ASSESSMENT OF SOME COMMERCIAL POULTRY FEEDS ON THE PERFORMANCE OF LAYERS IN MUBI, ADAMAWA STATE

BY

ANDREW, ZAKARIYA
(M.TECH/AS/08/0054)

APRIL, 2013

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BEING A THESIS SUBMITTED TO THE DEPARTMENT OF ANIMAL SCIENCE AND RANGE MANAGEMENT
MODIBBO ADAMA UNIVERSITY OF TECHNOLOGY, YOLA. IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTERS OF TECHNOLOGY IN ANIMAL PRODUCTION MANAGEMENT, DEPARTMENT OF ANIMAL SCIENCE AND RANGE MANAGEMENT SCHOOL OF AGRIC AND AGRIC. TECHNOLOGY

APRIL, 2013

DECLARATION

I hereby declare that this project was written by me and it is a record of my own research work. It has not been presented before in any previous application for a degree. All references cited have been duly acknowledged.

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ZAKARIYA, ANDREW   Date

DEDICATION

This thesis report is dedicated to my loving wife (Rosa) and her children (Wahya, Gashom and Faliwa)

APPROVAL PAGE

This project/thesis entitled "assessment of some common poultry feeds on the performance of layers in Mubi, Adamawa State" meets the regulation governing the award of masters of technology in animal science and range management, Modibbo Adama University of Technology, Yola and is approved for its contribution to knowledge.

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ABSTRACT

This study was designed to asses the performance of layers on formulated and common commercial feed sold in Mubi. On the performance production, egg quality and Hematological indices as well as economy of production. One hundred and twenty (120), twenty two (22) weeks old Rhode Island Red layers were randomly divided into four dietary treatment groups of 30 birds per group and were further replicated three times with 10 birds per replicate. They were fed four experimental diets T1 (vital feed), T2 (ECWA feed), T3 (Chip Chip feed), and T4 (Home made feed). Feed and water were provided *ad libtum* throughout the experimental period. The result obtained did not show significant ($P>0.05$). Difference on daily weight gain, feed conversion ration, hen-day production, yolk height, haugh unit, yolk diameter, MCHC, MCH, MCV, and mortality across the treatment. However, significant differences ($P<0.05$) were observed for feed intake, Albumen weight and height, yolk weight and height, yolk index and shell thickness across the treatment group. Data generated were subjected to one way analysis of variance (ANOVA). Proximate composition of experimental diets shows that the percentage crude protein, metabolizable energy, calcium and phosphorus are within the range of nutrient requirements recommended for layers in the tropics. T4 (formulated feed) were significantly ($P<0.05$) better in terms of feed cost per dozen egg (N/dozen egg) which is a measure of profitability.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Feed nutrients are the major determinants of life processes in animals. The significance of feed in poultry production can be visualized from the fact that feed accounts for about 75% of the cost of production of chickens (Atteh, 2002). Animal protein constitutes about 17% of the total protein consumption in the average Nigerian diet compared to 60% to 71% in the (World Bank, 2001). Therefore, there is every need to jack up such a lower protein intake in Nigeria.

One of the ways to meet up such challenges is to intensify poultry production and domestic chicken in particular which supply both meat and egg of highly valued protein. To meet such challenges the need to investigate the nutrition of chickens cannot be over emphasized. The nutrition of a chicken is hinged on appropriate combination of feed ingredients that provides for feed nutrients in their correct amount and proportion (Ogunwolere and Onwuka, 1997). These nutrients are in the forms of both basic and micro nutrients, with the former being required in larger quantity and the latter in smaller quantities. The basic ones are energy (carbohydrates and lipids), protein and fibre while minerals and vitamins constitute the micro class (Babtunde and Fatuga,1976).

Ogunwolere and Onwuka (1997) reported that most of the commercial poultry farmers depend on commercial feeds for their stock. It is expected that poultry nutritionist have to quantify resultant losses in birds performance when birds are fed sub standard commercial diets compared to standard once. Dick, (2002) suggested that harmonisation of feed qualities can only be possible when a given standard is adopted nation wide.

In recent times, it has been noted that most commercial feeds failed to meet up with the nutritional requirement of birds. In many cases there observed delaying in reaching laying period; the proliferation of feed meals with different trade marks has not adequately created economically viable competition for poultry farmers. Esonu, (2000) stated that the general objective of nutritionist is to maximize the economic production of birds. Diets are formulated by least cost linear programme to provide specified level of nutrient that is needed for optimum performance.

According to Smith *et al* (1979) modern animal nutrition should be able to provide as economically as possible a diet that will meet nutrients requirements of an animal for specific production function. Nutrition affects both productivity and welfare of animals. It is very important that only quality feeds from all angles as listed by Okol *et al* (2009) and Omade (2008) be fed to animals so as to maximise performance and production.

1.2 Justification of the study:

Feed have been the major hindrances to effective poultry production in Nigeria. This is mainly because of the high cost and low quality of the common commercial poultry feed found within the area of study.

Given the increasing number of people venturing into poultry business in Nigeria and the consequent high demand for commercial feeds, there is increasing tendency for feed manufacturers to produce substandard feeds especially as the quality control agencies in Nigeria are either less concerned or non functional (Oluyemi, 1984). It appears the farmers, consumer and the public at large are left at the mercy of commercial feed millers. This postulation is not an exaggeration considering the fact that feeding poultry alone accounts for about 75% of the total cost of production (Kekeocha, 1984).This depend on the region and season of production (Amir *et al*, 2001). It appears the manufacturers are aiming at high profit margins instead of focusing on quality of their products (Jones, 2005).

This research focuses on the evaluation of the nutrient qualities of the commercial poultry feeds on the performance of layers so as to make practical recommendation to poultry farmers regarding feeds of high nutritive value to uplift poultry production in the study area.

1.3 The Objectives of the Study are to:

1. Determine the feed intake and laying performance of layers fed commercial and formulated diets.

2. Evaluate the hematological indices of layers fed different commercial and formulated 3. Determine the egg quality of layers fed commercial and formulated diets.

4. Determine the economics of production of layers fed commercial and formulated feed.

CHAPTER TWO

LITERATURE REVIEW

2.1 The Significance of Poultry and Poultry Products

Different authors have different definition for poultry. According to Jordan and Patti son (1996), Poultry are domesticated chicken, turkey, duck, and certain other birds. The economic significant of poultry varies considerably although production in many countries has become increasingly specialized and integrated into a dynamic industry of major national and international importance.

There are fewer religious or social taboos associated with poultry than there are with pigs and cattle, thus product produced from poultry provide an acceptable form of animal protein to most people in develop and developing countries(Anthony, 1990). Some important factors in the continued growth of poultry industry in many countries are efficiency of poultry in converting vegetable protein into animal protein. The attractiveness and acceptability of poultry meat in human diets, acceptability to all Nigerians and relative ease with which new technology can be transferred between countries (Raph. 1987).

Penda (1985) reported that eggs have been recognised as an important source of protein in the diet of man, it is a protective food because it contains nutrients which protect and complement body loses in a different state. Sparks (2006) reported that chicken meat and eggs provide not only high quality protein, but also important vitamins and minerals. Worldwide 2 billion people depend on rice as their staple food. Most eat polished white rice stripped of many essential fats, the B Complex vitamins and several minerals.

Windhorst (2008) reported that in the least developed countries, the projected increase in egg consumption between 2005 and 2015 is 26 percent, and 1.6 percent, respectively. Jadhav and Sidiqui (2007) indicated that egg is the only wholesome food of animal origin which cannot be adulterated by any human means. Committee has recommended consuming at least half an egg per person per day to meet the nutritional needs of human life.

2.2 Management of laying chicken

Oluyime and Roberts, (1979) reported that house for poultry must suite the climatic condition and differs distinctly between temperate and tropical countries. There are three basic systems of confinement rearing for chickens (Bogart and Taylor 1983).They include deep litter system, slated floor and battery cages. The first important consideration arising from the confinement of the birds is the requirement of highly balanced diets with housing protecting chicken from physical hazard, rain and extremes of heat and cold (Penda, 1985).

