Several varieties of chicken have been produced to meet Malaysia's market demand for chicken meat. Red jungle fowl and Malaysian village chicken are examples of low-performance breeds, while commercial chickens are classified as high-performance breeds. Commercial chickens can be divided into two main groups, broiler chickens and layer chickens. Likewise, commercial broiler chicken strains in Malaysia consist of Ross, Cobb that are products of intense and successful selection programs for rapid growth and body conformation, markedly in terms of breast muscle development. Alternatively, Red jungle fowl breeds are a slow-growing type of chickens that are protected by the Malaysian government and have a potential niche market in the future (Nematbaksh et.al, 2021).

The present Malaysian village chicken, commonly known as “Ayam Kampung” in Malay language, is the result of crossbreeding of the Red jungle fowl with mixed exotic domestic breeds brought by Europeans, mainly the British. The original

Malayan fowl were the descendants of the southeast Asian jungle fowl (*Gallus bankiva*) through natural mating and selection. Village chicken is popular in many southeast Asian countries such as Malaysia and it has been superior compared to commercial broiler chickens in terms of wholesomeness and health benefits. Recently, rising awareness of people about using drugs such as antibiotics in commercial poultry production led to a significant increase in demand for free-range native chicken, such as village chicken, which covers a large niche market compared to previous years because of emergent food safety and animal welfare concerns. Today, the marketing and export of village chickens to supply the growing market already exists in Southeast Asia.

Moreover, in Malaysia, there is little information available on village chicken breeds, therefore, food fraud is a big business and is covering various food commodities, more notably meat and meat products, thus the main concern of food safety regulators and trading partners is the ability to confirm the security and authenticity of food products. In the same way, due to the high demand for village chicken in Malaysia, there is a concern that commercial chicken, due to their cheap cost, are claimed as the village chicken to fraud consumers for economic gain since there is no strategy to authenticate different chicken breeds in Malaysia.

1.2. Justification

Since there are limited reports and research published on authentication of village chicken breeds in Malaysia, data obtained from this study will provide insight to one of the ways to authenticate variability of phenotypic characteristics of village chickens and their relationship with different farm management practices.

1.3 Objective of this study

To determine the variability of phenotypic characteristics in village chickens from different farm management practices and to assess the relationship between phenotypic characteristics and farm management practices of village chickens.



2.0 LITERATURE REVIEW

2.1 Poultry industry in Malaysia

One of the agricultural industries with the quickest growth is poultry. The poultry business produces high-quality, reasonably priced meat that is favoured by nearly every culture. The poultry farming industry has been around for a very long time in Malaysia. Major purchasers, processors, and suppliers of processed goods to the retail and end consumer markets make up the subsectors of this industry (Ahmad Shabuddin et.al 2014). These markets are subject to a number of hazards, such as the volatility of input commodity prices, large capital requirements, the inherent commercial and climate risks associated with the numerous subsectors, and other difficulties. From important to small role players in the agricultural supply chain, particularly in the feed and livestock markets, these factors have a significant effect on decision makers.

In 2019, the livestock sector in Malaysia demonstrated notable economic importance. The total ex-farm value of livestock products exceeded RM 24 billion, with poultry meat contributing RM 12.4 billion and eggs contributing RM 5.8 billion. Consequently, the poultry industry constituted nearly 76% of the overall livestock ex-farm value. It's essential to distinguish the ex-farm value from the contribution to the GDP. In 2019, the agricultural sector contributed RM 103.8 billion to Malaysia's GDP, accounting for 7.3%. Within this, the livestock industry comprised 14.9% of the agricultural contribution to the GDP, as reported by the Department of Statistics Malaysia (DOSM) in 2019.

The annual per capita consumption of chicken in Malaysia is approximately 50 kg, ranking third globally and first in Asia. Concurrently, egg consumption stands at around 20 kg per capita annually. The Malaysian poultry industry exhibits self-sufficiency, meeting 98.4% of the national demand for poultry meat and exceeding demand for chicken and duck eggs by 113.8%. Singapore is the primary importer of Malaysian poultry products, accounting for 37% of poultry imports and 73% of egg imports (Goh, 2019). For context, Singaporeans consume 34 kg of chicken per capita annually. From 2006 to 2019, per capita poultry consumption witnessed a 40% increase, rising from 35 to 49 kg per year, and it is projected to surpass 50 kg by 2025. Poultry serves as the primary protein source for Malaysians. In comparison, the estimated annual per capita consumption for beef and veal is 5.42 kg, pork is 5.31 kg, and sheep is 1.18 kg, according to [statista.com](https://www.statista.com)

2.2 Village chickens in Malaysia

The current breed of Malaysian village chicken, commonly referred to as "Ayam Kampung," is a product of crossbreeding between the Red jungle fowl and various exotic domestic breeds introduced by Europeans, primarily the British. The original Malayan fowl were descendants of the southeast Asian jungle fowl (*Gallus bankiva*), resulting from natural mating and selective breeding. Ayam Kampung is widely favoured in several Southeast Asian nations, including Malaysia, and is considered superior to commercial broiler chickens in terms of wholesomeness and health benefits.

In response to the growing awareness among the public regarding the use of antibiotics in commercial poultry farming, there has been a notable surge in the demand for free-range native chicken varieties, such as the village chicken. This demand has created a substantial niche market, driven by emerging concerns about food safety and animal welfare. Presently, there is an established market and export system for village chickens to meet the expanding demand in Southeast Asia.

2.3 Authenticating village chicken breeds

Authenticating village chicken breeds based on phenotypic characteristics in Malaysia involves identifying and distinguishing these breeds through observable physical traits. Phenotypic characteristics refer to the visible and measurable traits of an organism, such as its size, colour, shape, and other morphological features. Authenticating village chicken breeds using phenotypic characteristics can be crucial for preserving genetic diversity and promoting sustainable poultry farming practices. Therefore, there are several ways to authenticate village chicken breeds based on phenotypic characteristics in Malaysia such as feather colour and pattern. Different village chicken breeds often exhibit distinct feather colours and patterns that include the coloration of feathers on various body parts, including the plumage, wings, and tail. Unique patterns or markings that can be used for breed identification. Body size and shape is also a distinct feature such as the body size and shape of the chickens. Different breeds may have variations in size, body length, wing length, and overall conformation. Therefore, features such as body weight, length, and the presence of specific body parts like comb type and wattles is important.

