ANALYSIS OF THE EFFECT OF BROILER BREEDER'S AGE ON PERFORMANCE AND BEHAVIOR OF CHICKEN TO FORTY-ONE DAYS OF REARING PERIOD

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Degree of Master of Science

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Thesis submitted in partial fulfillment of the requirements for the Degree of Master of Science in Operational Research

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Abstract

The study was based on analysis of the effect of broiler breeder's age on performance and behavior of chicken during the rearing period (41 days). Broiler chicks (1200 birds) from three different ages of broiler breeders (56 weeks, 72 weeks and 95 weeks (post molted breeder)) were studied for their body weight, feed conversion ratio (FCR), overall mortality rate and behavior for 41 days. The performance of the broiler was analyzed by considering the body weight, FCR and the overall mortality while eating, drinking, moving, laying were considered in behavior analysis. There were three experiment groups based on the age of broiler breeders and additional experiment group was made with mixed chicks from all the three breeders. Data were collected in weekly basis for the four experiment groups. Behavior of broilers was observed according to the scan sampling method at every five minutes interval. Data on body weight, FCR, mortality rate and behavior were analysed by using ANOVA. Mean values of body weight, FCR and behavior were separated by Tukey's Studentized Range (HSD) tests. Principal Component Analysis (PCA) was carried out in order to develop an overall behavior index by using sub behavior variables (eating, drinking, moving, laying, other behaviour).

Results revealed that body weight of broilers was significantly different and the lowest body weight was found in the youngest breeder batch in the sixth week compared to the 72 weeks old breeder batch. The FCR was significantly different in the 4^{th} week and the population mean FCR value of 56 weeks old breeder is greater than the 72 weeks old breeder. However, the overall mortality rate was not significantly different among all the breeder groups during the rearing period. The 72 weeks old broiler breeder group was identified as the best breeder group in terms of profit and the performance when the body weight values, FCR values, mortality rates and breeder maintenance cost are considered.

According to the week wise analysis, the drinking behavior was significantly different among the breeder groups in the 6^{th} week and the mean drinking amount of 95 weeks old breeder group was greater than the mixed aged breeder group.

When the moving behavior is considered, it was significantly different among the breeder groups in the 6^{th} week and the mean moving value of 72 and 56 weeks old breeders were greater than the mixed aged breeder group. Further, results revealed that the population overall behavior (overall behavior index value) was not significantly different during the rearing period and also there is no effect on performance of broilers by mixing of chicks from different age breeders. As a concussion, it was found in this study that the breeders' age influences on the body weight, FCR, performance and some sub behavior parameters of broilers.

Keywords: Broiler chicken, Body weight, Behavior, Feed conversion ratio, Mortality

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Table of Contents

List of Figures

List of Tables

List of Appendices

List of Abbreviations

ANOVA	Analysis of Variance
CV	Coefficient of Variation
PCA	Principal Component Analysis
FCR	Feed Conversion Ratio

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Meat has become an essential component in the diet as it is an excellent source of proteins and micronutrients which are mandatory for the growth and development of human (Jung et al., 2015). Therefore, the consumption of meat and meat products show an upward trend in Sri Lanka during the last decade and it is expected to have a further increase in the future. Local meat consumption continues to grow at one of the highest rates compared to any other agricultural commodity due to increasing incomes, changing consumer preferences and lowering costs of meat production and meat prices (Devine, 2003).

Although the different types of meat are available throughout the country in small retail shops and supermarkets, chicken meat, particularly broiler chicken meat is the most consumed meat-type among the Sri Lankan meat consumers (Silva et al., 2010) because certain religious and sociocultural views have a strong influence on meat consumption pattern in a country like Sri Lanka where religious beliefs reduce the consumption of beef and pork. Moreover, chicken meat is also considered as a healthy meat-type by the majority of local consumers. Therefore, broiler chicken meat production has increased rapidly during the past decades to fulfil the demand.

Therefore, today the broiler industry is one of the most tightly coordinated business out of the other major agricultural commodity in Sri Lanka. Many governments and private sectors have already involved in this broiler industry. Currently, broiler hatching eggs and broiler chicken meat are being exported to the Middle East and Maldives. Industry experts have already given their full potential to improve the quality of the products targeting the European Union market as well.

Broiler chicken production at the mass level has already tried to improve the meat quality by altering the various characteristics of broiler meat such as appearance, texture, juiciness, wateriness, firmness, tenderness, odour and flavour which are the most important features that influence the initial and final quality judgment by consumers before and after purchasing a meat product (Cross et al., 1986). Apart from the aforementioned characteristics, broiler management does play an important role in the meat quality as nutrition and performance of the broilers has a significant direct impact on meat quality (Bircan et al., 2018). Broilers' performance can be monitored by using certain parameters such as Feed Conversion Rate (FCR), Overall mortality rate, broilers' body weights and their feed intake (Baracho et al., 2019). Geneticists employed in breeding companies have greatly increased the broilers' growth rate while reducing the FCR and age to slaughter for commercial broilers (Havensteinet et al., 1994) to make more profit in the business.

1.2 Overview of the Company

Madonna farm (Pvt) Ltd is an agro-based business, which is located in a village called Mudungoda of Gampaha district in the western province, which is near to the main town Gampaha. Its journey was started back in 1981, as back yard chicken farm with twenty-five broiler chicks, now has been developed rapidly throughout the Gampaha district with the involvement of family members, hundreds of employees and many of suppliers, up to a small and medium level enterprise. At present, the company owns nearly eighty-five acres' land and six farms, which are being operated throughout the Gampaha district with twelve cooler vehicles having island-wide marketing. Besides currently, three chicken and pork meat shops are being operated in Divlapitiya, Mudungoda and Dankotuwa.

Moreover, the company contains an integrated livestock component in a hatchery, a broiler farm, a feed mill and meat processing plant. Modern-day technologies such as automatic water distribution systems, lighting systems, cooling fans and feeder pan systems were introducing to the farm facility to reduce the waste of water and chicken feed. Other than the broiler chickens the company involving in the swine industry and it's one the major income source. Mainly large white breed animals are used to produce the pork meat. The company won the gold award for medium sector industries category for best agriculture enterprise, a competition held by western province council. The current person engages in the company one hundred and twenty including family members and Annual turnover around two hundred and fifty million LKR. The farms are located in Mudungoda, Divlapitiya, kiridiwela, Dankotuwa areas. In the poultry industry, the major expense is chicken feed cost. To mitigate that problem company, start a feed mill and processing plant to produce chicken feed by their own using local ingredient maize, soya. The hatchery is using for incubating best quality eggs received from there are own and local suppliers to produce quality chicks for the farming industry. The broiler farm facility used high-quality chicks and preserve high biosecurity measures to produce best quality chicken meat products.

1.3 Research Problem

During the past few years it was noticed that the Madona poultry farm has been achieved different values of standard body weight, weight gain, mortality rate values and feed consumption relationships in broiler chicks when the chicks are hatched and during their rearing period. Thus, having different values for the aforementioned parameters is a great barrier for strategic planning of the company in which the efficient production forecasting is not possible. Therefore, the management of the Madona poultry farm has done several numbers of trails to find out the reason for this problem. During the analysis of the observed data, it was noticed that the biosecurity measures and different management practices haven't increased the aforesaid parameters of broiler chicks.

Madona poultry farm uses healthy feeds and healthy chicks and the broilers are reared under controlled houses. Typically, Hubbard F15 broiler breeders are used in the company for breeding process because of the most striking feature in its size. Hubbard F15 broiler is genetically selected to obtain a standard-sized broiler from a dwarf breeder (Marcu et al., 2012). The other significant reason is Hubbard F15 produces high chick numbers at the lowest cost.

However, it was noticed in Madona poultry that they have maintained these chicks batches as a one cluster during the growing period and these chicks are from different age groups of breeder batches in the same broiler strain, Hubbard F15. Several literatures have sown that making a quality broiler chicken depends on the broiler breeder strain, nutrition and performance of the broiler. Moreover, broiler breeders' (known as "parents") age is also another key factor that produces high-quality broiler chicken (Ipek & Sozcu, 2015). However, it is more important to carry out scientific research based on the broiler production management data to find out the exact factors that will enhance the performance of the broiler chicken.

Therefore, this research is based on the data obtained from the hatchery, broiler farm and processing plant of Madona Farm (Pvt) Ltd to find out the broiler breeders optimum age in the aim of improving the commercial broiler chicken weight while keeping the broilers overall production cost minimum.

Since the study of broiler behavior is one of the novel scientific discipline and the lack researches on this subject matter, farm management encouraged to further extend this analysis to find out the effect of breeder's age on the behavior of the broiler chicken.

1.4 Objectives of the Study

Therefore, this study was planned to investigate the effect of age of broiler breeders on performance and behavior of chicken to forty-one days of rearing period. Therefore, the objectives of this study were,

- To find out the optimum age of the broiler breeder on the body weight of the commercial broiler chicks.

Specific objectives:

- To Analyze the effect of broiler breeder age on the FCR of the broiler chicks.
- To Analyze the effect of broiler breeder age on the mortality rate of the broiler chicks.
- To Analyze the effect of broiler breeder age on the behavior of the broiler chicks.

- Prepare a new index value for overall behavior by using sub variables such as eating, drinking, moving, laying, Other behaviors (pecking, stir up litter, scratching feathers etc.)

- To Analyze the effect of broiler breeder age on the overall behavior (Index value) for the broiler chicks.

- To find out the mixing effect of broiler chicks from a different age of breeders on body weight, mortality rate, FCR and overall behavior (index value)

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Literature Review related to Poultry Industry is discussed in this chapter.

2.2 What is Poultry

The term poultry is any domesticated bird used for food of mankind such as meat and eggs raised commercially or domestically. However, varieties include chicken, turkey, goose, duck, Rock Cornish hens, and game birds such as pheasant, squab and guinea fowl. Also included are huge birds such as ostrich, emu and rhea (ratites). Moreover, they provide feathers, fertilizer, animal food and other by-products such as pharmaceuticals.

2.3 The global poultry industry

When taking into account the growth or the structural changes in the global poultry industry during the past decades have been occurred due to rapid development of the modern technological production methods, biogenetic improvements, developed vaccinations to control disease and biosecurity measures and the human population. These global changes have been effected on the poultry products and particularly smallholders and mid-level entrepreneurs to improve their farm income.

Over the last four decades, there has been rapid growth in livestock production and a rapid change in how animal products are produced, processed, consumed and marketed. Growth in livestock production in both developed and developing countries has been led by poultry. From the 1990s to 2005, consumption of poultry meat in developing countries increased by 35 million tonnes – almost double the increase that occurred in developed countries (Thornton, 2010).

The increase in poultry meat consumption has been most evident in East and Southeast Asia and in Latin America, particularly in China and Brazil. The share of the world's poultry meat consumed in developing countries rose from 43 to 54 % between 1990 and 2015, which accounted for 36 % of the large net increase in meat consumption in developing countries over this period (Food and Agriculture Organization Report 2016). Further, the proportion of the world's poultry meat produced in developing countries rose from 42 to 57 %. It is estimated that production and consumption of poultry meat in developing countries will increase by 3.6 % and 3.5 %, respectively, per annum from 2005 to 2030 because of rising incomes, diversification of diets and expanding markets, particularly in Brazil, China and India (Steinfeld et al., 2006).

2.4 Poultry industry of Sri Lanka

During past three decades, the poultry industry has been developed into significant level in terms of commercial, although it is considered as Small Medium Enterprise category or back-yard industry.

After the independence, the authorities of Sri Lanka have executed several programs in order to develop the poultry industry. In this case, the authorities have encouraged the private sector to involve in the industry. For instance, the broiler sector plays a vital role in this industry after the proprietors have involved. As a result of that the government were able to fulfil the people's demand for the consumption.

However, the poultry industry is fully owned by private sector at the moment. Therefore, it is essential to pay attention on health and safety matters of the industry which helps to strengthen the industry. Not only health and safety matters but also research and development is crucial on behalf of the better poultry industry

As per the records, 70% of livestock industry is from poultry such as chicken meat and eggs. As mentioned earlier, the poultry industry is capable of supplying consumer requirements of the country. Further, poultry products are cheaper than other animal products. Moreover, poultry products such as chicken and eggs are highly available in most of the retail shops and super markets of the country. In other words, Sri Lanka has high availability of poultry products chicken and eggs which indicate 4.8 kg and 57 eggs respectively per capita (Department of Animal Production and Health). Hence, the consumers are able to get the proteins easily and cheaper in order to maintain the healthy lifestyle.

As far as the broiler industry of Sri Lanka is concerned, the employment opportunities have also been provided the contract farming system between agribusiness and farmers. According to the livestock statistical bulletin 2017 published by Department of Animal Production and Health Department there are 15 broiler processors in Sri Lanka who has the capability to supply for foreign demand. Currently four processors and five further processing companies have obtained internationally recognized certification under Hazard Analysis Critical Control Point (HACCP) management system.

Further, the 70% of parent-birds' needs are fulfilled by two grand-parent farms of the country. Also, two multinational companies and local feed manufactures have been supplying high quality poultry feed. But 85% of raw materials for the feed manufacturing are imported. Therefore, Sri Lankan authorities have initiated to increase the raw materials such as maize within Sri Lanka. For instance, the corn or maize cultivation have been expanded and the farmers have been encouraged to involve in the cultivation through subsidizing and imposing taxes on imported maize. As a result of that the country will be able to fulfill and produce the feed raw material requirements within the country itself. Consequently, it helps to develop the poultry industry in Sri Lanka.

2.5 Biological classification of poultry

When taking into consideration nowadays the most popular and the common domesticated chicken is the type Red jungle fowl (Gallus gallus or Gallus bankiva).

2.6 Commercial classification poultry

Due to the rapid demand to satisfy the nutrition needs of humans the poultry products especially Chickens rose which use to produce eggs and meat have raised and consumed. Therefore, to fulfil this either egg or meat requirements Chicken are selected and bred to produce quality eggs and with vigorous rapid growing offspring characteristics.

2.7 Broiler management

To fulfil the rapid requirements of nutrition for humans, modern broiler chicken which is prepared for meat and eggs is extremely fast-growing and efficient. Therefore, from the perspective view of efficient broiler management, it should have the ability to produce muscle with a minimum of feed. However, nowadays this a real scenario because of the geneticists and nutritionists who have made great advances in the broiler chicken breeding and feeding process. Moreover, rapid improvements in the broiler management mechanism have also significantly enhanced the efficiency of broiler production. In this Poultry industry, proper broiler management has become more sophisticated due to the rapid growth of today's enhanced performance of broiler chicken.

2.8 Broiler breeders

The parents or hatching egg producers are called broiler breeders. In most cases, pure line is from male line broiler parents genetically in spite of female line broiler parents are two-way crossed. Further, the commercial broiler chicks are considered as terminal crosses because of the slaughter of offspring. The reason is to get better production for the market.

2.9 Consumption of poultry products

During 1960 to 2019, the consumption of poultry products has been increasing compared to other animal products in Sri Lanka. There are various reasons were affected on this demand such as cheapness, mildness, nutrition, ease to digest, high availability etc. (Magdelaine et al. 2008) express that the consumption has increased due to two services; ready to eat and the catering outside the home. In other words, people have been encouraged to consume foods as result of convenience of having foods.

2.10 Feed intake

Birds eat primarily to satisfy energy needs. Also the temperature of environment has an important influence on feed intake, the warmer the environment the less the feed intake. Therefore, the requirement of all nutrients expressed as a percentage of the diet is dependent upon the environment temperature. Other factors affecting feed intake are health, genetics, form of feed, nutritional balance, stress, body size and rate of egg production or growth (Ensminger, 1992).

Poultry eat a daily amount of feed that is equivalent to approximately 5% of their body weight. They eat the amount of food that approximately meets their energy requirements. Food intakes are usually based on an estimate of the requirement of poultry for metabolizable energy.

The feed intakes of poultry may be further altered by factors that are not directly related to the nutrient content of the feed. Intakes of pelleted feeds are typically 5-8% greater than when the birds are given the same feed in meal form.

Short day lengths result in low food intakes, especially in young birds. Feed troughs with poor access or high stocking densities reduce feed intakes. Providing food as a wet mash a short-term stimulus to food intakes. High moisture foods are prone to bacterial spoilage and so they are not generally used in large poultry enterprises (Rose, 1997).

2.11 Feed conversion ratio (FCR)

FCR is calculated by dividing the total mass of feed with the net production (mass of the output is subtracted from the starting mass) over the specific period of time. Therefore, FCR is unit less. The low FCR indicates the high efficiency in terms of feed gained. In general, 2 to 3kg of feed can be converted into 1kg of live weight.

2.12 Age of Breeder

Incubating egg weight and day old chick weight at hatch depends on the age of the breeder have been reported in literature. Similarly, Hill (2001) reported an increase in chick length with increasing age of the breeder. The occurrence of chicks of subnormal quality is higher in chicks in hatching eggs of older breeders (Decuypere and Bruggeman, 2006). However, although chicks hatched from young (39 weeks) breeder weighed less than chicks from older (53 weeks) breeders, the chicks from young age breeders had greater chick quality characteristics (Willemse et al., 2008).

2.13 Factors effect on broiler performance

The broiler performance factors of financially importance such as body weight gain, feed conversion rate (FCR), mortality rate and carcass yield are continuously enhanced together with genetic improvements, environment management, health management, nutrient management and awareness to bird welfare throughout their life time. All of these factors are interdependent. If any factor less than the highest standard, then total broiler performance will reduce.

Literature have revealed that the performance of poultry does not only depend on inherited capability but also to a great extent upon the environment (Cambell and Lasley, 1975) The environmental conditions affecting the performance, health productivity of a chicken include temperature, relative humidity, stocking density (Cravener et al., 1992; Puron et al., 1997), lightning program (Buyse et al., 1996; Ingram et al., 2000), ventilation (Lott et al., 1998; Yahav et al., 2004) and feed form (Acar et al., 1991; Moriz et al., 2001), housing system are well documented throughout the literature to impact bird performance.

2.14 Future of poultry genetics and breeding

In recent years, the rate of genetic progress has declined because of physiological limitations. Nowadays, there are many benefits have been gained by closely monitoring the environment of chicken. However, fringe benefits can be achieved with the knowledge of interaction in complex manner.

2.15 Poultry behavior

In the poultry industry, the study of animals has been become significant in contemporary scientific practice in the sector in order to produce high quality products. In this case not only the farmer but also the other people such as hatchery designers, equipment suppliers should be well-aware about the behavior of animals. Hence, it will help to get optimum output from poultry industry. Also it helps for the betterment of the industry.

2.16 Statistical methods in previous studies

According to the previous statistical studies found in several literatures, it was found that body weight gain, feed intake, feed conversion, live weight and mortality are the basic variables used to analyse the performance of broilers (Baracho et al., 2019). Further, it was found that the behaviour of broiler chicken can be analysed by using the main behaviour characteristics such as eating, drinking, moving and laying (Toghyani et al., 2010).

Many statistical studies reveal that the breeder's age is one of the most vital factor that affects the performance of broilers, chick quality (İpek & Sözcü, 2013) slaughter yield (Peebles et al., 2013) and egg weight (Iqbal et al., 2014).

As per the literatures, the experimental design (completely randomized) method has been used in order to analyse the effect of breeder's age on the broiler performance and the slaughter yield (Peebles et al., 2013). Moreover, Meta-analysis method based on multiple scientific studies with ANOVA test have also been used in the case of analysing the broiler performance (Baracho et al., 2019). Also, it was found in literatures, that the effect of breeder's age on first-week broiler performance was analysed by using the ANOVA method (Ipek et al., 2014). Meanwhile, General Linear Model procedure (Toghyani et al., 2010) has been used to analyse the effect of litter material on behaviours of broilers.

Principle Component Analysis method simply, PCA has been used as a variable reduction method in most statistical analysis studies found in the literatures. This method has been implemented in estimating the variation in egg weight and egg component for two genetic lines of Kurdish local chicken and their relationship with shank feathering (Shaker et al., 2017). Further, PCA has also been used to describe the interdependence in the original eleven egg quality characteristics in chicken by three egg traits (Ukwu et al., 2014). The same method has been used in analysing the body measurements in three strains of broilers and it was able to define the body size of broilers by three principle components instead of eight body parameters (Udesh et al., 2011).

In order to find wheter there exists a significance difference in tratements ANOVA has been used in many statistical reseaches. The effect of litter treatment on growth performance in broiler chicken has been analysed by using the ANOVA test and means were seperated by Tukey's HSD post-hoc test. The P-value 0.05 was used to evaluate significance among means (Taherparvar et al., 2016).

Based on the previous statistical studies as mentioned above, ANOVA and the PCA methods are going to implement in this study to analyse the effect of breeder's age on the performance and the behaviour of the broiler strain "Hubbard F15". Further, Tukey's HSD post-hoc test is used to separate the means.

CHAPTER 3

METHODOLOGY

3.1 Research Method

The experiment was conducted in three closed houses with concrete floor and evaporative cooling system at Madonna farm (Pvt) Ltd at Divlapitiya, Dankotuwa premises.

