Growth Performance and Carcass Characteristics of Broiler Chickens (Gallus Gallus Domesticus) Fed with Alternative Organic Feeds

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GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKENS (*Gallus gallus domesticus*) FED WITH ALTERNATIVE ORGANIC FEEDS

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ABSTRACT

LLANES, JES ALBREN L., (April 2022). **GROWTH PERFORMANCE AND CARCASS FAT CHARACTERISTICS OF BROILER (*Gallus Gallus domesticus*) CHICKENS FED WITH ALTERNATIVE ORGANIC FEEDS.** Masters of Science in Education Major in General Science. Ilocos Sur Polytechnic State College, Tagudin Campus, College of Graduate Studies, Tagudin, Ilocos Sur.

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This study was conducted to determine the growth performance and carcass fat content of 90 broiler chickens fed with varying levels of Alternative Organic Feeds (AOF). The AOF is made up of four plant materials which are: ipil-ipil leaves, coconut meat, corn cob and water hyacinth. The study made use of Complete Randomized design (CRD). The broilers underwent acclimatization period for two weeks for them to adapt to their environment. Broiler chickens on T_0 were fed with 100% Commercial feeds (CF) whereas, the other treatments were given varying combinations of AOF and CF which are as follows: T_1 (75% AOF + 25% CF), T_2 (50% AOF +50% CF), T_3 (25% AOF + 75% CF) and lastly T_4 (100% AOF). Proximate Analysis of the AOF revealed that it contains standard nutrient contents on moisture, ash, crude fat and crude fiber. Whereas, crude protein, phosphorus and calcium don't meet the required nutrient content. Significantly, these nutrients had a positive effect on the health and growth performance of the broilers the mere fact that there is progress on the weight of the broilers as well as no mortality was recorded in the study. Fat analysis was also done and samples were obtained from the abdomen of the carcass which revealed that T_0 (34.11 g/ 100g) has the highest amount of crude fat while T_4 was observed to be the lowest (8.21 g/ 100g). it was concluded that there is a significant difference between and among the treatments in terms of weight gain, feed consumption and efficiency, carcass fat content. The consumption of AOF was also concluded to have a good economic result which yields to good return of investment. It was recommended to make use of pelletizer machine with different blade sizes to cater the broiler chickens on their different ages and to test the AOF for its shelf-life.

Keywords: Broiler, Growth Performance, Carcass Fat Content, Proximate Analysis, Alternative Organic Feeds

Chapter I

INTRODUCTION

Background of the Study

The world's population is predicted to increase each year by 70-80 million in third world and developing countries, and shows an increase from 6.1 billion to 7.9 billion in 2025. The human population of the Philippines up to this day is 111 million. The increase economy of many third world and developing countries improve the demand for animal products, especially meat as a source of protein and chicken continues to be the least expensive meat in most of these countries. In fact, hardly there will be any community without either domestic or exotic chickens.

The broiler industry is therefore ideally suited to meet this expected increased demand for animal protein with improved efficiency of production. Broilers, which is the most common poultry species can be utilized for its meat in just a span of 5 to 6 weeks compared to other poultry species. Broilers have high dietary protein requirements, so identification of the optimum protein concentration in broiler diets, for either maximizing broiler performance or profit, requires more knowledge about birds' requirements for protein and amino acids and their effects on the birds' growth performance and development. It also requires knowledge about the protein sources available that can be used in poultry diets.

Efforts are being made to make for an increase to its productivity by engaging in not only the utilization of crops but also animal husbandry to provide food for man.

Since 1973, poultry raising has been a highly specialized business in the country. The establishment and the proliferation of poultry breeding farms added a new dimension to the industry (Gapuz, 2012). While there is an increasing demand for livestock products, many countries are still experiencing inadequate source of animal feed materials to raise healthy livestock and poultry.

Broiler chicken production is one of the top priorities in animal enterprises in the Philippines today. Due to its increasing demand, the industrial adaptation in this particular agricultural sector has given importance because of its economic result. Since chicken producers have drawn interest in lesser production cost but good quality of their products, they focus on selecting good breeds and feeds of high quality and nutritional value but in local conditions. Moreover, feeding makes up the major cost of poultry production. It plays an essential factor in raising chickens. Thus, nutrition is reflected in bird's growth performance and their products (Fanatico, 2008). The use of alternative domestic feeds, and supplements has become the focus of researches. Some studies use medicinal herbs, grass, spices, beans, nuts and tree crops as an alternative in synthesized inputs. However, few studies were conducted using agricultural wastes.