The comb (the fleshy crest on the chicken's head) and wattles (dangling lobes of flesh under the chicken's chin) can vary among breeds. Shape, size, and colour of combs and wattles, as these can be distinctive characteristics for breed authentication. Leg colour and length also plays a role in differentiating village chicken breeds as well as the colour and length of the chicken's legs and digits. Leg colour can range from yellow to dark grey, and the length of the shanks may differ among breeds. Some breeds may also have feathers on their legs. The shape and colour of the beak can vary between breeds. The length, curvature, and coloration of the beak as part of the authentication process. Other than that, egg characteristics. While not strictly phenotypic, characteristics of eggs, such as size, shape, colour, and shell texture, can also be considered in breed authentication. Different village chicken breeds may produce eggs with unique features.

In addition to phenotypic characteristics, consider using genetic testing methods to further confirm breed identity. Genetic markers can provide more precise information about the genetic makeup of individual chickens.

By combining these methods, researchers, breeders, and conservationists can contribute to the accurate authentication and preservation of village chicken breeds in Malaysia based on their phenotypic characteristics. This information is valuable for sustaining genetic diversity, supporting local agriculture, and maintaining cultural heritage associated with traditional chicken breeds.

3.0 METHODOLOGY

3.1 Source of Data

Three village chicken farms in Selangor were selected in this study. A total of 116 village chickens were observed from each farm that were located at Batu 24, Sungai Lui, Hulu Langat, Selangor (Farm 1), Fahis Agrotech Enterprise, Batu 13, Puchong, Selangor (Farm 2) and Kampung Merbau Sempak, Selangor (Farm 3). Overall farm management and village chickens' phenotypic characteristics that include quantitative and qualitative were observed and evaluated using observational techniques adopted from Tadele et al., 2018. Quantitative traits include body weight (kg), body length (cm), chest circumference (cm) and shank length. Body weight was taken using a measuring scale while the village chickens were placed in a modified plastic cage as a restraining method (UPM/IACUC/AUP-U010/2023). Body length, chest circumference and shank length were measured using measuring tape. For qualitative traits, that includes feather colour and comb type, both were visually observed. Indigenous chickens will be randomly sampled from each farm. The correlation between farm management practice with phenotypic characteristics of village chickens particularly on authenticity of village chickens will be determined by looking at the management practices such as feed, water, brooding and litter management as well as disease prevention adapted on the farm.

3.2 Data management

Phenotypic characteristics will include the quantitative and qualitative traits that have been observed and analysed on the three different farms as well as the farm management practices. A table was created using Microsoft Excel Worksheet for data collection and analysing.

3.3 Statistical analysis

For this study, comparison between sex and farms was conducted by using descriptive statistical analysis and performed by using SPSS software version 26 such as frequency median, mean and standard deviation as well as correlation between phenotypic characteristics of village chickens between farms.

4.0 RESULT

4.1 Quantitative traits of village chickens in the selected farms in Selangor. N=116

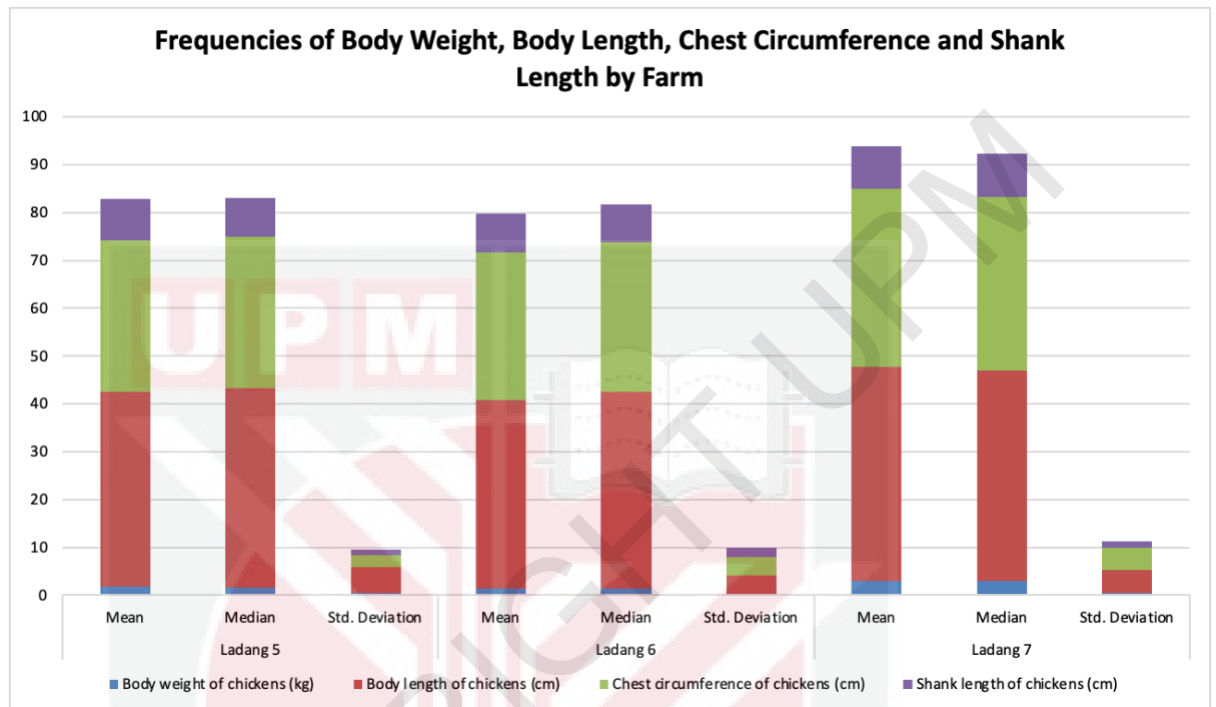


Figure 4.1: Frequency of body weight, body length, chest circumference and shank length according to farm, N=116.

