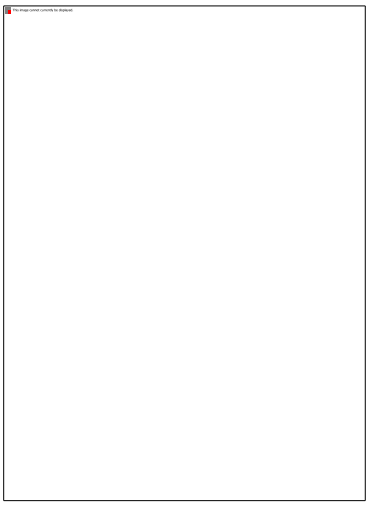
BINDURA UNIVERSITY OF SCIENCE EDUCATION FACULTY OF

AGRICULTURE AND ENVIROMENTAL SCIENCE DEPARTMENT OF

ANIMAL SCIENCE

Evaluation of the effect of feeding *Moringa oleifera* seeds as a protein source on growth performance of broiler chickens.



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A dissertation submitted in partial fulfilment of the requirements for the Bachelors of Agricultural Science Honours Degree in Animal Health and Production Extension.

JUNE 2025

APPROVAL PAGE

I hereby declare that the research project entitled "**Evaluation of the effect of feeding *Moringa oleifera* seeds as a protein source on growth performance of broiler chickens**" submitted to Bindura University of Science Education, Department of Animal Science is a record of an original work done by me under the guidance of my project supervisor. This work is submitted in partial fulfillment of the requirements for the award of the Bachelor of Agricultural Science Honours Degree in Animal Health and Production Extension. The results embodied in this dissertation have not been submitted to any University or Institute for the award of any degree or diploma.

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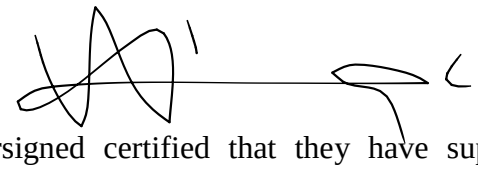
Signature: 

The undersigned certified that they have supervised and recommended to Bindura University of Science Education for acceptance of the dissertation entitled **"Evaluation of the effect of feeding *Moringa oleifera* seeds as a protein source on growth performance of broiler chickens".** Submitted in partial fulfillment of the Bachelor of Agricultural Science Honours Degree in Animal Health and Production Extension.

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ABSTRACT

This study evaluates the effects of feeding *Moringa oleifera* seeds as a protein source on the growth performance of broiler chickens from day-old to six weeks of age. With the growing demand for affordable protein sources in poultry production, *Moringa oleifera* presents a viable alternative due to its rich nutritional profile. A total of sixty broilers were divided into two groups: one fed with commercial feed and the other with an experimental diet incorporating roasted *Moringa oleifera* seeds. Key metrics assessed included daily feed intake, weekly weight gain, and feed conversion ratio.

Results indicated no significant difference in feed intake between the two groups during the first three weeks. However, the experimental group displayed an enhanced weekly weight gain in the fourth week ($P<0.05$), with no significant differences observed in weeks five and six. Mortality rates were comparable, with primary causes being environmental stressors. This research underscores the potential of *Moringa oleifera* seeds as a sustainable protein source for broiler production. Given the findings, it is recommended that poultry farmers consider incorporating *Moringa oleifera* seeds into broiler diets to improve growth performance, particularly when heat-treated to mitigate antinutritional factors.

Key words: *Moringa oleifera*, broiler chickens, protein source, growth performance, feed conversion.

Dedication

I want to dedicate this project to my wife and children for the support which they gave me to continue working hard during my studies.

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I want to thank my supervisor Mr A Pagute for assisting me during my study. I also want to thank my wife for supporting me a lot. I want to thank my friends and classmates for working closely with me. Mr Chikosha, your staff and all workers at your farm are God given in making this project a reality. I thank my District Veterinary Officer, Dr B Bande for encouragement and guide throughout the project, may it be so to all others who will need your guidance in future. God bless you.

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Chapter 1

1.0 Introduction and background

The rapid growth of human and livestock population create increasing demands for food and nutrition security in the least developed countries such that alternative feed resources must be identified and evaluated, (Olugbemi, et al. 2017). Plant products have been used by humans for centuries as sources of food and traditional medicine to treat diseases. Natural medicinal products originating from herbs and spices have been used as feed additives for farm animals (Guo 2020).*Moringa oleifera* plant is of great potential that could be cultivated as economically profitable crop to contribute in poverty alleviation, (Fatima and Muna 2015). *Moringa oleifera* leaves, fruits, immature pods and flowers are integrated into the traditional food of humans in several tropical and subtropical countries (Siddhuraju and Becker 2013; Anhwange, et al. 2004). Leaves of the Moringa tree are the preferred part for use in animal diets as leaf meal. A series of researches were conducted to study the effect of this leaf meal on the growth performance of layer chicks, (Melesse et al. 2017), on the productive performance of laying hens, (Kakengi, et al. 2015 Abou-Elezz 2021), on the broilers' performance, (Olugbemi, et al. 2017) and on the growth, carcass and blood indices of weaner rabbits, (Nuhu 2016).

The effect of *Moringa oleifera* seeds on broilers' performance was revealed to affect the performance during starter period, (Abbas & Ahmed 2018). *Moringa oleifera* is a highly valued food plant characterized by a multipurpose use, (Anwar, et al. 2017), and Abbas (2018) reviewed the use of this tree in poultry diets. Furthermore, *Moringa oleifera* seeds have been reported as

good sources of the main feed ingredients including fats, proteins and minerals, (Compaoré, et al. 2011). *Moringa oleifera* can play an important role in the economy of poultry industry. Partial substitution of fish meal for *Moringa oleifera* leaf meal has been found to decrease the feed cost, (Zanu, et al. 2020). The purpose of this study is to evaluate the effect of feeding *Moringa oleifera* leaf meal on growth performance of broiler chickens from day old up to six weeks of age.

1.1 Problem statement

The major challenge in broiler production is high cost of feed as well as inadequate supply of the raw materials to use in making stock feeds. In addition to this, the other challenge is inadequate quantities of protein sources available for the farmers to use. Many farmers are relying on feeding the broilers straight feeds which normally already contain the calculated protein ingredients in it. Non-availability of suitable substitutes presents a serious problem to the poultry industry. Despite the current use of a variety of alternative growth and production enhancers there is no single treatment or product that has been successful in replicating the relatively consistent. Moringa is also a source of vitamins and minerals and its use as protein source can address the challenge of vitamin - mineral deficiencies. Another problem is that some additives such as vitamin E and selenium, which are usually added in mono-gastric feeds, are very expensive. Identifying naturally occurring alternatives, such as plants is a possible alternative. The effect of moringa supplement as an alternative can improve intake of broilers, growth performance, digestibility, and feed use efficiency.

1.2 Justification

Despite the high nutritional content and the medicinal value of moringa oleifera, there is little information regarding its utilization in poultry feeding as an alternative protein source for broilers.

Such information is needed in identifying feeding strategies, to improve broiler production considering that the use of synthetic growth promoters and biotics have been banned in some countries. Although plant supplements are common dietary additives for humans, (Cross, et al., 2017) they are rarely used in animal diets, because knowledge on their mode of action and application is still limited, (Windisch, et al., 2018). This is despite the fact that there is available literature on plants such *Moringa oleifera*. This widespread claim of *Moringa oleifera's* nutritional and medicinal properties on humans is encouraging to further investigate its use as an additive in chickens. This research will help the broiler farmers by identifying the intake and growth performance of boilers when supplemented with moringa seeds.

1.4 Objectives

The main objective of the study was to evaluate the effect of feeding moringa oleifera seeds as a protein source on growth performance of broiler chickens from day old up to six weeks of age.

1.5 Specific objectives

1. To determine the daily intake of *Moringa oleifera* seeds when fed to broilers from day old up to six weeks of age.

2. To determine the weekly weight gain of the broilers fed with *Moringa oleifera* seeds from day old up to six weeks of age.