Akinyosoye, (1985) reported that cage system is the best because it makes the most economic use of land and labour. Cages are of different type either the wooden type or metal, each unit having drinking and feeding troughs attached to it. Each cell can accommodate one or more birds, depending on the dimension of the cells used (North, 1984). The floor of the cage is made of wire and this permits the passage of the faecal dropping to the pit thus preventing the incidence of worms and coccidiosis which apart from viral disease are the common barnes of chicken egg production. Oluyime and Robert, (1982) birds are free from various problems associated with mutual contact or social frictions resulting in vices such as (egg eating and cannibalism) habit and stress, less exposed to disease which the disadvantages are high initial capital.

According to McNitt, (1983); Mohanial, (1985) the cage is more modern, beneficial and economic than deep litter. Moisture avoidance that prevent disease outbreak and integration with other systems such as fish and swamp rice farming. It also enable effective production of clean eggs, records keeping, prompt culling, identification of poor producers and less feed wastage.

Today, multiple hen cage have essentially replaced floor pens. North (1984) estimated that 75% of all the commercial layers in the world are now kept in cages, and United States, 93% of layers are in cages. According to Joy and Wibberley (1979) the use of battery cage is the most popular intensive system used by large scale commercial poultry farmers. Oluyime and Robert (1982) recommended that 22.5 to 25cm capacity of one bird 30-38cm for two birds and 42.5 to 45cm for three birds. The two bird’s size can be used for three birds if the birds are of light strain.

Numerous field tests have shown that five layers in a cage will result in low production and low feed efficiency. Campbell and Wesley, (1975) reported that the the level of performance of laying hen depends not only on inherited capacity but also to a great extent upon her environmental conditions temperature, sunshine, housing system and ventilation.

Cages are usually constructed in single, double or triple which are respectively describe as 1-tier, 2-tier and 3-tier. From part studies the performance of layer chicken have been observed to vary with a number of factors such as feed utilization and body weight (Harms et al., 1982), water availability. (Oluyime and Robert, 1979), tier of cages (North, 1984), infection (MCNitt, 1983) and ambient temperature (Mowbray and Sykes, 1971).

2.3 The effects of temperature and humidity on the performance of laying chickens.

Oluyime and Robert, (1982) reported that the body temperature of the domesticated fowl is 38.9 degree for the day old chick and 49.9 degree centigrade for adults; it has a small variation of +5 degree centigrade although a range of 38.9-43.6 degree centigrade has been reported. Jadhav and Sidiqui, (2007) reported that the computable temperature for optimum laying ranges from 18.3-21.5 degree centigrade. Both higher and lower temperature adversely affect egg production and quality of egg adversely. Egg production start declining when temperature rises more than 27 degree centigrade while size starts reducing from temperature of 24.5 degree centigrade onwards only. The higher temperature in general is more harmful to birds. Oluyime and Robert, (1982). Adult birds reduce egg production, size, specific gravity and shell thickness at temperature above 22 degree centigrade. Olomu and Offiong, (1983) reported that production is depressed at temperature constantly above 29 degree centigrade. Mortality is increased at 35 degree centigrade.

2.4 Quality Control of Poultry Feed.

Use of conventional and raw materials such as agro-industrial and animal by-products and wastes along with wide variation in quality of raw materials for poultry feed, it is necessary to asses the suitability of ingredient to incorporate it in feed. Quality control of poultry feed involves analysis and quality control of feed ingredients and feed by physical inspection, chemical analysis and biological evaluation of nutrients for their nutrient value. (Jadhav and Sadiqui, 2007).

2.4.1 Physical examination

Physical examination of raw materials forms one of the most important components of quality control programme. All the raw materials should be free from common and uncommon adulterants. The cereals and their by-products, agro-industrial by-products and other ingredients used for poultry feeds should not have the following qualities: Pebbles, extraneous materials, insect infestation and fungus mould growth. Moisture content should be less than 11 to 12 per cent, Cereals with high moisture content are more susceptible to fungal growth. Similarly grains with high insect infestation will be less in weight and have low nutrient value, Cereal by-products should be free from musty odour, sourness, lumps, dirt, extraneous materials, husk, fungus growth, insect infestation, vegetable protein feedstuffs must be free from bitterness, adulterants, rancidity, and fungal growth. The ingredients should have original texture, taste and free from iron and other metallic pieces, Animal by-products like fish-meal, meat meal, liver residue meal and silk worm pupae meal, etc. should have pleesant odour and be free from any other odour indicating spoilage.Microscopic examination of ingredient should be carried out to identify the type of adulterant or contaminant (Jadhav and Sadiqui, 2007).

2.4.2 Chemical analysis

Beyer (2003) reported that nutrient which are essential for birds or animals can be assessed in ingredients or finished feed directly by chemical analysis. It is useful for formulation of ration giving the information about potentiality of raw materials. The common analytical technique used worldwide for this is ‘proximate principles analysis or Weende method of analyses, which was developed at Weende Research Station in Germany around 1865 by Wilhelm Henneberg and Friedrich Stohmann. As per the system the feedstuffs partitioned into major six (6) components i.e mositure, ash, crude protein,crude firbre,crude lipid and nitrogen free extract (Jadhav and sadiqui, 2007).

2.5 Importance of feed evaluation

McDonald *et al.*, (2002) reported that feed evaluation is important because ingredients that belong to the same class contain different nutrient; for example maize provide more energy than wheat while soya beans contain more protein than lupins. The same ingredient varies from one supplier to the other. In drought year, cereals fill poorly and are therefore lower in quality. Most importantly, if feeds are not evaluated, it is not possible to tell if the material will be suitable for feeding poultry (Scanes *et al.,* 2004). Feeding standards have already been set for different types of poultry, so the requirements for different nutrient must be met precisely, with the current state of knowledge, to predict poultry growth or a production by modelling feed quality, type of housing, class of poultry and duration of feeding. The central key issue in these models is feed quality, which can only be obtained through feed evaluation (Jadhav and sadiqui, 2007).

2.6 Adulterants/contaminations in feed.

According to Jadhav and Sadiqui (2007) the variation in nutrients of feed ingredients is mainly through the following three ways:

2.6.1 Natural

This occurs primarily because of fertility of soil, fertilization and variety of plant species itself. However, grains and grain by-products are more consistence in their nutrient compositions as compared to protein supplements like fish-meal.

2.6.2 Processing

Processing considerably affects quality of raw material of feed. A good standard rice milling plant can produce rice bran of good quality (germ and outer layer of rice seed coat), whereas low standard plant produces comparatively low quality rice bran (with considerable portion of rice husk). Large variation in heat treatment in oil extraction produces poor quality soya bean meal (Jadhav and Sadiqui 2007).

2.6.3 Deliberate adulteration

This is most hazardous, intentional and affects the quality of feed adversely due to alteration of chemical composition of ingredient. It is mostly done with one or more similar cheaper ingredients to earn more profit margin. It is man made ailment lowering the quality considerably (Jadhav and Sadiqui 2007).

2.7 Evaluation of egg Qualities.

They are the characteristics of an egg which are liked by customers. Study and evaluation of them help in their improvement by research. Some of the important egg qualities are shape, shell colour, shell strength, cleanliness, albumen quality, yolk quality, presence of meat and blood spots, qualify of air-cell etc.. Egg qualities can be broadly classified as external and internal (Jadhav and Sadiqui 2007).

2.7.1 External Egg quality

Oluyemi and Robert (1979) reported that the qualities in which consumers are much more Interested are shape, shell colour and shell quality. Because linking of attractive and descent things is the natural tendency of human beings.

2.7.1.1 Shape

An egg should have normal ovoid shape because abnormal shape eggs like round, elongated, flay, conical, etc. are not liked by consumers because these are thought to be of diseased birds by them. Therefore, even slight abnormal shaped eggs are graded as 'B' or 'C' grade eggs instead of 'A' grade. (Singh, 1985).

Nowadays type of colour, whether white or brown colour does not matter but brightness of colour definitely affects liking of customers. Dull or stained colour does not preferred by consumer. Similarly, fading of colour indicates whether egg is fresh or stale as colour slowly fades, with time of storage. But fading of colour due to old age cannot be corrected which is to be convinced to consumers. Visual scoring, comparison with colour fans and photoelectric determination of percentage of reflection are some of the method of evaluating shell colour. (Mathivanan and Selvaraj, 2003).