A total of 116 cases of village chickens which met the criteria of this research objectives were used in this analytical study. In this study, frequency of body weight, body length, chest circumference and shank length such as mean, median and standard deviation for all three farms is studied. A mean in maths is the average of a data set, found by adding all numbers together and then dividing the sum of the numbers by the number of numbers. Median is the middle number; found by ordering all data points and picking out the one in the middle while standard deviation (or σ) is a measure of how dispersed the data is in relation to the mean. Low, or small, standard deviation

indicates data are clustered tightly around the mean, and high, or large, standard deviation indicates data are more spread out.

For Farm 1, the mean for body weight is 1.764 kg with a median of 1.725 kg and standard deviation of 0.452 kg. For Farm 2, they have mean of 1.391 kg, 1.490 kg as median and standard deviation of 0.323 kg whereas Farm 3 have mean of 2.989 kg, 3.030 kg as median and standard deviation of 0.509 kg.

Body length of chickens in Farm 1 has a mean of 40.700 cm, median of 41.500 cm. Standard deviation of the farm is 5.440 cm. For Farm 2, they have a mean of 39.385 cm, 41.000 cm as median and standard deviation of 3.775 cm. For Farm 3, the mean is 44.838 cm, median of 44.000 cm and standard deviation of 4.806 cm.

For Farm 1, the mean for chest circumference is 31.767 cm with a median of 31.750 cm and standard deviation of 2.469 cm. For Farm 2, they have mean of 30.948 cm, 31.250 cm as median and standard deviation of 3.854 cm whereas Farm 3 have mean of 37.063 cm, 36.250 cm as median and standard deviation of 4.645 cm.

Shank length of chickens in Farm 1 has a mean of 8.650 cm, median of 8.000 cm. Standard deviation of the farm is 1.108 cm. For Farm 2, they have a mean of 8.080 cm, 8.000 cm as median and standard deviation of 1.987 cm. For Farm 3, the mean is 8.958 cm, median of 9.000 cm and standard deviation of 1.413cm.

Overall mean body weight of chickens(kg), body length of chickens (cm), chest circumference of chickens (cm) and shank length of chickens (cm) were 2.04 kg, 41.61 cm, 33.27 cm and 8.53 cm respectively.

4.2. Quantitative traits of village chickens in the selected farms in Selangor based on gender, N=116

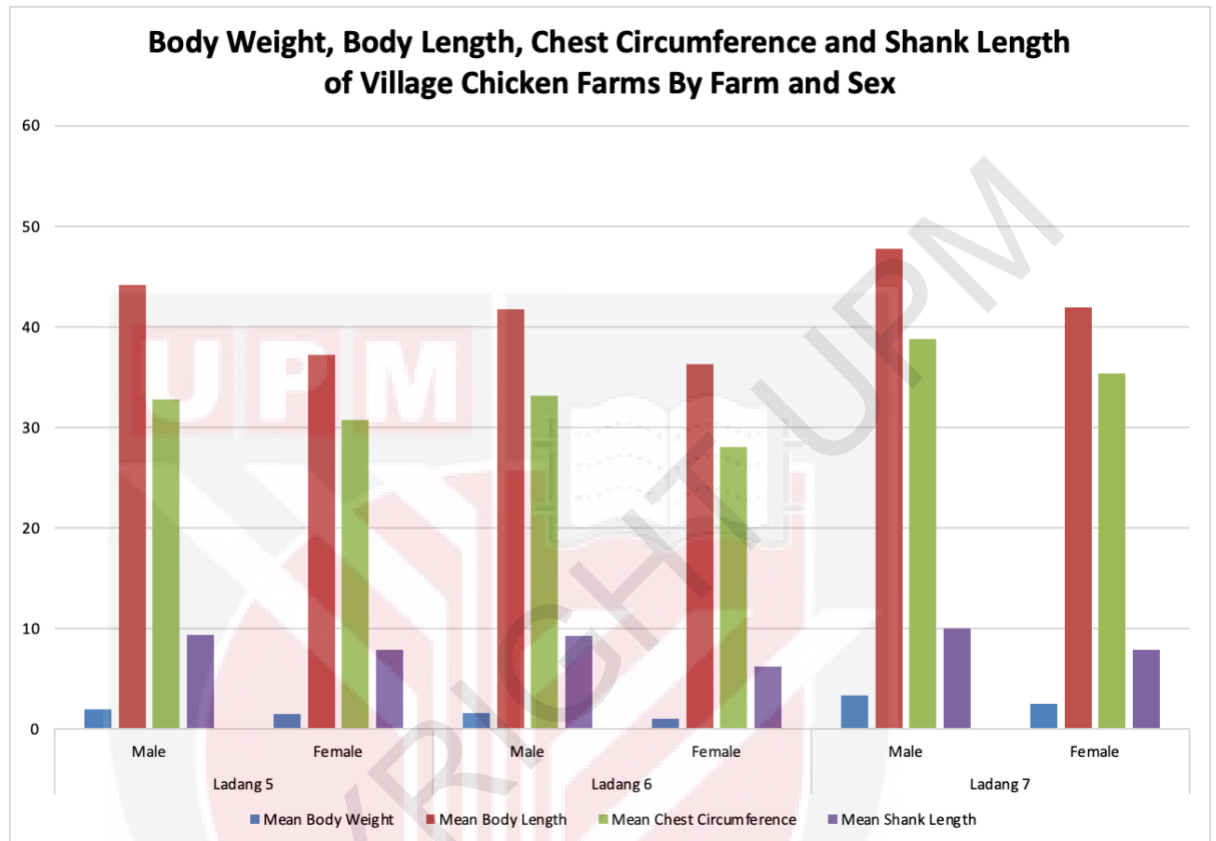


Figure 4.2: Body Weight, Body Length, Chest Circumference and Shank Length of Village Chickens According to Farm and Sex, N=116.