3. To determine the feed conversion ratio of broilers fed with *Moringa oleifera* seeds from day old up to six weeks of age.

1.6 Research Hypothesis

In order to test the effect of feeding broiler chickens with dried *Moringa oleifera* seeds on growth performance, the following hypothesis were tested.

H_0: *Moringa oleifera* seeds have low intake, weekly weight gain and conversion efficiency when fed to broiler chickens from day old up to six weeks of age.

H_1: *Moringa oleifera* seeds have high intake, weekly weight gain and conversion efficiency when fed to broiler chickens from day old up to six weeks of age.

Chapter 2

LITERATURE REVIEW

2.0 Introduction

Poultry is the most abundant livestock species that account for more than 90% of the total bird's population of the world (Biswas *et al*. 2011) and contributes significantly to income and employment among people of Africa. The number of birds in the Nigerian poultry industry has been reported to increase from 107.065 to 156.255 million within a period of ten years from 2001 to 2011 (Strydom *et al*., 2019) representing a substantial increase in the domestic animal supply and by implication the animal protein availability in the menu of the citizens.

2.1 Significance of feed to poultry

Feeds and feeding are integral part of poultry production that account for about 70-75% of the cost of production and at the same time dictates the production strength and quality based on the observed feeding regime and feeding quality. In most developing countries, the major sources of protein in commercial poultry production are fishmeal (FM) and Soya bean cakes. However, these ingredients 140 limit profitability in the poultry industry as they are usually scarce, expensive and used extensively by other livestock and humans. Thus there is a need to look for non-conventional, cheap, locally available and less competitive plant protein sources as alternative protein sources for feed formulation in poultry diets. The use of leguminous multipurpose trees and shrubs has been suggested to be a viable alternative source of proteins, vitamins and minerals for poultry feeding. Plants leaves are commonly processed into leaf meals for use as poultry feed. A review of available literature shows that *Leucaena leucocephala, Gliricidia sepium, Sesbania sesban* and *Manihot esculenta* have been widely used in feeding non-ruminants and especially poultry resulting in improvement of their productivity, (Anhwange *et al*., 2004). Research has shown that

Moringa oleifera is a promising protein source for inclusion in poultry diets at low levels, (Chiseva, 2015).

2.2 Nutritional content of Moringa

Moringa plant scientifically referred to as *Moringa oleifera* (genus Moringa and family Moringaceae) originates from Asia and is well distributed in Africa, (Francis *et al*., 2005). The tree is considered one of the world most useful plants known for its nutritional, medicinal and significant economic importance. *Moringa oleifera* possess multiple advantages, because different parts of the tree (leaves, fruits, immature pods and flowers) are edibles and forms part of the traditional diets in many tropical and sub-tropical countries, (Siddhuraju and Becker, 2013). The leaf of the plant contains 86% dry matter, 29.7% crude protein, 4.38% crude fiber, 29.9% either extracts, 3,056 kcal/kg energy, 0.26% calcium, 0.03% phosphorus and negligible amount of tannin, (Kakengi *et al*., 2003). Regarding chemical composition, Compaoré *et al*. (2019) have reported that *Moringa oleifera* seeds are good source of fats, proteins and minerals.

2.3 Effect of moringa seeds

Moringa oleifera has been under investigation in many counties for its utility in water treatment, human nutrition and immune boosting properties. Jahn (2016) has reported that rural women in Sudan use *Moringa oleifera* seeds instead of alum to remove turbidity from Nile water. Similarly, Madsen et al. (2007) have documented that *Moringa oleifera* seeds were used to reduce bacterial count of turbid Nile water in Sudan by 1 - 4 log units (90-99.9%) within the first 1 -2 hours of treatment. *Moringa oleifera* seeds have also been reported to have antimicrobial effects (Sarwalt et al., 2020). In addition, Walter et al. (2018) have observed that *Moringa oleifera* and *Moringa stenopetala* methanol and n-hexane seed extracts produced inhibition effect on *Salmonella typhii*, Vibrio cholerae and *Escherichia coli*, which normally cause water borne diseases. Moringa plant (miracle tree) has been reported to have many medicinal use such as possession of hypocholesterolemic properties (Olugbemi et al., 2017) and impaction of carotenoid compound

into the poultry muscle and as such could substitute conventional feedstuffs as it possesses useful characteristic (Sarwalt et al., 2020). The objective of this study was to evaluate the performance of broiler chicks in terms of growth and meat yield when fed on *Moringa oleifera* leaf meal as a protein supplement.

2.4 Medicinal use of Moringa oleifera

2.4.1. Antioxidants

Moringa oleifera has been reported to possess some antioxidant properties (Atawodi *et al*., 2017). Although there are several enzyme systems within the body which scavenge free radicals, the natural (vitamin) antioxidants are vitamin E, bêtacarotene, and vitamin C (Nair *et al*., 2003). These micronutrient antioxidants may be used as defense system to prevent free radicals from damaging the animal's body. This therefore provides protection to animals against infections and degenerative diseases (Verma *et al*, 2019). A survey conducted by Yang *et al.* (2016) and Jung *et al*. (2020), on 120 edible plant species showed that *M.oleifera* was among the most promising species based on their high antioxidant activity, high contents of micro-nutrients and phytochemicals, processing properties, ease of growing, and also on palatability, stability and shelf life of meat products.

2.5 Factors affecting intake in broilers

2.5.1 House temperature

Probably the most important non-dietary factor influencing feed conversion is the ambient temperature of the poultry house. Chickens are homeotherms (warm-blooded) meaning they maintain a relatively constant body temperature regardless of the environmental temperature (Talha *et al*.,2011). Broilers perform best when there is minimal variation in house temperature over a 24 hour period of time. There is a tradeoff between energy provided by feed or fuel, and the most economical temperature will depend on the relative prices of the two.

In a cool environment, broilers will eat more feed but many of the calories they obtain from this feed will be used to sustain normal body temperature. When the calories are used for warmth, they are not converted to meat (Lohmann, 2024). Optimum temperatures allow the broilers to convert nutrients into growth rather than using the calories for temperature regulation. The ideal environmental temperatures for promoting feed conversion will be provided by your service personnel.

At high environmental temperatures, broilers consume less feed, and convert this feed less efficiently. The biological cooling mechanisms that birds use during hot weather (panting, etc.) require energy, just as the warming mechanisms do during cool weather (UGA Cooperative Extension, 2024).

2.5.2 Litter quality

Litter conditions significantly influence broiler performance and, ultimately, the profits of growers and integrators. Litter is defined as the combination of bedding material, excreta, feathers, wasted feed, and wasted water (FCR)(UKY, 2024).

2.5.3 Feed wastage and feed deprivation

Placing too much feed in the chick feeders results in feed wastage and contributes to an inferior feed conversion. To prevent excessive loss of feed, add small quantities of feed to the feeder lids by running the automatic feeders frequently for short periods. This will stimulate the chicks to eat more often. Also, this will encourage the chicks to feed from the automatic feeding equipment quickly. Feed deprivation can occur during the growing period and contribute to an inferior feed conversion. This often occurs the first time the automatic feeding system is raised. Be careful not to raise the feeders too early and/or too high during the production cycle. Early feed deprivation will result in uneven growth, causing poor uniformity (Scientific Research, 2021).

2.5.4 Diseases and culling

The general health of a flock influences feed conversions. Sick broilers do not perform well. Watch closely for early signs of disease and treat broilers quickly and properly. Carefully use vaccines and medication since reactions caused by improper administration can adversely affect weight gain and feed conversion. Eliminate, as early in the grow-out as possible, broilers that have no chance of making it to market.

Obviously an unhealthy broiler is likely to have poor feed efficiency. The main reason for this is that feed intake is reduced, and so again proportionally more feed is directed towards maintenance. With enteric diseases there can be more subtle changes in feed utilization because various parasites and microbes can reduce the efficiency of digestion and absorption of nutrients. A broiler with sub-clinical coccidiosis is not likely to absorb nutrients with optimum efficiency, because the oocytes will destroy some of the cells lining the cut. More recently the phenomenon of so-called 'feed-passage' has been observed in broilers (Bansal *et al*., 2021). Undigested feed particles are seen in the excreta, and so consequently feed efficiency will be affected. The exact cause of this problem is unknown, but is most likely the consequences of a microbial challenge.