Houses were cleaned and disinfected before preparation of brooder houses. Experiment units were established along the right side of each house from the front end.

The research is carried out with a sample of 1200 broiler chicks (birds) bred from “Hubbard F15” broiler breeders of three different age groups (56 weeks, 72 weeks and 95 weeks) in the same broiler strain. Hubbard F15 breeder is a “mini-type” breeder and is well recognized for its feed saving characteristic which produces high chick numbers at the lowest cost that meets the requirements of modern poultry producers looking for low live cost and good carcass yield.

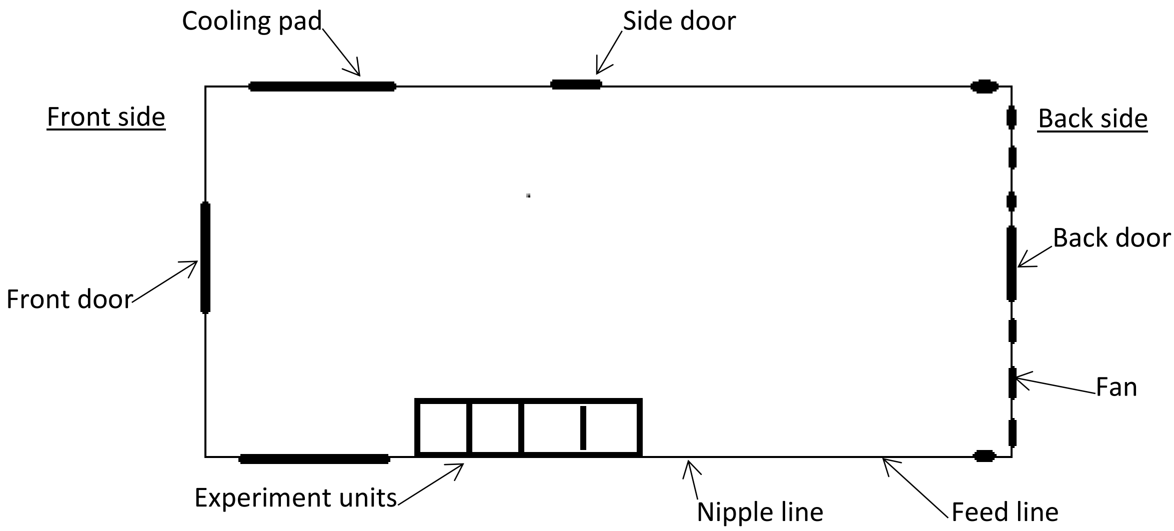

Figure 3. 1: Structure of the house with the experimental units

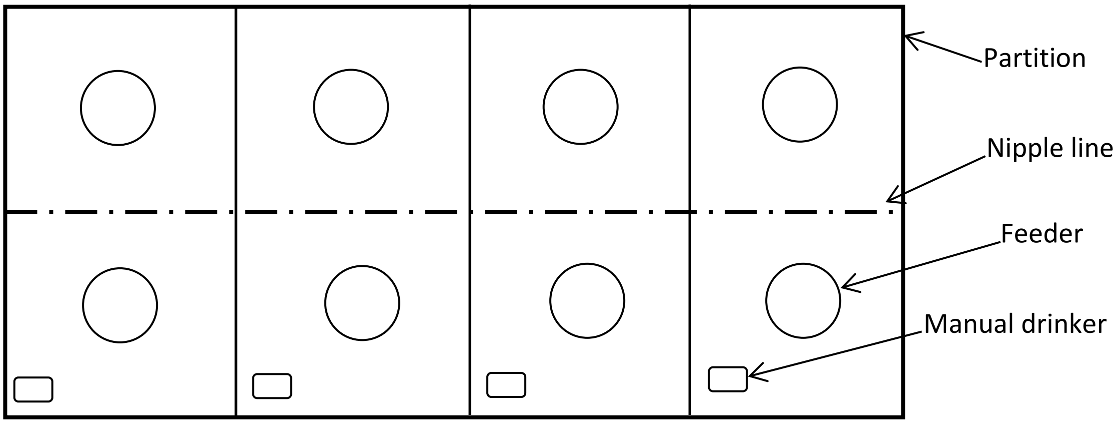

Figure 3. 2: Structure of four experimental units

A total of 400 newly hatched broiler chicks were randomly allocated in to four experiment groups based on breeder's age. As shown in Figure 3.1, 100 birds were reared in a pen as one experiment group; like that there were four experiment groups. And the research was handled in three closed houses as three replicates.

Chicks were transported from the hatchery from separate three breeder batches (56 weeks, 72 weeks, 95 weeks age) as 150 chicks from one breeder batch. They were selected premium quality chicks which has weight of 38g or more than that. The chicks were separated according to the breeder batches wise in to four separate experiment pens and 100 chicks were allocated for one pen. Experiment groups were as fallows,

- Experiment Group A - Chicks from the 95 weeks aged breeder batch
- Experiment Group B - Chicks from the 72 weeks aged breeder batch
- Experiment Group C - Chicks from the 56 weeks aged breeder batch
- Experiment Group D - Mixed chicks from above three batches (33 from A, 33 from B and 34 from C)

As shown in Figure 3.2, each floor pen was equipped with two feeders, nipple drinkers and manual drinker to allow chicks to feed and water consumption. These chicks were reared until they reached to their 41 days old. They are fed with standard farm feed manufactured by the Madonna feed mill. Farm management used different types of broiler feeds according to broiler bird's age. During the first week used check booster feed type and within next eleven days' time period used check starter likewise grower, finisher and withdrawal feed types was used. The nutritive value of each feed type and their composition is shown in the Table 3.1.

Table 3. 1: Nutritive value of given feed

	Broiler Chick Booster	**Broiler Starter**	**Broiler Grower**	**Broiler Finisher**	**Broiler Withdrawal**
Feeding time period	From day 1 to day 7	From day 7 to day 18	From day 18 to day 26	From day 26 to day 32	From day 32 to day 41
Protein	23.5%, (min)	22% (min)	21.0% (min)	20% (min)	20% (min)
Fat	7%, (min)	6% (min)	6.5% (min)	7% (min)	7% (min)
Ash	7%, (max)	7% (max)	6.5% (max)	7.5% (max)	7.5% (max)
Fibre	4.5%, (max)	4.5% (max)	4.5% (max)	4.5% (max)	4.5% (max)
Calcium	1.0-1.2%	0.95-1.2%	1.0%	0.9-1.2%	0.9-1.2%
Phosphorus	0.7-1.0%	0.7-1.0%	0.7%	0.65-1.0%	0.65-1.0%
Metabolizable Energy	3000 kcal/Kg (min)	3000 kcal/Kg (min)	3000 kcal/Kg (min)	3100 kcal/Kg (min)	3100 kcal/Kg (min)
Methionine	0.56% (min)	-	-	-	-

Brooding temperature was maintained around 32^0C -34^0C at first seven days and gradually reduced daily by 0.3-0.5^0C. On 41st day the temperature was maintained at 28^0C. The temperature was maintained according to the behavior of the birds, avoiding panting the birds. Maintains of brooder house temperature was done by gas brooders. Floor space was $0.018m^2$ per bird at first day and gradually increased the space given to the birds daily, up to 0.054 m^2 per bird at 17 days. Again floor space was increased up to 0.072 m^2 on 36^{th} day of age and was continued till the end (See Table 3.2).

Table 3. 2: Space chart

Age of the birds (Days)	**Total space per one treatment pen for 100 birds (m^2)**
0-5	0.0180
6-7	0.0234
8	0.0264
9	0.0297
10	0.0324
11	0.0351
12	0.0378
13	0.0405
14	0.0432
15	0.0477
16	0.0513
17-35	0.0540
36-41	0.0720

Lighting program was provided according to the standard practices at Madonna farm (Pvt) Ltd. Vaccines and all other drugs were given as same as the farm is practicing. All birds were vaccinated against Gamboro disease (Infectious Bursal Disease) and against Newcastle disease.

Due to the poor litter management broilers may cause leg abnormalities, footpad dermatitis and breast burns. Therefore, an ideal bedding material must be used for the houses which have the characteristics of reasonable drying time, absorbent. Previous experience of the farm management for flor bedding material in closed houses (cages) rice hulls were used. Broilers are reared on deep-litter to prevent brushing of muscles due to cages. Maintain low moisture content, ensure controlled ammonia concentration and meet the hygienic requirements litter was raked two wised a day in morning and evening.

Table 3.3 to Table 3.6 shows that the lighting programme, light intensity value, vaccination schedule and the drugs used within the experiment period respectively by the farm management.

Table 3. 3: Lighting programme

Age of birds (Days)	Lighting schedule
1 - 5	0.5 hours after every 3.5 hours
6 - 7	4 hours off in night time
8 - 14	6 hours off in night time
15 - 20	6 hours off in night time
21 - 25	0.5 hours off in night time
26 - 41	2 hours off in night time

Table 3. 4: Light intensity value

Age of birds (Days)	Light intensity
1 -5	50 lux
6 -7	30 lux
8 – 14	20 lux
15 -41	10 lux

Table 3. 5: Vaccination schedule

Age (Days)	Disease	Vaccine	Rout
7	New Castle Disease	ND live (Avinew)	Drinking water
18	Infectious Bursal Disease	IBD live (Gallieac)	Drinking water
23	Infectious Bursal Disease	IBD live (Gallieac)	Drinking water

Table 3. 6: Drugs used within the experiment period

Drug	Dose	Time period
Evifloxin (Endofloxine)	1ml in 2 liters of drinking water (Double dose within first 3 days and then as normal)	1-5, days old
Sulprim	2ml in 4.5 liter of drinking water	1-5 days old
Niodox	1g in 10 liters of drinking water	10-13 days old
Vitalyte plus with probiotics	150g in 450 liters of drinking water	1-5, 7, 17-18, 23 days old
Multi-vitamin	1-2 ml in 5 liters of drinking water	13-16 days old

3.2 Body weight of the birds

Body weights of birds were measured separately in four experiment pens in the evening. The body weights were measured daily within the first 7 days (brooding period) and after that measured twice a week. Weights of all the birds were taken once a week after the brooding period. However, during the gap between the weekly weight measurements, weights of 20 birds were obtained once each week. Avery scale was used.

3.3 Feed Conversion Ratio (FCR)

The feed was given after measuring and then the remaining feed amount was measured. Then total feed consumption was determined. Finally feed conversion ratio was calculated. These data were also taken in same day of the data that taken the body weight. Avery scale was used.

Total feed consumption of birds = (Given total feed amount – Remaining total feed amount)

$$FCR = \frac{(\text{Cumulative of feed consumption})}{(\text{Body weight})}$$

3.4 Mortality

Mortality was observed daily throughout 41 days in separate four pens. And mortality rate in separate four treatments were calculated.

$$\text{Mortality rate} = \frac{(\text{Number of dead birds in one experimental unit}) * 100}{(\text{Total number of birds per experimental units})}$$

3.5 Observing Behavior

The Eating, Drinking, Moving, Laying behaviors were mainly observed. Rests of the behaviors were categorized under all other behaviors (pecking, stir up litter, scratching feathers etc.) These behaviors were observed separately in separate four pens. Scan sampling technique at every 5 minutes interval was practiced. Data were taken two days per week and per one day two hour in the morning and one hour in the evening.

Table 3. 7: Description of behavior of birds

Behavior	Description
Eating	Chicks/ birds eating from the feed baskets, feed trays, Feed paper and in the litter around these
Drinking	Chicks/Birds drinking from nipple drinkers, manual drinker and birds who swallowing water
Moving	Chicks/Birds who are running here and there and walking around the pen
Laying	Chicks/Birds laying on litter, feeders
Other behaviors (pecking, stirring up litter, scratching feathers etc.)	All the other behaviors than mentioned above

3.6 Statistical method used to analyze

The experimental data on broilers' body weight, ANOVA method is applied in weekly basis in order to identify whether there exists a significance of mean body weight among the broiler chicken population taken from different age breeders. Mean body weights of the broiler chicken from different age of broiler breeders are separated by using Tukey's Studentized Range (HSD) test.

Data on Feed Conversion ratio (FCR) and behavior are analyzed in weekly basis by using ANOVA method where means are separated by Tukey's Studentized Range (HSD) Test. Having analyzed the data on broiler chicks' behavior, a new index is defined for overall behavior by using PCA method considering all sub behavioral variables such as eating, drinking**,** moving, laying and other behaviors. Finally, to analyze the effect of broiler breeder's age on the mortality percentage of the broiler chicks, ANOVA and graphical representations (multiple bar chats) are used.

Aforementioned analysis is based on main statistical techniques that can be described as follows.

3.6.1 Descriptive Statistics

Descriptive statistics are the first statistical technique that is used to describe the basic characteristics of sample data set. Measures of variability and measures of central tendency are the main two elements of the descriptive statistics. Measures of central tendency includes the mean, median, and mode while the measures of variability includes the standard deviation and variance. Therefore, by analysing the descriptive statistics a basic idea about the sample data set can be obtained.

3.6.2 Levene Test of Homogeneity

Before the ANOVA test is performed, it is essential to fulfil the requirement of the basic assumption in ANOVA which is known as the assumption of homogeneity or the independent variable groups have equal variances. In order to check assumption of homogeneity which was mentioned above, Levene test of homogeneity is performed. The null hypothesis of Levene test is the variance are homogenous across the experiment groups. A decision of hypothesises can be made by examining the significance value or the P-value of Levene test results. If the significance value of Levene test is greater than significance level 0.05, the null hypothesis is accepted and the ANOVA test can be continued.

Set hypothesis for the Levene Statistics (Levene test)

H_0 : variances are equal across the breeder groups .$(\sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \sigma_4^2)$

H_1 : variances are not homogenous across the breeder groups. $(\sigma_1^2 \neq \sigma_2^2 \neq \sigma_3^2 \neq \sigma_4^2)$

Decision making criteria

P-value > significance level α (0.05), fails to reject null hypothesis.

3.6.3 Welch Robust Test

If the Levene statistic test results does not fulfil the homogeneity variance assumptions, Welch robust test is required to perform in order to check the homogenous variance assumption. The null hypothesis for Welch robust test is the variance are homogenous across the treatment groups. The significance value or the P-value of Welch robust test results can be used to make a decision of hypothesises. If the significance value of Welch robust test is greater than significance level 0.05, the null hypothesis is accepted.

Set hypothesis for the Welch's test

H_0 : variances are equal across the breeder groups. $(\sigma_1^2 = \sigma_2^2 = \sigma_3^2 = \sigma_4^2)$

H_1 : variances are not homogenous across the breeder groups. $(\sigma_1^2 \neq \sigma_2^2 \neq \sigma_3^2 \neq \sigma_4^2)$

Decision making criteria

P-value > significance level α (0.05), fails to reject null hypothesis.

3.6.4 One-Way ANOVA Test

The one-way ANOVA is used to determine whether there are any statistically significant differences between the population means of three or more independent groups. The null hypothesis for ANOVA test is the population means are equal across the treatment groups. A decision of hypothesises can be done by comparing the test statistics (calculated F-value) and tabulated F-value received from the F distribution table. If test statistic is greater than the tabulated F-value, the null hypothesis can be rejected. Moreover, it is also possible to prove that the null hypothesis is true by comparing the P-value or the significance value with the significance level, 0.05. ANOVA test assumes that the data is normally distributed, homogeneity of variance and the observations are independent of each other.

Set hypothesis for the ANOVA Test

H_0: Population means among different age breeder groups are not significantly different.

$(\mu_1 = \mu_2 = \mu_3 = \mu_4)$

H1: At least one population mean among different age breeder groups is significant.

$(\mu_1 \neq \mu_2 \neq \mu_3 \neq \mu_4)$

Decision making criteria

P-value > significance level α (0.05), fails to reject null hypothesis.

3.6.5 Tukey's HSD Multiple Comparison Test

The one-way ANOVA test rejects null hypothesis which implies that at least one population mean is deferent from other population means. However, it does not revel where the deference exists. Therefore, it is required to conduct Tukey's HSD Post hoc test in order to identify where the significance exists among populations. The null hypothesis for Tukey's HSD Post hoc test is the population means among treatment groups are not significant. A decision of hypothesises can be done by using the significance values of Tukey HSD multiple comparison test results. If the significance value of Tukey HSD multiple comparison test is greater than significance level, 0.05, the null hypothesis can be accepted.

Set hypothesis for the Tukey HSD Test

H_0: Population means among different age breeder groups are not significant.

$(\mu_i = \mu_j)$

H_1: Population mean among different age breeder groups is significant.

$(\mu_i \neq \mu_j)$

Decision making criteria

P-value > significance level α (0.05), fails to reject null hypothesis

3.7 Principle Component Analysis

PCA is a multivariate technique that analyses a data table in which observations are described by several inter-correlated quantitative dependent variables. Its goal is to extract the important information from the statistical data to represent it as a set of new orthogonal variables called principal components. Sample adequacy and the sphericity assumptions are the prerequisites to perform PCA. In order to select the optimal number of components, eigenvalue criteria or the Kaiser's criteria was used. Under this criteria, components with an Eigen value larger than one are retained, or factors which explain a total of 70-80% of the variance are retained. Moreover, the scree plot is also useful to determine the number of components to retain. The point of interest is where the curve starts to flatten and retain all factors above the elbow.

3.7.1 Kaiser Meyer Olkin Test

The sample adequacy of PCA is measured by using Kaiser Meyer Olkin test. In order to satisfy the sample adequacy, Kaiser Meyer Olkin test value should have bare minimum of 0.5. The Kaiser Meyer Olkin test value between 0.5 and 0.7 are mediocre, value between 0.7 and 0.8 are good, value between 0.8 and 0.9 are great and value between 0.9 and above are superb (Hutcheson & Sofroniou, 1999).

3.7.2 Bartlett's Test of Sphericity

The sphericity assumptions is measured by using Bartlett's Test of Sphericity. The null hypothesis for Bartlett's Test of Sphericity is the original correlation matrix is an identity matrix. In order to continue PCA, Bartlett's Test null hypothesis should be rejected. Therefore, the significance value or the P-value for Bartlett's Test of Sphericity, should be less than significance level 0.05 which implies data do not produce an identity matrix and thus approximately multivariate normal.

Set hypothesis for the Bartlett's Test

H_0: original correlation matrix is an identity matrix.

H_1: original correlation matrix is not an identity matrix.

Decision making criteria

P-value > significance level α (0.05), fails to reject null hypothesis

CHAPTER 4

DATA ANALYSIS

One of the biggest concern of the modern day broiler chicken farming is to get a good chicken caucus yield at minimum cost. Therefore, the famers habitually try for rear broiler breeds which produce higher body weights of broilers at the end of the rearing period. Apart from that, the famers also have to maintain an efficient broiler management system with quality chicken feeds and better welfare facilities in order to get a good chicken caucus yield.

4.1 Analyze the effect of breeder's age on the body weight of broiler chicken.

In this analysis, the effect of broiler breeder's age on the body weight of chicken was analyzed. There are four breeder groups of different ages that provide chicks to the farm. These breeder groups are characterized as 56 weeks old breeders, 72 weeks old breeders, 95 weeks old breeders and the mixed breeders.

Having gathered the raw data of the body weight of broiler chicken for over the period of forty-one days, the ANOVA was performed weekly in order to identify whether there exists a significant difference in the body weight of broiler chicken produced from different breeder groups. Before the ANOVA was performed, a descriptive statistic was conducted for each week in an attempt to summarize the chicken body weight data.

The Table 4.1 was prepared by considering the one-day old chicks body weight statistics. As can be seen in the Table 4.1, the 95 weeks old breeder group has the highest body weight mean value for the one-day old chicks while the 56 weeks old breeder group is having the lowest mean value for same. This is more clearly visible in the graph shown in Figure 4.1 which is drawn for the mean body weights distribution among the four breeder groups. It can also be noticed in the Figure 4.1 that 72 weeks old breeder group and mixed breeder group have appeared similar body weight mean values.