According to the observed data, the mean of body weight, body length, chest circumference and shank length of village chickens according to farm and sex are the highest involving male species compared to female species.

4.3. Qualitative traits of village chickens (comb type) in the selected farms in Selangor, N=116

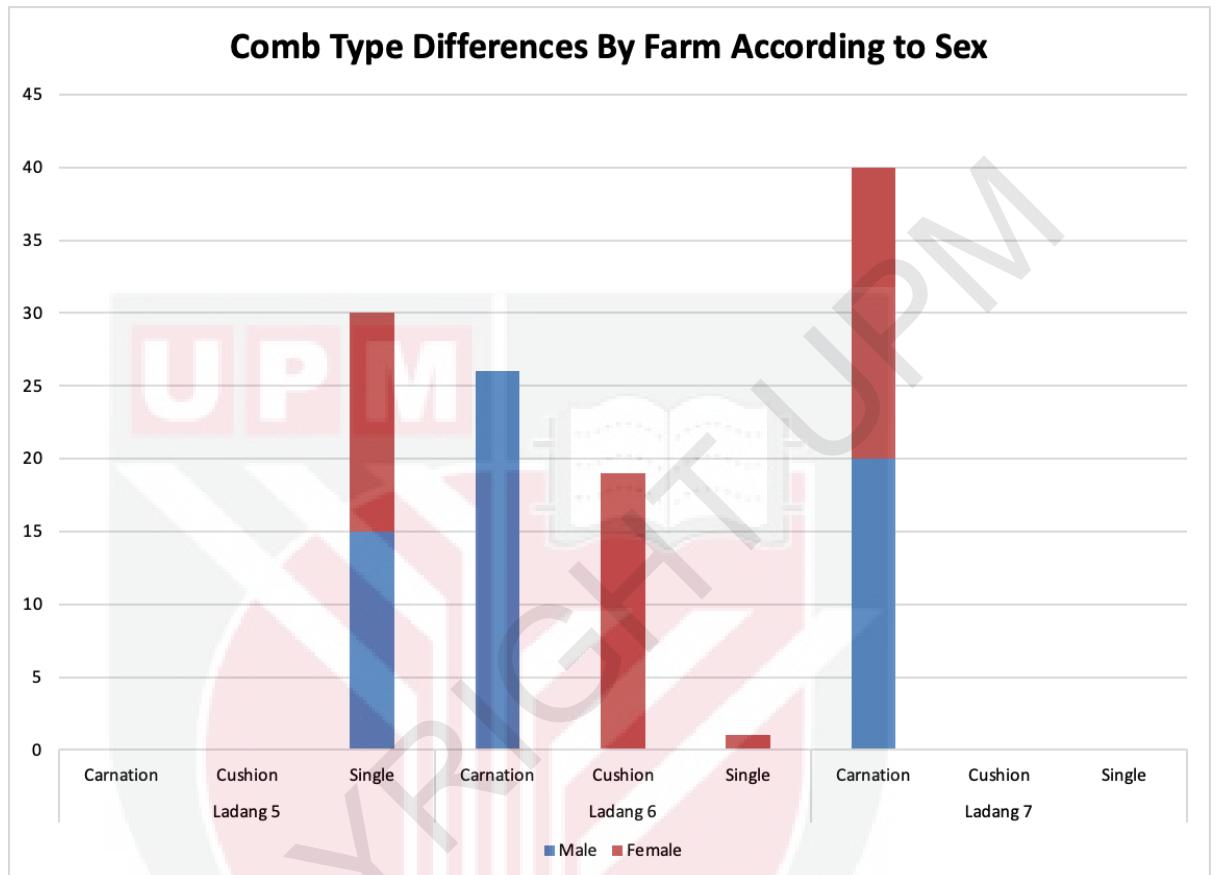


Figure 4.3: Comb Type Differences According to Farm and Sex, N=116

From the data obtained in this study as shown in graph, Farm 1 has one variation of comb type which is the single comb type. Both male and female village chickens possessed the same comb type where male at 50% (N=15) and female also at 50% (N=15). For Farm 2, there are three variation of comb observed which are carnation, cushion and single with carnation being the predominant comb type there at 56.5% (N=26) for male, followed by cushion 41.3% (N=19) for female and single comb type at 2% (N=1) for female as well. Farm 3 has one variation of comb as well which is carnation. Both male and female village chickens possessed the same comb type where

male at 50% (N=20) and female also at 50% (N=20). Thus, the predominant comb type for males were carnation (75.41%) followed by single (24.59%) while 36.36 % of females were carnation combed followed by cushion (34.55%) and single combed (29.10%).