2.5.5 Human factors

Research studying the relationship between human behavior, broiler fear levels and productivity indicate potential that exists to improve productivity by reducing fear levels in broiler chickens. In this study, the behavioral response of broilers to humans was used in the study as a measure of broilers' fear of humans (Research Gate, 2022). A significant positive correction was observed between speed of movement and first week mortality, which would appear to be mediated by broiler fear levels. This would indicate that very young broilers may be susceptible to stressors such as the stockperson's speed of movement. However, this susceptibility may be reduced as the broilers grow and become habituated to stockperson behavior.

2.6 Nutritive properties of *Moringa oleifera*

Every part of M. oleifera is a storehouse of important nutrients and antinutrients. The leaves of moringa oleifera are rich in minerals like calcium, potassium, zinc, magnesium, iron and copper. Vitamins like beta-carotene of vitamin A, vitamin B such as folic acid, pyridoxine and nicotinic acid, vitamin C, D and E also present in Moringa oleifera (Moyoetal.,2011). Phytochemicals, sterols, terpenoids, flavonoids, saponins, anthraquinones, alkaloi ds and reducing sugar present along with anti-cancerous such as tannins agents like glucosinolates,isothiocyanates, glycoside compounds and glycerol-1-9-octadecanoate. Moringa leaves also have a low calorific value and can be used in the diet of the obese. The pods are fibrous and are valuable to treat digestive problems and thwart colon cancer. A research shows that immature pods contain around 46.78% fiber and around 20.66% protein content. Pods have 30% of amino acid content, the leaves have 44% and flowers have 31%. The immature pods and flowers showed similar amounts of palmitic, linolenic, linoleic and oleic acids (Sundaram, 2018).

2.7 Mineral content of Moringa

Moringa has lot of minerals that are essential for growth and development among which, calcium is considered as one of the important minerals for human growth. While 8 litres of milk can provide 300–400 mg, moringa leaves can provide 1000 mg and moringa powder can provide more than 4000 mg. Moringa powder can be used as a substitute for iron tablets, hence as a treatment for anemia. Beef has only 2 mg of iron while moringa leaf powder has 28 mg of iron. It has been reported that moringa contains more iron than spinach. A good dietary intake of zinc is essential for proper growth of sperm cells and is also necessary for the synthesis of DNA and RNA (Exploring, 202).

Chapter 3

3.0 Study area

The research was conducted at Ruoka Farm in Mvurwi, Mazowe District, located at a latitude of -17.20799 and longitude of 30.71409 in Mashonaland Central Province of northern Zimbabwe. The area has an altitude of 950 m above sea level and receives an annual rainfall of 650-900mm. Maximum temperatures reach 29°C, while minimum temperatures range from 11°C to 15°C. The region features fertile ferrasols, which are nutrient-rich and well-suited for agricultural activities. These soils support the cultivation of various crops, significantly contributing to local food security and economic activities. The natural vegetation predominantly consists of miombo woodlands, characterized by a mix of deciduous trees such as Brachystegia and Julbernardia, which provide vital habitats for diverse wildlife. These favorable climatic and soil conditions, combined with the

rich vegetation, make the Mvurwi area particularly productive for agriculture while also supporting a variety of ecological interactions within the Mazowe District.

3.1 Animal sample size

A total of sixty (60) broilers were used for the research study. The broilers were purchased as day old chicks from Super chick. The purchased broilers were fed at adlib; in batches of thirty each; with both commercial broiler feed in phases of starter and from day old age up to four (4) weeks of life and finisher in the last two (2) weeks. The other batch were fed with experimental diet formulated to be starter and finisher; again in phases of first four (4) weeks and last two (2) weeks; respectively. The commercial feed was purchased from Profeeds Company. The parameters used to assess the performance of the broilers fed with commercial feed and moringa seed formulated diet were:

1. Daily weight gain - measured on a weekly basis out of the total of 6 weeks rearing period while using a digital scale.
2. Feed intake - measured on a daily basis during feeding times using a digital scale for measuring feed offered and feed refused in the morning.

3.2 Feed formulation

Thirty broilers, out of sixty broilers were fed with the experimental diet, formulated with crushed maize and crushed moringa seeds. The other thirty were fed with commercial broiler feed. The formulated experimental feed was made to produce broiler starter of 20 % crude protein (CP) which is similar to the commercial broiler starter. The moringa formulated diet was also made to be a broiler finisher diet of 18 % crude protein (CP) which was also similar to commercial broiler finisher feed. The moringa seeds were roasted to reduce the effect of antinutritional effect of Phytochemicals which prevent the availability of minerals when the feed is consumed. Maize constituted of sixty three (63) % (CP) while roasted and crushed moringa (both to 3mm mesh size)

constituted thirty seven (37) % Crude protein (CP); and this was fed to the thirty experimental broilers as starter feed. In the finisher feed, maize constituted of sixty nine (69) % (CP) while roasted and crushed moringa (both to 3mm mesh size) constituted thirty one (31) % Crude protein (CP).

3.3 Data analysis

The collected data of weekly weight gain, daily intake and feed conversion was analyzed using while using mixed procedures of SAS, version of 2004. The daily feed intake was determined through measuring the quantity offered in troughs and the quantity refused. The weekly weight gain of a six weeks rearing period was collected and measured by taking the weight on the first day of the week and on a seven day interval thereafter. The collected weekly weight gain and daily intake was used to determine the weekly feed conversion ratio of the broilers, both batches under experimental feed and those on commercial feed. The feed conversion ratios were determined by dividing the weekly weight gain by the weekly intake. The weekly weight gain was determined the difference in weight of broilers from the current and previous week.

3.4 Experimental design

The study is used a total of sixty (60) broilers in order to analyze the effect of supplementing moringa seed formulated diet as a protein source to broilers. Thirty broilers were randomly assigned to feed on commercial feed (treatment 1) and the other thirty broilers were assigned to feed on moringa seed formulated diet (treatment 2), both for a period of six weeks from day old. Each batch of thirty were divided into fifteen birds, and thus the experiment was replicated twice in each treatment for the purpose of accuracy when feeding and collecting results. Hence the design was a Completely Randomized Design (CRD), regardless of sex of birds.

3.4 Statistical model

The collected data of weekly weight gain, daily intake and feed conversion was analyzed using Proc Mixed Procedures in SAS (2004). The model of the study of treatment effect with time is as follows:

$$Y_{ijk} = \mu + T_i + K_j + (T_i*K_j) + E_{ijk}$$

Where:

Y_{ijk} = response variable (weight gain, feed intake);

μ = overall mean (constant);

T_i = effect of feeding (Commercial feed and moringa seed formulated diet;

K_j = effect of week (j= 1, 2, 3, 4, 5, 6);

(T_i*K_j) = effect of time and treatment interaction; and

E_{ijk} = random residual error associated with the observations

Chapter 4

4.0 Effect of feed on broiler feed intake

Table 4.1 shows that the feed intake of broilers for both treatments in week 1, 2 3, were not significantly different ($P>0.05$); treatment 1 (commercially purchased feed) and treatment 2 (moringa seed formulated diet). However, there was a significant difference in intake for treatment 2 (moringa seed formulated diet) in week 4 and 5, ($P<0.05$) as shown in table 4.1 below. The intake of broilers for both treatments in week 6 have not shown a significant difference in intake among all the three treatments, ($P>0.05$). The mortality of broilers which was fed on commercially purchased diet had shown a lower mortality percentage of 10% in comparison to those fed on moringa formulated diet (treatment 2) which had a percentage of 11.6% as shown in Table 4.3. The major causes of deaths were observed to be the same for both treatments. The causes of mortality during the research period are indicated in table 4.4 below.