2.7.1.2 Shell quality

Sound, smooth and complete shell are most important in shell quality (Jadhav and Jadiqui, 2007). Broken, rough, incomplete or weak shell at some places is taken as inferior quality. Such eggs are rejected by customers. Similarly, cleanliness of shell is also of prime importance. Soiled with dirt, dust or droppings of birds or stained with blood gives ugly appearance to eggs and they will not be liked by consumers. Shell porosity is also an important technical point as it plays major role in moisture loss from egg besides gaseous exchange (Singh *et al.*, 2000). The water loss from egg highly affects internal egg quality during storage. For table eggs low porosity is better, but it might be a problem for hatching egg shell porosity can be evaluated by three methods, viz (I) direct counting of pores (ii) rate of flow of gas or fluid under counted pressure; and (iii) reduction in weight under standard conditions of temperature and humidity. Among all, third one is best to judge shell porosity. Evaluation on shell strength is also a good measure of shell quality, which has been discussed in the "Practical Manual for Avian Production and Management" by same author. The shell strength can be measured by screw gauge (padhi *et al.*, 1998).

2.7.2 Internal Egg quality

Jadhav and Sadiqui, (2007).These are the qualities important for increasing and keeping qualities of eggs. If egg is inferior in its internal qualities, deterioration is faster and keeping quality is reduced. Therefore, these are important from research point of view for their improvement. Secondly, they greatly affect nutrient values of eggs. Air-cell, albumen and yolk qualities are important in these qualities.

For grading of intact eggs these qualities can be assessed through candling which has been discussed in detail in the "Practical Manual for Avian Production and Management". For research, albumen and yolk qualities can be evaluated after breaking eggs as follows:

2.7.2.1 Yolk quality.

A quality yolk should be brightly coloured., compact, round, placed in centre and free from blood or meat spots. The yolk which is flat, spread or off-centered with faint colour indicates poor quality. Another mathematical measure for yolk quality is to calculate yolk index by using following formula. Kondaiah *et al.,* 1983).

The height of yolk can be measured by spheroidally at the highest point of its surface and width can be measured at long and short axis by Vernier calliper(Kondaiah, et al 1983).

2.7.2.2 Albumen quality.

Good quality albumen should be properly thick, firm, viscous and be spread in circular manner around yolk. The albumen which is loose, thin and spreads with zigzag periphery around yolk indicates poor quality. Similarly, better quality albumen should be practically free from any defects and blood or meat spots. (Jadhav and Sadiqui, 2007).

Singh (2000) another measure of albumen quality is to calculate albumen index and Haugh units by using following formula. Height and width of albumen can be measured in the same manner as that for yolk index (Padhi, 1998).

Haugh unit (HU): for research purpose it is still common method of evaluating albumen quality (Haugh, 1937).

2.8 Nutrient Requirements of Chickens

2.8.1 Energy Requirements

A good part of the energy need of chickens is met from cereal grains and to lesser extent tubers, underground stems and some legumes. In fact cereal grains may constitute up to 70% of most rations used for poultry (Homer and Schiable (1980). In spite of this, William *et al.*, (1987) reported that more financial risk is involved in adopting an "all-cereal system of feeding". Maize is usually considered the richest source of energy for poultry diets with the exception of fats and oils. It has high energy content, low in fibre and usually ground for feeding (Homer and Schiable, 1980). Other sources of energy for poultry include: sorghum which can make up to 65% of the diet; wheat up to 25% and with enzyme up to 45% ,wheat-by products (bran, shorts etc.) up to 15% barley up to 15%, and with enzyme up to 35%; rice up to 15%; rice by-products up to 15% and molasses up to 5% of the diet (Julian, 2004).

Energy is required for maintenance of the body - breathing, heart action, digestion, thermo genesis and heat for the production of meat and egg (Vandu, 2000). Various species of birds adjust intake of feed to satisfy their energy requirements but the adjustment operates within certain limit and tends to vary with temperature (Morris, 1986). The report of Hurwitz *et al.*,

(1980) showed an increase in energy requirement at temperature above 30c° where an increased additional input of energy is necessary \in order to dissipate the obligatory heat generated by metabolism. Inadequate supply of energy to the birds leads to weakness, cessation of growth and eventual death. According to Daghir (1996) the requirement for metabolizable energy (ME) begin to increase when ambient temperature increase from 28 to 3O and continue to increase up to 36 when it stabilizes and perhaps decrease thereafter. The report concluded that this phenomenon is true of broiler chickens reared under high temperature.

Like any other nutrient, the requirement for energy varies with type and class of chickens. 2600 Kcal/kg for pullets and 2,500Kcal/kg for layers. Earlier reports (Singh and Barsoul, 1976) showed that egg production increased slightly with an increase in dietary energy level from 1575Kcal to 2921Kcal/kg. Oluyemi and Robert (2007) recommended that adult layers from the age of 20week above require 2800- 2900 ME kcal/kg .

2.8.2 Protein Requirement

Under normal circumstances a bird eats more, as it grows older. Therefore total protein consumed increases as bird gets older and presumably increases in weight (Olomu, 1995). However, protein consumed per unit gain will either decrease or remain constant. The later case is neither beneficial to the bird nor economical to the farmer. The report added that any consumption in excess of the birds' requirement is not stored in the body to any appreciable extent but oxidized for energy, which is an expensive fuel for energy. Also Tekdek (2005) reported that excess protein is catabolized by the body releasing nitrogen which is converted to uric acid resulting into hyperuriceamia and articular gout. On the other hand, the report showed that, continuous feeding of low protein diet may result in protein deficiency, symptomless by reduced feed consumption, reduced growth, reduced egg production and egg size and loss of body weight in adult.

The work of Anon (1981) 12% CP for replacement pullets. On the other hand Olomu, (1995) recommended 20% CP for chicks; 16% CP for 8 -16 weeks old pullet and laying/breeding flocks while16 - 20 weeks old pullets should be fed 14% CP. For the meat type, 24% CP was recommended for the starters and 20% CP for finishers while roasters should be fed 16% CP to

18%CP. Oluyemi and Robert (2007) reported that adult laying chicken from the age of 20 weeks above require 18% crude protein.

Smith (2001) defined protein requirement of birds as the requirement for the supply of each essential amino acid together with a sufficient supply of suitable nitrogenous compound from which non essential amino acids can be synthesized. He was of the view that it was unsatisfactory to specify protein requirement as a single figure since the amount of protein, which must be supplied, depends on the yield of amino acid to the birds when that protein is digested. The report of Schutte (1987) and Parr and Summers (1991) showed that optimal performance was obtained with low protein diet supplemented with amino acid. Earlier, Summers and Leeson (1985) found that carcass fat tend to increase with low protein diets. On the contrary, Keshavart (1991) reported that low protein diets have several advantages, by way of increasing the tolerance of birds to elevated temperatures. This was because, in his own view, heat production associated with utilization of protein is greater than the utilization of carbohydrates and fats. Excessive protein supply is undesirable. On the average, an increase of one percentage point in protein level increases water consumption by 3% (Francessch and Brufau, 2004).

2.8.3 Vitamins requirements

Vitamins are dietary essential elements required in even smaller amount than minerals for the maintenance of body functions and health. Processes like digestion, absorption, excretion, growth, maintenance of body weight, metabolism, egg production, hatchability and normal activities of the body are only effected in the presence of vitamins, being structural component of enzyme and co-enzyme systems (Olomu, 1995). Vitamins could either by fat soluble (A, D2, D3,E, K) or water soluble (B2, B6, B12, C). The kind of vitamins needed in the diet vary from species to species e.g. Man, Monkeys, Guinea pig and some other species require vitamin C but most animal species do not because they can synthesize their vitamin C (Church, 1979).

Vitamins are so essential that their imbalances can lead to serious disorders (Van Eekeren er al, 1995). The report of Tekdek (2005) also showed that all vitamins are essential in poultry rations except for vitamin C. Housed poultry are entirely dependent on the vitamins present in their compounded feed so it is important that they are provided in the correct amount.

2.8.3.1 Vitamin A requirement

Vitamin A can be provided either in pure form or as precursor or pro vitamin — beta-carotene, which can be converted into vitamin A in the animal's body. Common sources are yellow maize, green leafy vegetables and fortifications. When dietary level of vitamin A is low growth rate is depressed, egg production in adult and fertility of eggs reduced, salivary and tear glands may fail to function in all ages, ataxia., weakness, muscular in coordination, ruffled feathers and death in prolonged cases of deficiency (Olomu, 1995; Smith, 2001).