Table 4. 1: Descriptive statistics on body weight of one-day old chicks

	N	Mean (**g**)	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	4672.00	25.632	14.799
Breeder 72 weeks Old	3	4501.67	155.107	89.551
Breeder 56 weeks Old	3	4441.67	117.721	67.966
Breeder Mixed Age Group	3	4478.33	56.862	32.830
Total	12	4523.42	126.997	36.661

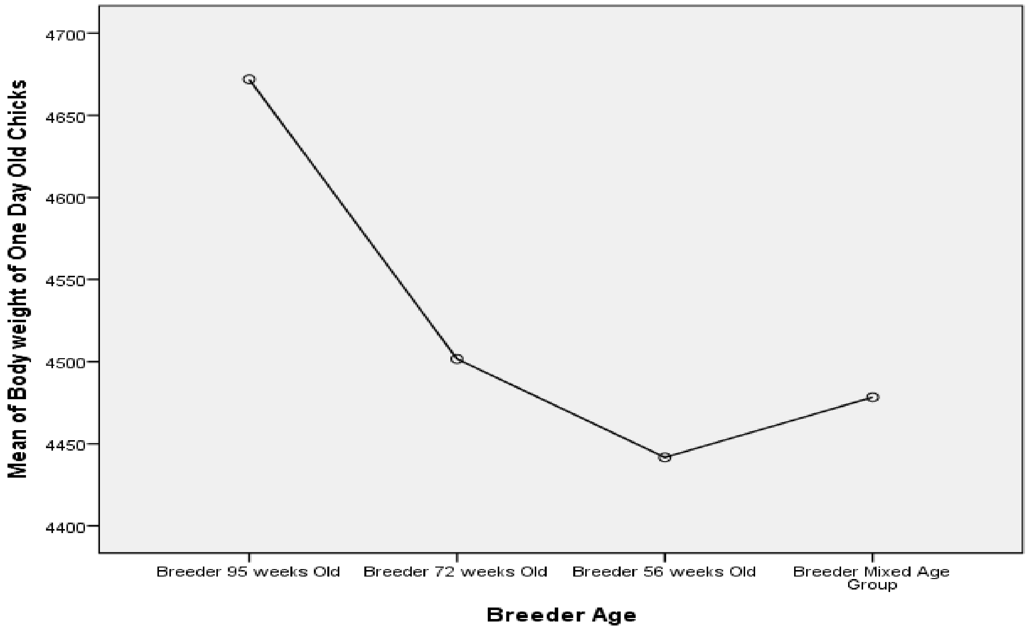

Figure 4. 1: Means plot for breeder type vs mean body weight of one-day old chicks

However, in the sense of variance appeared in the Table 4.1, 72 weeks old breeder group has received the highest variance whereas the 95 weeks old breeder group holds the lowest variance. Hence during the day-one, 95 weeks old breeder group is better than the other three breeder groups as it has the highest mean value and the lowest variance for the body weight of the chicks.

In broiler chicken industry body weight broiler chicken has to be high. When the body weight of chicken increases proportionally broiler production (caucus yield) also increases. Therefore, the poultry farmers try to get high weight gaining broiler breeds for their industry.

Before the ANOVA test is performed, it is essential to fulfil the requirement of the basic assumption in ANOVA which is known as assumption of homogeneity (i.e. the independent variable groups have equal variances). Therefore, Levene test of homogeneity was conducted in order to check whether the equal variance assumption is meet or not and the test results are summarized as shown in the Table 4.2. According to the Levene statistic test results shown in Table 4.2, it is obvious that the significance value of 0.282 is already greater than the significance level, α (0.05). This means that the body weight variances are equal across the groups of one-day old chicks produced from different age breeders. In other words, null hypothesis, H_0 is true. Therefore, ANOVA can be continued.

Table 4. 2: Levene Statistics on body weight of one-day old chicks

Test of Homogeneity of Variances			
Body weight of one day old chicks			
Levene Statistic	df1	df2	Sig.
1.521	3	8	0.282

Table 4.3 illustrates the statistic results obtained by performing the ANOVA test for body weight of one-day old chicks. As can be seen in the Table 4.3, the significance value or the P-value is 0.096 whereas the significance level is consider as 0.05. As the significance level is less than the P-value, the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference between the population mean body weights of one-day old chicks produced from the different age breeders. Therefore, the body weight of chicks from different breeders are almost the same at the beginning of the study.

Table 4. 3: ANOVA Table on body weight of one-day old chicks

ANOVA					
Body weight of one day old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	93796.917	3	31265.639	2.991	0.096
Within Groups	83614.000	8	10451.750		
Total	177410.917	11			

Table 4. 4: Descriptive statistics on body weight of one-week old broilers

	N	Mean (**g**)	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	13318.666	928.1407	535.8623
Breeder 72 weeks Old	3	12751.666	1094.7640	632.0623
Breeder 56 weeks Old	3	12764.900	1392.2319	803.8054
Breeder Mixed Age Group	3	13002.550	1056.8630	610.1801
Total	12	12959.445	993.8995	286.9140

Descriptive statistics on body weight of one-week old chicks are shown in the Table 4.4. By observing the descriptive statistic Table 4.4, it is apparent that the lowest mean body weight value is obtained by the 72 weeks old breeder group while the highest mean body weight value is obtained by the 95 weeks old breeder group. The 56 weeks old breeder group and the mixed age breeder group have slightly different mean body weight values of 12.76 kg and 13 kg respectively. But in the sense of variance, 56 weeks old breeder group has received the highest value of the variance over the other breeder groups and the 95 weeks old bleeder group claims the lowest value of the variance.

According to the Levene statistic test results shown in Table 4.5, the significance value is 0.810 which is almost greater than the significance level, α (0.05). Therefore, it is concluded that the variances are homogenous across the breeder groups of one-week old broiler chicken produced from deferent age breeders. So that the ANOVA test can be continued as the null hypothesis, H_0 is true.

Table 4. 5: Levene Statistics on body weight of one-week old broilers

Test of Homogeneity of Variances			
Body weight of chicken after one week old			
Levene Statistic	df1	df2	Sig.
0.322	3	8	0.810

Table 4.6 illustrates the statistic results obtained by performing the ANOVA test for body weight of one-week old chicks. As can be seen in the Table 4.6, the significance value or the P-value for ANOVA test is found as 0.917 whereas the significance level for the same is consider as 0.05. Hence, it is clear that the significance level α is less than the P-value which makes the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference between the population body weights of one-week old broiler chicken produced from the different age breeders.

Table 4. 6: ANOVA Table on body weight of one-week old broilers

ANOVA					
Body weight of chicken after one week old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	635753.519	3	211917.840	0.166	0.917
Within Groups	10230445.808	8	1278805.726		
Total	10866199.327	11			

Table 4.7 displays the descriptive statistics on body weight of two-weeks old chicks. By examining the descriptive statistic Table 4.7, it seems obvious that the mixed age breeder group claims the lowest mean body weight value while the 95 weeks old breeder group is having the highest mean body weight value for the same. Further, the 72 weeks old breeder group and 56 weeks old breeder group have slightly similar mean body weight values as can be seen in the same Table 4.7. However, in terms of

Variance, mixed age breeder group has received the highest variance while the 56 weeks old breeder group is having the lowest variance for the same.

Table 4. 7: Descriptive statistics on body weight of two-weeks old broilers

	N	Mean (**g**)	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	28468.733	2279.69840	1316.1844
Breeder 72 weeks Old	3	27543.333	1929.62000	1114.0666
Breeder 56 weeks Old	3	27412.133	1527.05738	881.64699
Breeder Mixed Age Group	3	26954.733	2526.33513	1458.5802
Total	12	27594.733	1880.47009	542.84496

Levene test of homogeneity was carried out in order to check whether the equal variance assumption is meet or not and the Levene test statistics results are summarized in the Table 4.8. According to the Table 4.8, the significance value is 0.629 which is greater than the significance level, α (0.05). Therefore, it reveals that the variances are homogenous across the breeder groups of two-weeks old broiler chicken produced from deferent age breeders. So that the ANOVA test can be continued as the null hypothesis, H_0 is true.

Table 4. 8: Levene Statistics on body weight of two-weeks old broilers

Test of Homogeneity of Variances			
Body weight of chicken after two weeks old			
Levene Statistic	df1	df2	Sig.
0.606	3	8	0.629

Table 4.9 illustrates the statistic results obtained by performing the ANOVA test for body weight of two-weeks old chicks. As can be seen in the Table 4.9, the significance value or the P-value for ANOVA test is found as 0.842 whereas the significance level for the same is consider as 0.05. Hence, it is clear that the significance level is less than the P-value that makes the null hypothesis, H_0 is true. Hence, it is concluded that there

is no significant difference between the population body weights of two-weeks old broiler chicken produced from the different age breeders.

Table 4. 9: ANOVA Table on body weight of two-weeks old broilers

ANOVA					
Body weight of chicken after two weeks old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3628382.160	3	1209460.720	0.274	0.842
Within Groups	35269463.207	8	4408682.901		
Total	38897845.367	11			

Table 4. 10: Descriptive statistics on body weight of three-weeks old broilers

	N	Mean (**g**)	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	61753.500	3087.83375	1782.7616
Breeder 72 weeks Old	3	60693.433	3274.29983	1890.4178
Breeder 56 weeks Old	3	59622.400	4180.23284	2413.4585
Breeder Mixed Age Group	3	59026.866	5153.50104	2975.3752
Total	12	60274.050	3588.00601	1035.7681

By considering the descriptive statistics available for the body weight of three-weeks chicks as presented in the Table 4.10, it is absolutely clear that the mean body weight of 95 weeks old breeder group is higher than the other three groups whereas the mixed age breeder group has the lowest mean body weight value. Further, the 56 weeks old breeder and mixed age breeders are having similar mean body weight values of 59.62 kg and 59.02 kg respectively. However, considering the variances as depicted in the same Table 4.10, the mixed age breeder group claims the highest variance while the 95 weeks old breeder group claims the lowest variance.

Levene test of homogeneity was carried out in order to check whether the equal variance assumption is meet or not and the Levene test statistics results are summarized in the Table 4.11. According to the Table 4.11, the significance value is 0.650 which is greater than the significance level, α (0.05). Therefore, it reveals that the variances are homogenous across the breeder groups of three-weeks old broiler chicken produced from deferent age breeders. So that the ANOVA test can be continued as the null hypothesis, H_0 is true.

Table 4. 11: Levene Statistics on body weight of three-weeks old broilers

Test of Homogeneity of Variances			
Body weight of chicken after three weeks old			
Levene Statistic	df1	df2	Sig.
0.571	3	8	0.650

Table 4.12 illustrates the statistic results obtained by performing the ANOVA test for body weight of three-weeks old chicks. As depicted in the Table 4.12, the significance value or the P-value for ANOVA test is found as 0.845 whereas the significance level for the same is consider as 0.05. Hence, it is clear that the significance level is less than the P-value that makes the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference between the population body weights of three-weeks old broiler chicken produced from the different age breeders.

Table 4. 12: ANOVA Table on body weight of three-weeks old broilers

ANOVA					
Body weight of chicken after three weeks old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13034306.017	3	4344768.672	0.270	0.845
Within Groups	128577352.313	8	16072169.039		
Total	141611658.330	11			

Table 4. 13: Descriptive statistics on body weight of four-weeks old broilers

	N	Mean (**g**)	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	113407.60	5506.447	3179.149
Breeder 72 weeks Old	3	115332.10	3248.208	1875.353
Breeder 56 weeks Old	3	108547.96	9567.072	5523.551
Breeder Mixed Age Group	3	112173.40	4769.928	2753.919
Total	12	112365.26	5906.831	1705.155

As can be seen in the descriptive statistics Table 4.13 for the body weight of four-weeks old chicks, it is very clear that the lowest mean body weight value is obtained by the 56 weeks old breeder group whereas the highest mean body weight value is obtained by the 72 weeks old breeder group. The 95 weeks old breeder group and mixed breeder group have slightly similar mean body weight values. But in the sense of the variance, 56 weeks old breeder group has received the highest variance while the 72 weeks old breeder group is having the lowest variance for the same.

Levene test of homogeneity was carried out in order to check whether the equal variance assumption is meet or not and the Levene test statistics results are summarized in the Table 4.14. According to the Table 4.14, the significance value is 0.109 which is obviously greater than the significance level, α (0.05). Therefore, it reveals that the variances are homogenous across the breeder groups of four-weeks old broiler chicken produced from deferent age breeders. So that the ANOVA test can be continued as the null hypothesis, H_0 is true.

Table 4. 14: Levene Statistics on body weight of four-weeks old broilers

Test of Homogeneity of Variances			
Body weight of chicken after four weeks old			
Levene Statistic	df1	df2	Sig.
2.797	3	8	0.109

Table 4.15 illustrates the statistic results obtained by performing the ANOVA test for body weight of four-weeks old chicks. As depicted in the Table 4.15, the significance value or the P-value for ANOVA test is found as 0.615 whereas the significance level for the same is consider as 0.05. Hence, it is clear that the significance level is less than the P-value that makes the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference between the body weights of four-weeks old broiler chicken produced from the different age breeders.

Table 4. 15: ANOVA Table on body weight of four-weeks old broilers

ANOVA					
Body weight of chicken after four weeks old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	73491452.740	3	24497150.913	0.632	0.615
Within Groups	310305822.327	8	38788227.791		
Total	383797275.067	11			

Table 4. 16: Descriptive statistics on body weight of five-weeks old broilers

	N	Mean (**g**)	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	166625.000	1907.0524	1101.0372
Breeder 72 weeks Old	3	172005.133	7991.0449	4613.6319
Breeder 56 weeks Old	3	166856.166	4650.5645	2685.0044
Breeder Mixed Age Group	3	166233.600	7711.3211	4452.1333
Total	12	167929.975	5753.9995	1661.0366

Table 4.16 displays the descriptive statistics on body weight of five-weeks old chicks. By examining the descriptive statistic Table 4.16, it seems obvious that the mixed age breeder group claims the lowest mean body weight value while the 72 weeks old breeder group is having the highest mean body weight value for the same. Additionally, according to the same Table 4.16, the 95 weeks old breeder group, the 56 weeks old breeder group and the mixed age breeder group have slightly similar

mean body weight values of 166.62 kg, 166.85 kg and 166.23 kg respectively. But in terms of variance, 72 weeks old breeder group has received the highest variance while the 95 weeks old breeder group is having the lowest variance for the same.

Levene test of homogeneity was carried out in order to check whether the equal variance assumption is meet or not and the Levene test statistics results are summarized in the Table 4.17. According to the Table 4.17, the significance value is 0.115 which is greater than the significance level, α (0.05). So that the variances are homogenous across the breeder groups of five-weeks old broiler chicken produced from deferent age breeders. Therefore, the ANOVA test can be continued as the null hypothesis, H_0 is true.

Table 4. 17: Levene Statistics on body weight of five-weeks old broilers

Test of Homogeneity of Variances			
Body weight of chicken after five weeks old			
Levene Statistic	df1	df2	Sig.
2.715	3	8	0.115

Table 4. 18: ANOVA Table on body weight of five-weeks old broilers

ANOVA					
Body weight of chicken after five weeks old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	67021883.009	3	22340627.670	0.601	0.632
Within Groups	297171737.033	8	37146467.129		
Total	364193620.042	11			

Table 4.18 illustrates the statistic results obtained by performing the ANOVA test for body weight of five-weeks old chicks. As can be seen in the Table 4.18, the significance value or the P-value for ANOVA test is found as 0.632 whereas the significance level for the same is consider as 0.05. Hence, it seems obvious that the significance level is less than the P-value that makes the null hypothesis, H_0 is true.

Hence, it is concluded that there is no significant difference between the body weights of five-weeks old broiler chicken produced from the different age breeders.

Table 4. 19: Descriptive statistics on body weight of six-weeks old broilers

	N	Mean (**g**)	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	206952.733	5107.9439	2949.0728
Breeder 72 weeks Old	3	212751.566	6550.0261	3781.6593
Breeder 56 weeks Old	3	199376.600	3696.1139	2133.9523
Breeder Mixed Age Group	3	200614.333	4066.9284	2348.0422
Total	12	204923.808	7023.2762	2027.4452

Descriptive statistics on body weight of six-weeks old chicks are shown in the Table 4.19. By observing the descriptive statistic Table 4.19, it is apparent that the lowest mean body weight value is obtained by the 56 weeks old breeder group while the highest mean body weight value is obtained by the 72 weeks old breeder group. The 95 weeks old breeder group and the mixed age breeder group have slightly different mean body weight values. However, in terms of variance, 72 weeks old breeder group has received the highest value of the variance over the other breeder groups and the 56 weeks old bleeder group claims the lowest value of the variance.

According to the Levene statistic test results shown in Table 4.20, the significance value is 0.491 which is almost higher than the significance level, α (0.05). Therefore, it is concluded that the variances are homogenous across the breeder groups of six-weeks old broiler chicken produced from deferent age breeders. So that the ANOVA test can be continued as the null hypothesis, H_0 is true.

Table 4. 20: Levene Statistics on body weight of six-weeks old broilers

Test of Homogeneity of Variances			
Body weight of chicken after six weeks old			
Levene Statistic	df1	df2	Sig.
0.880	3	8	0.491

Table 4.21 illustrates the statistic results obtained by performing the ANOVA test for body weight of six-weeks old chicks. As can be seen in the Table 4.21, the significance value or the P-value for ANOVA test is found as 0.037 whereas the significance level for the same is consider as 0.05. But in this case, it is found that significance level greater than the P-value that make the alternative hypothesis, H_1 is true. Hence, it is concluded that there is a significant difference between the population body weights of six-weeks old broiler chicken produced from the different age breeders.

Table 4. 21: ANOVA Table on body weight of six-weeks old broilers

ANOVA					
Body weight of chicken after six weeks old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	344200296.749	3	114733432.250	4.627	0.037
Within Groups	198390198.280	8	24798774.785		
Total	542590495.029	11			

The one-way ANOVA test rejects null hypothesis which implies that at least one population mean is different from other population means. The ANOVA test does not revel where the mean difference exists. Therefore, it is required to conduct the Post hoc test in order to identify where the significance exists among populations. Tukey's HSD (Honestly Significant Difference) Post hoc test is applicable when the data satisfy the assumption of homogeneity of variances. But, if the data fail to meet the assumption of homogeneity of variance, Games Howell post hoc test has to be used. In this scenario, Tukey's HSD Post hoc test was carried out as the data already satisfied the assumption of homogeneity of variances. Table 4.22 explains the results found in SPSS output table after getting done Tukey's HSD Post hoc test.

Having examined Tukey HSD multiple comparison test output Table 4.22, it reveals that the significance mean body weight difference lies between the 72 weeks old breeder group and the 56 weeks old breeder group. As can be seen in the Table 4.22 the P-value, 0.044 corresponds to the 72 weeks old breeder group and 56 weeks old breeder group is less than significance level, α (0.05). Therefore, the null hypothesis can be rejected in Tukey HSD test. Other group combinations except the 72 weeks old breeder and 56 weeks old breeder do not show the significant mean difference of body weights among the groups.

Table 4. 22: Tukey HSD Table on body weight of six-weeks old broilers

Multiple Comparisons of Tukey HSD						
Dependent Variable: Body weight of Chicken after Six weeks Old						
(I) Breeder Age	(J) Breeder Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	Breeder 72 weeks Old	-5798.833	4066.019	.519	-18819.65	7221.99
	Breeder 56 weeks Old	7576.133	4066.019	.314	-5444.69	20596.95
	Breeder Mixed Age Group	6338.400	4066.019	.450	-6682.42	19359.22
Breeder 72 weeks Old	Breeder 95 weeks Old	5798.833	4066.019	.519	-7221.99	18819.65
	Breeder 56 weeks Old	13374.966*	4066.019	.044	354.14	26395.79
	Breeder Mixed Age Group	12137.233	4066.019	.068	-883.59	25158.05
Breeder 56 weeks Old	Breeder 95 weeks Old	-7576.133	4066.019	.314	-20596.95	5444.69
	Breeder 72 weeks Old	-13374.966*	4066.019	.044	-26395.79	-354.14
	Breeder Mixed Age Group	-1237.733	4066.019	.989	-14258.55	11783.09
Breeder Mixed Age Group	Breeder 95 weeks Old	-6338.400	4066.019	.450	-19359.22	6682.42
	Breeder 72 weeks Old	-12137.233	4066.019	.068	-25158.05	883.59
	Breeder 56 weeks Old	1237.733	4066.019	.989	-11783.09	14258.55

The following decision taken from Tukey HSD multiple comparison test.

Population mean body weight value of chicken from 72 weeks old breeder is greater than the population mean body weight value of chicken from 56 weeks old breeder.

Apart from the Tukey HSD test, a basic idea on where the significant mean difference occurs can be found by looking at the graph shown in the Figure 4.2 also, which is drawn for the mean body weights distribution of six-weeks old chicks among the four breeder groups. According to the plot in the Figure 4.2, the 72 weeks old breeder group claims for the highest mean value of body weight while the 56 weeks old breeder group is having the lowest value for the same. In this scenario, the mean body weights distribution plot, Figure 4.2 clearly visualize that the significant mean difference of body weight occurs between the 72 weeks old breeder group and 56 weeks old breeder group.