Table 4.1: Least square means of treatment × week interaction on feed intake

Week	Treatment 1	Treatment 2	
	Estimate (kg)	Estimate (kg)	s.e
1	0.05[a]	0.04[a]	0.09
2	0.46[a]	0.41[a]	0.09
3	1.66[a]	1.72[a]	0.09
4	6.91[a]	6.55[b]	0.09
5	8.47[a]	8.01[b]	0.09
6	9.22[a]	9.06[a]	0.09

[ab] Values with different letters in the same row are significantly different (P<0.05)

4.2 Effect of feed on average daily weight gain

Table 4.1 of treatment × week interactions on weekly weight gain shows that there was no significant difference for both treatments from week 1 up to week 3; (P>0.05). The results showed that there was a significant difference in weight gain of broilers fed with commercially purchased diet (treatment 1) and those fed with moringa formulated diet (treatment 2), in week 4, (P<0.05). Week 5 and 6 did not show any significant difference in weight gain for both treatments, (P>0.05).

Table 4.2: Least square means of treatment × week interaction on weekly weight gain

Week	Treatment 1	Treatment 2

	Estimate (kg)	Estimate (kg)	s.e
1	0.009[a]	0.010[a]	0.0008
2	0.038[a]	0.041[b]	0.0008
3	0.118[a]	0.117[a]	0.0008
4	0.414[a]	0.418[b]	0.0008
5	0.590[a]	0.588[a]	0.0008
6	0.715[a]	0.717[a]	0.0008

[abc] Values with different letters in the same row are significantly different (P<0.05)

Table 4.3: Effect of treatment on mortality

Treatment	Mortality (%)
1	9
2	6

Table 4.4: Weekly deaths and major causes of mortality

Week	**Treatment 1**	**Treatment 2**
	Number and Cause	**Number and Cause**
1	3 chilling and sudden death	3 chilling and sudden deat
2	1 stress related	0
3	1 respiratory failure	3 respiratory failure
4	0	0

5	2	heat stress	1 heat stress
6	0		1 respiratory failure
Total	**7**		**8**

Chapter 5

5.0 Discussion and conclusion

5.1 Broiler feed intake

The results revealed that there was no significant difference in feed intake of broilers fed with commercially purchased diet and those fed with moringa seed formulated diet; from first week of age up to the third week. This can be attributed to the fact that the broilers were still adapting to the diets and could not show any significant differences in intake. In addition to this, the broilers were consuming almost similar quantities of both diets since their sizes in weight as shown in table 4.2 above were also similar from week 1 up to week 3. This influenced the similarity in intake. Generally, the sensory aspects of feed intake can be categorized in three basic stages of food ingestion which are: 1) food recognition; 2) food prehension and ingestion; and 3) gastrointestinal activity. Food recognition in poultry primarily involves vision. Newly hatched birds have an innate preference for food of certain colors, (Hess, 2012). Also the broilers when feeding have an innate preference for food with certain shape and size, (Gentile, 2009). The difference in intake of broilers from wee 4 and 5 could be attributed to the fact that broilers had developed in age and size and had a strong bias to use visual (shape and color, when feeding, hence the two treatments had also differences in shape and colour, (commercially purchased diet and moringa formulated diet).

5.2 Weight gain of broilers

The results showed a similar trend to the daily feed intake, in weight gain of broilers fed with commercially purchased diet (treatment 1) and those fed with moringa seed formulated diet (treatment 2). This could be the fact that the commercial diet was formulated from a mixture of maize and soya beans as major ingredients while moringa seed formulated diet was also made from maize based carbohydrate. In comparison, soya cake have a crude protein of 44% while moringa treated seed had a crude protein of 40%. The only significant difference in weight gain was observed to be in week 4 of production. In addition to this, Ayssiwede *et al*. (2011) observed that the inclusion of moringa seed in broiler feed have no negative impact on live body weight, average daily weight gain, feed conversion ratio.

5.3 Mortality

The major causes of death to the broilers were chilling and sudden deaths caused by cold stress in the first week of age of broilers. Apart from that, the broiler chicks were still adapting to the new treatment environment. The other factors were respiratory failure and heat stress. Much of the mortalities in all the three treatments had been experienced in early life during the brooding stage up to 4 weeks of age. Sanotra et al., (2016), also attributed the early poultry age mortalities to cold stress, failure to adapt to environment and sudden deaths.

Chapter 6

6.0 Conclusions and Recommendations

6.1 Conclusion

The results obtained from this study indicated that there was no a significant difference in intake and weekly weight gain of broilers fed with commercially purchased feeds and that of moringa seed formulated diet; from first week of ages up to the third week of age. This was also observed in week 5 and 6 of production and in regard to these observation, this study conclude that there is no significant difference in intake, weight gain and feed conversion efficiency of broilers fed with commercially purchased feeds and with that of moringa seed formulated diet. Hence moringa seed when heat treated will provide a comparably broiler performance to the available broiler feeds on market.

6.2 Recommendations

- It can be recommended from this study that moringa seed can be used as a protein source to formulate the feeds for broilers from day old up to six weeks of age since it has comparatively good protein source of 40 %
- It is also recommended to heat treat moringa seed before using it to formulate the feeds for broilers since it contains chemicals which prevent the availability of essential minerals and vitamins.
- It is also recommended to control factors that lead to early age of broiler mortality.

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6 APPENDICES

Appendix 1: Type 3 Tests of Fixed Effects on weight gain

Effect	DF	Num DF	Den F Value	Pr > F
trt	2	54	9.73	0.0002
week	5	54	459273	<.0001
trt*week	10	54	15.02	<.0001

Appendix 2: LS Means of treatments on weekly weight gain

Effect	trt	week	Estimate	Error	DF	t Value	Pr > |t|
trt	1		0.3143	0.000314	54	1000.56	<.0001
trt	2		0.3153	0.000314	54	1003.87	<.0001
trt	3		0.3134	0.000314	54	997.64	<.0001
week		1	0.008750	0.000444	54	19.70	<.0001
week		2	0.03842	0.000444	54	86.48	<.0001
week		3	0.1206	0.000444	54	271.45	<.0001
week		4	0.4140	0.000444	54	931.96	<.0001

week		5	0.5890	0.000444	54	1325.90	<.0001
week	6	0.7153	0.000444	54	1610.10	<.0001	
trt*week	1	1	0.008500	0.000769	54	11.05	<.0001
trt*week	1	2	0.03800	0.000769	54	49.39	<.0001
trt*week	1	3	0.1188	0.000769	54	154.34	<.0001
trt*week	1	4	0.4150	0.000769	54	539.36	<.0001
trt*week	1	5	0.5900	0.000769	54	766.81	<.0001
trt*week	1	6	0.7155	0.000769	54	929.92	<.0001
trt*week	2	1	0.01000	0.000769	54	13.00	<.0001
trt*week	2	2	0.04100	0.000769	54	53.29	<.0001
trt*week	2	3	0.1178	0.000769	54	153.04	<.0001
trt*week	2	4	0.4180	0.000769	54	543.26	<.0001
trt*week	2	5	0.5880	0.000769	54	764.21	<.0001
trt*week	2	6	0.7173	0.000769	54	932.19	<.0001
trt*week	3	1	0.007750	0.000769	54	10.07	<.0001
trt*week	3	2	0.03625	0.000769	54	47.11	<.0001
trt*week	3	3	0.1252	0.000769	54	162.78	<.0001
trt*week	3	4	0.4090	0.000769	54	531.57	<.0001
trt*week	3	5	0.5890	0.000769	54	765.51	<.0001
trt*week	3	6	0.7130	0.000769	54	926.67	<.0001