4.4 Quantitative traits of village chickens (feather colour) in Batu 24, Sungai Lui, Selangor, N=30

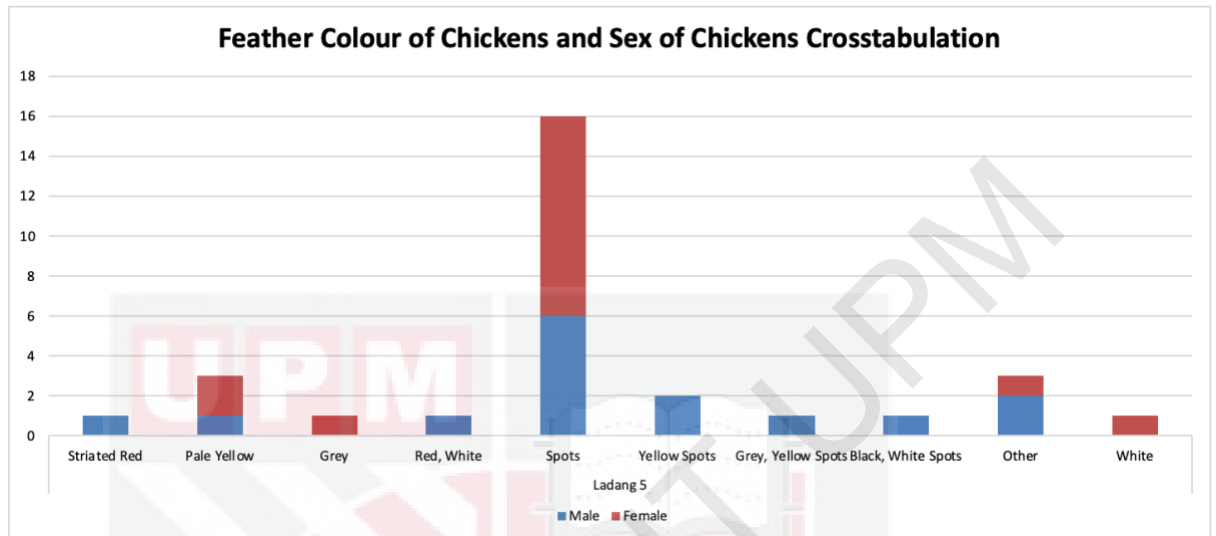


Figure 4.4: Feather Colour of Village Chickens in Farm 1 According to Sex, N=30

From the data obtained in this study as shown in graph for Farm 1, most of the village chickens in this farm can be distinguished as spots-coloured at 53.33% (N=16). 6 of them are male and 10 are female. Colours such as striated red, grey, red and white, grey and yellow spots, black and white spots, white and others were only observed once each whether it is from female or male village chickens (3.33%).

4.5 Quantitative traits of village chickens (feather colour) in Batu 13, Puchong, Selangor, N=46

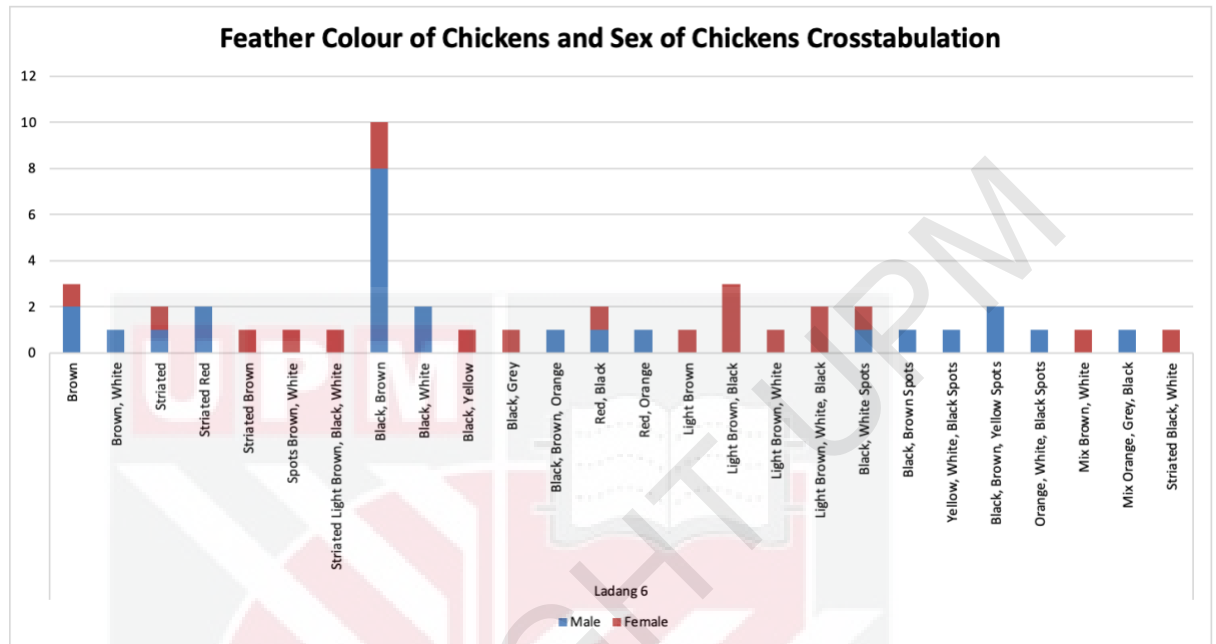


Figure 4.5: Feather Colour of Village Chickens in Farm 2 According to Sex, N=46

From the data obtained in this study as shown in graph for Farm 2, most of the male village chickens in this farm can be distinguished as black and brown colour at 30.77% (N=26) whereas female village chickens are predominantly light brown and black coloured 15% (N=20). Other colours observed in the farm such as black and white and black and yellow that was observed are the recessive colours.