2.8.3.2 Vitamin D requirement

Vitamin D deficiency is rarely encountered in free ranging chicks because it can be synthesized in the skin from precursor when chickens are exposed to sunlight (Van Eekeren et al, 1995). Vitamin D functions to ensure proper calcium and phosphorus metabolism for normal skeleton, hard beak, claws and strong egg shell (Tekdek, 2005). The report added that Vitamin D stimulates intestinal absorption of calcium.

When Vitamin D3 (cholecalceferol) is not present in sufficient quantity, birds are unable to use the Ca and P in the diet; it causes rickets in chicks and Osteoporosis in adults (Van Eekeren et al., 1995). They added that hatch ability is also reduced and egg production may even cease. Church (1979) reported anorexia, reduced growth rate and staggering gait. Other deficiency symptoms include parathyroid enlargement, bone fracture, bending of the ribs at their junction with spinal column, cranio-lateral bending of the ribs, tibial dyschondroplasia in broilers and egg paralysis in layers (Tekdek, 2005).

2.8.3.3 Vitamin E (Tocopherol) requirement

The report of Tekdek (2005) showed that this vitamin maintains normal reproduction and serves as effective anti oxidant for the prevention of encephalomalacia. It prevents the accumulation of hydrogen peroxide. Olumu (1995) observed that dietary requirement for vitamin E is highly variable and depends on the concentration and type of fat in the diet; the concentration of selenium and presence of anti oxidant. The amount of Vitamin E in the natural food should be discounted because it is easily destroyed as such it should be protected by adding anti oxidant like ethoxiquin to the food mixture (Smith, 2001). Of course, naturally occurring in most diets, vitamin E deficiency symptoms, most often in conjunction with selenium were reported by several scholars. Deficiency symptoms include: poor hatchability, sterility, poor growth, impaired fat digestion, poor feathering, encephalomalacia, or "crazy chick disease", spasm, in coordinationidative diathesis and impaired immune response (Van Eekeren, 1995; Olomu, 1995; Smith, 2001; Tekdek, 2005).

The report of Smith (2001) revealed that laying birds that were kept at 350C for 28 days and were fed on a diet containing 500mg/kg of Vitamin E produced 16% more than those fed the diet containing the normally recommended inclusion level of 10mg/kg. Subsequent experiments have indicated that 250mg/kg is probably the best level of inclusion for laying birds kept at high ambient temperature.

2.8.3.4 Vitamin K (K1 Phylloquinone, K2 Menaqeu none and K3 Monaphthone) requirement

This vitamin is otherwise called anti haemorrhagic factor, being an essential factor in blood clotting (Smith, 2001). It is present in all green foods and its synthetic form is also obtainable (Menadione sodium bipthosphate). Tekdek (2005) observed that of course it is required in smaller quantity than other vitamins. It is however useful to add to poultry diets much higher than its minimum value especially when there is coccidiosis or suiphaquinixaline administration. Haemorrhage (especially around legs, wings and breast) is the only gross evidence of deficiency. However, blood spots are also seen in eggs (Tekdek, 2005; Smith, 2001). It is more severe in younger chicks than older ones as observed by Olomu, (1995).

2.8.3.5 Vitamin B Complex (B1 Thiamine, B3 Riboflavin, B6 Pyndoxine B12 Cyanocobalamin, Biotin, Choline, folic acid, pantothenic acid etc.) requirement

Thiamine is usually adequate in normal feedstuffs such as fermentation by-products, brewers' dried grains, soluble distillers etc. it is very essential for carbohydrate metabolism with pyruvic acid as the intermediate product (Olomu, 1995; Smith, 2001). Therefore the requirement for thiamine is largely dependent on content of carbohydrate in the diet. When in excess, thiamine may interfere with efficiency of certain coccidiostats like amprolium, oxythiamine and pyritiamine (‘fekdek, 2005).

Riboflavin functions as co enzymeeeee of a number of enzymes involved in oxidation - reduction reactions (Olomu, 1995) while its deficiency can lead to a condition known as “curl toe paralysis” in chicks (Smith, 2001; Tekdek, 2005); poor appetite, diarrhea, leg paralysis droppy wings, reduced egg production and increased embryonic death (Tekdek, 2005).

Pyridoxine (B6) is required in several enzymatic reactions especially those involving transamination, and decarboxylation of amino acids and also important in the formation of neurotransmitter, the chemical messengers of the nervous system (Olomu, 1995; Tekdek, 2005). Reduced appetite and poor growth, perosis, nerve jerky movement of the leg, convulsion and death after aimless running about in chicks was reported by Tekdek (2005).

Cyanocobalamine (B12) is exclusively found in protein foods of animals origin and products of bacterial fermentation which produce antibiotics like streptomycin, penicillin, terramycin among others (Olomu, 1995). It plays role in several co enzymee systems and in transaminatione.g.g synthesis of glycine fromseinee and methionine from fr6iii homocystine and also metabolism of nervous system and fat/oil. The works of Olomu (1995) and Tekdek (2005) reported slow growth, reduced egg size and hatchability, fatty liver, kidney and heart, gizzard erosion in chicks and increased mortality in cases of deficiency.

Biotin is present in most practical rations. It is more required in turkeys than chickens where it functions as cofactor in carboxylation and decarboxilation reaction (Tekdek, 2005). It is also important in embryonic development, normal functioning of the thyroid and adrenal glands and nervous system (Olomu, 1995). If deficiency occurs it is more common in turkeys with perosis like disorder abmodell dermatitis resembling that of pantothemic acid deficiency except that it appears first on the feet while that of pantothemic acid appears first on the head (Whitehead and Banister, 1981; Oloyo, 1991; Olomu, 1995; Tekdek 2005).

Choline could not qualify to be a vitamin being required in large amount. Choline along with Methionine and betain serve as an important source of methyl group which are necessary for metabolism (Olomu, 1995). Choline deficiency is rare in adult chickens and turkey. However, where it occurs (in chicks), poor growth, perosis, and pinpoint haemorrhages of the hock are very common.Folic acid (placing) is involved in enzyme system of a single carbon metabolism such as conversion of serine to glycine and vice versa, involved in catabolism of thereonine and histidine, required in normal nucleic acid metabolism and formation of nucleoprotein required for cell multiplication (Olomu, 1995; Tekdek, 2005). Deficiency signs include: poor feathering, feather de-pigmentation, reduced egg production, anaemia with characteristic cervical paralysis in poults.

2.8.3.6 Vitamin C (Ascorbic acid) requirement

The reports of Njoku (1986), Ubosi and Geidam (1990) and Kultu (1995) have all suggested that Vitamin C enhance the performance of chickens generally. Vitamin C can be synthesized by poultry and other monogastrics. However, according to Olomu (1995) for laying birds under stressed condition (e.g. hot weather) inclusion of Vitamin C in the diet would improve eggshell strength and thus reducing the number of broken eggs due to thin shells. The report also showed that inclusion of vitamin C in the diet might result in increase resistance to fowl typhoid and have some protective effect against encephalomalacia. The role of Vitamin C in enhancing the mineralization of skeleton has also been reported by Franchini et al (1993) while Kultu and Forbes (1993) observed that 1eding chickens with supplemental vitamin C improves feed intake and dry matter efficiency.

Vitamin C supplementation was also reported to increase growth rate by 4.5% and improve the tolerability to stresses and reduce mortality by 5°/a (McKee and Harrison, 1995). Further studies by Ubosi and Gandu (1995) revealed that Vitamin C generally improved the performance of broilers at high temperature but no advantage in this regard at low or normal temperature when ascorbic acid was supplemented at 250mg/kg. The report concluded by classifying the use of vitamin C as an effective method for alleviating the effects of heat stress. In the same vein Whitehead and Keller (2003) concluded that ascorbic acid limits the metabolic signs of stress and alleviates the physiological consequences of stress resulting in improved performance, immunological competence and behaviour of layers. More recently the work of Gous and Morris (2005) concluded that some advantage might be gained by adding Vitamin C or E to feed because of their action in reducing lipid peroxidation resulting from the increased body temperature of the birds.

2.8.4 Mineral Requirement of Chickens

The importance of minerals in poultry diets is as important as the presence of vitamins and amino acids in the metabolism and health of poultry (Tekdek, 2005). Minerals are therefore dietary essentials. The importance of minerals in the nutrition of chickens can be seen in the light of being part of bone composition and giving rigidity and strength needed to support the soft tissues in combination with protein, lipids and other substances that make up the tissues. Minerals also maintain osmotic pressure, acid-base balance, nervous responses and function in enzymatic activities (Tekdek, 2095). Most essential minerals are calcium, phosphorus, manganese, potassium sodium and chlorine in that order. Therefore calcium and phosphorus occupy a crucial position in the nutrition of chicken (Flargreave, 1982; Woolford, 1985; Olomu, 1995; Tekdek, 2005).