Appendix 3: Differences of LS Means of treatments on weekly weight gain

Effect	**trt**	**week**	**_trt**	**_week**	**Estimate**	**Error**	**DF**	**t Value**	**Pr > |t|**
trt	1		2		-0.00104	0.000444	54	-2.34	0.0227
trt	1		3		0.000917	0.000444	54	2.06	0.0439

trt	2		3		0.001958	0.000444	54	4.41	<.0001
week		1		2	-0.02967	0.000628	54	-47.22	<.0001
week		1		3	-0.1118	0.000628	54	-178.01	<.0001
week		1		4	-0.4053	0.000628	54	-645.06	<.0001
week		1		5	-0.5803	0.000628	54	-923.62	<.0001
week		1		6	-0.7065	0.000628	54	-1124.6	<.0001
week		2		3	-0.08217	0.000628	54	-130.79	<.0001
week		2		4	-0.3756	0.000628	54	-597.84	<.0001
week		2		5	-0.5506	0.000628	54	-876.40	<.0001
week		2		6	-0.6768	0.000628	54	-1077.4	<.0001
week		3		4	-0.2934	0.000628	54	-467.05	<.0001
week		3		5	-0.4684	0.000628	54	-745.61	<.0001
week		3		6	-0.5947	0.000628	54	-946.57	<.0001
week		4		5	-0.1750	0.000628	54	-278.56	<.0001
week		4		6	-0.3013	0.000628	54	-479.52	<.0001
week		5		6	-0.1262	0.000628	54	-200.96	<.0001
trt*week	1	1	1	2	-0.02950	0.001088	54	-27.11	<.0001
trt*week	1	1	1	3	-0.1102	0.001088	54	-101.32	<.0001
trt*week	1	1	1	4	-0.4065	0.001088	54	-373.58	<.0001
trt*week	1	1	1	5	-0.5815	0.001088	54	-534.40	<.0001
trt*week	1	1	1	6	-0.7070	0.001088	54	-649.74	<.0001
trt*week	1	1	2	1	-0.00150	0.001088	54	-1.38	0.1737
trt*week	1	1	2	2	-0.03250	0.001088	54	-29.87	<.0001
trt*week	1	1	2	3	-0.1092	0.001088	54	-100.40	<.0001
trt*week	1	1	2	4	-0.4095	0.001088	54	-376.33	<.0001
trt*week	1	1	2	5	-0.5795	0.001088	54	-532.56	<.0001
trt*week	1	1	2	6	-0.7087	0.001088	54	-651.35	<.0001
trt*week	1	1	3	1	0.000750	0.001088	54	0.69	0.4936
trt*week	1	1	3	2	-0.02775	0.001088	54	-25.50	<.0001
trt*week	1	1	3	3	-0.1167	0.001088	54	-107.29	<.0001
trt*week	1	1	3	4	-0.4005	0.001088	54	-368.06	<.0001

trt*week	1	1	3	5	-0.5805	0.001088	54	-533.48	<.0001
trt*week	1	1	3	6	-0.7045	0.001088	54	-647.44	<.0001
trt*week	1	2	1	3	-0.08075	0.001088	54	-74.21	<.0001
trt*week	1	2	1	4	-0.3770	0.001088	54	-346.47	<.0001
trt*week	1	2	1	5	-0.5520	0.001088	54	-507.29	<.0001
trt*week	1	2	1	6	-0.6775	0.001088	54	-622.63	<.0001
Effect	**trt**	**week**	**_trt**	**_week**	**Estimate**	**Error**	**DF**	**t Value**	**Pr > |t|**
trt*week	1	2	2	1	0.02800	0.001088	54	25.73	<.0001
trt*week	1	2	2	2	-0.00300	0.001088	54	-2.76	0.0079
trt*week	1	2	2	3	-0.07975	0.001088	54	-73.29	<.0001
trt*week	1	2	2	4	-0.3800	0.001088	54	-349.22	<.0001
trt*week	1	2	2	5	-0.5500	0.001088	54	-505.45	<.0001
trt*week	1	2	2	6	-0.6793	0.001088	54	-624.24	<.0001
trt*week	1	2	3	1	0.03025	0.001088	54	27.80	<.0001
trt*week	1	2	3	2	0.001750	0.001088	54	1.61	0.1136
trt*week	1	2	3	3	-0.08725	0.001088	54	-80.18	<.0001
trt*week	1	2	3	4	-0.3710	0.001088	54	-340.95	<.0001
trt*week	1	2	3	5	-0.5510	0.001088	54	-506.37	<.0001
trt*week	1	2	3	6	-0.6750	0.001088	54	-620.33	<.0001
trt*week	1	3	1	4	-0.2963	0.001088	54	-272.26	<.0001
trt*week	1	3	1	5	-0.4713	0.001088	54	-433.08	<.0001
trt*week	1	3	1	6	-0.5967	0.001088	54	-548.42	<.0001
trt*week	1	3	2	1	0.1087	0.001088	54	99.94	<.0001
trt*week	1	3	2	2	0.07775	0.001088	54	71.45	<.0001
trt*week	1	3	2	3	0.001000	0.001088	54	0.92	0.3622
trt*week	1	3	2	4	-0.2992	0.001088	54	-275.01	<.0001
trt*week	1	3	2	5	-0.4693	0.001088	54	-431.24	<.0001
trt*week	1	3	2	6	-0.5985	0.001088	54	-550.03	<.0001
trt*week	1	3	3	1	0.1110	0.001088	54	102.01	<.0001
trt*week	1	3	3	2	0.08250	0.001088	54	75.82	<.0001
trt*week	1	3	3	3	-0.00650	0.001088	54	-5.97	<.0001

trt*week	1	3	3	4	-0.2903	0.001088	54	-266.74	<.0001
trt*week	1	3	3	5	-0.4703	0.001088	54	-432.16	<.0001
trt*week	1	3	3	6	-0.5943	0.001088	54	-546.12	<.0001
trt*week	1	4	1	5	-0.1750	0.001088	54	-160.83	<.0001
trt*week	1	4	1	6	-0.3005	0.001088	54	-276.16	<.0001
trt*week	1	4	2	1	0.4050	0.001088	54	372.20	<.0001
trt*week	1	4	2	2	0.3740	0.001088	54	343.71	<.0001
trt*week	1	4	2	3	0.2973	0.001088	54	273.17	<.0001
trt*week	1	4	2	4	-0.00300	0.001088	54	-2.76	0.0079
trt*week	1	4	2	5	-0.1730	0.001088	54	-158.99	<.0001
trt*week	1	4	2	6	-0.3023	0.001088	54	-277.77	<.0001
trt*week	1	4	3	1	0.4073	0.001088	54	374.27	<.0001
trt*week	1	4	3	2	0.3788	0.001088	54	348.07	<.0001
trt*week	1	4	3	3	0.2898	0.001088	54	266.28	<.0001
trt*week	1	4	3	4	0.006000	0.001088	54	5.51	<.0001
trt*week	1	4	3	5	-0.1740	0.001088	54	-159.91	<.0001
trt*week	1	4	3	6	-0.2980	0.001088	54	-273.86	<.0001
trt*week	1	5	1	6	-0.1255	0.001088	54	-115.34	<.0001
trt*week	1	5	2	1	0.5800	0.001088	54	533.02	<.0001
trt*week	1	5	2	2	0.5490	0.001088	54	504.54	<.0001
Effect	**trt**	**week**	**_trt**	**_week**	**Estimate**	**Error**	**DF**	**t Value**	**Pr > |t|**
trt*week	1	5	2	3	0.4723	0.001088	54	434.00	<.0001
trt*week	1	5	2	4	0.1720	0.001088	54	158.07	<.0001
trt*week	1	5	2	5	0.002000	0.001088	54	1.84	0.0716
trt*week	1	5	2	6	-0.1272	0.001088	54	-116.94	<.0001
trt*week	1	5	3	1	0.5823	0.001088	54	535.09	<.0001
trt*week	1	5	3	2	0.5538	0.001088	54	508.90	<.0001
trt*week	1	5	3	3	0.4648	0.001088	54	427.11	<.0001
trt*week	1	5	3	4	0.1810	0.001088	54	166.34	<.0001
trt*week	1	5	3	5	0.001000	0.001088	54	0.92	0.3622
trt*week	1	5	3	6	-0.1230	0.001088	54	-113.04	<.0001