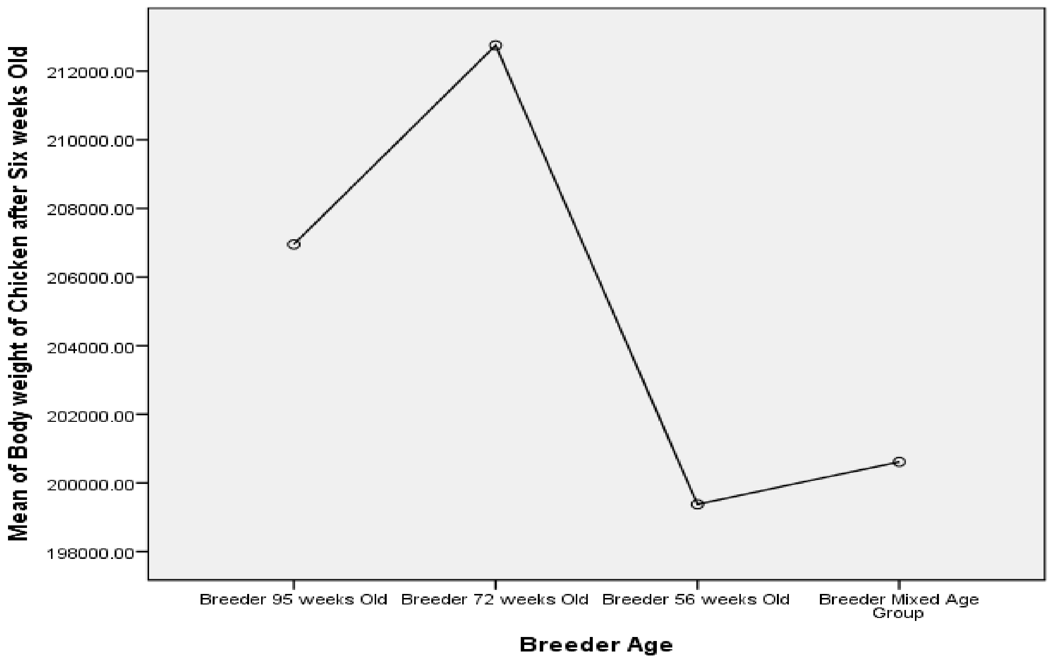

Figure 4. 2: Means plot for breeder type vs mean body weight of Six weeks old broilers

As the low Feed Conversion Ratio (FCR) is epitome in the broiler chicken industry, the poultry farmers usually try to get low FCR broiler breeds for the industry. Cost for the animal feeds is one of the main expense in the broiler chicken industry which is addressed by the farmers by referring rare low FCR version breeds in order to minimize the total cost.

4.2 Analyze the effect of breeder's age on the FCR of broiler chicken.

Table 4. 23: Descriptive statistics on FCR of one-week old broilers

	N	Mean	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	1.1190	0.06781	0.03915
Breeder 72 weeks Old	3	0.9569	0.27122	0.15659
Breeder 56 weeks Old	3	1.1112	0.09105	0.05257
Breeder Mixed Age Group	3	1.1305	0.06857	0.03959
Total	12	1.0794	0.14859	0.04289

By examining the FCR statistics of one-week old chicks from deferent age breeder groups of broiler chicken shown in Table 4.23, it reveals that the mixed age breeder group claims the highest mean FCR over the other three breeder groups while the 72 weeks old breeder group has the lowest FCR mean value. But in the sense of the variance, 72 weeks old breeder group and the 95 weeks old breeder group claim for the highest and lowest variance for FCR respectively. Having considered the descriptive statistics of feed saving characteristics of above four different age breeder groups, 72 weeks old breeder group is better than others.

One of the main assumptions of ANOVA is that the independent variable groups have equal variances or in short the assumptions of homogeneity. In order to check whether the equal variance assumption is met or not, Levene test of Homogeneity is applied. If Levene Homogeneity test is found that that there is no significance difference in variance, ANOVA can be continued. But if the same test is found that there is significance in variance, Welch's test need to be performed.

After satisfying the Equal sample size, equal variance assumption, independent and Normality assumptions one can conduct the ANOVA. The violation of above assumptions in comparison of means lead us to conduct non parametric test such as kruskal wallis test.

According to the Levene statistic test results shown in Table 4.24, the significance value 0.017 is almost less than the significance level, α (0.05). Therefore, it is concluded that the variances of the feed conversion ratios are not homogenous across the groups. Hence, it is violating the assumption of homogeneity variance. Therefore, Welch's test needs to be performed for further analyse the variance of FCR values.

Table 4. 24: Levene statistics on FCR of one-week old broilers

Test of Homogeneity of Variances			
Feed conversion ratio of chicken after one week old			
Levene Statistic	df1	df2	Sig.
6.211	3	8	0.017

Welch's test results are illustrated in Table 4.25. As can be seen in the Table 4.25 the significance value of 0.826 is greater than the significance level α (0.05). Hence, the ANOVA assumption of equal variance is satisfied through Welch's test and the ANOVA can be continued.

Table 4. 25: Welch Statistics on FCR of one-week old broilers

Robust Tests of Equality of Means				
Feed conversion ratio of chicken after one week old				
	Statistic	df1	df2	Sig.
Welch	0.299	3	4.279	0.826

Table 4. 26 illustrates the statistic results obtained by performing the ANOVA test. As can be seen in the Table 4.26, the significance value or the P-value for ANOVA test is found as 0.488 whereas the significance level for the same is consider as 0.05. Hence, it seems obvious that the significance level is less than the P-value that makes the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference

between the population FCR values of one-week old broiler chicken produced from the deferent age breeders.

Table 4. 26: ANOVA Table on FCR of one-week old broilers

ANOVA					
Feed conversion ratio of chicken after one week old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.061	3	0.020	0.886	0.488
Within Groups	0.182	8	0.023		
Total	0.243	11			

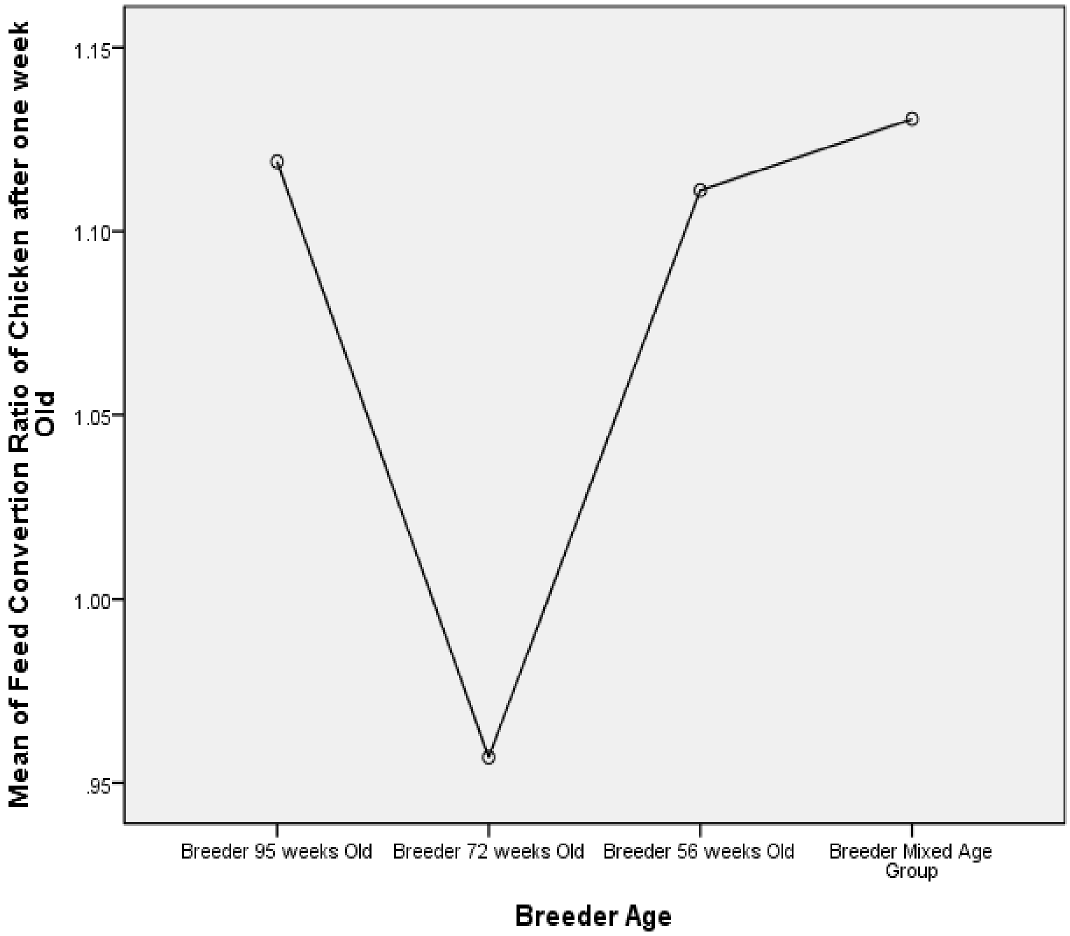

Figure 4. 3: Means plot for breeder type vs mean FCR of one-week old broilers

From the means plot for FCR versus breeders' age shown in Figure 4.3 it is obvious that the 72 weeks old breeder group has the lowest mean FCR value. Low FCR values imply high feed saving characteristics. Hence, the low FCR value groups are more profitable compared to the higher value groups. Therefore, by considering the mean FCR values shown in Figure 4.3 the 72 weeks old breeder group is more profitable than others. Further, the 95 weeks old breeder group, 56 weeks old breeder group and mixed breeder group have appeared similar mean FCR values between 1.1 and1.15 as can be seen in the same plot shown in Figure 4.3.

Table 4. 27: Descriptive statistics on FCR of two-weeks old broilers

	N	Mean	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	1.471662	0.0199695	0.0115294
Breeder 72 weeks Old	3	1.403302	0.1259118	0.0726952
Breeder 56 weeks Old	3	1.498898	0.0708647	0.0409137
Breeder Mixed Age Group	3	1.549528	0.0976121	0.0563564
Total	12	1.480847	0.0929449	0.0268309

Descriptive statistics on feed conversion ratios for different age breeder groups of broiler chicken at the end of the second week are shown in the Table 4.27. According to the Table 4.27, the mean FCR of mixed age breeder group is higher than the other three groups however the 72 weeks old breeder group has the lowest mean FCR value. But in the sense of variance, 72 weeks old breeder group has received the highest variance while the 95 weeks old breeder group claims the lowest variance for the FCR ratio. Also, the 56 weeks old breeder and mixed age breeder group have similar variance values 0.097 and 0.070 respectively. Levene test of homogeneity was performed to check whether the equal variance assumption is met or not.

According to the Levene statistic test results shown in Table 4.28, the significance value 0.247 is almost greater than the significance level, α (0.05). Since the P-value is greater that the significance level, null hypothesis, H_0 is failed to reject. It means that the variances are equal across the FCR value groups of two-weeks old broiler chicken produced from deferent age breeders. Therefore, the ANOVA can be continued.

Table 4. 28: Levene Statistics on FCR of two-weeks old broilers

Test of Homogeneity of Variances			
Feed conversion ratio of chicken after two weeks old			
Levene Statistic	df1	df2	Sig.
1.681	3	8	0.247

Statistic results obtained by performing the ANOVA test are shown in the Table 4.29. According to the Table 4.29, the significance value or the P-value for ANOVA test is found as 0.300 whereas the significance level for the same is consider as 0.05. Hence, it is clear that the significance level is less than the P-value that makes the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference between the population FCR values of two-weeks old broiler chicken produced from the deferent age breeders.

Table 4. 29: ANOVA Table on FCR of two-weeks old broilers

ANOVA					
Feed conversion ratio of chicken after two weeks old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.033	3	0.011	1.447	0.300
Within Groups	0.062	8	0.008		
Total	0.095	11			

Table 4.30 illustrate the descriptive statistics on FCR values for different age breeder groups of broiler chicken at the end of the third week. By examining the Table 4.30, it is more clear that the lowest mean FCR is obtained by the 72 weeks old breeder group while the highest mean value FCR is obtained by the mixed breeder group. Moreover, the 72 weeks old breeder group and the 95 weeks old breeder groups have almost similar mean FCR values. Also, the 56 weeks old breeder group and the mixed age breeder groups have quite similar mean FCR values 1.51 and 1.54 respectively. But,

in the sense of variance, mixed age breeder group claims the highest variance while the 56 weeks old breeder group is having the lowest variance for the same. Levene test of homogeneity was implemented to check whether the equal variance assumption is met or not.

Table 4. 30: Descriptive statistics on FCR of three-weeks old broilers

	N	Mean	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	1.478379	0.0438952	0.0253429
Breeder 72 weeks Old	3	1.465604	0.0556701	0.0321412
Breeder 56 weeks Old	3	1.513412	0.0153376	0.0088552
Breeder Mixed Age Group	3	1.542026	0.0651117	0.0375922
Total	12	1.499855	0.0520410	0.0150229

According to the Levene statistic test results shown in Table 4.31, the significance value 0.276 is larger than the significance level, α (0.05). Since the P-value is greater that the significance level, null hypothesis, H_0 is failed to reject. Therefore, it obvious that the variances are equal across the FCR value groups of three-weeks old broiler chicken produced from deferent age breeders. Hence, the ANOVA can be continued.

Table 4. 31: Levene Statistics on FCR of three-weeks old broilers

Test of Homogeneity of Variances			
Feed conversion ratio of chicken after three weeks old			
Levene Statistic	df1	df2	Sig.
1.549	3	8	0.276

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Table 4.32 illustrates the statistic results obtained by performing the ANOVA test. As can be seen in the Table 4.32, the significance value or the P-value for ANOVA test is found as 0.284 whereas the significance level for the same is consider as 0.05. Hence, it seems obvious that the significance level is less than the P-value that makes the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference between the population FCR values of three-weeks old broiler chicken produced from the deferent age breeders.

Table 4. 32: ANOVA Table on FCR of three-weeks old broilers

ANOVA					
Feed conversion ratio of chicken after three weeks old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.011	3	0.004	1.514	0.284
Within Groups	0.019	8	0.002		
Total	0.030	11			

Table 4. 33: Descriptive statistics on FCR of four-weeks old broilers

	N	Mean	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	1.5208970	0.0084257	0.0048646
Breeder 72 weeks Old	3	1.4700650	0.0421187	0.0243172
Breeder 56 weeks Old	3	1.5573340	0.0318023	0.0183611
Breeder Mixed Age Group	3	1.5332620	0.0160197	0.0092490
Total	12	1.5203890	0.0409170	0.0118117

Table 4.33 illustrates the descriptive statistics on FCR ratios for different age breeder groups of broiler chicken at the end of the fourth week. As was seen in the Table 4.33, the lowest mean FCR is obtained by the 72 weeks old breeder group while the highest mean value FCR is obtained by the 56 weeks old breeder group. Other two groups have similar mean FCR values 1.52 and 1.53 respectively. But in the sense of the Variance, 72 weeks old breeder group has received the highest variance while the lowest variability is obtained by the 95 weeks old breeder group. Levene test of homogeneity was implemented to check whether the equal variance assumption is met or not.

According to the Levene statistic test results shown in Table 4.34, the significance value, 0.053 is larger than the significance level, α (0.05). Since the P-value is greater that the significance level, null hypothesis, H_0 is failed to reject. Therefore, it seems obvious that the variances are equal across the FCR groups of four-weeks old broiler chicken produced from deferent age breeders. So that the ANOVA can be continued.

Table 4. 34: Levene Statistics on FCR of four-weeks old broilers

Test of Homogeneity of Variances			
Feed conversion ratio of chicken after four weeks old			
Levene Statistic	df1	df2	Sig.
3.953	3	8	0.053

Table 4.35 illustrates the statistic results obtained by performing the ANOVA test. As can be seen in the Table 4.35, the significance value or the P-value for ANOVA test is found as 0.027 whereas the significance level for the same is consider as 0.05. Hence, it seems obvious that the significance level is greater than the P-value that makes the null hypothesis, H_0 is rejected. Hence, it is concluded that there is significant difference between the population FCR values of four-weeks old broiler chicken produce from the deferent age breeders.

Table 4. 35: ANOVA Table on FCR of four-weeks old broilers

ANOVA					
Feed conversion ratio of chicken after four weeks old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.012	3	0.004	5.221	0.027
Within Groups	0.006	8	0.001		
Total	0.018	11			

Rejecting the null hypothesis of the one-way ANOVA refers that at least one population mean is deferent from other population means. But the ANOVA does not revel where the deference exists. Therefore, the post hoc test was performed to identify the significance among populations. Tukey's HSD (Honestly Significant Difference) post hoc test is used if the data satisfy the assumption of homogeneity of variances through Levene Statistics. Otherwise, Games Howell post hoc test have to be used. In this Scenario Tukey's HSD post hoc test was performed and the result are tabulated in SPSS output table as shown in the Table 4.36.

Table 4. 36: Tukey HSD Table on FCR of four-weeks old broilers

Multiple Comparisons of Tukey HSD						
Dependent Variable: Feed Conversion Ratio of Chicken after Four weeks Old						
(I) Breeder Age	(J) Breeder Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	Breeder 72 weeks Old	0.050833	0.0227779	0.194	-0.02211	0.123775
	Breeder 56 weeks Old	-0.036437	0.0227779	0.430	-0.10938	0.036506
	Breeder Mixed Age Group	-0.012365	0.0227779	0.946	-0.08531	0.060578
Breeder 72 weeks Old	Breeder 95 weeks Old	-0.050833	0.0227779	0.194	-0.12378	0.022110
	Breeder 56 weeks Old	-.0872691*	0.0227779	0.021	-0.16021	-0.014326
	Breeder Mixed Age Group	-0.063197	0.0227779	0.091	-0.13614	0.009746
Breeder 56 weeks Old	Breeder 95 weeks Old	0.036437	0.0227779	0.430	-0.03651	0.109379
	Breeder 72 weeks Old	.0872691*	0.0227779	0.021	0.01433	0.160212
	Breeder Mixed Age Group	0.024072	0.0227779	0.723	-0.04887	0.097015
Breeder Mixed Age Group	Breeder 95 weeks Old	0.012365	0.0227779	0.946	-0.06058	0.085308
	Breeder 72 weeks Old	0.063197	0.0227779	0.091	-0.00975	0.136140
	Breeder 56 weeks Old	-0.024072	0.0227779	0.723	-0.09702	0.048871

Examining the Tukey HSD multiple comparison test output table, it's reveal that significance mean difference lies between the mean FCR value of 72 weeks old breeder group and mean FCR value of 56 weeks old breeder group. The P-value 0.021 relevant to the72 weeks old breeder group and 56 weeks old breeder group is less than significance level α, therefore we can reject the null hypothesis in Tukey HSD test. Other than the 72 weeks old breeder group and 56 weeks old breeder group, other groups do not have significant mean difference between the groups.

The following result were obtained from Tukey HSD multiple comparison test. Population mean FCR value of broilers from 56 weeks old breeder is greater than the Population mean FCR value of broilers from 72 weeks old breeder.

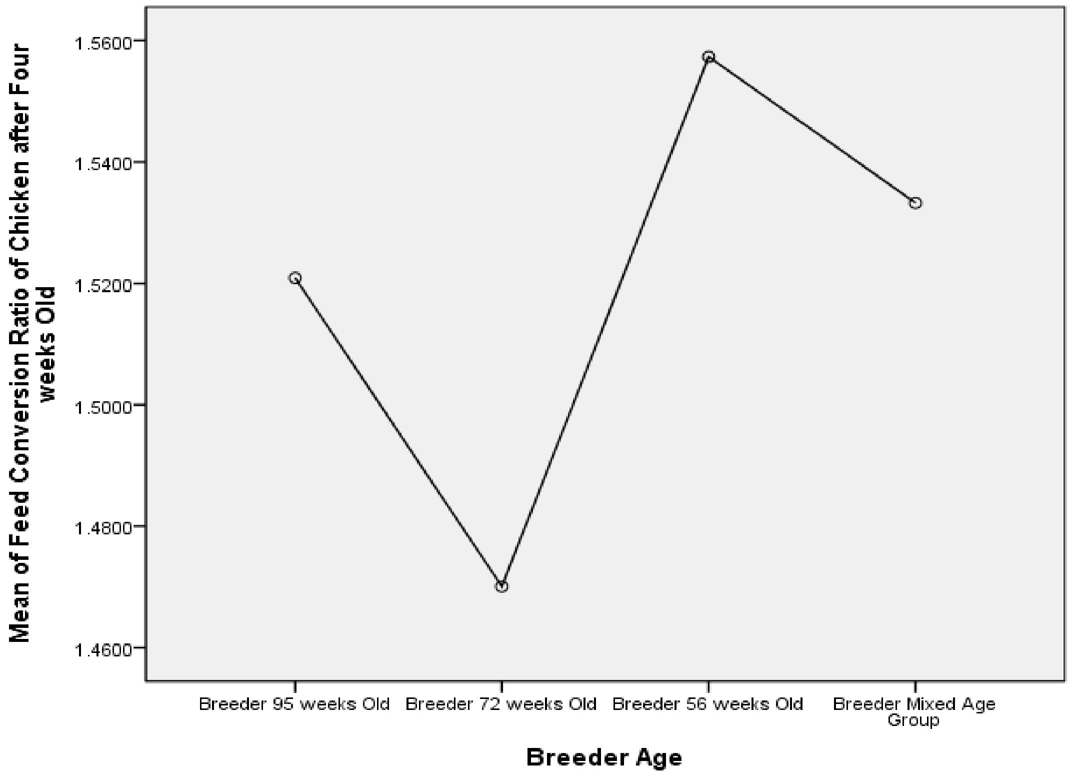

Figure 4. 4: Means plot for breeder type vs mean FCR of four-weeks old broilers

It was also noticed in ANOVA that there is significant mean effect. But it was not possible to find where the significance exists. Hence Tukey HSD multiple comparison test was done to find where the significant mean difference exists. Tukey HSD multiple comparison test is mainly based on the mean difference among the FCR groups. Besides, a basic idea on where the mean differences exists can also be judged by observing the means plot for the FCR of chicken as shown in the Figure 4.4, According to the Figure 4.4, the highest mean difference is happened in between the 72 weeks old breeder group and the 56 weeks old breeder group. Therefore, in the current scenario, it seems obvious that the significant mean difference exists in between the 72 weeks old breeder group and the 56 weeks old breeder group compared to other mean differences.