2.8.4.1 Distribution and role of Calcium (Ca) and Phosphorus (P).

Mineral element distribution within the body is not uniform since some tissues selectively concentrate specific elements. According to Church (1979) bone is the primary storage site for many of the essential elements including Ca, P, Mg, K, Na,Mn Mo and Zn. The report further revealed that Ca and P are most involved, than any other mineral, in bone formation and maintenance, egg shell formation, muscular and neural function, blood clotting, metabolic energy transfer and nucleic acid formation. Also Frandson (1986) reported that calcium phosphate (CaPO4) makes up about 80% of the mineral matter of the bone, with the remainder composed largely of CaCO3. Therefore Ca and to certain extent P are the chief building blocks during calcification and ossification of the bones. In addition to its function in bone, phosphorus plays a primary role in carbohydrate metabolism, fat metabolism, and helps to regulate acid-based balance of the body (Jacob *et al*., 1998).

The report of Van Eekeren, *et al* (1995) showed that the skeleton accounts for about 99% of the total Ca and 80% of P in the body. Also McDonald et al. (1998) reported that 99% of the total body Ca is Ibund in the skeleton and it is an essential constituent of the living cell and tissue fluid. Ca is essential for the activity of a number of enzyme systems including those necessary for the transmission of impulses and for the contractile properties of muscle. The report revealed further that Ca is concerned with coagulation of blood, where it occurs in the plasma with concentration of 80mg- 120mg Ca/litre for mammals and between 300mg/lit and 400mg/litre for chickens. Olomu (1995) reported that bone contains about 99% of the total Ca in the body - the remaining balance of 1% is found inside and outside the cells (bound with protein) and in plasma. Ca occurs usually along with P and Mg in bone and egg formation. Earlier Woolford (1985) reported Ca and P to be the major nutritional factors involved in shell formation. It was also reported (llurwitz *et al*, 1995; Underwood and Suttle, 2001) that Ca and P and a couple of essential inorganic materials are involved in many physiological functions of the body of living animals.

The work of Belnave *et al*. (1992) showed that egg shell formation in the laying hen relies on an adequate supply of Ca and CO3 to the lumen of the shell gland (uterus). The report added that problems associated with poor egg shell formation are normally considered to reflect an inadequate supply of Ca. In addition to Ca, Yoselewitz and Belnave (1989) reported the involvement of CO3 in an experiment involving saline drinking water. Calcium and Phosphorus are closely associated with each other in the metabolism of bone and egg shell formation. The report of Tekdek (2005) showed that major functions of Ca are bone formation in chicks/pouts and egg shell formation in adults, blood clotting, normal function of the heart (in conjunction with Na and K) and regulation of cellular metabolic processes. For P, the report added, in addition to bone formation it is an essential component of purine nucleotides and other phosphorylated compounds for the transfer and conversion of free energy. Oluyemi and Robert (2007) recommended that adult layer require 3.8 and 4.2 g/bird/day. While phosphrus should be 0.8 g/bird/day.

2.9 Feed intake of laying chickens

Poultry generally consume just enough feed to meet their nutreint requirement. Anthony (1990) the amount of feed intake of laying hen depends upon the Metabolizable Energy level of feed, enviromental condition (esp. temperature), palatability of the feed, health status of the bird activity and management system. Oluyemi and Roberts, (2007) reported that the lower the temperature the higer the feed intake. From 15-25 degree clecius feed intake decreases by approximently 15% per degree celcius. While at temperature of 25-30 degree celcius, the consumption of feed decrease it requirement for protein, vitamin and mineral are still the same. Obiaha (1992) reported that the feed requirement of adult layer 125g/bird/ day.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Area.

The research was conducted at Chip Chip Poultry Farms, located in Mubi, Adamawa State of Nigeria. Mubi lies within Guinea savannah zone of Nigeria, with latitude 9^0 and 11^0 North, Longitude 12^0 and 28^0 East. It has a dry season and rainy season. The rainy season commences in April and ends in late October. It has an annual rainfall of about 750 to 1,050mm and average minimum temperature of 15^0C and maximum temperature of 32^0C (Adebayo and Tukur, 1999).

3.2 Experimental Diets.

Three commercial poultry feeds found in Mubi were selected and used for this experiment. The diet are Vital, Evangelical Church of West African, Chip Chip and formulated were designated as treatment 1, 2, 3 and 4 respectively. Treatment 4 was formulated from locally available feeds ingredients in Mubi. The percentage composition of formulated diet is shown in Table 1.

Table 1: Ingredients Composition of formulated feeds

Ingredient	**Percentage (%)**
Maize	62.7
Maize offal	13.4
Fish meal	4.5
Bone meal	5.7
Groundnut cake	17.9
Premix*	2.50
Salt	0.30
Lysine	0.70
Methionine	0.30
Total	**100**
Calculated Analysis	
Crude protein (%)	18.5
M.E (Kcal/kg)	2913.42
Calcium (%)	2.24
Phosphorus (%)	1.34
Lysine (%)	0.67
Methionine (%)	0.3

* Layers premix supplied the following per kg diet:/Vit. A, 10000iu; Vit. D3; 20000iu; Vit. E, 10iu; Vit. K, 2.0mg; Thiamine B1, 15mg; Riboflavin B2, 4.0mg; Pyroidoxine B6, 15mg; Niacine, 150mg; Vit. B12, 0.01mg; Pantothenic acid 50mg; forlic acid, 5mg; Biotin, 0.2mg; Choline chloride, 2mg; Anti oxidant, 1.5g; Manganese, 0.8g; Zinc, 0.5g; Iron, 0.2g; Copper, 0.5g; Iodine, 0.12g; Selelium, 2mg; Cobalt, 2mg.

3.3 Experimental Design and Animal Management

One hundred and twenty (120) Rhodes Island Red (RIR) layers at 22 weeks old were randomly allotted to four treatments (T_1, T_2, T_3 and T_4)in a completely randomized design, replicated three times with ten birds per replicate. The research was carried out between November – February. The layers were housed in 3-tier battery cage located in an open-sided poultry house covered with wire gauge roofed with zinc sheet. The battery cages were equipped with open manual feeding troughs and nipple drinkers. Water supply to the nipple drinkers was from overhead tank (500liters capacity). The cage is divided into cells of 60 by 42 by 40cm.each contain two (2) layer. The feeding troughs was demarcated with flat aluminum sheet to prevent feed from one replicate treatment mixing with another and also prevent birds from one replicate feeding from another .Water and feed was provided *ad libtum.*

The layers were vaccinated against Newcastle disease with (Lasota, Komrov), Gumboro and Fowl pox during the rearing period. Following strictly the vaccination schedule on appendix v.

3.4 Measurement

3.4.1 Egg Quality Parameters

Egg shell thickness was measured with a micrometer screw gauge after 12weeks.e Yolk and albumen diameter, height and weight was obtained after cutting the eggs open. Diameter was determined with a vainer caliper. yolk and albumen height was measured using Ames tripod, weight was measured with electronics scale. Yolk index was calculated as yolk diameter divided by yolk height. Albumen index calculated as albumen diameter divided by the height. Haugh unit was determined according to the formular of Haugh, (1937). Yolk was separated from albumen with a separating spoon and each weighed with an electronic scale.

3.5 Haematological indices.

Blood Samples was collected from 36 birds, 3 from each treatment at 12th weeks of the research period. Samples were collected from the ulna vein with 5mls syringe and 10guage needle. Two and half miles of the blood was mixed immediately with anticoagulant depotassium ethylene diamint tatraacid (1.5mg/dc) Whole blood was used for the complete count.Red blood count (RBC) was determined using haematocrit. Packed cell volume (PCV) was determined by cetrifugation at (10000G for 5mins). Heamoglobin (Hb) content was determined by cyanide free haemoglobin determination Mean cell volume (MCV),mean capusular haemoglobin (MCH),and mean corpuscular haemoglobin concentration (MCHC), was calculated using the following equations (Campbell,1995):

3.6 Growth Performance Parameters

The initial live weight of the birds per replicate was recorded in grams and the average weight obtained for each bird per treatment by dividing the total weight by the number of birds in that treatment was done weekly. The average live weight gain of each treatment group was calculated as the average weight of the group in the current week less the average weight of the group in the previous week. Daily weight gain obtained by dividing average live weight gain by number of days in a week (7). Perforated polythene bag was used for the weighing with manual weighing balance.