trt*week	1	6	2	1	0.7055	0.001088	54	648.36	<.0001
trt*week	1	6	2	2	0.6745	0.001088	54	619.87	<.0001
trt*week	1	6	2	3	0.5977	0.001088	54	549.34	<.0001
trt*week	1	6	2	4	0.2975	0.001088	54	273.40	<.0001
trt*week	1	6	2	5	0.1275	0.001088	54	117.17	<.0001
trt*week	1	6	2	6	-0.00175	0.001088	54	-1.61	0.1136
trt*week	1	6	3	1	0.7077	0.001088	54	650.43	<.0001
trt*week	1	6	3	2	0.6793	0.001088	54	624.24	<.0001
trt*week	1	6	3	3	0.5902	0.001088	54	542.44	<.0001
trt*week	1	6	3	4	0.3065	0.001088	54	281.68	<.0001
trt*week	1	6	3	5	0.1265	0.001088	54	116.25	<.0001
trt*week	1	6	3	6	0.002500	0.001088	54	2.30	0.0255
trt*week	2	1	2	2	-0.03100	0.001088	54	-28.49	<.0001
trt*week	2	1	2	3	-0.1077	0.001088	54	-99.02	<.0001
trt*week	2	1	2	4	-0.4080	0.001088	54	-374.96	<.0001
trt*week	2	1	2	5	-0.5780	0.001088	54	-531.19	<.0001
trt*week	2	1	2	6	-0.7072	0.001088	54	-649.97	<.0001
trt*week	2	1	3	1	0.002250	0.001088	54	2.07	0.0435
trt*week	2	1	3	2	-0.02625	0.001088	54	-24.12	<.0001
trt*week	2	1	3	3	-0.1152	0.001088	54	-105.92	<.0001
trt*week	2	1	3	4	-0.3990	0.001088	54	-366.68	<.0001
trt*week	2	1	3	5	-0.5790	0.001088	54	-532.11	<.0001
trt*week	2	1	3	6	-0.7030	0.001088	54	-646.06	<.0001
trt*week	2	2	2	3	-0.07675	0.001088	54	-70.53	<.0001
trt*week	2	2	2	4	-0.3770	0.001088	54	-346.47	<.0001
trt*week	2	2	2	5	-0.5470	0.001088	54	-502.70	<.0001
trt*week	2	2	2	6	-0.6763	0.001088	54	-621.48	<.0001
trt*week	2	2	3	1	0.03325	0.001088	54	30.56	<.0001
trt*week	2	2	3	2	0.004750	0.001088	54	4.37	<.0001
trt*week	2	2	3	3	-0.08425	0.001088	54	-77.43	<.0001
trt*week	2	2	3	4	-0.3680	0.001088	54	-338.19	<.0001

trt*week	2	2	3	5	-0.5480	0.001088	54	-503.62	<.0001
trt*week	2	2	3	6	-0.6720	0.001088	54	-617.57	<.0001
trt*week	2	3	2	4	-0.3002	0.001088	54	-275.93	<.0001
Effect	**trt**	**week**	**_trt**	**_week**	**Estimate**	**Error**	**DF**	**t Value**	**Pr > |t|**
trt*week	2	3	2	5	-0.4703	0.001088	54	-432.16	<.0001
trt*week	2	3	2	6	-0.5995	0.001088	54	-550.94	<.0001
trt*week	2	3	3	1	0.1100	0.001088	54	101.09	<.0001
trt*week	2	3	3	2	0.08150	0.001088	54	74.90	<.0001
trt*week	2	3	3	3	-0.00750	0.001088	54	-6.89	<.0001
trt*week	2	3	3	4	-0.2913	0.001088	54	-267.66	<.0001
trt*week	2	3	3	5	-0.4713	0.001088	54	-433.08	<.0001
trt*week	2	3	3	6	-0.5953	0.001088	54	-547.04	<.0001
trt*week	2	4	2	5	-0.1700	0.001088	54	-156.23	<.0001
trt*week	2	4	2	6	-0.2993	0.001088	54	-275.01	<.0001
trt*week	2	4	3	1	0.4103	0.001088	54	377.02	<.0001
trt*week	2	4	3	2	0.3818	0.001088	54	350.83	<.0001
trt*week	2	4	3	3	0.2928	0.001088	54	269.04	<.0001
trt*week	2	4	3	4	0.009000	0.001088	54	8.27	<.0001
trt*week	2	4	3	5	-0.1710	0.001088	54	-157.15	<.0001
trt*week	2	4	3	6	-0.2950	0.001088	54	-271.11	<.0001
trt*week	2	5	2	6	-0.1292	0.001088	54	-118.78	<.0001
trt*week	2	5	3	1	0.5803	0.001088	54	533.25	<.0001
trt*week	2	5	3	2	0.5518	0.001088	54	507.06	<.0001
trt*week	2	5	3	3	0.4628	0.001088	54	425.27	<.0001
trt*week	2	5	3	4	0.1790	0.001088	54	164.50	<.0001
trt*week	2	5	3	5	-0.00100	0.001088	54	-0.92	0.3622
trt*week	2	5	3	6	-0.1250	0.001088	54	-114.88	<.0001
trt*week	2	6	3	1	0.7095	0.001088	54	652.04	<.0001
trt*week	2	6	3	2	0.6810	0.001088	54	625.84	<.0001
trt*week	2	6	3	3	0.5920	0.001088	54	544.05	<.0001
trt*week	2	6	3	4	0.3083	0.001088	54	283.28	<.0001

trt*week	2	6	3	5	0.1282	0.001088	54	117.86	<.0001
trt*week	2	6	3	6	0.004250	0.001088	54	3.91	0.0003
trt*week	3	1	3	2	-0.02850	0.001088	54	-26.19	<.0001
trt*week	3	1	3	3	-0.1175	0.001088	54	-107.98	<.0001
trt*week	3	1	3	4	-0.4013	0.001088	54	-368.75	<.0001
trt*week	3	1	3	5	-0.5813	0.001088	54	-534.17	<.0001
trt*week	3	1	3	6	-0.7053	0.001088	54	-648.13	<.0001
trt*week	3	2	3	3	-0.08900	0.001088	54	-81.79	<.0001
trt*week	3	2	3	4	-0.3728	0.001088	54	-342.56	<.0001
trt*week	3	2	3	5	-0.5528	0.001088	54	-507.98	<.0001
trt*week	3	2	3	6	-0.6768	0.001088	54	-621.94	<.0001
trt*week	3	3	3	4	-0.2838	0.001088	54	-260.77	<.0001
trt*week	3	3	3	5	-0.4638	0.001088	54	-426.19	<.0001
trt*week	3	3	3	6	-0.5878	0.001088	54	-540.15	<.0001
trt*week	3	4	3	5	-0.1800	0.001088	54	-165.42	<.0001
trt*week	3	4	3	6	-0.3040	0.001088	54	-279.38	<.0001
trt*week	3	5	3	6	-0.1240	0.001088	54	-113.96	<.0001

Appendix 4: Type 3 Tests of Fixed Effects on feed intake

Effect	**Num DF**	**Den DF**	**F Value**	**Pr > F**
trt	2	54	9.24	0.0004
week	5	54	5581.56	<.0001
trt*week	10	54	1.69	0.1060

Appendix 5: LS Means of treatments on feed intake

Effect	trt	week	Estimate	Standard Error	DF	t Value	Pr > |t|
trt	1		4.4621	0.03927	54	113.62	<.0001
trt	2		4.5296	0.03927	54	115.34	<.0001
trt	3		4.2975	0.03927	54	109.43	<.0001
week	1		0.04417	0.05554	54	0.80	0.4300
week	2		0.4542	0.05554	54	8.18	<.0001
week	3		1.7250	0.05554	54	31.06	<.0001
week	4		6.8108	0.05554	54	122.63	<.0001
week	5		8.3533	0.0555	54	150.40	<. 0001
week	6		9.1908	0.05554	54	165.48	<.0001
trt*week	1	1	0.04500	0.09620	54	0.47	0.6418
trt*week	1	2	0.4600	0.09620	54	4.78	<.0001
trt*week	1	3	1.6600	0.09620	54	17.26	<.0001
trt*week	1	4	6.9150	0.09620	54	71.88	<.0001
trt*week	1	5	8.4750	0.09620	54	88.10	<.0001
trt*week	1	6	9.2175	0.09620	54	95.82	<.0001
trt*week	2	1	0.05000	0.09620	54	0.52	0.6054
trt*week	2	2	0.4950	0.09620	54	5.15	<.0001
trt*week	2	3	1.7950	0.09620	54	18.66	<.0001
trt*week	2	4	6.9650	0.09620	54	72.40	<.0001
trt*week	2	5	8.5775	0.09620	54	89.17	<.0001
trt*week	2	6	9.2950	0.09620	54	96.62	<.0001
trt*week	3	1	0.03750	0.09620	54	0.39	0.6982
trt*week	3	2	0.4075	0.09620	54	4.24	<.0001
trt*week	3	3	1.7200	0.09620	54	17.88	<.0001

trt*week	3	4	6.5525	0.09620	54	68.11	<.0001
trt*week	3	5	8.0075	0.09620	54	83.24	<.0001
trt*week	3	6	9.0600	0.09620	54	94.18	<.0001