4.6 Quantitative traits of village chickens (Feather Colour) in Kampung Merbau Sempak, Selangor, N=40

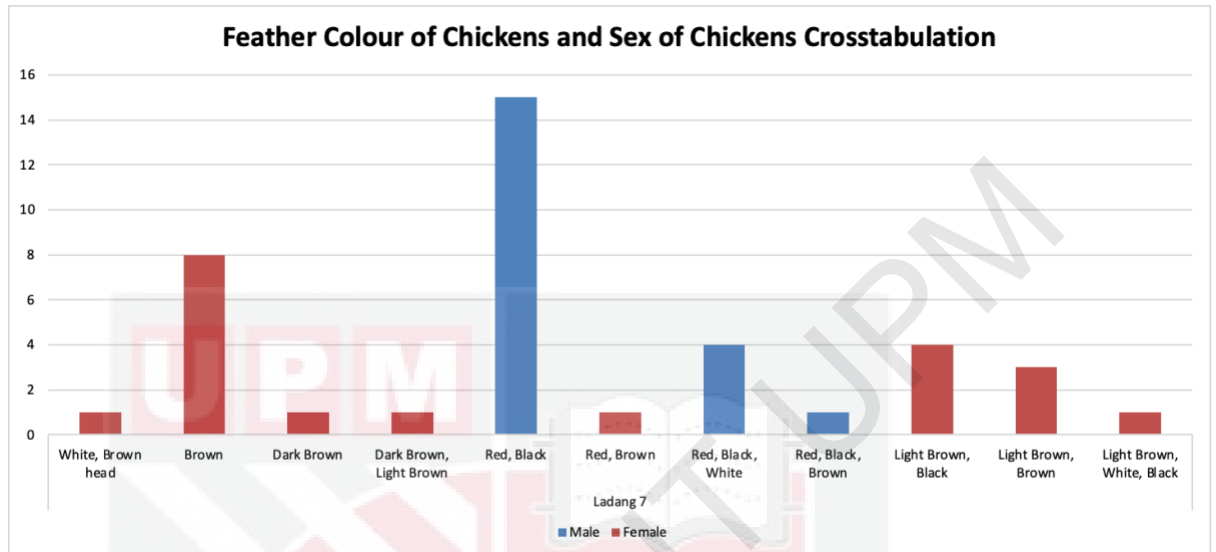


Figure 4.6: Feather Colour of Village Chickens in Farm 3 According to Sex, N=40

From the data obtained in this study as shown in graph for Farm 3, most of the male village chickens in this farm can be distinguished as red and black colour at 75% (N=15) whereas female village chickens are predominantly brown coloured 40% (N=8). Red, black and white colour and light brown and black is the second runner up for male and female respectively where both at 20% (N=4). Other colours observed in the farm such as red and brown and dark brown that was observed are the recessive colours.

4.7 Chi square test (qualitative traits) on chicken farms visited and feather colour of chickens

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	189.176 ^a	82	.000
Likelihood Ratio	205.192	82	.000
Linear-by-Linear Association	15.205	1	.000
N of Valid Cases	116		

Figure 4.7: Chicken farms visited and feather colour of chickens

From the data obtained in this study, asymptotic sig is the same as p-value ($p < 0.05$). Therefore, data has significant differences. Linear-by-linear association is just plotting the linear line, therefore, no significant finding.

4.8 Chi square test (qualitative traits) on chicken farms visited and comb type of chickens

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	140.384 ^a	4	.000
Likelihood Ratio	154.077	4	.000
Linear-by-Linear Association	86.337	1	.000
N of Valid Cases	116		

Figure 4.8: Chicken farms visited and feather colour of chickens

From the data obtained in this study, asymptotic sig is the same as p-value ($p < 0.05$).

Therefore, data has significant differences.

4.9 Chi square test (qualitative traits) on sex of chickens and feather colour of chickens

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	76.852 ^a	41	.001
Likelihood Ratio	100.873	41	.000
Linear-by-Linear Association	.524	1	.469
N of Valid Cases	116		

Figure 4.9: Chicken farms visited and feather colour of chickens

From the data obtained in this study, asymptotic sig is the same as p-value ($p < 0.05$). Therefore, data has significant differences. Linear-by-linear association is just about plotting the linear line, therefore, no significant finding.

5.0 Chi square test (qualitative traits) on sex of chickens and comb type of chickens

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	29.042 ^a	2	.000
Likelihood Ratio	36.587	2	.000
Linear-by-Linear Association	7.297	1	.000
N of Valid Cases	116		

Figure 5: Chicken farms visited and feather colour of chickens

From the data obtained in this study, asymptotic sig is the same as p-value ($p < 0.05$). Therefore, data has significant differences. Linear-by-linear association is just about plotting the linear line, therefore, no significant finding.

5.1 One-way ANOVA for (quantitative traits) on chickens farms visited

		Sum of squares	df	Mean Square	F	Sig.
Body Weight	Between groups	57.699	2	28.849	157.243	.000
	Within groups	20.732	113	.183		
	Total	78.431	115			
Body Length	Between groups	669.284	2	334.642	15.754	.000
	Within groups	2400.253	113	21.241		
	Total	3069.537	115			
Chest Circumference	Between groups	891.177	2	445.588	29.849	.000
	Within groups	1686.895	113	14.928		
	Total	2578.072	115			
Shank Length	Between groups	17.039	2	8.520	3.308	.000
	Within groups	290.985	113	2.575		
	Total	308.024	115			

Figure 5.1: Chicken farms visited and quantitative traits

From the data obtained in this study, asymptotic sig is the same as p-value ($p < 0.05$). Therefore, data has significant differences. Linear-by-linear association is just about plotting the linear line, no significant finding.

5.2 One-way ANOVA for (quantitative traits) on sex of chickens

		Sum of squares	df	Mean Square	F	Sig.
Body Weight	Between groups	9.252	1	9.252	15.247	.000
	Within groups	69.179	114	.607		
	Total	78.431	115			
Body Length	Between groups	943.418	1	943.418	50.585	.000
	Within groups	2126.119	114	18.650		
	Total	3069.537	115			
Chest Circumference	Between groups	350.928	1	350.928	17.963	.000
	Within groups	2227.144	114	19.536		
	Total	2578.072	115			
Shank Length	Between groups	140.999	1	140.999	96.236	.000
	Within groups	167.025	114	1.465		
	Total	308.024	115			

Figure 5.2: Sex of chickens and quantitative traits

From the data obtained in this study, asymptotic sig is the same as p-value ($p < 0.05$). Therefore, data has significant differences. Linear-by-linear association is just about plotting the linear line, no significant finding.