In this study, four plant materials were processed to make an Alternative Organic Feeds and were utilized to test its effectiveness in providing a quality growth performance to broilers.

One of the plant materials that were used in the study is ipil- ipil (Leucaena *leucocephala)* leaves. Lowry (2014) emphasized that ipil – ipil (Leucaena *leucocephala)* was known as a high potential fodder for several centuries. Its nutritional value is comparable or superior to alfalfa (Medicago sativa) with high ß-carotene content. The leaves of ipil – ipil (Leucaena *leucocephala)* are most commonly used to feed chicken and pigs and processed as a pellet for freshwater fish. The dry matter digestibility (DMD) of ipil –

ipil (Leucaena *leucocephala)* was fifty-seven point seven percent (57.7%) and crude protein based on the dry matter was twenty-nine point five percent (29.5%). Several reports showed that ipil – ipil (Leucaena *leucocephala)* could be a substitute for the imported protein supplements fed to chickens.

Analysis of ipil – ipil (Leucaena leucocephala) from various localities in Western Nigeria shows that young leaves, pods and seeds contain more crude protein but lower crude fibre and ether extract than mature ones. The mineral composition of the dry matter of mature leaves is two-point eight percent (2.8%) calcium, zero-point twenty-six percent (0.26%) phosphorus, zero-point thirty-seven percent (0.37%) magnesium, one point seventy-eight potassium, zero-point twenty-one sodium and zero-point twelve percent iron.

For the corn (*Zea mays*) cob, Jansen (2012) emphasized that they are excellent carriers for vitamins and antibiotics in animal feeds. Corn (*Zea mays*) cob is a good source of vitamin A, vitamin B and Vitamin C. It is important in cell repair and, boosting immunity whereas, B vitamins are important in energy metabolism control.

Another plant material that was utilized in the study is coconut (*Cocus nucifera*) meat. Gerpacio (2009) suggested that one way of alleviating the situation is to feed the fresh nuts to farm animals for conversion into high-priced animal products like meat and eggs which are saleable in the market. It is common knowledge that coconut residue either as meal, flour or presscake ("sapal") is used as feed ingredient, but its large-scale incorporation in non-ruminant's diet is limited due to its low digestibility.

Castillo (2009) analyzed the proximate composition of (*Cocus nucifera*) meat to be ninety percent (90%) dry matter, six-point one percent (6.1%) crude protein, five percent ether extract (5%), thirty-four point seven percent (34.7%)

crude fiber, one-point five percent (1.5%) ash and twenty-four point three percent (24.3%)nitrogen-free extract.

As for the water hyacinth, Raynes (2011) emphasized that this plant species has perhaps been the subject of intensive study than any other aquatic plants because it is the number one aquatic pest-species due to its vegetative reproductive and high growth rate. Water hyacinths spread rapidly, clogging drainage ditches, shading out other aquatic vegetation and eutrophication.

He added, a nutrient analysis of water hyacinths grown in sewage wastewaters was conducted. Crude protein averaged thirty-two point nine percent (32.9%) dry weight in the leaves, where it was most concentrated. The amino acid content of water hyacinth leaves was found to compare favorably with that of soybean and cottonseed meal. The vitamin and mineral content of dried water hyacinths met or exceeded the FAO recommended daily allowance, in many cases. It is concluded that in favorable climatic zones, water hyacinths grown in enriched mediums, such as sewage lagoons, could potentially serve as a substantial dietary supplement or nutrient source.

This study was conceptualized to create an Alternative Organic Feeds made from natural materials that will provide the maximum growth performance and nutrition to broilers without harming the people that will consume them once they will be processed in meat production at the same time reducing the agricultural wastes and plant-pest species in our environment. This implied, Growth Performance and Carcass Characteristics of Broiler Chickens (*Gallus gallus domesticus*) Fed with Alternative Organic Feeds.