Table 4. 37: Descriptive statistics on FCR of five-weeks old broilers

	N	Mean	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	1.711165	0.0390608	0.0225518
Breeder 72 weeks Old	3	1.621957	0.0558918	0.0322691
Breeder 56 weeks Old	3	1.663467	0.0235791	0.0136134
Breeder Mixed Age Group	3	1.700519	0.0240053	0.0138595
Total	12	1.674277	0.0488733	0.0141085

Table 4.37 illustrate the descriptive statistics on FCR ratios for different age breeder groups of broiler chicken at the end of the fifth week. By examining the Table 4.37, the lowest mean value for FCR is obtained by the 72 weeks old breeder group whereas the highest mean value for FCR is obtained by the 95 weeks old breeder group. The 56 weeks old and mixed age breeder groups have slightly difference mean FCR values 1.66 and 1.70 respectively. But in the sense of variance, 72 weeks old breeder group has received a larger variance value compared to other breeder groups. Meanwhile, the 56 weeks old breeder group claims the lowest variability. Levene test of homogeneity was implemented to check whether the equal variance assumption is met or not.

According to the Levene statistic test results shown in Table 4.38, the significance value, 0.207 is larger than the significance level, α (0.05). Since the P-value is greater that the significance level, null hypothesis, H_0 is failed to reject. Therefore, it is obvious that the variances are equal across the FCR value groups of five-weeks old broiler chicken produced from deferent age breeders. Hence, the ANOVA can be continued.

Table 4. 38: Levene Statistics on FCR of five-weeks old broilers

Test of Homogeneity of Variances			
Feed conversion ratio of chicken after five weeks old			
Levene Statistic	df1	df2	Sig.
1.908	3	8	0.207

Table 4.39 illustrates the statistic results obtained by performing the ANOVA test. As depicted in the Table 4.39, the significance value or the P-value for ANOVA test is found as 0.074 whereas the significance level for the same is consider as 0.05. Hence, it is clear that the significance level is less than the P-value that makes the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference between the population FCR values of five-weeks old broiler chicken produced from the deferent age breeders.

Table 4. 39: ANOVA Table on FCR of five-weeks old broilers

ANOVA					
Feed conversion ratio of chicken after five weeks old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.015	3	0.005	3.392	0.074
Within Groups	0.012	8	0.001		
Total	0.026	11			

Table 4. 40: Descriptive statistics on FCR of six-weeks old broilers

	N	Mean	Std. Deviation	Std. Error
Breeder 95 weeks Old	3	1.835197	0.0513937	0.0296721
Breeder 72 weeks Old	3	1.764253	0.078919	0.0455639
Breeder 56 weeks Old	3	1.871825	0.1084909	0.0626372
Breeder Mixed Age Group	3	1.873474	0.0654491	0.0377871
Total	12	1.836187	0.0816615	0.0235736

Table 4.40 illustrates the descriptive statistics on FCR ratios for different age breeder groups of broiler chicken at the end of the sixth week. According to the Table 4.40, the lowest mean value for FCR is obtained by the 72 weeks old breeder group and the highest mean value for FCR is obtained by the mixed breeder group. Mixed breeder group and 56 weeks old breeder group have similar mean FCR values 1.873 and 1.871 respectively. But in the sense of the Variance, 72 weeks old breeder group has received the highest value of variance while 95 weeks old breeder group is having the lowest

variability for the same. Levene test of homogeneity was implemented to check whether the equal variance assumption is met or not.

According to the Levene statistic test results shown in Table 4.41, the significance value, 0.435 is larger than the significance level, α (0.05). Since the P-value is greater that the significance level, null hypothesis, H_0 is failed to reject. Therefore, it is obvious that the variances are equal across the FCR value groups of six-weeks old broiler chicken produced from deferent age breeders. Hence, the ANOVA can be continued.

Table 4. 41: Levene Statistics on FCR of six-weeks old broilers

Test of Homogeneity of Variances			
Feed conversion ratio of chicken after six weeks old			
Levene Statistic	df1	df2	Sig.
1.016	3	8	0.435

Table 4.42 illustrates the statistic results obtained by performing the ANOVA test. As depicted in the Table 4.42, the significance value or the P-value for ANOVA test is found as 0. 352 whereas the significance level for the same is consider as 0.05. Hence, it is clear that the significance level is less than the P-value that makes the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference between the population FCR values of six-weeks old broiler chicken produced from the deferent age breeders.

Table 4. 42: ANOVA Table on FCR of six-weeks old broilers

ANOVA					
Feed conversion ratio of chicken after six weeks old					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.024	3	0.008	1.258	0.352
Within Groups	0.050	8	0.006		
Total	0.073	11			

4.3 Analyze the effect of breeder's age on Mortality rate of broiler chicken

In broiler chicken industry, mortality causes a significant lost in total income of farmers. Even though the mortality is a common phenomenon in broiler production, growers should conduct management programs to mitigate its overall effect on flock performance. Due to the poor hygiene management and lack of attention on broiler welfare causes to receive high mortality values during the rearing period. A study has shown that the farm capacity (Number of bird), number of workers, consumed feed (tonne), production (tonne) have a strong relationship with the mortality (Cuma Akbay and Jwamer Abdulwahab, 2016). Therefore, it is vital to maintain proper hygiene management and broiler welfare system to retain lower mortality rates during the rearing period which allow farmers to maximize the profit gain from the broiler farming industry.

In order to identify the breeder's effect on the mortality rate, the graphical representation for sample data and ANOVA test were used. The clustered column chart of Mortality rate of different aged breeders on weekly basis are shown in Figure 4.5 that makes a clear indication on how the mortality rates disseminate within the six weeks rearing period.

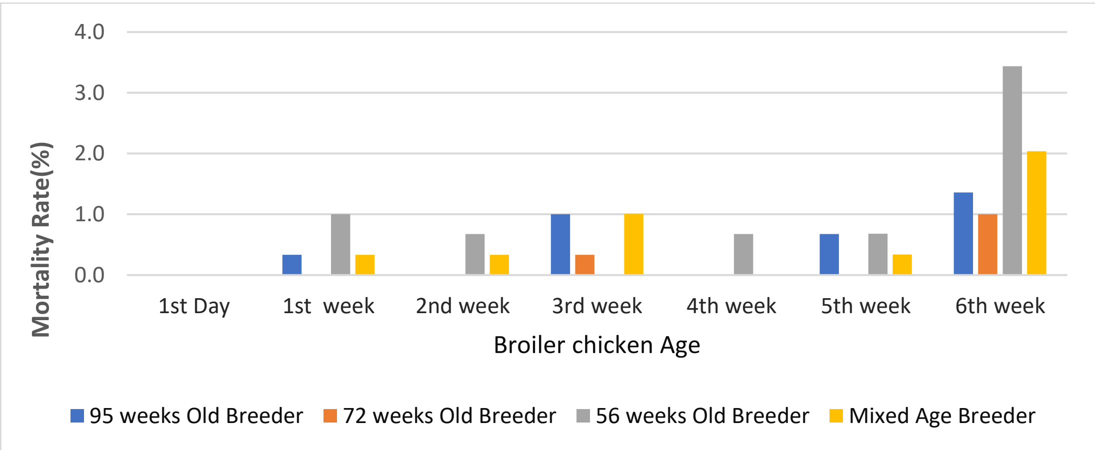

Figure 4. 5: Clustered Column Chart of Week Wise Mortality Rate of Difference Breeders

It is more clear in the graphs shown in Figure 4.5 that there is zero mortality rate in all four breeder groups of one-day old broiler chicks. But, at the end of the 1st week, all breeder groups except 72 weeks aged group have shown some mortality rate values in which the 56 weeks aged breeder groups claims for the maximum mortality rate. The chicks from 95 weeks aged breeder and mixed age breeder group have more or less similar mortality rates.

Within the second week, 95 weeks aged breeder and 72 weeks aged breeder groups claims for zero mortality rates whereas the 56 weeks aged breeder has the highest mortality rate. As can be seen in the Figure 4.5, although the 56 weeks aged breeder has shown zero mortality rate for the third week, the highest equal mortality rates are shown by the 95 weeks aged breeder and mixed age breeder groups.

For the fourth week of the rearing period, only the 56 weeks aged breeder has shown the mortality while there is no mortality in other breeders.

In the fifth week, zero mortality rate is shown in the 72 weeks aged breeder group while the 95 weeks aged breeder and 56 weeks aged breeder groups claim for the highest mortality rate.

However, in the sixth week mortality rates are highly fluctuated in breeder groups compared to the other weeks. It is obvious in the Figure 4.5 that all the breeder groups have shown their highest mortality rates at the end of the sixth week. The highest mortality rate is shown by the 56 weeks aged breeder group while the least mortality rate is shown by the 72 weeks aged breeder group.

According to this analysis, it seems more obvious that the breeder’s age influences broiler mortality differently throughout their grow-out period as Peebles et al. also originated in 1999.

The results also reveal that the higher mortality rate is occurred in the broilers from younger breeder hens compared to the old breeders as it was stated by McNaughton in 1977.

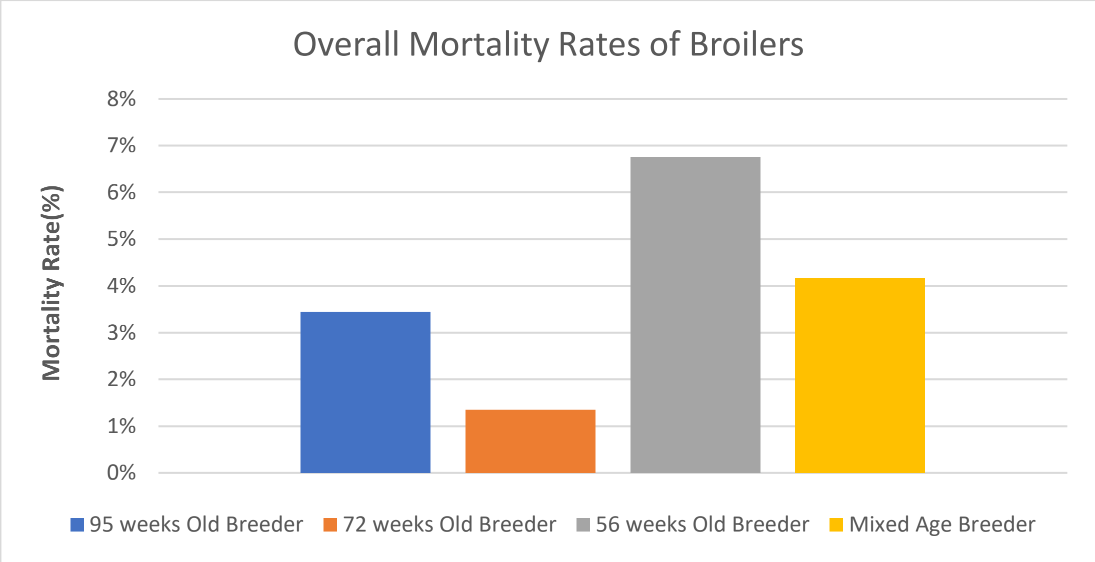

Figure 4. 6: Bar Chart for Overall Mortality Rates of Different Breeders.

A study (Xin et al., 1994) has shown that broiler mortality usually peaks at approximately 3 to 4 days after placement, declines until approximately day 9 or 10 then stabilizes until approximately day 30. After day 30 a gradually increase is seen until approximately day 40 to 45. But in this scenario the similar low mortality rates can be seen in the first five weeks and highest mortality rates are shown in the sixth week. The similar pattern can also be seen in Xin et al. (1994) study in the sixth week.

By analyzing the sample overall mortality rates of broilers from different breeder groups shown in Figure 4.6, it is more clear that the 72 weeks old breeder group claims low mortality rate than the other breeder groups. The 56 weeks old breeder group claims the height mortality rate which reveals the performance efficiency of this breeder group is lower than the other breeder groups. The 95 weeks old breeder group and the mixed age breeder group have the second and third highest mortality rates respectively by comparing the sample overall mortality rates

In order to identify whether there exists a significance among the population mortality rates of broilers produce from the different age breeder groups, we needed to conduct ANOVA test for sample mortality data.

According to the Levene statistic test results shown in Table 4.43, the significance value is 0.401 which is almost higher than the significance level, α (0.05). Therefore, it is concluded that the variances are homogenous across the deferent breeder groups. So that the ANOVA test can be continued as the null hypothesis, H_0 is true.

Table 4. 43: Levene Statistics on Mortality Rate of broilers

Test of Homogeneity of Variances			
Overall Mortality Rate of chicken			
Levene Statistic	df1	df2	Sig.
1.019	3	24	0.401

Table 4.44 illustrates the statistic results obtained by performing the ANOVA test. As depicted in the Table 4.44, the significance value or the P-value for ANOVA test is found as 0. 371 whereas the significance level for the same is consider as 0.05. Hence, it is clear that the significance level is less than the P-value that makes the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference between the population mortality rates of broiler chicken produced from the different age breeders.

Table 4. 44: ANOVA Table on Mortality Rate of broilers

ANOVA					
Mortality Rate of broiler chicken					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.921	3	0.640	1.093	0.371
Within Groups	14.056	24	0.586		
Total	15.977	27			

4.4 Analyze the effect of breeder's age on the behavior of broiler chicken.

Welfare of the animal is one of the main concern in modern broiler farming. To maintain a better welfare within the broiler birds, the management should have a better understanding about the behaviors of broilers. So the study of animal behavior is one of the novel scientific disciplines. Poultry producers and other external parties need to be aware of the behavioral characteristics so that meat and eggs can be produced with optimum efficiency and concern for the welfare and well-being of the birds.

During this study ANOVA test and principal component analysis method was used to analyze the behavioral characteristics; eating, drinking, laying, moving and other behaviors such as pecking, stirring up litter, scratching feathers etc. Levene Statistics test and the ANOVA tests were conducted for the aforementioned behavioral characteristics in weekly basis and the results are summarized in summary tables Table 4.45 to Table 4.51. All the Levene Statistics tables and the ANOVA tables are given in the Appendix for more information.

4.4.1 Analyze the effect of breeder's age on the Eating behavior of broilers

Table 4. 45: Eating behavior week wise summary statistics table

Behavior	Week	Levene Statistic (Sig)	F- Value	P- Value	Mean Effect
Eating	1st Week	0.172	0.276	0.841	Not Significant
	2nd Week	0.58	1.654	0.253	Not Significant
	3rd Week	0.93	0.008	0.999	Not Significant
	4th Week	0.668	0.1	0.958	Not Significant
	5th Week	0.105	1.737	0.237	Not Significant
	6th Week	0.053	1.786	0.228	Not Significant

The eating behavior of the broiler chicken throughout the six weeks were considered and the data were analyzed weekly basis in order to identify whether there exists a significance among the different age breeder groups. Levene statistics were used to test the homogeneity of variance in the four breeder groups and the significance value should be more than 0.05 in order to satisfy the assumption of homogeneity of variance. Considering the weekly basis Levene statistics significance values shown in

Table 4.45, all the breeder groups have already satisfied the homogeneity of variance. Therefore, the ANOVA can be continued and F-value and P-value can be found.

Weekly basis F-values and P-values related to eating behavior are tabulated in Table 4.45. Decision making criteria can be done using the P-value. If P-value is less than the significance level, α (0.05) null hypothesis can be rejected. Having considered all the P values given in Table 4.45, it is concluded that there is no significant difference in eating behavior among the broiler chicken produced from different age breeders. As a conclusion, the effect of eating behavior is not significant throughout the rearing period of broiler chicken produced from the four different age breeder groups.

4.4.2 Analyze the effect of breeder's age on the Drinking behavior of broilers

Table 4. 46: Drinking Behavior week wise summary statistics table

Behavior	Week	Levene Statistic(Sig)	Welch Statistic	F- Value	P- Value	Mean Effect
Drinking	1st Week	0.257	-	0.335	0.801	Not Significant
	2nd Week	0.135	-	1.666	0.25	Not Significant
	3rd Week	0.411	-	0.659	0.6	Not Significant
	4th Week	0.027	0.969	0.173	0.912	Not Significant
	5th Week	0.605	-	1.437	0.302	Not Significant
	6th Week	0.059	-	5.731	0.022	Significant

The drinking behavior data tabulated in Table 4.46 were analyzed weekly basis to check whether there exists a significance among the different age breeder groups. Levene statistics were used to test the homogeneity of variance. If the Levene statistics significance value is more than 0.05, the assumption of homogeneity is satisfied. But in this scenario, Levene statistics significance value obtained for the fourth week is less than the significance level (0.05) as can be seen in the Table 4.46. So that, Welch robust test need to be performed in order to check whether the fourth week drinking behavior data satisfy the homogeneity of variance. Welch statistics significance value obtained from Welch robust test is now greater than the significance level (0.05) and hence the assumption of homogeneity of variance is met for the fourth week. Other than the fourth week, others have already satisfied the homogeneity of variance assumption through Levene statistics test. The ANOVA can be continued as all the six weeks have however satisfied the homogeneity of variance assumption.

Weekly basis F-values and P-values received from the ANOVA table are also tabulated in table 4.46. Examining P-values obtained from the first five weeks in related to drinking behavior, they are greater than the significance level. Therefore, it is concluded that there is no significant difference in drinking behavior among the broilers produced from different age breeders in first five weeks. But considering the P-value obtained for the sixth week, it seems that there exists a significance difference in drinking behavior among the broiler birds produced from the different age breeders.

Table 4. 47: Turkey HSD Test results for sixth week Drinking Behavior

Multiple Comparisons of Tukey HSD						
Dependent Variable: Drinking behavior of Chicken after Six weeks Old						
(I) Breeder Age	(J) Breeder Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	Breeder 72 weeks Old	0.168990	0.10812	0.448	-0.17720	0.515200
	Breeder 56 weeks Old	0.101700	0.10812	0.785	-0.24450	0.447900
	Breeder Mixed Age Group	.42888*	0.10812	0.017	0.08270	0.775100
Breeder 72 weeks Old	Breeder 95 weeks Old	-0.168990	0.10812	0.448	-0.51520	0.177200
	Breeder 56 weeks Old	-0.067290	0.10812	0.922	-0.41350	0.278900
	Breeder Mixed Age Group	0.259890	0.10812	0.154	-0.08630	0.606100
Breeder 56 weeks Old	Breeder 95 weeks Old	-0.101700	0.10812	0.785	-0.44790	0.244500
	Breeder 72 weeks Old	0.067290	0.10812	0.922	-0.27890	0.413500
	Breeder Mixed Age Group	0.327180	0.10812	0.064	-0.01900	0.673400
Breeder Mixed Age Group	Breeder 95 weeks Old	-.42888*	0.10812	0.017	-0.77510	-0.082700
	Breeder 72 weeks Old	-0.259890	0.10812	0.154	-0.60610	0.086300
	Breeder 56 weeks Old	-0.327180	0.10812	0.064	-0.67340	0.019000

As there is a significance difference in drinking behavior among the broiler birds for the sixth week, Turkey HSD Test was conducted and the test results are tabulated in the Table 4.47. In order to identify where the significance difference exists, the turkey post hoc test was used. According to the turkey HSD test, the significance difference lies between the 95 weeks old breeder group and the mixed aged breeder group. Further, mean drinking behavior value of 95 weeks old breeder group is higher than the mean drinking behavior value of mixed aged breeder group.

4.4.3 Analyze the effect of breeder's age on the Moving behavior of broilers

Table 4. 48: Moving Behavior week wise summary statistics table

Behavior	Week	Levene Statistic (Sig)	Welch Statistic	F- Value	P- Value	Mean Effect
Moving	1st Week	0.019	0.557	1.018	0.434	Not Significant
	2nd Week	0.458	-	1.238	0.358	Not Significant
	3rd Week	0.883	-	0.289	0.832	Not Significant
	4th Week	0.288	-	0.297	0.827	Not Significant
	5th Week	0.007	0.081	1.019	0.434	Not Significant
	6th Week	0.818	-	6.959	0.013	Significant

The moving behavior data tabulated in Table 4.48 were analyzed weekly basis in order to check whether there exists a significance among the different age breeder groups. Levene statistics was used to test the homogeneity of variance. To satisfy the assumption of homogeneity of variance, Levene statistics significance value should greater than 0.05. But in this case, Levene statistics significance values obtained for the first week and the fifth week are less than the significance level (0.05). Therefore, Welch robust test is required to conduct to check whether the first and fifth weeks moving behavior data satisfy the homogeneity of variance. Welch statistics significance values received for both weeks are almost greater than the significance level (0.05) as can be seen in the Table 4.48. Hence the assumption of homogeneity of variance is fulfilled. Other than the first and fifth weeks, other weeks have already satisfied the homogeneity of variance assumption through Levene statistics test. So that the ANOVA test can be continued for all the weeks.