The four experimental diets were fed *ad-libtum* each day and the left-over feed at the beginning of the next day was weighed. The difference between the amount fed and the left-over feed represent the quantity of feed consumed.

The feed conversion ratio for body weight gain and for egg production was calculated as described by Jadhav and Siddiqui (2005). Percent Hen day Egg production was obtained as number of egg laid divided by Number of live birds times hundred over one.

3.7 Mortality

Daily inspection of the replicate cages was conducted throughout the experimental period and mortality was recorded as they accrued and percentage mortality calculated thus;

Mortality = Number of dead bird /number of live bird in each treat x 100%

Feed conversion ratio =feed intake/egg mass

Egg mass = number of egg x average weight of egg

3.8 Cost Analysis

In order to asses the cost implication of the experimental feedstuffs, the following parameters were calculated;

a. Cost of Egg production (N/egg)

b. Total cost of feed consumed per bird (N/g) in each treatment.

c. Feed cost per dozen egg produced (N/dozen egg).

3.9 Proximate Analysis

The four experimental diets were analyzed to determine their proximate composition using the Procedure described by AOAC (1990). The metabolizable energy (ME, kcal/kg) of the diets were estimated using the procedure of Pauzenga (1985) as follows: ME=35 x Cp% + 81.8 x EE%+35.5 x NFE%

3.10 Statistical Analysis

Data obtained from the experiment was subjected to analysis of variance1(Steel and Torrie, 1980).Differences among means was separated using Duncan's Multiple Range test.

CHAPTER FOUR

RESULTS

4.1 Proximate Composition of Commercial and Formulated Diets

The Table of chemical composition of the various diets (Table2) shows that the percentage Ash, Crude protein(CP),crude Fibre (CF), Ether extract (EE), Metabolizable energy (ME), Nitrogen free extract (NFE), are within the range of nutrients recommended for layer in the tropics. The percentage crude protein (CP) of the experimental diets ranges from 15.36% in T_2 to 18.01 in T_4, Crude fibre (CP) values of diet in T_1 to T_4 are similar (6.5), ether extract (EE) values of the diet in T_1 to T_4 were (4.0%) higher than that of diet in T_2 and T_3 which is (3.5%).The result revealed that the ash content of the experimental diets are 4.0, 4.1, 4.3 and 3.4 respectively. Metabolizable energy (ME) value were higher in diet T_4 (2902.9kcal/kg) and lower in diet T_3 (2550kcal/kg).

Table 2: Proximate composition of experimental diets

Nutrient	Treatments			
	T_1	T_2	T_3	T_4
Crude protein (%)	16.50	15.36	16.5	18.01
Crude fibre (%)	6.50	6.50	6.50	6.70
Ether extract (%)	4.50	3.50	3.50	4.50
Ash (%)	4.00	4.13	4.37	3.61
Nitrogen free extract (%)	60.90	63.05	65.00	64.40
Metabolizable energy (Kcal/kg)	2650	2800	2550	2902.02

4.2 Effect of Commercial and formulated feed on Growth Performance of Layer chickens.

The result on feed intake was significantly higher ($p<0.001$) in treatment 1(124.50g) compared to the rest of the other treatments whose values did not differ significantly ($p>0.05$) between each other the lowest (121.90g/d/b) numerical value was obtained in treatment 4.

The values on weight gain obtained shows that there was no significant ($P>0.05$) difference among the treatment means.

Feed conversion ratio for egg production of layers fed the experimental diets were not significantly ($P>0.05$) different between treatment means. But numerically however, T_1 and T_2 (1.78) tended to be higher. While T_3 and T_4 lower.

Final live weight obtained from this research indicated that there was no significant ($P>0.05$) difference among the treatment means. Numerically T_1 (2333.7g) recorded the highest, followed byT_4 (2320.3g),T_2 (2237.5g) withT_3 (2186.7g) having the lowest value.

The percentage hen egg production values in this study revealed that there was no significant ($P>0.05$) difference among treatment means. Though birds fed diet (T_1) and formulated diet (T_4) tended to produce higher (83%).While T3 (76%) was lower numerically.

Table 3: Effect of commercial and formulated feeds on the Growth performance of layers.

Treatment

Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**SEM**
Initial weight(g/b)	1843.8^{ab}	1823.6^{b}	1826.7^{ab}	1852.3^{a}	8.03^{*}
Final live weight g/b/d	2333.7	2237.5	2186.7	2320.3	6.23^{ns}
Weight gain g/b/d	5.73	4.60	4.00	5.20	0.55^{ns}
Feed intake g/b/d	124.50^{a}	122.60^{b}	122.20^{b}	121.90^{b}	0.33^{**}
Feed cov.ratio/egg prod.	1.86	1.86	1.79	1.8	0.02^{ns}
Hen-day prod.(%)	83	80	76	83	3.33^{ns}
Mortality	0.00	2.4o	1.17	3.70	2.28^{ns}

Means on the same raw with different superscripts are significantly different (P< 0.05)and(p<0.001)

Key

NS= not significant

SEM = standard error mean

4.3 Effects of Commercial and formulated feed on Egg Quality Parameters

Result of shell thickness showed that there was a significant (P<0.05) different among treament diets, with T3 (5.00mm) having significantly (P<0.05) thicker shell than the other treaments.WhileT_1 (4.28mm) and T2 (4.31mm) were similar, and the lowest value was observed in T4 (3.6).

The value recorded for Haugh unit revealed that the Haugh unit of layers fed the four experimental diets were not significantly (P>0.05) different across the treatments. However, there was only numerical differences with T_3 (98.30) having the highest followed by T_4 (96.70), T_1 (95.87) and T_2 (94.60) recorded the least Haugh Unit.

Result of yolk height shows that Treatment 4 had significantly lower values compared to the other treatments whose values did not differ significantly between each other.

Result of the study reveals that there is a significant (P < 0.05) difference in yolk weight. T_3 (18.50) has significantly the highest value followed by T_1 and T_4 whose values did not differ significantly between each other while the least value was recorded in T_2 (15.3).

The result of the yolk index shows that T_1 and T_3 were significantly (P< 0.05) higher and same than that of T_2 and T_4 whose values did not differ significantly between each other.

There was no significant (P>0.05) differences for yolk diameter across the treatment though the values obtained were numerically different. Highest value was obtained in T_1 (5.82) while the lowest was observed in T_4 (3.95).

Results obtain for albumen height revealed that there was significant (P < 0.05) different among the values. Highest value was obtained in T_3 (1.02). While similar value was obtained in T_1 (0.92) and T_2 (0.92) as shown in Table 5

The results of albumen Weight was significantly (P < 0.05) difference among the treatment means. A higher value was observed in T_3 (42.50g). While T_2 (40.40) recorded the lowest value.

Table 4: Effect of commercial and formulated feeds on egg quality

Treatment

Parameters	**T_1**	**T_2**	**T_3**	**T_4**	**SEM**
Albumen weight(g)	42.40^{a}	40.40^{b}	42.50^{a}	40.47^{b}	0.14^{**}
Albumen height (cm)	0.92^{c}	0.92^{c}	1.02^{a}	0.97^{b}	9.28^{***}
Yolk diameter(cm)	5.82	4.01	3.98	3.95	5.95^{ns}
Yolk weight(g)	16.28^{b}	15.30^{c}	18.50^{a}	17.60^{b}	0.14^{***}
Yolk index	0.42^{a}	0.38^{b}	0.41^{a}	0.38^{b}	5.00^{***}
Yolk height (cm)	1.67^{a}	1.54^{a}	1.63^{a}	1.51^{b}	0.01^{*}
Haugh unit	95.87	94.60	98.30	96.70	0.89^{ns}
Shell thickness (mm)	4.28^{b}	4.31^{b}	5.00^{a}	3.60^{c}	0.16^{*}

Means on the same raw with different superscripts are significantly ($P < 0.05$)

Key

NS= not significance

SEM = standard error mean

4.4 Effect of Commercial and formulated feeds on Haematological indices of layers

The result of haematology shown in Table 3, indicates that there was no significant ($P>0.05$) difference among the treatment in MCH, MCV, MCHC. However Hb, WBC, PCV and lymphocytes were significantly ($P<0.05$) different between the treatments. Hb for the formulated feeds indicated (T_4) the lowest value (8.80) while treatment (T_3) had the highest value (12.00). T_1 is ($P<0.05$) similar to T_2.