Statement of the Objectives

This study was to test “Growth Performance and Carcass Characteristics of Broiler Chickens (*Gallus gallus domesticus*) Fed with Alternative Organic Feeds.” with its varying levels.

Specifically, the study aimed to:

1. Formulate a sustainable Alternative Organic feeds for Broilers;
2. Determine the Proximate analysis of the Alternative Organic Feeds;
3. Identify the effectiveness of the Alternative Organic Feeds (AOF) in terms of:
   a. weight gain;
   b. feed consumption and efficiency;
   c. carcass fat content; and
   d. survival rate
4. Determine the significant difference between and among the treatments in terms of:
   a. weight gain; and
   b. feed consumption and efficiency; and
5. Determine the Return of Investment of the AOF for Broilers

Importance of the Study

The study is important to the following sectors:

Environment. We will achieve a cleaner environment since the plant materials that will be used are mostly left unused and some are a part of agricultural wastes and aquatic pest-species.

Livestock sector. The findings of this study will help and support the Livestock and Poultry programs such as increase livestock production, improve livestock productivity and increase the income of livestock farmers.

Poultry Raising. The findings of this study will help poultry raisers to have an alternative choice use of organic feeds which is much cheaper compared to the commercialized feeds.

Researcher. The researcher will be able to achieve a broader understanding of the importance and benefits of ipil-ipil leaves, coconut meat, corn cob and water hyacinth as an Alternative Organic Feeds used in poultry production.

Future Researchers. The results and procedures used will be utilized for further experimentations related to the discovery of other potential benefits of the ipil-ipil leaves, coconut meat, corn cob and water hyacinth that gives practical values.

Time and Place of the Study

This study was designed to test "Growth Performance and Carcass Characteristics of Broiler Chickens (*Gallus gallus domesticus*) Fed with Alternative Organic Feeds". The study was conducted in a BAI accredited broiler facility on January 6, 2022 until February 15, 2022 at Becques, Tagudin, Ilocos Sur where the instruments as well as plant materials were readily available. The Proximate analysis of the AOF was conducted last February 24, 2022 at the Laboratory of Department of Agriculture located at Sta. Barbara, Pangasinan. As for the Total Fat Analysis, it was conducted at the Department of Science and Technology located at Don Mariano Marcos Memorial State University (DMMMSU), City of San Fernando, La Union on February 28, 2022.

Definition of Terms

For the purpose of clarity and understanding, the following terms used in the study are either defined operationally and conceptually.

Alternative Organic Feeds (AOF). It refers to an organic feed made from ipil-ipil leaves, coconut meat, corn cob and water hyacinth.

Coconut meat. It is the grated and squeezed coconut fruit which has prebiotic properties aiding in broilers' good digestion of food.

Corn cob. It refers to the part of a corn where the pulps are taken that has a component which will aid the broilers in boosting their immunity and energy metabolism control.

Ipil-ipil leaves. It is a plant that is used as a feed additive due to its anthelminthic property.

Water hyacinth. It is an aquatic plant-pest species which has a good source of amino acid which will help the broilers.

Proximate Analysis. It is a method or procedure used to determine the beneficial contents of the alternative feeds that will help broilers achieve their maximum health and growth.

Growth Performance. It refers to the ability of the broilers to show efficiency in meat production.

Weight gain. It is the total amount of weight added to the initial weight of each of the broilers.

Feed consumption. It refers to the amount of feeds to be given to the broilers.

Feed Efficiency. It refers to the amount of feed required to produce a kilogram gain in weight and was determined by dividing the total feed consumed by the total gain in weight of the broilers at the end of the feeding period.

Total Fat Analysis. It refers to the method to determine the sum of saturated, monounsaturated and polyunsaturated fats contained in the different samples

Carcass Fat content. It refers to the amount of fat contained in the samples.

Survival rate. It is the total amount of broilers that will survive during the research.

Broiler. It refers to a type of chicken raised up to 45 days for meat production.

Return of Investment. It refers to the ration that shows the amount of profit from the research project.

Review of Related Literature

The following readings are rich sources of information in the conceptualization of the study.