5.3 Similarities of farm managements

Farm management	Farm 1	Farm 2	Farm 3
Biosecurity	Biosecurity such as fencing, foot dip, staff houses and strict restriction of entry especially for the public	Biosecurity such as fencing, foot dip, staff houses and strict restriction of entry especially for the public	Biosecurity such as fencing, foot dip, staff houses and strict restriction of entry especially for the public
Management	Semi-intensive	Semi-intensive	Semi-intensive
Type of house	Open house system	Open house system	Open house system
Type of litter	Deep litter	Deep litter	Deep litter
Feed	Commercial, alternative	Commercial, alternative	Commercial
Supplements	VP1000	VP1000	Betachicken
Death/year	<100	<100	<100
Preventive medicine	Vaccination	Vaccination	Vaccination

Figure 5.3: Similarities in all three farm management practices

From the data obtained in this study, there are similarities between the farm management of all three farms, Farm 1, Farm 2 and Farm 3. The similarities include, all three farms possessed biosecurity such as fencing, foot dip, staff houses and strict restriction of entry especially for the public. They also reared their village chickens in a semi-intensive farming with open-house system and uses deep litter. For Farm 1, they also have another alternative for deep litter which is the traditional litter. Feed that was given to the village chickens for all three farms is a commercial feed and for Farm 1 and Farm 2, they also have other alternative feed. All village chickens are supplemented with vitamins. For example, both Farm 1 and Farm 2 use VP1000 as a

supplement while Farm 3 provided Betachicken for their village chickens. Death rates for all three farms are less than 100 per year and the prevention use for diseases include vaccination.



5.4 Differences of farm managements

Farm management	Farm 1	Farm 2	Farm 3
Uses	Breeding	Meat	Breeding
Breed	Pure village chickens (AKA)	Pure village chickens (AKA)	Hubbard crossbred village chicken (AKK)
Type of pellet use	Bran, pellet	Grains	Pellets

Figure 5.4: Differences in all three farm management practices

From the data obtained in this study, there are differences that lie between the farm management of all three farms, Farm 1, Farm 2 and Farm 3. The differences include the use of the village chickens. For Farm 1 and Farm 3, the chickens are used for breeding whereas for Farm 2, village chickens are used for meat. The breed of village chickens in all three farms is also different. Farm 1 and Farm 2 uses pure village chicken or also known as Ayam Kampung Asli (AKA) while Farm 3 reared crossbred village chicken or also known Ayam Kampung Kacuk (AKK) which is crossbred with Hubbard chicken. The type of pellet use also differs according to farms such as grains and pellet.

5.5 Correlations of different farm management practices and all phenotypic characteristics

			Farm management	All phenotypic characteristics
Spearman's rho	Farm management	Correlation coefficient	1.000	.304
		Sig. (2-tailed)	.	.001
		N	0.304	116
	All phenotypic characteristics	Correlation coefficient	.304	1.000
		Sig. (2-tailed)	.001	.
		N	116	116

Figure 5.5: Correlation test between farm management practices and phenotypic characteristics

From the data obtained in this study, all farm management practices that include the differences and similarities were correlated with both quantitative and qualitative traits of phenotypic characteristics of village chickens in all three farms (Farm 1, Farm 2 and Farm 3). From the data observed, the correlation is less than 0.01. Therefore, there is correlation between farm managements and phenotypic characteristics.

5.0 DISCUSSION

Authentication of village chickens is important in the poultry livestock industry by using genotypic and phenotypic approaches in Malaysia.

From this study, it is noted that Farm 3 has the highest frequencies such as mean, median and standard deviation of body weight, body length, chest circumference and shank length of village chickens out of all three farms. When the farm data and management was observed, it was noted that Farm 3 reared crossbred village chicken or also known Ayam Kampung Kacuk (AKK) which is crossbred with Hubbard chicken. Hubbard chicken is a commercial broiler chicken breed and also known as coloured chicken. According to Nematbakhsh et. al 2021, commercial broiler chicken strains in Malaysia have intense rapid growth and body conformation, markedly in terms of breast muscle development. Hence, the above the range frequencies on Farm 3.

Body weight, body length, chest circumference and shank length of village chickens according to farms and sex also showed overall, male on all 3 farms has higher mean of body weight, body length, chest circumference and shank length compared to female. Sex differences were among the key factors that contributed to the observed variation (Tadele et. al 2018). One of them is sexual dimorphism where males and female chickens do vary in growth rate as a result of hormonal actions. Other than that, body length is influenced by age of animals, ago-climatic conditions,

and the status of nutrition of chickens whereas shank length is a good indicator of skeletal development related to the amount of meat a chicken can carry.

This study also identified that comb type differences are seen among all three farms according to sex. The dominant comb type for male and females on all three farms are carnations. There are no studies showing why carnation is the dominant comb type in village chickens in Malaysia, according to Tadele et. al 2018, the variation of comb type observed indicates the existence of genetic variability among the indigenous chicken populations. Comb type is also a result of interactions of various genes while comb size is associated with gonadal development and the intensity of light, either in natural or by artificial means.

Feather colour of chickens according to sex for Farm 1 was predominantly spots coloured for both male and female. For Farm 2, male is predominantly black and brown coloured while for female is light brown and black coloured. Male in Farm 3 is dominated by red and black colour while female is dominated by brown colour. Overall, male in all three farms are dominated by red and black colour and this is supported by Azahan et. al 1980, where he stated that the feather colour of village chickens varies considerably with the most common being a black-red variety. Although there are no studies that support this finding, genetic background is one of the influential factors, which has a dominant effect on phenotypic characteristics which leads to specific and various phenotypes (Nematbakhsh et. al 2021). Apart from

genetic makeup, the environment plays a crucial role in the phenotypic variation of chicken breeds.