Table 5: Haematological indices of layers fed commercial and formulated feed.

Treatment

Parameters	$\mathbf{T_1}$	$\mathbf{T_2}$	$\mathbf{T_3}$	$\mathbf{T_4}$	**SEM**
Hb (g/100ml)	10.07^{b}	10.33^{b}	12.00^{a}	8.80^{c}	0.30**
RBC (X $10^{6/l}$)	6.30^{a}	6.00^{ab}	6.60^{a}	5.07^{b}	0.30**
PCV (%)	32.67^{b}	35.00^{ab}	40.00^{a}	30.00^{b}	1.65*
MCHC (gm)	31.17	29.66	30.03	29.37	1.65^{ns}
MCH (pg)	15.93	17.57	18.67	17.40	0.95^{ns}
MCV (FL)	50.67	59.20	60.63	59.20	3.53^{ns}
WBC (x$10^{9/l}$)	8.20^{b}	9.27^{a}	8.27^{b}	8.00^{b}	0.94***
Lymphocytes (%)	46.00^{a}	44.00^{a}	40.40^{b}	40.37^{b}	1.06*

Means on the same raw with different superscripts are significantly ($P<0.05$)

Key

NS= not significance

SEM = standard error mean

4.5 Mortality

There was no particular pattern of mortality observed during the period of the research. Treatment diets did not have any significant ($P < 0.05$) influence on mortality.

The percentage mortality has no significant ($P>0.05$) pair wise difference among the means. But there is numerical ($P<0.05$) in T_4 (3.7) T_2 (2.4), T_3 (1.2) and T_1 (0.00) the least indicated in (Table 3)

4.6 Economic analysis of Layers fed commercial and formulated feed

Based on the result obtained from the experiment after selling the eggs produced at the various market prices, it was revealed that the home formulated feed which is represented by T4 was found of the research revealed that formulated layers feed was found to be significantly ($P<0.05$) better than the three commercial layer feed in terms of feed cost N/egg T_1 (12.4), T_2 (12.5), T_3 (12.7), and T_4 (8.7) which was the least. Feed cost N/dozen egg production T_1 (338.9), T_2 (373.8), T_3 (381.6), and T_4 (260.1) and feed cost N/kg T_1 (1030), T_2 (997.5), T_3 (967.8), and T_4 (719.6).

Table 6: Economic analysis of commercial and formulated layers feed

	Treatment				
Parameter	**T1**	**T2**	**T3**	**T4**	**SEM**
Cost of total					
Feed intake (#/Kg)	1030.9	997.8	967.9	719.6	0.30***
Feed cost (#/egg)	12.40	12.50	12.70	8.70	0.36***
Feed cost (/dozen Egg)	338.87	373.80	381.60	260.13	16.92**

Means on the same raw with different superscripts are significantly (P<0.05)

Key

NS= not significance

SEM = standard error mean

CHAPTER FIVE
DISCUSSION

5.1 Proximate Composition of Experimental Diets.

The result of proximate composition showed that all of the experimental diets has crude protein value which ranges from 15.36-18.01% and the values favorably agreed with the values reported by Olumu (1995), Oluyemi and Robbert (2000), Jadhav and Sadiqui (2005).

Metabolizable energy (ME) values of the experimental diets favorably agrees with the report of Jadhav and Saddiqui (2005), Oluyemi and Robbert (2000), Soniya and Savan (2004) Ether extract, Crude fibre, Nitrogen free extract and Ash content of all the experimental diets were within the range of nutrient requirements recommended for layers in the tropics (Oluyemi and Robert, 2000).

5.1 Effects of Commercial and formulated feeds on Growth Performance of Layers

The feed intake indicated that the experimental diets met the recommended energy (2550 kcal/kg) and protein (15%) level, as reported by (Oluyemi and Robert 2005). The daily feed intake obtained in this study is within the range of (121.07-122.62g/d) as reported by (Abeke *et al* 2008). But did not agree with the rage of 125g/d recommendation by Obioha (1992) and Onwudike (1983). The layers fed formulated feed consumed the lowest gram of feed/day which may be because it was high in metabolisable energy 2902.02 than the three commercial layers feed. This agrees with the work of Onwudike (1983) that the bird on the lowest energy level of tends consume more so as to meet their requirement.

The value of daily weight gain obtained in the study shows that weight gain increases with age. The range of 4.00-5.73 g/b/d was obtained which is similar to the report by Smith, (1967), Harms and Damron (1969) layers fed with creal formulated diets. The similarity in increase weight for birds in all the treatment may be as the result of adequate protein (15.36-18.01%) and energy (2550-2902kcal/kg) in the diets.

The result of final live weight gain recorded during the study showed that the weight gain of layers fed the experimental feed increases with age. This result favourably agrees with the report of Abeke, *et al* (2008) and Onwudike, (1983).

The similarity in feed conversion ratio indicates that the treatment diet were all properly utilized. The feed conversion ratio from this study agrees with the range reported by Theshiulor, *et al* (2010). But it is did not agree with the report of Hargreare, (1982). This variation could be has a result of the particle size and protein level of the diet.

Result obtained from this study favorably agrees with the report of Abeke, *et al* (2008), Onwudike (1983). The report of Ayior and Helliens (1982) was contrary compared to the result from the study. This may be because of high level of nutrients used in the formulation of experimental diet.

5.3 Effect of commercial and formulated feeds on egg quality

Variation in the egg shell thickness in layers have long been established (Tekdek, 2005). This variation may be due to unequal level of minerals especially calcium in the feed and the fact that egg shell thickeners increases as the hen age increase in lay. Belnave *et al* .,(1992) reported that the egg shell formation in the laying hen increase on the adequate supply of calcium as contained in this study. Similarly the report of Abeke (2008) 0.9mm-0.4mm can be compared favorably Parmer *et al*, (2006) 0.27mm-100.37. Mohammad *et al* (2003) 0.38mm did not agree with this study.

Large yolk index and weight of a chicken egg obtained across the birds fed commercial feeds and formulated feed indicated that the birds were healthy and the environmental temperature was normal. Freshness of an egg and large index determines the keeping quality of the egg. The report of Abeke (2008), Odukwe et al (2004) and Nwaju *et al*, (2010). Favorably agrees with this work.

The relative better of the albumen height and diameter in birds fed commercial diet than the formulated diets may be because of the fact that birds that lay fewer eggs tend to have bigger egg size than those that lay many eggs (Nwagu et al, 2007) vales from this report which ranges from (40.20 – 42.5g). This is compared favourably with the report of Amalfule, et al (2004) 40.2 – 48.8g. However the report of parmar, et al (2006) was unfavoruably compared to this report.

The Haugh unit indicated that eggs obtained from birds fed, the commercial and formulated feeds are up to the standard 94.6 – 98.3 Hu micrometers (Theshiulor *et al*(2010), 94.6-98.3 hu micrometer and (Abeke et al 2006) 94.6-98.3 Hu micrometers.

5.3,1 Heamatological Indices of Layers feed Formulated and commercial Feed.

Tewe *et al*, (2006) stated that the purpose of investigating blood composition is to have a way of distinguishing normal state from a state of stress in an animal. The stress factors include inadequate nutrition, poor management, environmental or physical stress. The functions of the blood in transporting hormones, Metabolites, a thermo-regulators and general homostasis has been reported to have significant influence on the hemotological variable ,(Veulterinora, 1991). The hematogical parameter shows that PCV values (30.00%-40.00%) and Hb (8.80-12.00g/100ml) fall within the normal range as reported by Theshiulor *et al* (2010) Mitruka and Rawslley (1977), Swenson and Reece (1993) Akinmutin and Onwudike (2001).

Generally, the result indicated the good health state of the bird as low PCV value are taken to indicate anaemia. The results obtained for Hb followed the same pattern with that of PCV. This shows that the experimental diet are nutritionally adequate to meet the protein needs of the birds. Babatunde and Fetuga (1976) showed that PCV and Hb are correlated with the nutritional states of the animal and balance of the diet fed to the animal.