Weekly basis F-values and P-values related to moving behavior are tabulated in Table 4.48. Decision making criteria can be done using the P-value. If P-value is less than the significance level, α (0.05), the null hypothesis can be rejected. Having examined the P-values obtained from the first five weeks in related to moving behavior, it is obvious that these P-values are almost greater than the significance level. Therefore, there is no significant difference in moving behavior among the broilers produced from the different age breeders in first five weeks. But for the P-value for the sixth week is less than the significance level. Hence, it is concluded that there exists a significance difference in moving behavior among the broiler birds produced from the different age breeders.

Table 4. 49: Turkey HSD Test results for sixth week Moving Behavior

Multiple Comparisons of Tukey HSD						
Dependent Variable: Moving behavior of Chicken after Six weeks Old						
(I) Breeder Age	(J) Breeder Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	Breeder 72 weeks Old	-0.614080	0.35666	0.373	-1.7562	0.5281
	Breeder 56 weeks Old	-0.367650	0.35666	0.737	-1.5098	0.7745
	Breeder Mixed Age Group	0.903890	0.35666	0.128	-0.2383	2.0460
Breeder 72 weeks Old	Breeder 95 weeks Old	0.614080	0.35666	0.373	-0.5281	1.7562
	Breeder 56 weeks Old	0.246430	0.35666	0.898	-0.8957	1.3886
	Breeder Mixed Age Group	1.51797*	0.35666	0.012	0.3758	2.6601
Breeder 56 weeks Old	Breeder 95 weeks Old	0.367650	0.35666	0.737	-0.7745	1.5098
	Breeder 72 weeks Old	-0.246430	0.35666	0.898	-1.3886	0.8957
	Breeder Mixed Age Group	1.27154*	0.35666	0.030	0.1294	2.4137
Breeder Mixed Age Group	Breeder 95 weeks Old	-0.903890	0.35666	0.128	-2.0460	0.2383
	Breeder 72 weeks Old	-1.51797*	0.35666	0.012	-2.6601	-0.3758
	Breeder 56 weeks Old	-1.27154*	0.35666	0.030	-2.4137	-0.1294

In order to identify where the significance difference exists among the breeder groups, the turkey post hoc test was used and the test results are shown in the Table 4.49. According to the turkey HSD test, the significance difference lies between the mixed aged breeder group with 72 weeks and 56 weeks old breeder groups. Further, mean moving behavior value of 72 weeks old breeder group is higher than the mean moving behavior value of mixed aged breeder group. Also, the mean moving behavior value of 56 weeks old breeder group is higher than the mean moving behavior value of mixed aged breeder group.

4.4.4 Analyze the effect of breeder's age on the Laying behavior of broilers

Table 4. 50: Laying Behavior week wise summary statistics table

Behavior	Week	Levene Statistic (Sig)	Welch Statistic	F- Value	P- Value	Mean Effect
Laying	1st Week	0.066	-	1.853	0.216	Not Significant
	2nd Week	0.06	-	1.73	0.238	Not Significant
	3rd Week	0.964	-	0.043	0.987	Not Significant
	4th Week	0.812	-	0.164	0.918	Not Significant
	5th Week	0.018	0.271	0.877	0.492	Not Significant
	6th Week	0.002	0.647	0.647	0.606	Not Significant

The laying behavior data shown in Table 4.50 were analyzed weekly basis to identify whether there exists a significance among the different age breeder groups. To satisfy the assumption of homogeneity of variance, Levene statistics significance value should be greater than 0.05. However, in this scenario Levene statistics significance values received in fifth and sixth weeks are less than the significance level (0.05). Hence, Welch robust test needs to be performed to check the whether the fifth and sixth weeks laying behavior data satisfy the homogeneity of variance. Welch statistics significance values received for the fifth and sixth weeks from the Welch robust test results given in Table 4.50 are greater than the significance level (0.05) and meet the assumption of homogeneity of variance. Hence, the ANOVA is continued.

Weekly basis F-values and P-values related to laying behavior are tabulated in same Table 4.50. Decision making criteria can be done using the P-value. If the P-value is less than the significance level, α (0.05), the null hypothesis can be rejected. Examining all the P-values in Table 4.50, It seems that there is no significant difference in laying behavior among the broiler chicken produced from the different age breeders. As a conclusion, the effect of laying behavior is not significant among the four different age breeder groups throughout the rearing period of broiler chicken.

4.4.5 Analyze the effect of breeder's age on the Other behavior of broilers

Table 4. 51: Other Behavior week wise summary statistics Table

Behavior	Week	Levene Statistic (Sig)	F- Value	P- Value	Mean Effect
Other behavior	1st Week	0.926	0.199	0.894	Not Significant
	2nd Week	0.179	0.41	0.75	Not Significant
	3rd Week	0.239	0.546	0.665	Not Significant
	4th Week	0.695	1.608	0.263	Not Significant
	5th Week	0.394	0.14	0.933	Not Significant
	6th Week	0.309	0.796	0.53	Not Significant

Behaviors other than the eating, drinking, moving, laying are fallen into the other behavior category and the statistics summary for the other behavior is tabulated in Table 4.51. Weekly basis Levene statistics significance values given in Table 4.51 are greater than the significance level α (0.05). Hence, the null hypothesis is accepted which means the homogeneity of variance is also accepted.

Weekly basis F-values and P-values received from the ANOVA table are tabulated in Table 4.51. After examining all the P-values in related to other behavior shown in

Table 4.51, It is concluded that there is no significant difference in other behavior among the broiler birds produced from the different age breeders.

4.4.6 Principal component analysis

Principal components analysis or PCA makes the assumption that there is no unique variance, the total variance is equal to common variance. The total variance can be partitioned into common and unique variance. If there is no unique variance, then common variance takes up total variance. If the total variance is 1, then the common variance is equal to the communality.

Table 4. 52: Descriptive statistics of Behaviors

Behavior	Mean	Std. Deviation	Coefficient of Variation (CV)	Analysis N
Eating	11.2710	6.59729	0.59	72
Drinking	3.7469	1.67191	0.45	72
Moving	10.5406	9.29605	0.88	72
Laying	68.0562	18.50450	0.27	72
Other	5.8785	2.46925	0.42	72

Table 4.52 illustrates the descriptive statistics of behavior variables of eating, drinking, moving, laying and other behaviors. By examining Table 4.52, the highest mean value is observed from the laying behavior and the minimum mean value is observed from the drinking behavior. Moreover, the highest and the lowest variances are received by laying and drinking behaviors, respectively. However, the Coefficient of Variance (CV) is minimum in laying behavior while the moving behavior is having the maximum for the same.

Table 4. 53: KMO and Bartlett's Test for Behaviors

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.791
Bartlett's Test of Sphericity	Approx. Chi-Square	494.776
	Df	10
	Sig.	0.000

The sample adequacy of this study was measured by using Kaiser Meyer Olkin test and the test results are shown in Table 4.53. Kaiser Meyer Olkin test value for this study was received as 0. 791 as can be seen in the Table 4.53. Kaiser (1974) recommends a bare minimum of 0.5 value, the value between 0.5 and 0.7 are mediocre, value between 0.7 and 0.8 are good, value between 0.8 and 0.9 are great and value between 0.9 and above are superb (Hutcheson & Sofroniou, 1999). As the Kaiser Meyer Olkin test value is 0. 791 for this case, it is evident that the data satisfies the sample adequacy as stated by Kaiser.

As can be seen in Table 4.53, Bartlett’s Test of Sphericity received P-value as 0.000. By default, SPSS reports P-values as 0.000 if the P-value is less than 0.001. Since the sample adequacy and Sphericity assumptions are satisfied, PCA can be continued. The null hypothesis of Bartlett’s Test is defined as the original correlation matrix is an identity matrix. The significant value less than 0.05 indicates that these data do not produce an identity matrix and thus approximately multivariate normal and acceptable for further analysis (Pallant, 2013; Field, 2000).

The eigenvalues give an indication about the variance that can be explained by a given principal component. Starting from the first component, each subsequent component is obtained from partialling out the previous component. Therefore, the component one explains the large portion of variance while the fifth component explains the least. By examining the Total Variance Explained as shown in Table 4.54, total variance explained can be seen for each component. In this scenario, the principal component one is explained nearly eighty-five percent of total variance while the second component is explained nearly seven percent of total variance. In order to select the optimal number of components, eigenvalue criteria or the Kaiser's criteria was used. Under this criteria, components with an Eigen value larger than one are retained, or factors which explain a total of 70-80% of the variance are retained. Since there is only one eigenvalue is greater than one in this case and also it explains more than 80% of total variance, the optimal number of component is one.

Table 4. 54: Total Variance Explained Table

Total Variance Explained						
	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.285	85.693	85.693	4.285	85.693	85.693
2	0.341	6.819	92.512			
3	0.235	4.695	97.208			
4	0.122	2.444	99.652			
5	0.017	0.348	100.000			

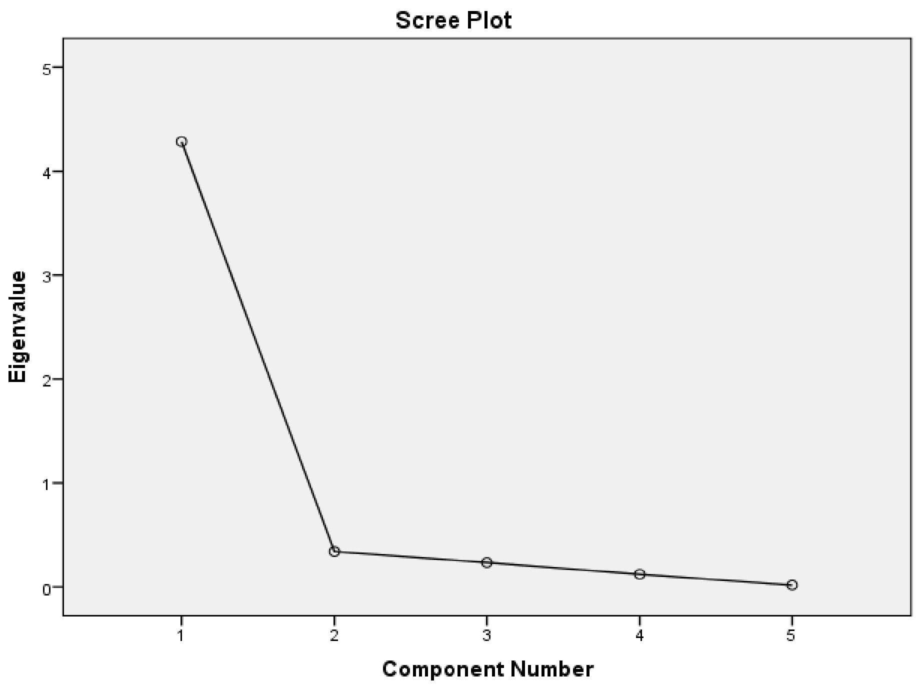

Figure 4. 7: Scree plot

The scree plot is a graph of the eigenvalues against all the components. The plot is useful for determining how many components to retain. The point of interest is where the curve starts to flatten or retain all factors above the elbow. Moreover, scree plot shown in Figure 4.7 also indicates that one component is enough to retain further analysis.

Table 4. 55: Component Matrix Table

Component Matrix	
Behaviour	Component
	1
Eating	0.949
Drinking	0.870
Moving	0.908
Laying	-0.982
Other	0.915

The component loadings can be interpreted as the correlation of each behavior with the component as shown in Table 4.55. Eating behavior is strong positively correlated 0.949 with the component. Drinking, moving and other behaviors are also positively correlated with the component. But the laying behavior is strong negatively correlated with the component.

Table 4. 56: Communalities Table

Communalities		
Behaviour	Initial	Extraction
Eating	1.000	0.900
Drinking	1.000	0.757
Moving	1.000	0.824
Laying	1.000	0.965
Other	1.000	0.838

The square of each factor loading represents the proportion of variance explained by a particular component as illustrated in Table 4.56. For eating behavior, 0.949^2 or 90.06% of its variance is explained by the component. Drinking, moving, laying and other behaviors are explained by the component 75.7%, 82.4%, 96.5%, 83.8% of its variance respectively. If communality values are received less than 0.3, then the respective behavior variables can be removed from the model. But in this case, all the behavior variable variances are explained by the component is greater than 30%. Therefore, all the variables need to be included in the principle component.

Table 4. 57: Component Score Table

Component Score Coefficient Matrix	
Behaviour	Component
	1
Eating	0.221
Drinking	0.203
Moving	0.212
Laying	-0.229
Other	0.214

During this PCA, the behavior data of broilers were studied. The component one included all the behavior variables; eating, drinking, moving, laying and other behaviors. Therefore, the component score can be named as the behavior component score or the behavior index value. The behavior index value is a linear combination of standardize behavior variables such as eating, drinking, moving, laying and other behavior. The negative correlation of the laying behavior is evident in behavior index while others are positively correlated. The linear combination can be written by using the coefficients given in the Table 4.57 as:

Behavior index value = $0.221 * Z_{Eating} + 0.203 * Z_{Drinking} + 0.212 * Z_{Moving} - 0.229 * Z_{Laying} + 0.214 * Z_{Other}$

$Z_{behavior}$ - Standardize behavior variable

Table 4. 58: week wise Behavior index value of different breeder groups

Week No.	BIV of 95 weeks old breeder	BIV of 72 weeks old breeder	BIV of 56 weeks old breeder	BIV of Mixed Age breeder
1	1.09	0.87	0.9	0.7
2	1.55	1.54	1.56	1.7
3	0.16	0.04	0.06	-0.01
4	-0.67	-0.51	-0.58	-0.57
5	-0.9	-0.74	-0.79	-0.87
6	-1.15	-1.13	-1.08	-1.16

BIV-Behavior index value

Using the above mentioned linear equation, behavior index values was generated by using the SPSS software. Behavior index values correspond to the different age breeder types and the chick age were sorted and tabulated as shown in the Table 4.58. The scatter plot shown in the Figure 4.8 was created by using the behavior index values and the corresponding breeder type and the chicks' age (in weeks) as given in the Table 4.58.

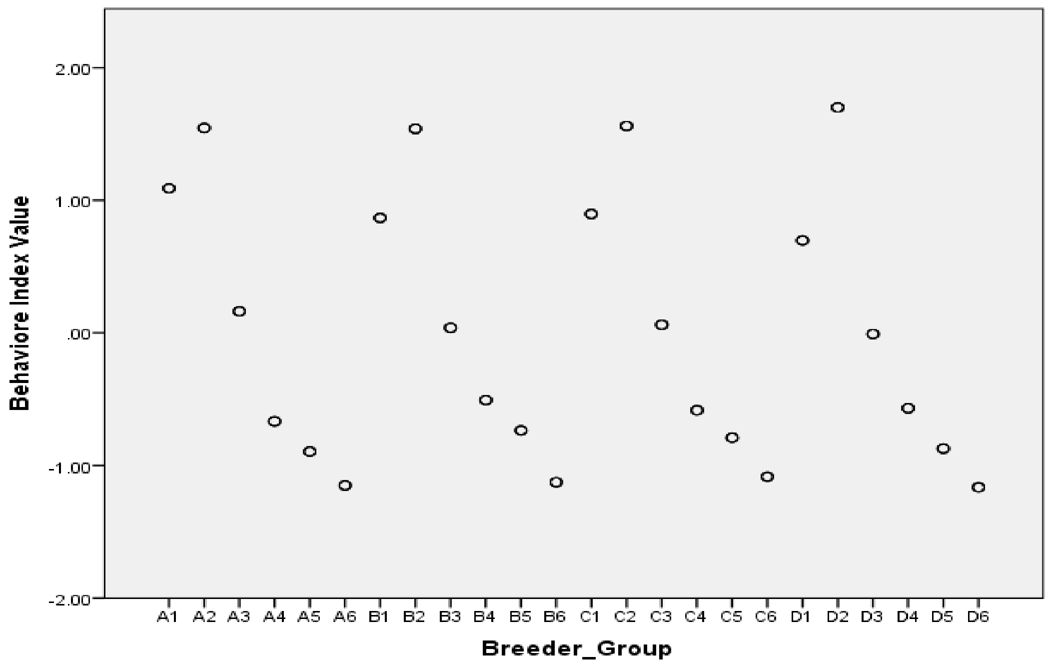

Figure 4. 8: Scatter plot for behavior index value vs chick's Age from different age breeders

A - 95 weeks old breeder group

B - 72 weeks old breeder group

C - 72 weeks old breeder group

B - Mixed Age breeder group

According to scatter plot in Figure 4.8, A1 means one week old chicks produce from the 95 weeks old breeder group. Likewise, A2 through D6 were defined. As can be seen in the Figure 4.8, behavior index values of chicks produced from 95 weeks old breeder group for first three weeks (A1, A2, A3) the index values are positive (refer the Table 4.58). By analyzing the linear combination coefficients and the raw data in behavior, it is found that the positive value is received mainly due to the eating and moving behaviors. The laying behavior has a negative effect on behavior index value. After two weeks the raw data moving behavior frequency is decreased for 95 weeks old breeder group. Hence, the third week index value is decreased to zero. After the third week, effect of laying behavior has become crucial impact towards the behavior index value. Hence, the behavior index value becomes negative from fourth week onwards. Behavior index values for fourth, fifth and sixth week are gradually decreasing. Having carefully analyzed the raw behavior data after the third week, it is reveal that the effect of eating, drinking, moving and other behaviors are over shadowed by the laying behavior.

Besides, 72 weeks old breeder group, 56 weeks old breeder group and mixed age breeder group also have the same behavior index trend pattern as the 95 weeks old breeder group as can be seen in the Figure 4.8. It also illustrates that the behavior index values of four breeder groups have similar trend pattern that slight increases in first and second weeks and gradually decreasing afterward until the sixth week.

4.4.7 Analyze the effect of breeder's age on the behavior index value of broilers.

PCA was used to obtain a behavior index value as it explains large proportion of variance from eating, drinking, moving, laying, and other behaviors. So the behavior index value is a good representation of overall behavior of broilers. To analyze whether there exists a significance among the behavior index values of broilers produced from the different age breeders, ANOVA test was used.

The Levene statistic test results for behavior index value is shown in Table 4.59. The significance value is 0.981 which is higher than the significance level, α (0.05). Therefore, it is concluded that the variances are homogenous across the breeder groups. So that the ANOVA test can be continued as the homogeneity variance assumption is true.

Table 4. 59: Levene Statistics on behavior index value of broilers

Test of Homogeneity of Variances			
Behavior index value of broiler chicken			
Levene Statistic	df1	df2	Sig.
0.057	3	20	0.981

Table 4.60 illustrates the statistic results obtained from behavior index by performing the ANOVA test. As depicted in the Table 4.60, the significance value or the P-value for ANOVA test is found as 1.000 whereas the significance level for the same is consider as 0.05. Hence, it is clear that the significance level is less than the P-value that makes the null hypothesis, H_0 is true. Hence, it is concluded that there is no significant difference between the behavior index values of broiler chicken produced from the different age breeders.

Table 4. 60: ANOVA Table on behavior index value of broilers

ANOVA					
Behavior index value of broiler chicken					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	0.010	3	0.003	0.003	1.000
Within Groups	22.584	20	1.129		
Total	22.594	23			

CHAPTER 5

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 Discussion

This scientific study was basically based on the data obtained from a reputed broiler farm in order to analyze the effect of broiler breeder's age on performance and behavior of commercial broiler chicken ("Hubbard F15"). The performance of broiler chicken was evaluated by considering the body weights, FCR and mortality. Meanwhile, eating, drinking, moving, laying and other behaviors (pecking, stirring up litter etc.) were treated for behavioral analysis of chicken. Apart from the main objective, the analysis was extended to find out the mixing effect of broiler chicks from different age of breeders on body weight, mortality rate, FCR and overall behavior as well.