Appendix 6: Differences of LS Means of treatments on feed intake

Effect	trt	week	_trt	_week	Estimate	Standard Error	DF	t Value	Pr > |t|
trt	1		2		-0.06750	0.05554	54	-1.22	0.2295
trt	1		3		0.1646	0.05554	54	2.96	0.0045
trt	2		3		0.2321	0.05554	54	4.18	0.0001
week		1		2	-0.4100	0.07855	54	-5.22	<.0001
week		1		3	-1.6808	0.07855	54	-21.40	<.0001
week		1		4	-6.7667	0.07855	54	-86.15	<.0001
week		1		5	-8.3092	0.07855	54	-105.79	<.0001
week		1		6	-9.1467	0.07855	54	-116.45	<.0001
week		2		3	-1.2708	0.07855	54	-16.18	<.0001
week		2		4	-6.3567	0.07855	54	-80.93	<.0001
week		2		5	-7.8992	0.07855	54	-100.57	<.0001
week		2		6	-8.7367	0.07855	54	-111.23	<.0001
week		3		4	-5.0858	0.07855	54	-64.75	<.0001
week		3		5	-6.6283	0.07855	54	-84.39	<.0001
week		3		6	-7.4658	0.07855	54	-95.05	<.0001
week		4		5	-1.5425	0.07855	54	-19.64	<.0001
week		4		6	-2.3800	0.07855	54	-30.30	<.0001
week		5		6	-0.8375	0.07855	54	-10.66	<.0001
trt*week	1	1	1	2	-0.4150	0.1360	54	-3.05	0.0035

trt*week	1	1	1	3	-1.6150	0.1360	54	-11.87	<.0001
trt*week	1	1	1	4	-6.8700	0.1360	54	-50.50	<.0001
trt*week	1	1	1	5	-8.4300	0.1360	54	-61.97	<.0001
trt*week	1	1	1	6	-9.1725	0.1360	54	-67.42	<.0001
trt*week	1	1	2	1	-0.00500	0.1360	54	-0.04	0.9708
trt*week	1	1	2	2	-0.4500	0.1360	54	-3.31	0.0017
trt*week	1	1	2	3	-1.7500	0.1360	54	-12.86	<.0001
trt*week	1	1	2	4	-6.9200	0.1360	54	-50.87	<.0001
trt*week	1	1	2	5	-8.5325	0.1360	54	-62.72	<.0001
trt*week	1	1	2	6	-9.2500	0.1360	54	-67.99	<.0001
trt*week	1	1	3	1	0.007500	0.1360	54	0.06	0.9562
trt*week	1	1	3	2	-0.3625	0.1360	54	-2.66	0.0101
trt*week	1	1	3	3	-1.6750	0.1360	54	-12.31	<.0001
trt*week	1	1	3	4	-6.5075	0.1360	54	-47.83	<.0001
trt*week	1	1	3	5	-7.9625	0.1360	54	-58.53	<.0001
trt*week	1	1	3	6	-9.0150	0.1360	54	-66.27	<.0001
trt*week	1	2	1	3	-1.2000	0.1360	54	-8.82	<.0001
trt*week	1	2	1	4	-6.4550	0.1360	54	-47.45	<.0001
trt*week	1	2	1	5	-8.0150	0.1360	54	-58.91	<.0001
trt*week	1	2	1	6	-8.7575	0.1360	54	-64.37	<.0001
trt*week	1	2	2	1	0.4100	0.1360	54	3.01	0.0039
trt*week	1	2	2	2	-0.03500	0.1360	54	-0.26	0.7979

Effect	**trt**	**week**	**_trt**	**_week**	**Estimate**	**Standard Error**	**DF**	**t Value**	**Pr > |t|**
trt*week	1	2	2	3	-1.3350	0.1360	54	-9.81	<.0001
trt*week	1	2	2	4	-6.5050	0.1360	54	-47.82	<.0001

trt*week	1	2	2	5	-8.1175	0.1360	54	-59.67	<.0001
trt*week	1	2	2	6	-8.8350	0.1360	54	-64.94	<.0001
trt*week	1	2	3	1	0.4225	0.1360	54	3.11	0.0030
trt*week	1	2	3	2	0.05250	0.1360	54	0.39	0.7011
trt*week	1	2	3	3	-1.2600	0.1360	54	-9.26	<.0001
trt*week	1	2	3	4	-6.0925	0.1360	54	-44.78	<.0001
trt*week	1	2	3	5	-7.5475	0.1360	54	-55.48	<.0001
trt*week	1	2	3	6	-8.6000	0.1360	54	-63.21	<.0001
trt*week	1	3	1	4	-5.2550	0.1360	54	-38.63	<.0001
trt*week	1	3	1	5	-6.8150	0.1360	54	-50.09	<.0001
trt*week	1	3	1	6	-7.5575	0.1360	54	-55.55	<.0001
trt*week	1	3	2	1	1.6100	0.1360	54	11.83	<.0001
trt*week	1	3	2	2	1.1650	0.1360	54	8.56	<.0001
trt*week	1	3	2	3	-0.1350	0.1360	54	-0.99	0.3255
trt*week	1	3	2	4	-5.3050	0.1360	54	-38.99	<.0001
trt*week	1	3	2	5	-6.9175	0.1360	54	-50.85	<.0001
trt*week	1	3	2	6	-7.6350	0.1360	54	-56.12	<.0001
trt*week	1	3	3	1	1.6225	0.1360	54	11.93	<.0001
trt*week	1	3	3	2	1.2525	0.1360	54	9.21	<.0001
trt*week	1	3	3	3	-0.06000	0.1360	54	-0.44	0.6609
trt*week	1	3	3	4	-4.8925	0.1360	54	-35.96	<.0001
trt*week	1	3	3	5	-6.3475	0.1360	54	-46.66	<.0001
trt*week	1	3	3	6	-7.4000	0.1360	54	-54.39	<.0001
trt*week	1	4	1	5	-1.5600	0.1360	54	-11.47	<.0001
trt*week	1	4	1	6	-2.3025	0.1360	54	-16.92	<.0001
trt*week	1	4	2	1	6.8650	0.1360	54	50.46	<.0001
trt*week	1	4	2	2	6.4200	0.1360	54	47.19	<.0001

trt*week	1	4	2	3	5.1200	0.1360	54	37.63	<.0001
trt*week	1	4	2	4	-0.05000	0.1360	54	-0.37	0.7147
trt*week	1	4	2	5	-1.6625	0.1360	54	-12.22	<.0001
trt*week	1	4	2	6	-2.3800	0.1360	54	-17.49	<.0001
trt*week	1	4	3	1	6.8775	0.1360	54	50.55	<.0001
trt*week	1	4	3	2	6.5075	0.1360	54	47.83	<.0001
trt*week	1	4	3	3	5.1950	0.1360	54	38.19	<.0001
trt*week	1	4	3	4	0.3625	0.1360	54	2.66	0.0101
trt*week	1	4	3	5	-1.0925	0.1360	54	-8.03	<.0001
trt*week	1	4	3	6	-2.1450	0.1360	54	-15.77	<.0001
trt*week	1	5	1	6	-0.7425	0.1360	54	-5.46	<.0001
trt*week	1	5	2	1	8.4250	0.1360	54	61.93	<.0001
trt*week	1	5	2	2	7.9800	0.1360	54	58.66	<.0001