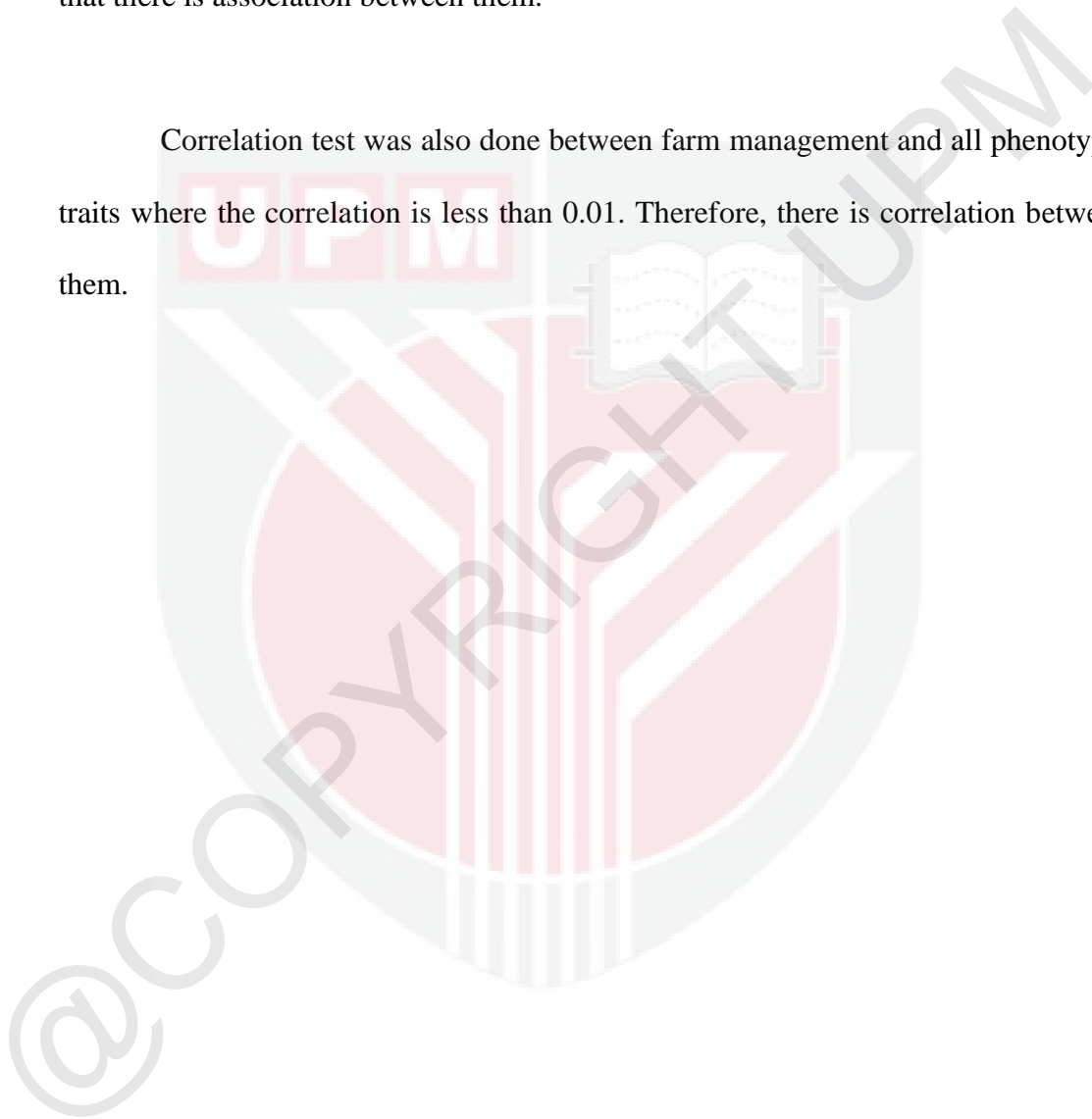
According to Tadele et. al (2018), distinct measurements on qualitative morphological traits were analyzed using frequency procedure of Chi-square (χ^2) test. The chi-square test is a statistical test used to determine if there is a significant association between two categorical variables, which in this case are chicken farms visited (Farm 1, Farm 2 and Farm) with feather colour of chickens and chicken farms visited with comb type of chickens. It is a non-parametric test, which means it makes no assumptions about the distribution of the data. Data that were observed showed p-value ($p < 0.05$) (data has significant difference), therefore, no significant finding.

Chi square test on sex of the chickens with comb types of chickens was also observed as well as sex of chickens with feather colour of chickens. Data that were observed showed p-value ($p < 0.05$) (data has significant difference), therefore, no significant finding. It suggests that the observed data is unlikely to have occurred by random chance alone under the assumption that there is no association between the variables. Therefore, reject the null hypothesis.

One-Way ANOVA was done to assess whether there are any statistically significant differences between the means of three or more independent (unrelated) groups. In a one-way ANOVA, one independent variable (also known as a factor) which are chicken farms visited with and sex of chickens three or more levels or groups (quantitative traits) were observed. The dependent variable is continuous. For

chicken farms visited with all quantitative traits, p-value ($p < 0.05$) (data has significant difference) shows that there is association between them. Sex of chickens with all quantitative traits also has p-value ($p < 0.05$) (data has significant difference) shows that there is association between them.

Correlation test was also done between farm management and all phenotypic traits where the correlation is less than 0.01. Therefore, there is correlation between them.



6.0 CONCLUSION

In conclusion, from this study the data on variability of phenotypic characteristics of village chickens and their relationship with different farm management practices were tabulated and analyzed. Therefore, the objective of this study was to determine the variability of phenotypic characteristics in village chickens from different farm management practices and to assess the relationship between phenotypic characteristics and farm management practices of village chickens were identified, categorized and analyzed. The phenotypic characteristics indicate variability of phenotypic characteristics of village chickens with different farm management practices. Body weight, body length, chest circumference, shank length, feather colour and comb type were the six parameters that were observed and associated with phenotypic characteristics of village chickens. The findings from this study gave additional information and this will assist field veterinarians and consumers to authenticate village chicken breeds in Malaysia apart from the commercial chicken breeds.

7.0 RECOMMENDATIONS

As for future recommendations, a better recording system by forming a logbook with precise information of the village chicken's origin is needed to be practiced by the farms. This will enable the future retrospective study to be more accurate. This would enable better identification of the chickens that are Malaysian village chicken breeds. On top of that, a computing recording system will be better than normal manual recording and it enables easier ways to access the case.

It is also recommended to have more research done on village chicken breeds, especially in-depth study in phenotypic characteristics, so that a reference can be published as a guide for future study. This would make it easier for the researcher and veterinarian to refer to be reported and investigated.

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