5.1.1 Effect of breeder's age on the body weight of broilers

Table 5. 1: Summary table for effect of breeder's age on the body weight of broilers

Age of Broiler Chicken	ANOVA P- value	ANOVA F- value	Table F value	Compare Means of Different Age Breeder Groups
Day one old	0.096	2.991	4.07	Not Significant
One Week old	0.917	0.116	4.07	Not Significant
Two Weeks old	0.842	0.274	4.07	Not Significant
Three Weeks old	0.845	0.270	4.07	Not Significant
Four Weeks old	0.615	0.632	4.07	Not Significant
Five Weeks old	0.601	0.632	4.07	Not Significant
Six Weeks old	0.037	4.627	4.07	Significant

In farmer’s perspective, the most important variable is the body weight of broiler chicken as it is proportional to the income received by the farmer. The table 5.1 illustrates the week wise summary statistics generated by ANOVA test for the body weight values of broiler chicken. ANOVA reveals that a significance difference of population body weight is existed only in the sixth week broiler that produced from different age broiler breeders. Turkey HSD test reveals that this significance difference of population body weight lies between the 72 weeks old breeders and the 56 weeks old breeders. Also, it shows that the population mean body weight value of 72 weeks old breeder is greater than the 56 weeks old breeder body weight value. However, there is no significant difference when the population body weight value of 72 weeks old breeder is compared with 95 weeks old and mixed age breeders.

If the 95 weeks old broiler breeder is compared with the 72 weeks old broiler breeder, there are some considerable disadvantages in 95 weeks old broiler breeder group which needs to be identified. The main drawback is broiler birds stop laying eggs for 2 to 4 weeks as the molting is getting started when they are about 80 weeks old. It costs significant amount to the farmer in terms of money. In general, the rearing time is proportional to the total cost incurred in terms of feeding and maintenance. Although there is no significance in terms of body weight between 72 and 95 weeks old breeder groups, it is clear that the 72 weeks old breeder is more economically sustained than the 95 weeks old breeder when the above factors are concerned. Moreover, the occurrence of chicks of subnormal quality is higher in chicks originated from old breeders (Decuypere and Bruggeman, 2006).

5.1.2 Effect of breeder’s age on the FCR of broilers

The population mean FCR values of broiler chicken from different age broiler breeders are not significantly different except fourth week as per the table 5.2 tabulated for summary statistics generated by ANOVA test for FCR of broiler chicken. Turkey HSD test reveals that the significance population mean FCR value lies between the 56 weeks old breeder and the 72 weeks old breeder.

Table 5. 2: Summary table for effect of breeder's age on the FCR of broilers

Age of Broiler Chicken	ANOVA P- value	ANOVA F- value	Table F value	Compare Means of Different Age Breeder Groups
One Week old	0.488	0.886	4.07	Not Significant
Two Weeks old	0.300	1.1447	4.07	Not Significant
Three Weeks old	0.284	1.514	4.07	Not Significant
Four Weeks old	0.027	5.221	4.07	Significant
Five Weeks old	0.74	3.392	4.07	Not Significant
Six Weeks old	0.352	1.258	4.07	Not Significant

Turkey HSD test reveals that population mean FCR value of 72 weeks old breeder is less than the 56 weeks old breeder. In general, low FCR value breeders are concerned as better feed savers and they are commercially viable in the poultry industry. Hence, 72 weeks old breeder group is better than the 56 weeks old breeder group in terms of feed saving characteristics.

Further, it is said that late weight gainers are better in terms of financial aspects. When the FCR value of fourth week is concerned, the broilers from the 56 weeks old broiler breeder have consumed more food than the broilers from 72 weeks old breeder. But, the broilers from the 72 weeks old breeder group claims higher population body weight value than the broilers from 56 weeks old breeder group by the 6^{th} week as can be seen in the table 5.1. Therefore, broilers from the 72 weeks old breeder group are the better late weight gainers than the broilers from the 56 weeks old breeder group.

5.1.3 Effect of breeder's age on the Mortality of broilers

By examining the graphical representation of mortality data shown in Figure 4.5, it clear that the farm management was able to maintain the mortality rate value less than 1% during the first five weeks. Also noticed that they have maintained even less than

0.5% mortality rate for 72 weeks old breeder group. But, mortality rates are considerably high by the sixth week for all the breeder groups. Especially, the 56 weeks old breeder group claims the highest mortality rate compared to other breeder groups.

The average body weight of the broiler chicken at the end of the 41-days of rearing period is nearly 2.1 kg for this study. If a death of chicken happens, the final meat harvest is lost nearly by 2 kg. High mortality rate happens at the end of the rearing period is a significant financial lost for the farm management. Therefore, its vital to identify the root causes for high mortality happened at the end of the rearing period and take necessary precautions to prevent it in order to optimize the profit margin.

It is reported in literatures that broiler mortality receives high values from first 3 to 4 days then stabilizes from 10 to 30 days and it gradually increases beyond 30 days till end of the rearing period (Xin et al. 1994). Although the typical mortality rate was so as mentioned by Xin, in this scenario the farm management has failed to take the necessary precautions to avoid the mortality at the end of the rearing period even they were success at the beginning.

The ANOVA test reveal that there is no significant difference among the population mortality rates of broiler chicken produced from the different age breeder groups. It means, the effect of population mortality rate of broilers is equal among the different age breeder groups.

5.1.4 Identify best age for broiler breeder in terms of performance and profit

Having compared the body weight values, FCR values and the mortality rates of different age breeder groups, it is essential to find the best performing breeder group.

In terms of body weight, there is no significance between the 72 and 95 weeks old breeder groups. Also it was verified that the 72 weeks old breeder group is the more economically sustained breeder group compared to 95 weeks old breeders.

In terms of FCR values, broilers from the 72 weeks old broiler breeder group is the better late weight gainer than the broilers from the 56 weeks old breeder group.

In terms of mortality rate, there is no significance population mortality rates among the breeder groups. Therefore, in this scenario mortality rate has no effect on performance.

After considering all the facts, 72 weeks old broiler breeder group can be identified as the best breeder group in terms of profit and the performance.

5.1.5 Effect of breeder's age on the behavior of broilers

According to the ANOVA test during the six weeks rearing period, the population eating behavior values shown that there is no any significant effect between the different age breeder groups. Broiler nutrition is one of the most important factor in the broiler industry and it mainly depends on eating and drinking behaviors. Therefore, it's important to understand the behavior of the eating throughout the rearing period.

ANOVA test reveals that there is no significant effect in population mean drinking values between the different age breeder groups during the first five weeks of rearing period. But there exists a significance effect in population mean drinking values between the different age breeder groups in the sixth week. The Turkey HSD test reveals that the significance of population mean drinking values lies between the 95 weeks old breeder and the mixed aged breeder group. Further, the population mean drinking value of 95 weeks old breeder is greater than the mixed aged breeder group.

ANOVA test also reveals that, there is no significant effect between the different age breeder groups during the first five weeks of rearing period by comparing the population moving behavior values. But in the sixth week, there exists a significance effect between the different age breeder groups. The Turkey HSD test reveals that the significance of population mean moving values lies between the mixed aged breeder group with 72 weeks and the 56 weeks old breeder groups. Further, the population mean moving value of 72 weeks old breeder and 56 weeks old breeder are greater than the mixed aged breeder mean moving value.

As per the ANOVA test during the six weeks rearing period, the population laying and other behavior values reveals that there is no any significant effect between the different age breeder groups.

5.1.6 Principal component analysis

The sample adequacy of Principal component analysis was measured by using Kaiser Meyer Olkin test. It is reported in literatures that Kaiser Meyer Olkin test value between 0.7 and 0.8 are good (Hutcheson & Sofroniou, 1999). As the Kaiser Meyer Olkin test value is 0. 791 for this case, it is evident that the data satisfy the sample adequacy.

The sample Sphericity of this study was measured by using Bartlett's Test. As the Bartlett's Test of Sphericity received P-value as 0.000, it is evident that the original correlation matrix is not an identity matrix.

Using the eigen values and scree plot, the principle component was extracted from behavior variables with a eigen value of 4.285. The principle component explained 85.69% of total variance presented in original five behavior variables.

The linear combination for behavior index value can be written by using the coefficients given in the Component Score Coefficient Matrix. The negative correlation of the laying behavior is evident in behavior index while others are positively correlated.

Behavior index value $= 0.221 * Z_{Eating} + 0.203 * Z_{Drinking} + 0.212 * Z_{Moving} - 0.229 * Z_{Laying} + 0.214 * Z_{Other}$

$Z_{behavior}$ - Standardize behavior variable

The farm management firmly believe that the broiler nutrition is very important during the first two weeks in order to survive the broilers till the end of 41 days of rearing period. The nutrition of broiler chicks is mainly affected by the feed intake (eating and drinking behaviors). In practice, the farm management knows that when the broilers are active (moving behavior) they tend to eat and drink a lot. Therefore, the management have taken several actions during the first two weeks in order to influence the eating, drinking and moving behaviors. Management practices such as providing sufficient continues feed and water supply and making sound effects in regular intervals during the daytime have been implemented in order to influence the activeness of the broilers. In this study, the behavior index values of chicks produced from all the breeder groups for first three weeks are almost positive due to the effect of eating and moving behavior standardized values. Aforesaid management practices have positively affected to behavior index value in this case. But the behavior index value from different breeder groups tends to zero due to the decrease of moving behavior.

Fourth week onwards, the behavior index value becomes negative and gradually decreases due to the effect of laying behavior. When the broilers become heavier they prefer to laying rather than moving. If the broilers move a lot they will waist their vital energy which is used for their weight gain. Also the frequently movement of broilers may cause leg disorders due to the heavy body weight. Therefore, farm management does not influence the broilers to move a lot because during this time they expected to get the maximum weight gain out of the broilers.

The zero, positive and negative values of behavior index can be explained by broiler behaviors such as eating, drinking, moving, laying, other and can be further justified though the management practices implemented by the farm management. Therefore, the behavior index value is reasonable to explain the overall behavior of broilers during the rearing period.

5.1.7 Effect of breeders' age on the Behavior index value

The ANOVA test conducted for behavior index values of different age broiler breeders reveals that the there is no significant difference among the population overall behavior values of broiler chicken produced from the different age breeder groups.

Finally, by analyzing the performance variables; body weight, FCR, mortality rate and overall behavior from ANOVA, it reveals that there is no significance in mixed age breeder population parameters with 72 and 95 weeks old breeder parameters. Therefore, it is concluded that the mixing of the broilers from different age breeders has no effect on the performance and overall behavior of “Hubbard F15” broilers.

5.2 Conclusion

According to this study, it is concluded that the broilers from 72 weeks old breeders have higher body weight than the 56 weeks old breeder group. The FCR was significantly different in the 4th week and the population mean FCR value of 56 weeks old breeder group is greater than 72 weeks old breeder group. The 72 weeks old breeder group is better late weight gainer compared to the 56 weeks old breeder group. However, the overall mortality rate was not significantly different during the rearing period. Having compared the body weight values, FCR values and the mortality rates of breeder groups it was found that that broiler performance is effected by the breeder’s age. If the overall maintenance cost is considered, the 72 weeks old breeder group was identified as the best breeder group in terms of profit and the performance.

If the behavior analysis is considered in weekly basis, drinking behavior was significantly different ($P<0.05$) among the experiment groups in the 6th week and the population mean drinking value of 95 weeks old breeder is greater than the mixed aged breeder group. The moving behavior was also significantly different ($P<0.05$) among the breeder groups in the 6th week and the population mean moving value of 72 and 56 weeks old breeders are greater than mixed aged breeder group.

The principle component (behavior index value) explained 85.69% of total variance presented in original behavior variables such as eating, drinking, moving, laying and other behaviors. The variation of behavior index can be explained by broiler behaviors and can also be further justified though the management practices implemented by the farm management. Therefore, the behavior index value is reasonable to explain the overall behavior of broilers during the rearing period. But, the population overall behavior was not significantly different during the rearing period. Further, mixing of broilers from different age breeders has no effect on the performance and overall behavior of “Hubbard F15” broilers. As a final comment, age of breeders’ effects on the body weight, FCR, performance and some sub behavior parameters of broilers.

5.3 Recommendations

Although there is no significance in terms of body weight between 72 and 95 weeks old breeder groups, it was clear that the 72 weeks old breeder is more economically sustained than the 95 weeks old breeder in terms of financially and chick quality. Further Turkey HSD test reveals that population mean body weight value of 72 weeks old breeder is greater than the 56 weeks old breeder. Hence, it is recommended to use the chicks from 72 weeks old breeder group rather than the chicks from 95 and 56 weeks old breeders.

It was also noticed that the high mortality rate happens in the sixth week of the rearing period compared to the other weeks. Therefore, the farm management is advised to be more focused on the mortality rates especially in the sixth week in order to identify the root causes which affects the high mortality values during that period. It is recommended to repeat the same study after taking the precautions for high mortality rate to check whether there exist any deviations in the population parameter results that were found in this study.

Since there is lack of literatures and studies about how the behavior of the broilers affects their performance, it is suggested to conduct a study the effects of broilers behavior on the performance.

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Appendix 1: SPSS Output Tables for Eating Behaviour Variable

Descriptives

Eating Behavior of Chicken after One-week Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	16.2949	2.66152	1.53663	9.6833	22.9065
Breeder 72 weeks Old	3	16.2500	.73682	.42540	14.4196	18.0804
Breeder 56 weeks Old	3	17.3590	2.25101	1.29962	11.7671	22.9508
Breeder Mixed Age Group	3	16.0705	1.47819	.85343	12.3985	19.7425
Total	12	16.4936	1.72778	.49877	15.3958	17.5914

Descriptives

Eating Behavior of Chicken after Two weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	18.4386	.77714	.44868	16.5080	20.3691
Breeder 72 weeks Old	3	20.4103	1.24664	.71975	17.3134	23.5071
Breeder 56 weeks Old	3	20.3739	1.74930	1.00996	16.0284	24.7194
Breeder Mixed Age Group	3	20.8447	1.77428	1.02438	16.4372	25.2523
Total	12	20.0169	1.56984	.45317	19.0194	21.0143

Test of Homogeneity of Variances

Eating Behavior of One week old chicks

Levene Statistic	df1	df2	Sig.
2.147	3	8	.172

Descriptives

Eating Behavior of Chicken after Three weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	15.1263	3.43183	1.98137	6.6012	23.6514
Breeder 72 weeks Old	3	14.8333	4.58170	2.64525	3.4518	26.2149
Breeder 56 weeks Old	3	14.9057	4.34842	2.51056	4.1036	25.7077
Breeder Mixed Age Group	3	14.6019	4.25251	2.45519	4.0381	25.1657
Total	12	14.8668	3.56682	1.02965	12.6005	17.1331

Descriptives

Eating Behavior of Chicken after Four weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	8.2784	1.80296	1.04094	3.7997	12.7572
Breeder 72 weeks Old	3	8.2784	1.80296	1.04094	3.7997	12.7572
Breeder 56 weeks Old	3	8.9412	2.07705	1.19919	3.7815	14.1009
Breeder Mixed Age Group	3	8.0174	2.80852	1.62150	1.0406	14.9942
Total	12	8.3789	1.87829	.54221	7.1855	9.5723

Test of Homogeneity of Variances			
Eating Behavior of Two weeks old chicks			
Levene Statistic	df1	df2	Sig.
.695	3	8	.580

Descriptives

Eating Behavior of Chicken after Five weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	3.9780	.15288	.08827	3.5983	4.3578
Breeder 72 weeks Old	3	5.0596	1.16871	.67475	2.1564	7.9629
Breeder 56 weeks Old	3	4.5727	.52346	.30222	3.2723	5.8730
Breeder Mixed Age Group	3	3.8986	.62556	.36117	2.3446	5.4525
Total	12	4.3772	.78545	.22674	3.8782	4.8763

Descriptives

Eating Behavior of Chicken after Six weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	2.9626	.24070	.13897	2.3647	3.5605
Breeder 72 weeks Old	3	3.2072	.06594	.03807	3.0434	3.3710
Breeder 56 weeks Old	3	3.5902	.40744	.23524	2.5781	4.6024
Breeder Mixed Age Group	3	2.9547	.60808	.35108	1.4442	4.4653
Total	12	3.1787	.42611	.12301	2.9079	3.4494

Test of Homogeneity of Variances			
Eating Behavior of Three weeks old chicks			
Levene Statistic	df1	df2	Sig.
.145	3	8	.930

Test of Homogeneity of Variances			
Eating Behavior of Four weeks old chicks			
Levene Statistic	df1	df2	Sig.
.540	3	8	.668

Test of Homogeneity of Variances			
Eating Behavior of Five weeks old chicks			
Levene Statistic	df1	df2	Sig.
2.844	3	8	.105

Test of Homogeneity of Variances			
Eating Behavior of Six weeks old chicks			
Levene Statistic	df1	df2	Sig.
3.948	3	8	.053

ANOVA					
Eating Behavior of One week old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.080	3	1.027	.276	.841
Within Groups	29.757	8	3.720		
Total	32.838	11			

ANOVA					
Eating Behavior of Two weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.376	3	3.459	1.654	.253
Within Groups	16.732	8	2.092		
Total	27.108	11			

ANOVA					
Eating Behavior of Three weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.420	3	.140	.008	.999
Within Groups	139.524	8	17.440		
Total	139.944	11			

ANOVA					
Eating Behavior of Four weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.420	3	.140	.008	.999
Within Groups	139.524	8	17.440		
Total	139.944	11			

ANOVA					
Eating Behavior of Four weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.401	3	.467	.100	.958
Within Groups	37.407	8	4.676		
Total	38.808	11			

ANOVA					
Eating Behavior of Five weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.677	3	.892	1.737	.237
Within Groups	4.109	8	.514		
Total	6.786	11			

ANOVA					
Eating Behavior of Six weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.801	3	.267	1.786	.228
Within Groups	1.196	8	.150		
Total	1.997	11			

Appendix 2: SPSS Output Tables for Drinking Behaviour Variable

Descriptives

Drinking Behavior of Chicken after One-week Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	5.2436	1.30788	.75511	1.9946	8.4925
Breeder 72 weeks Old	3	4.4679	1.16411	.67210	1.5761	7.3598
Breeder 56 weeks Old	3	4.5962	.49104	.28350	3.3763	5.8160
Breeder Mixed Age Group	3	4.2115	1.89976	1.09683	-.5077	8.9308
Total	12	4.6298	1.18969	.34343	3.8739	5.3857

Descriptives

Drinking Behavior of Chicken after Two weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	4.6759	.17314	.09996	4.2457	5.1060
Breeder 72 weeks Old	3	5.6410	1.28851	.74392	2.4402	8.8419
Breeder 56 weeks Old	3	6.6654	1.88287	1.08708	1.9881	11.3427
Breeder Mixed Age Group	3	7.4644	2.31800	1.33830	1.7062	13.2227
Total	12	6.1117	1.77036	.51106	4.9868	7.2365

Descriptives

Drinking Behavior of Chicken after Three weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	4.7232	1.86401	1.07618	.0927	9.3536
Breeder 72 weeks Old	3	3.3590	.59657	.34443	1.8770	4.8409
Breeder 56 weeks Old	3	3.9989	1.04672	.60432	1.3987	6.5991
Breeder Mixed Age Group	3	3.6803	1.13172	.65340	.8690	6.4917
Total	12	3.9403	1.18625	.34244	3.1866	4.6940

Descriptives

Drinking Behavior of Chicken after Four weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	2.7766	.39109	.22579	1.8051	3.7482
Breeder 72 weeks Old	3	2.9507	.77553	.44775	1.0241	4.8772
Breeder 56 weeks Old	3	2.7280	.19488	.11251	2.2439	3.2121
Breeder Mixed Age Group	3	2.7176	.13867	.08006	2.3731	3.0620
Total	12	2.7932	.39638	.11443	2.5414	3.0451

Test of Homogeneity of Variances

Drinking Behavior of One week old chicks

Levene Statistic	df1	df2	Sig.
1.635	3	8	.257

Descriptives

Drinking Behavior of Chicken after Five weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	2.5954	.50473	.29141	1.3416	3.8493
Breeder 72 weeks Old	3	3.3338	.63570	.36702	1.7546	4.9129
Breeder 56 weeks Old	3	2.7986	.26822	.15486	2.1323	3.4649
Breeder Mixed Age Group	3	2.7216	.39057	.22549	1.7514	3.6918
Total	12	2.8624	.49715	.14352	2.5465	3.1782

Descriptives

Drinking Behavior of Chicken after Six weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	2.3187	.19195	.11082	1.8418	2.7955
Breeder 72 weeks Old	3	2.1497	.05332	.03079	2.0172	2.2821
Breeder 56 weeks Old	3	2.2170	.00950	.00548	2.1934	2.2406
Breeder Mixed Age Group	3	1.8898	.17423	.10059	1.4570	2.3226
Total	12	2.1438	.20039	.05785	2.0164	2.2711

Test of Homogeneity of Variances

Drinking Behavior of Two weeks old chicks

Levene Statistic	df1	df2	Sig.
2.488	3	8	.135

Test of Homogeneity of Variances			
Drinking Behavior of Three weeks old chicks			
Levene Statistic	df1	df2	Sig.
1.081	3	8	.411

Test of Homogeneity of Variances			
Drinking Behavior of Four weeks old chicks			
Levene Statistic	df1	df2	Sig.
5.272	3	8	.027