Effect	trt	week	_trt	_week	Estimate	Standard Error	DF	t Value	Pr > |t|
trt*week	1	5	2	3	6.6800	0.1360	54	49.10	<.0001
trt*week	1	5	2	4	1.5100	0.1360	54	11.10	<.0001
trt*week	1	5	2	5	-0.1025	0.1360	54	-0.75	0.4545
trt*week	1	5	2	6	-0.8200	0.1360	54	-6.03	<.0001
trt*week	1	5	3	1	8.4375	0.1360	54	62.02	<.0001
trt*week	1	5	3	2	8.0675	0.1360	54	59.30	<.0001
trt*week	1	5	3	3	6.7550	0.1360	54	49.65	<.0001
trt*week	1	5	3	4	1.9225	0.1360	54	14.13	<.0001
trt*week	1	5	3	5	0.4675	0.1360	54	3.44	0.0011
trt*week	1	5	3	6	-0.5850	0.1360	54	-4.30	<.0001
trt*week	1	6	2	1	9.1675	0.1360	54	67.39	<.0001

trt*week	1	6	2	2	8.7225	0.1360	54	64.12	<.0001
trt*week	1	6	2	3	7.4225	0.1360	54	54.56	<.0001
trt*week	1	6	2	4	2.2525	0.1360	54	16.56	<.0001
trt*week	1	6	2	5	0.6400	0.1360	54	4.70	<.0001
trt*week	1	6	2	6	-0.07750	0.1360	54	-0.57	0.5713
trt*week	1	6	3	1	9.1800	0.1360	54	67.48	<.0001
trt*week	1	6	3	2	8.8100	0.1360	54	64.76	<.0001
trt*week	1	6	3	3	7.4975	0.1360	54	55.11	<.0001
trt*week	1	6	3	4	2.6650	0.1360	54	19.59	<.0001
trt*week	1	6	3	5	1.2100	0.1360	54	8.89	<.0001
trt*week	1	6	3	6	0.1575	0.1360	54	1.16	0.2521
trt*week	2	1	2	2	-0.4450	0.1360	54	-3.27	0.0019
trt*week	2	1	2	3	-1.7450	0.1360	54	-12.83	<.0001
trt*week	2	1	2	4	-6.9150	0.1360	54	-50.83	<.0001
trt*week	2	1	2	5	-8.5275	0.1360	54	-62.68	<.0001
trt*week	2	1	2	6	-9.2450	0.1360	54	-67.96	<.0001
trt*week	2	1	3	1	0.01250	0.1360	54	0.09	0.9271
trt*week	2	1	3	2	-0.3575	0.1360	54	-2.63	0.0112
trt*week	2	1	3	3	-1.6700	0.1360	54	-12.28	<.0001
trt*week	2	1	3	4	-6.5025	0.1360	54	-47.80	<.0001
trt*week	2	1	3	5	-7.9575	0.1360	54	-58.49	<.0001
trt*week	2	1	3	6	-9.0100	0.1360	54	-66.23	<.0001
trt*week	2	2	2	3	-1.3000	0.1360	54	-9.56	<.0001
trt*week	2	2	2	4	-6.4700	0.1360	54	-47.56	<.0001
trt*week	2	2	2	5	-8.0825	0.1360	54	-59.41	<.0001
trt*week	2	2	2	6	-8.8000	0.1360	54	-64.68	<.0001
trt*week	2	2	3	1	0.4575	0.1360	54	3.36	0.0014

trt*week	2	2	3	2	0.08750	0.1360	54	0.64	0.5228
trt*week	2	2	3	3	-1.2250	0.1360	54	-9.00	<.0001
trt*week	2	2	3	4	-6.0575	0.1360	54	-44.53	<.0001
trt*week	2	2	3	5	-7.5125	0.1360	54	-55.22	<.0001
trt*week	2	2	3	6	-8.5650	0.1360	54	-62.96	<.0001

Effect	trt	week	_trt	_week	Estimate	Standard Error	DF	t Value	Pr > |t|
trt*week	2	3	2	4	-5.1700	0.1360	54	-38.00	<.0001
trt*week	2	3	2	5	-6.7825	0.1360	54	-49.86	<.0001
trt*week	2	3	2	6	-7.5000	0.1360	54	-55.13	<.0001
trt*week	2	3	3	1	1.7575	0.1360	54	12.92	<.0001
trt*week	2	3	3	2	1.3875	0.1360	54	10.20	<.0001
trt*week	2	3	3	3	0.07500	0.1360	54	0.55	0.5837
trt*week	2	3	3	4	-4.7575	0.1360	54	-34.97	<.0001
trt*week	2	3	3	5	-6.2125	0.1360	54	-45.67	<.0001
trt*week	2	3	3	6	-7.2650	0.1360	54	-53.40	<.0001
trt*week	2	4	2	5	-1.6125	0.1360	54	-11.85	<.0001
trt*week	2	4	2	6	-2.3300	0.1360	54	-17.13	<.0001
trt*week	2	4	3	1	6.9275	0.1360	54	50.92	<.0001
trt*week	2	4	3	2	6.5575	0.1360	54	48.20	<.0001
trt*week	2	4	3	3	5.2450	0.1360	54	38.55	<.0001
trt*week	2	4	3	4	0.4125	0.1360	54	3.03	0.0037
trt*week	2	4	3	5	-1.0425	0.1360	54	-7.66	<.0001
trt*week	2	4	3	6	-2.0950	0.1360	54	-15.40	<.0001
trt*week	2	5	2	6	-0.7175	0.1360	54	-5.27	<.0001
trt*week	2	5	3	1	8.5400	0.1360	54	62.77	<.0001
trt*week	2	5	3	2	8.1700	0.1360	54	60.05	<.0001

trt*week	2	5	3	3	6.8575	0.1360	54	50.41	<.0001
trt*week	2	5	3	4	2.0250	0.1360	54	14.88	<.0001
trt*week	2	5	3	5	0.5700	0.1360	54	4.19	0.0001
trt*week	2	5	3	6	-0.4825	0.1360	54	-3.55	0.0008
trt*week	2	6	3	1	9.2575	0.1360	54	68.05	<.0001
trt*week	2	6	3	2	8.8875	0.1360	54	65.33	<.0001
trt*week	2	6	3	3	7.5750	0.1360	54	55.68	<.0001
trt*week	2	6	3	4	2.7425	0.1360	54	20.16	<.0001
trt*week	2	6	3	5	1.2875	0.1360	54	9.46	<.0001
trt*week	2	6	3	6	0.2350	0.1360	54	1.73	0.0898
trt*week	3	1	3	2	-0.3700	0.1360	54	-2.72	0.0088
trt*week	3	1	3	3	-1.6825	0.1360	54	-12.37	<.0001
trt*week	3	1	3	4	-6.5150	0.1360	54	-47.89	<.0001
trt*week	3	1	3	5	-7.9700	0.1360	54	-58.58	<.0001
trt*week	3	1	3	6	-9.0225	0.1360	54	-66.32	<.0001
trt*week	3	2	3	3	-1.3125	0.1360	54	-9.65	<.0001
trt*week	3	2	3	4	-6.1450	0.1360	54	-45.17	<.0001
trt*week	3	2	3	5	-7.6000	0.1360	54	-55.86	<.0001
trt*week	3	2	3	6	-8.6525	0.1360	54	-63.60	<.0001
trt*week	3	3	3	4	-4.8325	0.1360	54	-35.52	<.0001
trt*week	3	3	3	5	-6.2875	0.1360	54	-46.22	<.0001
trt*week	3	3	3	6	-7.3400	0.1360	54	-53.95	<.0001
trt*week	3	4	3	5	-1.4550	0.1360	54	-10.70	<.0001
trt*week	3	4	3	6	-2.5075	0.1360	54	-18.43	<.0001
trt*week	3	5	3	6	-1.0525	0.1360	54	-7.74	<.0001