5.4 Economic analysis

Esoun (2000) stated that the general objectives of nutrientist is to maximize the economic production of bird. The study shows that there was significant ($P<0.05$) differences between formulated and the commercial feeds in terms of feed cost N/kg, feed cost N/dozen egg produced and feed cost N/egg. This report agrees favorably with the report of Abeke *et al.* (2008). This is expected because commercial feed milling involves a lot of cost which are passed to the end users of their feeds. Najime (2003), Oladunjoye *et al* (2005), Ogundipe *et al.* (2003), Emelalon *et al.* (2007) and Igene *et al.* (2002) reported that all effort should be made to reduce feed cost either by toll milling (similar to home made feed) or the use of well processed but cheap unconventional feed ingredients. The authors pointed that this is a way forward in the poultry industry.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

The aim of this study was to asses the laying performance of layers fed formulated and commercial feed. One hundred and twenty (120) Rhode Island Red laying bird at twenty two weeks (22) old were randomly alloted to four dietary treatment groups in a completely randomized design. Parameters measured were daily feed intake, body weight gain, feed conversion ratio, egg quality parameters, Hematological indices and the economic analysis of the diets. The performance parameters obtained from the study were not significant ($P>0.05$) difference among the treatment groups. Albumen weight and height, yolk height and index, Hb, RBC, WBC, Lymphocyte and shell thickness were significantly ($P<0.05$) among the treatment means.

Feed cost were 1030.9, 997.5, 967.8 and 719.6 respectively for T1, T2, T3 and T4.Feed cost per dozen egg produced were 338.87, 373.8, 381.60 and 260.13for T1, T2, T3, and T4. Formulated feeds had the lowest cost while commercial feeds T_1 had the highest feeds cost.

6.2 Conclusion

The formulated feed was better than all the commercial feed in-terms of feed cost naira per bird, naira per dozen egg, naira per egg. This study has shown that a well formulated and properly mixed feed will not only reduce cost of production but will increase profit margins of the enterprise.

6.3 Recommendations

Based on the economic performance of the diet, it is recommended that formulated diets should be used in layers production to reduce costs and increase the profit margin of the producer.

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APPENDIXES

Appendix 1: ANOVA Table for Effect of Commercial and Formulated Feeds on Growth Performance of Layers.

a. ANOVA table for Initial Live Weight.

Source	DF	SS	MS	F	P
TRT	3	1696.56	565.521	2.92	0.1003
Error	8	1549.41	193.677		
Total	11	3245.98			

b. ANOVA table for Final Weight.

Source	DF	SS	MS	F	P
TRT	3	43782	14594.0	1.54	0.2779
Error	8	75890	9486.3		
Total	11	119673			

c. **ANOVA table for Daily Weight Gain**

Source	DF	SS	MS	F	P
TRT	3	5.0500	1.68333	1.86	0.2150
Error	8	7.2467	0.90583		
Total	11	12.2967			

d. ANOVA table for Feed Intake Bird/Day

Source	DF	SS	MS	F	P
TRT	3	12.3000	4.10000	12.7	0.0021
Error	8	2.5800	0.32250		
Total	11	14.8800			

e. ANOVA table for Mortality.

Source	DF	SS	MS	F	P
TRT	3	22.830	7.6100	0.49	0.7004
Error	8	124.867	15.6083		
Total	11	147.697			

f. ANOVA table for Feed Conversion Ratio.

Source	DF	SS	MS	F	P
TRT	3	0.01063	0.00354	2.81	0.1075
Error	8	0.01007	0.00126		
Total	11	0.02069			

Appendix ii: ANOVA Table for effect of Commercial and Formulated Feeds on Economic performance on layers.

a. ANOVA table for Feed Cost N /Bird

Source	DF	SS	MS	F	P
TRT	3	181289	60429.7	230208	0.0000
Error	8	2	0.3		
Total	11	181291			

b. ANOVA table for Cost oF Feed N/Egg

Source	DF	SS	MS	F	P
TRT	3	33.2025	11.0675	28.9	0.0001
Error	8	3.0600	0.3825		
Total	11	36.262			

c. ANOVA table for Feed Cost /Dozen Egg

Source	DF	SS	MS	F	P
TRT	3	27735.4	9245.13	10.8	0.0035
Error	8	6868.6	858.57		
Total	11	34604.			

d. ANOVA table for Percentage Hen-Day Egg production

Source	DF	SS	MS	F	P
TRT	3	99.000	33.0000	0.99	0.4441
Error	8	266.000	33.2500		
Total	11	365.000			

Appendix iii: ANOVA Table for Effect of commercial and Formulated feeds on Egg quality.

a. ANOVA table for Albumen Height

Source	DF	SS	MS	F	P
TRT	3	0.02040	0.00680	26.3	0.0002
Error	8	0.00207	0.00026		
Total	11	0.02247			

b. ANOVA table for Albumen Weight

Source	DF	SS	MS	F	P
TRT	3	13.540	4.51467	72.3	0.0000
Error	8	0.4994	0.06242		
Total	11	14.0434			

c. ANOVA table for Yolk

Source	DF	SS	MS	F	P
TRT	3	315.42	105.141	0.99	0.4444
Error	8	848.24	106.029		
Total	11	1163.66			

d. ANOVA table for Yolk Index

Source	DF	SS	MS	F	P
TRT	3	0.00382	0.00127	17.0	0.0008
Error	8	0.00060	0.00008		
Total	11	0.00442			

e. ANOVA table for Yolk weight

Source	DF	SS	MS	F	P
TRT	3	17.9784	5.99280	106	0.0000
Error	8	0.4544	0.05680		
Total	11	18.4328			

f. ANOVA table for Haugh Unit

Source	DF	SS	MS	F	P
TRT	3	21.6600	7.22000	3.06	0.0914
Error	8	18.8667	2.35833		
Total	11	40.5267			

g. ANOVA table for Shell Thickeness

Source	DF	SS	MS	F	P
TRT	3	2.94143	0.98048	13.2	0.0028
Error	8	0.59220	0.07402		
Total	11	3.53363			

h. ANOVA For Yolk weight

Source	DF	SS	MS	F	P
TRT	3	0.04833	0.01611	24.2	0.0002
Error	8	0.00533	0.00067		
Total	11	0.05367			

Appendix iv, ANOVA table for Effect of Commercial and formulated feeds on Haematological indices of layers.

a. ANOVA table for HB

Source	DF	SS	MS	F	P
TRT	3	15.5867	5.19556	19.7	0.0005
Error	8	2.1133	0.26417		
Total	11	17.7000			

b. ANOVA table for PCV

Source	DF	SS	MS	F	P
TRT	3	162.250	54.0833	7.64	0.0098
Error	8	56.667	7.0833		
Total	11	218.917			

c. ANOVA table for RBC

Source	DF	SS	MS	F	P
TRT	3	3.96250	1.32083	4.88	0.0325
Error	8	2.16667	0.27083		
Total	11	6.12917			

d. ANOVA Table for MCHC

Source	DF	SS	MS	F	P
TRT	3	5.5825	1.86083	0.23	0.8751
Error	8	65.6067	8.20083		
Total	11	71.1892			

e. ANOVA table for MCH

Source	DF	SS	MS	F	P
TRT	3	8.0867	2.69556	1.00	0.4425
Error	8	21.6400	2.70500		
Total	11	29.267			

f. ANOVA table for MCV

Source	DF	SS	MS	F	P
TRT	3	186.809	62.2697	1.67	0.2506
Error	8	299.133	37.3917		
Total	11	485.942			

g. ANOVA table for WBC

Source	DF	SS	MS	F	P
TRT	3	2.89333	0.96444	36.2	0.0001
Error	8	0.21333	0.02667		
Total	11	3.10667			

h. ANOVA table for Lymphocytes

Source	DF	SS	MS	F	P
TRT	3	69.9425	23.3142	6.87	0.0133
Error	8	27.1667	3.3958		
Total	11	97.1092			

Appendix v: Vaccination schedule

Age/(Week)	Vaccination
1.	Gumboro disease vaccine
2.	Newcastle disease Vaccine (Lasota)
3.	Gumboro disease vaccine (2nd dose)
4.	Newcastle disease (Lasota 2nd dose)
6.	Fowl pox vaccine
8.	Newcastle disease vaccine (komorov)

Source (Vaccination schedule for chip chip poultry farm Mubi)