Feeds

The poultry industry is the most dynamic sector within the global meat business during the last decade, with the greatest growth reflected in the food global demand increase. It is expected that, in the next years, the meat industry will increase production driven by global population growth, especially in developing countries. Chickens and turkeys are the most common sources of poultry meat, but there is also commercially available meat from ducks, geese, pigeons, quails, pheasants, ostriches and emus. Consumer preference also has been changing in many developed countries, characterized by greater demand for low-calorie foods and changes in lifestyle, which reduces the consumer time spent on food preparation. By this approach, the chicken meat highlights and the largest producer countries are United States, China, Brazil and European Union, being Brazil and United States are also the main exporter countries. These two countries together provide two-thirds of global trade (FAO, 2010; FAO, 2012; USDA, 2012).

Feedstuff is an aspect of high economic importance in the rearing of commercial poultry not only because it is primarily responsible for the growth response of birds, but mainly because it represents the largest cost in the production cycle (Avila et al., 2012). For instance, the broilers' energy requirements are responsible for seventy percent (70%) of the cost of the ration (Skinner *et al.*, 2012) and, besides, the processing method and the grain type interfere differently on the economic viability and animal performance. The advantages of using processed feed have been well documented, although they represent a high cost for manufacturing. Under natural conditions, birds have to deal with different types of feed, which have different energy and protein levels. Despite domestication and selection for fast growth, broiler chickens did not lose their ability to discriminate different types of diets (Emmans & Kyriazakis, 2011). It has been suggested that the birds associate the feed physical characteristics with nutritional content, which indicates that the contact perception contributes to the identification of the feed.

Physical feed form is considered to have a very significant impact on broiler growth and feed intake (Dozier et al., 2012). Feed form and feed particle size of cereals require a significant amount of attention when producing broiler feed. Today, commercial feed mills are producing different forms of broiler feed for birds at different ages (Jahan et al., 2016). While feed processing to change feed form increases the cost of feed it can be balanced out by improved performance. Many researchers report that broilers fed pelleted diets have higher BW and improved feed conversion than those fed mash feed (McKinney and Teeter, 2012, Amerah et al., 2014, Chewning et al., 2016), and today pelleting has become a common processing method widely employed by the feed manufacturers to improve farm animal performance. Compared with mash, pellets enhance bird performance by decreasing feed wastage, alleviating selective feeding, destroying pathogens, improving palatability and increasing nutrient digestibility. With regards to feed particle size, one traditional view was that a smaller particle size would be associated with a larger surface area of the grain, possibly resulting in higher digestibility in poultry due to a greater interaction with digestive enzymes in the gastrointestinal tract (Preston et al., 2011). In more recent years, however, it is thought that a large particle size aided by some structural components is beneficial to gizzard functions and gut development (Hetland et al., 2012, Svihus et al., 2014, Choct, 2019).

Alternative Organic Feeds (AOF)

Feed has been a major cost in modern broiler production, accounting about 70% of the total production cost (Sugiharto, 2019). The increase in feed price may therefore imply in the increase in total production cost and thus decrease the profit margin of broiler industry. Attempt has recently been taken to reduce the cost of feed, including the incorporation of agro-industrial by-products in broiler diets as an energy source (Sugiharto et al 2018; Sugiharto 2019; Sugiharto and Rajitkar 2019). However, some limitations may exist when using the agro-industrial by-products as the ingredients in broiler rations. The high and low contents of fibre and protein in the by-products may limit the digestibility and thus inclusion level of such by-products (Sugiharto et al 2018). In addition to the agro-industrial by-products, the application of leaf meal as the ingredient in broiler feeds has also been conducted (Abdulsalam et al 2015; Aroche et al 2018; Mustafa 2019). Compared to agro-industrial by-products, the content of crude protein in leaf meal is much higher (Tesfaye et al 2013; Sugiharto et al 2018a). This may be beneficial in reducing the proportion of the conventional-expensive protein-rich feed ingredients in broiler rations.