Test of Homogeneity of Variances			
Drinking Behavior of Five weeks old chicks			
Levene Statistic	df1	df2	Sig.
.649	3	8	.605

Test of Homogeneity of Variances			
Drinking Behavior of Six weeks old chicks			
Levene Statistic	df1	df2	Sig.
3.779	3	8	.059

Robust Tests of Equality of Means				
Drinking Behavior of Four weeks old chicks				
	Statistic	df1	df2	Sig.
Welch	.078	3	4.065	.969

ANOVA					
Drinking Behavior of One week old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.737	3	.579	.335	.801
Within Groups	13.832	8	1.729		
Total	15.569	11			

ANOVA					
Drinking Behavior of Two weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	13.259	3	4.420	1.666	.250
Within Groups	21.217	8	2.652		
Total	34.476	11			

ANOVA					
Drinking Behavior of Three weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.065	3	1.022	.659	.600
Within Groups	12.414	8	1.552		
Total	15.479	11			

ANOVA					
Drinking Behavior of Four weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.105	3	.035	.173	.912
Within Groups	1.623	8	.203		
Total	1.728	11			

ANOVA					
Drinking Behavior of Five weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.952	3	.317	1.437	.302
Within Groups	1.767	8	.221		
Total	2.719	11			

ANOVA					
Drinking Behavior of Six weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.301	3	.100	5.731	.022
Within Groups	.140	8	.018		
Total	.442	11			

Multiple Comparisons of Tukey HSD						
Dependent Variable Drinking Behavior of Six weeks old chicks						
(I) Breeder Age	(J) Breeder Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	Breeder 72 weeks Old	.16899	.10812	.448	-.1772	.5152
	Breeder 56 weeks Old	.10170	.10812	.785	-.2445	.4479
	Breeder Mixed Age Group	.42888*	.10812	.017	.0827	.7751
Breeder 72 weeks Old	Breeder 95 weeks Old	-.16899	.10812	.448	-.5152	.1772
	Breeder 56 weeks Old	-.06729	.10812	.922	-.4135	.2789
	Breeder Mixed Age Group	.25989	.10812	.154	-.0863	.6061
Breeder 56 weeks Old	Breeder 95 weeks Old	-.10170	.10812	.785	-.4479	.2445
	Breeder 72 weeks Old	.06729	.10812	.922	-.2789	.4135
	Breeder Mixed Age Group	.32718	.10812	.064	-.0190	.6734
Breeder Mixed Age Group	Breeder 95 weeks Old	-.42888*	.10812	.017	-.7751	-.0827
	Breeder 72 weeks Old	-.25989	.10812	.154	-.6061	.0863
	Breeder 56 weeks Old	-.32718	.10812	.064	-.6734	.0190

Appendix 3: SPSS Output Tables for Moving Behaviour Variable

Descriptives

Moving Behavior of Chicken after One-week Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	20.1410	5.53583	3.19612	6.3893	33.8928
Breeder 72 weeks Old	3	17.5128	1.96957	1.13713	12.6201	22.4055
Breeder 56 weeks Old	3	17.2179	.61488	.35500	15.6905	18.7454
Breeder Mixed Age Group	3	15.9231	1.40740	.81256	12.4269	19.4192
Total	12	17.6987	3.04388	.87869	15.7647	19.6327

Descriptives

Moving Behavior of Chicken after Two weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	31.5618	5.75925	3.32510	17.2551	45.8686
Breeder 72 weeks Old	3	26.4551	4.81005	2.77708	14.5063	38.4040
Breeder 56 weeks Old	3	26.2701	2.81440	1.62490	19.2787	33.2614
Breeder Mixed Age Group	3	24.8588	4.40972	2.54596	13.9045	35.8132
Total	12	27.2865	4.71972	1.36247	24.2877	30.2852

Test of Homogeneity of Variances

Moving Behavior of One week old chicks

Levene Statistic	df1	df2	Sig.
5.986	3	8	.019

Descriptives

Moving Behavior of Chicken after Three weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	6.6466	1.08767	.62797	3.9446	9.3485
Breeder 72 weeks Old	3	5.9295	1.03030	.59484	3.3701	8.4889
Breeder 56 weeks Old	3	6.8572	1.50777	.87051	3.1117	10.6027
Breeder Mixed Age Group	3	6.3971	1.44721	.83555	2.8020	9.9921
Total	12	6.4576	1.15438	.33324	5.7241	7.1910

Descriptives

Moving Behavior of Chicken after Four weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	4.7926	.31639	.18267	4.0066	5.5785
Breeder 72 weeks Old	3	4.7593	1.06784	.61652	2.1067	7.4120
Breeder 56 weeks Old	3	4.3821	.32233	.18609	3.5814	5.1828
Breeder Mixed Age Group	3	4.5328	.42883	.24758	3.4675	5.5981
Total	12	4.6167	.55566	.16041	4.2637	4.9698

Robust Tests of Equality of Means

Moving Behavior of One week old chicks

	Statistic	df1	df2	Sig.
Welch	.801	3	3.819	.557

Descriptives

Moving Behavior of Chicken after Five weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	3.4684	.10433	.06023	3.2092	3.7276
Breeder 72 weeks Old	3	4.0240	1.09114	.62997	1.3134	6.7345
Breeder 56 weeks Old	3	4.2129	.31048	.17926	3.4416	4.9842
Breeder Mixed Age Group	3	3.6887	.10604	.06122	3.4253	3.9522
Total	12	3.8485	.57358	.16558	3.4841	4.2129

Descriptives

Moving Behavior of Chicken after Six weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	3.3163	.51120	.29514	2.0464	4.5862
Breeder 72 weeks Old	3	3.9304	.34683	.20024	3.0688	4.7920
Breeder 56 weeks Old	3	3.6839	.38423	.22183	2.7295	4.6384
Breeder Mixed Age Group	3	2.4124	.48372	.27927	1.2108	3.6140
Total	12	3.3358	.70773	.20430	2.8861	3.7854

Test of Homogeneity of Variances

Moving Behavior of Two weeks old chicks

Levene Statistic	df1	df2	Sig.
5.986	3	8	.019

Robust Tests of Equality of Means				
Moving Behavior of Two weeks old chicks				
	Statistic	df1	df2	Sig.
Welch	.801	3	3.819	.557

Test of Homogeneity of Variances			
Moving Behavior of Three weeks old chicks			
Levene Statistic	df1	df2	Sig.
.215	3	8	.883

Test of Homogeneity of Variances			
Moving Behavior of Four weeks old chicks			
Levene Statistic	df1	df2	Sig.
1.497	3	8	.288

Test of Homogeneity of Variances			
Moving Behavior of Five weeks old chicks			
Levene Statistic	df1	df2	Sig.
8.420	3	8	.007

Robust Tests of Equality of Means				
Moving Behavior of Two weeks old chicks				
	Statistic	df1	df2	Sig.
Welch	4.755	3	4.088	.081

Test of Homogeneity of Variances			
Moving Behavior of Six weeks old chicks			
Levene Statistic	df1	df2	Sig.
.310	3	8	.818

ANOVA					
Moving Behavior of One week old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	28.150	3	9.383	1.018	.434
Within Groups	73.767	8	9.221		
Total	101.917	11			

ANOVA					
Moving Behavior of Two weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	77.689	3	25.896	1.238	.358
Within Groups	167.344	8	20.918		
Total	245.033	11			

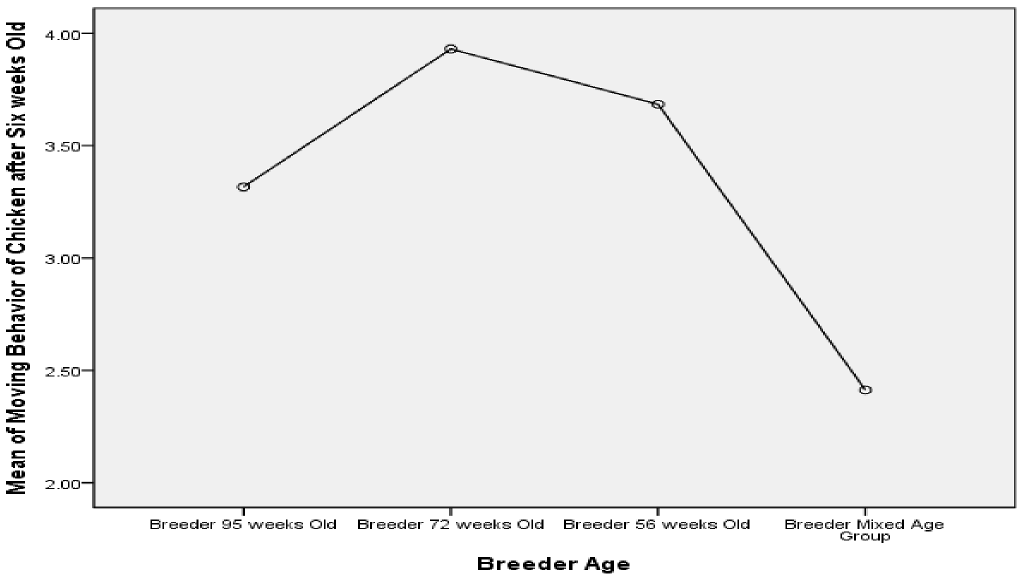
ANOVA					
Moving Behavior of Three weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.434	3	.478	.289	.832
Within Groups	13.225	8	1.653		
Total	14.659	11			

ANOVA					
Moving Behavior of Four weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.340	3	.113	.297	.827
Within Groups	3.056	8	.382		
Total	3.396	11			

ANOVA					
Moving Behavior of Five weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.001	3	.334	1.019	.434
Within Groups	2.618	8	.327		
Total	3.619	11			

ANOVA					
Moving Behavior of Six weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.983	3	1.328	6.959	.013
Within Groups	1.526	8	.191		
Total	5.510	11			

Multiple Comparisons of Tukey HSD						
Dependent Variable : Moving Behavior of Chicken after Six weeks Old						
(I) Breeder Age	(J) Breeder Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	Breeder 72 weeks Old	-.61408	.35666	.373	-1.7562	.5281
	Breeder 56 weeks Old	-.36765	.35666	.737	-1.5098	.7745
	Breeder Mixed Age Group	.90389	.35666	.128	-.2383	2.0460
Breeder 72 weeks Old	Breeder 95 weeks Old	.61408	.35666	.373	-.5281	1.7562
	Breeder 56 weeks Old	.24643	.35666	.898	-.8957	1.3886
	Breeder Mixed Age Group	1.51797*	.35666	.012	.3758	2.6601
Breeder 56 weeks Old	Breeder 95 weeks Old	.36765	.35666	.737	-.7745	1.5098
	Breeder 72 weeks Old	-.24643	.35666	.898	-1.3886	.8957
	Breeder Mixed Age Group	1.27154*	.35666	.030	.1294	2.4137
Breeder Mixed Age Group	Breeder 95 weeks Old	-.90389	.35666	.128	-2.0460	.2383
	Breeder 72 weeks Old	-1.51797*	.35666	.012	-2.6601	-.3758
	Breeder 56 weeks Old	-1.27154*	.35666	.030	-2.4137	-.1294



Appendix 4: SPSS Output Tables for Laying Behaviour Variable

Descriptives

Laying Behavior of Chicken after One-week Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	48.8526	2.62923	1.51799	42.3212	55.3839
Breeder 72 weeks Old	3	52.8333	.80891	.46703	50.8239	54.8428
Breeder 56 weeks Old	3	52.1731	3.89711	2.25000	42.4921	61.8540
Breeder Mixed Age Group	3	55.1923	4.64585	2.68228	43.6514	66.7332
Total	12	52.2628	3.69660	1.06712	49.9141	54.6115

Test of Homogeneity of Variances

Laying Behavior of One weeks old chicks

Levene Statistic	df1	df2	Sig.
3.596	3	8	.066

Descriptives

Laying Behavior of Chicken after Two weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	34.7026	3.96236	2.28767	24.8596	44.5456
Breeder 72 weeks Old	3	38.0962	.52349	.30224	36.7957	39.3966
Breeder 56 weeks Old	3	38.3934	2.34106	1.35161	32.5779	44.2089
Breeder Mixed Age Group	3	38.1689	.31614	.18252	37.3836	38.9542
Total	12	37.3403	2.54206	.73383	35.7251	38.9554

Descriptives

Laying Behavior of Chicken after Three weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	67.4993	6.27857	3.62493	51.9024	83.0961
Breeder 72 weeks Old	3	69.0385	7.83476	4.52340	49.5758	88.5011
Breeder 56 weeks Old	3	68.3959	6.63141	3.82864	51.9226	84.8692
Breeder Mixed Age Group	3	69.4501	7.51774	4.34037	50.7750	88.1252
Total	12	68.5959	6.09841	1.76046	64.7212	72.4707

Test of Homogeneity of Variances

Laying Behavior of Two weeks old chicks

Levene Statistic	df1	df2	Sig.
3.746	3	8	.060

Descriptives

Laying Behavior of Chicken after Four weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	79.8470	2.55902	1.47745	73.4900	86.2040
Breeder 72 weeks Old	3	78.0023	4.56955	2.63823	66.6509	89.3537
Breeder 56 weeks Old	3	79.2566	3.23749	1.86917	71.2143	87.2990
Breeder Mixed Age Group	3	79.4973	3.04582	1.75851	71.9311	87.0636
Total	12	79.1508	3.01783	.87117	77.2334	81.0683

Descriptives

Laying Behavior of Chicken after Five weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	85.6034	.63536	.36683	84.0251	87.1818
Breeder 72 weeks Old	3	83.3214	3.66251	2.11455	74.2232	92.4196
Breeder 56 weeks Old	3	83.8238	1.00221	.57863	81.3342	86.3134
Breeder Mixed Age Group	3	85.3215	1.48912	.85974	81.6223	89.0207
Total	12	84.5175	2.02914	.58576	83.2283	85.8068

Test of Homogeneity of Variances			
Laying Behavior of Three weeks old chicks			
Levene Statistic	df1	df2	Sig.
.088	3	8	.964

Descriptives

Laying Behavior of Chicken after Six weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	88.7292	1.33186	.76895	85.4207	92.0377
Breeder 72 weeks Old	3	87.6766	.28006	.16169	86.9809	88.3723
Breeder 56 weeks Old	3	87.4541	1.20103	.69341	84.4706	90.4376
Breeder Mixed Age Group	3	82.0205	12.86611	7.42825	50.0594	113.9817
Total	12	86.4701	6.17650	1.78300	82.5457	90.3945

Test of Homogeneity of Variances			
Laying Behavior of Four weeks old chicks			
Levene Statistic	df1	df2	Sig.
.318	3	8	.812

Test of Homogeneity of Variances			
Laying Behavior of Five weeks old chicks			
Levene Statistic	df1	df2	Sig.
6.188	3	8	.018

Robust Tests of Equality of Means				
Laying Behavior of Five weeks old chicks				
	Statistic	df1	df2	Sig.
Welch	1.888	3	4.067	.271

Test of Homogeneity of Variances			
Laying Behavior of Six weeks old chicks			
Levene Statistic	df1	df2	Sig.
13.473	3	8	.002

Robust Tests of Equality of Means				
Laying Behavior of Six weeks old chicks				
	Statistic	df1	df2	Sig.
Welch	.610	3	3.531	.647

ANOVA					
Moving Behavior of One week old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	61.636	3	20.545	1.853	.216
Within Groups	88.677	8	11.085		
Total	150.313	11			

ANOVA					
Laying Behavior of Two weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	27.973	3	9.324	1.730	.238
Within Groups	43.110	8	5.389		
Total	71.083	11			

ANOVA					
Laying Behavior of Three weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	6.504	3	2.168	.043	.987
Within Groups	402.592	8	50.324		
Total	409.096	11			

ANOVA					
Laying Behavior of Four weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.805	3	1.935	.164	.918
Within Groups	94.376	8	11.797		
Total	100.181	11			

ANOVA					
Laying Behavior of Five weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	11.212	3	3.737	.877	.492
Within Groups	34.079	8	4.260		
Total	45.291	11			

ANOVA					
Laying Behavior of Six weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	81.978	3	27.326	.647	.606
Within Groups	337.663	8	42.208		
Total	419.641	11			

Test of Homogeneity of Variances			
Other Behavior of one-week old chicks			
Levene Statistic	df1	df2	Sig.
.151	3	8	.926

Appendix 5: SPSS Output Tables for Other Behaviours Variable

Descriptives

Other Behavior of Chicken after One-week Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	9.1410	1.56637	.90435	5.2499	13.0321
Breeder 72 weeks Old	3	8.9359	1.91076	1.10318	4.1893	13.6825
Breeder 56 weeks Old	3	8.6538	1.66843	.96327	4.5092	12.7985
Breeder Mixed Age Group	3	8.1603	1.41072	.81448	4.6558	11.6647
Total	12	8.7228	1.45793	.42087	7.7964	9.6491

Descriptives

Other Behavior of Chicken after Two weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	9.3391	1.74416	1.00699	5.0064	13.6718
Breeder 72 weeks Old	3	8.9808	2.59345	1.49733	2.5383	15.4232
Breeder 56 weeks Old	3	7.8941	.92606	.53466	5.5936	10.1946
Breeder Mixed Age Group	3	8.5389	.84012	.48504	6.4519	10.6258
Total	12	8.6882	1.54182	.44509	7.7086	9.6678

Test of Homogeneity of Variances

Other Behavior of Two weeks old chicks

Levene Statistic	df1	df2	Sig.
2.096	3	8	.179

Descriptives

Other Behavior of Chicken after Three weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	5.8380	.37390	.21587	4.9092	6.7669
Breeder 72 weeks Old	3	6.8397	1.81640	1.04870	2.3276	11.3519
Breeder 56 weeks Old	3	5.8423	.50779	.29317	4.5809	7.1037
Breeder Mixed Age Group	3	5.8707	1.29886	.74990	2.6441	9.0972
Total	12	6.0977	1.08596	.31349	5.4077	6.7877

Descriptives

Other Behavior of Chicken after Four weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	3.8887	.62729	.36217	2.3304	5.4469
Breeder 72 weeks Old	3	4.7535	.65580	.37863	3.1244	6.3826
Breeder 56 weeks Old	3	4.6920	1.01446	.58570	2.1720	7.2121
Breeder Mixed Age Group	3	5.2349	.68638	.39628	3.5298	6.9399
Total	12	4.6423	.82294	.23756	4.1194	5.1651

Test of Homogeneity of Variances

Other Behavior of Two weeks old chicks

Levene Statistic	df1	df2	Sig.
2.096	3	8	.179

Descriptives

Other Behavior of Chicken after Five weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	4.3547	.38914	.22467	3.3880	5.3213
Breeder 72 weeks Old	3	4.2612	.92004	.53119	1.9757	6.5467
Breeder 56 weeks Old	3	4.5920	.63857	.36868	3.0057	6.1783
Breeder Mixed Age Group	3	4.3696	.52870	.30525	3.0562	5.6830
Total	12	4.3944	.56787	.16393	4.0335	4.7552

Descriptives

Other Behavior of Chicken after Six weeks Old

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean	
					Lower Bound	Upper Bound
Breeder 95 weeks Old	3	2.6732	.75770	.43746	.7910	4.5555
Breeder 72 weeks Old	3	2.7862	.48165	.27808	1.5897	3.9827
Breeder 56 weeks Old	3	3.0548	.42683	.24643	1.9945	4.1151
Breeder Mixed Age Group	3	2.3892	.39564	.22842	1.4064	3.3720
Total	12	2.7259	.51991	.15009	2.3955	3.0562

Test of Homogeneity of Variances

Other Behavior of Three weeks old chicks

Levene Statistic	df1	df2	Sig.
1.723	3	8	.239

Test of Homogeneity of Variances			
Other Behavior of Four weeks old chicks			
Levene Statistic	df1	df2	Sig.
.497	3	8	.695

Test of Homogeneity of Variances			
Other Behavior of Five weeks old chicks			
Levene Statistic	df1	df2	Sig.
1.127	3	8	.394

Test of Homogeneity of Variances			
Other Behavior of Six weeks old chicks			
Levene Statistic	df1	df2	Sig.
1.413	3	8	.309

ANOVA					
Other Behavior of One week old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.625	3	.542	.199	.894
Within Groups	21.757	8	2.720		
Total	23.381	11			

ANOVA					
Other Behavior of Two weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.486	3	1.162	.410	.750
Within Groups	22.663	8	2.833		
Total	26.149	11			

ANOVA					
Other Behavior of Three weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.204	3	.735	.546	.665
Within Groups	10.768	8	1.346		
Total	12.972	11			

ANOVA					
Other Behavior of Four weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.802	3	.934	1.608	.263
Within Groups	4.648	8	.581		
Total	7.449	11			

ANOVA					
Other Behavior of Five weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.177	3	.059	.140	.933
Within Groups	3.370	8	.421		
Total	3.547	11			

ANOVA					
Other Behavior of Six weeks old chicks					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.684	3	.228	.796	.530
Within Groups	2.290	8	.286		
Total	2.973	11			