It has been known that some particular foliages contain a number of bioactive compounds that are beneficial for the health of chickens (Rama Rao et al 2019). These compounds include vitamins, phenolic acids, flavonoids, isothiocyanates, tannins as well as saponins (Vergara-Jimenez et al 2017). In this regard, the use of leaf meal in rations may not only reduce the cost of feeds, but also elicit the health-promoting effect on broiler chickens. Apart from their benefits, the use of leaf meals in broiler diets may be limited by their high content of crude fibre (Santoso and Sartini 2001; Ubua et al 2019). In general, broiler chickens showed low tolerance to dietary fibre, and therefore feeding diets containing high levels of leaf meal may impose in compromised nutrient digestibility and thus alleviated growth performance of broilers (Buragohain 2016). To deal with the latter problem, dietary supplementation of enzymes (fibre-degrading enzymes) (Fasuyi and Akindahunsi 2009; Oloruntola et al 2016) and fermentation has been conducted to particularly degrade the fibre and hence increase the incorporation levels of leaf meal (Mandey et al 2015; Santoso et al 2015). The present review provided a comprehensive view concerning the recent advances in the application of leaf meal in broiler rations.

Ipil-ipil (*Leucaena leucocephala*) leaves

The utilization of the plant materials (*Leucaena leucocephala)*, was recognized when the College of Agriculture of the University of the Philippines at Los Banos, Laguna Province, published its findings on the possibilities of ipil-ipil (*Leucaena leucocephala)*, leaf meal for poultry feed. Molina (1952) found that ipil-ipil (*Leucaena leucocephala)*, leaf meal possesses a potent effect in promoting animal growth without endangering health.

Cattle, sheep, goats, poultry, and pigs are common sources of animal proteins. The high cost of producing these animals has been a setback for the livestock industry. Broiler production is becoming more popular, prompting academic researchers to investigate new sources of high-quality plant proteins in the broiler diet. With the scarcity of healthy animal protein and the high expense of commercial feed, forage, when converted to meat, may play an essential role in improving the quality of human meals, particularly in developing countries. (Cheeke, 2013).

Ipil- ipil *(Leucaena leucocephala)*, which is common in many regions, is one of these alternative plant protein sources that is locally available and can assure production sustainability. In addition to its huge potential in afforestation and agroforestry, it has been shown to be beneficial as animal feed, fuel, ground cover, fertilizer, and wind breaker (Kang and Lawson, 2015). Many ruminant species consume trees, leaves, and bushes naturally, and they have long been used as sources of feed for domesticated livestock throughout Asia, Africa, and the Pacific (Skerman and Riveros, 2014; Nas, 2018).

Ipil- ipil *(Leucaena leucocephala*) leaves could be incorporated into the diet of broilers. Ipil- ipil *(Leucaena leucocephala*, being a legume, is rich in proteins and other nutrients. Jones (2019) showed that ipil- ipil *(Leucaena leucocephala)* leaves have been fed to livestock with some degree of success. Equally too, Glasby, (2015) report that the use of ipil- ipil *(Leucaena leucocephala)* leaves at high dietary levels from forty percent (40%) upward has been limited by the toxic amino acid named mimosine present in its leaves, stems and seeds. Otesile and Akapokodje (2007) indicate that in spite of the nutritive potential of ipil- ipil *(Leucaena leucocephala)*, its use by cattle as feed may result in certain undesirable effects. Ipil- ipil *(Leucaena leucocephala)* leaves levels should not exceed thirty percent (30%) for ruminants, twenty percent (20%) for rabbits, and seventy-five percent (75%) for poultry on a dry matter basis (Barry, 2007). The anti-nutritional factor present therein, i.e. mimosine, has limited the percentage that can be included in the diet. However, some animals have built resistance with microorganisms that can degrade the mimosine and its product (Palmer, et.al., 2006). Therefore, the purpose of this study is to examine the nutritional worth of including ipil- ipil *(Leucaena leucocephala)* leaf meal as a plant protein source in the diet of broilers.

The crude protein and ash contents of ipil- ipil *(Leucaena leucocephala)* leaf meal are within the range reported by Vohra, et. al. (2012). The nutrient composition is also similar to that recorded by Carew, et. al. (2010). The nutrient composition values also portray ipil- ipil *(Leucaena leucocephala)* to be on the high side when compared to banana leaf meal, cassava leaf meal, and wild sunflower. It also compares favourably well with conventional feedstuffs such as wheat bran, dried brewers grain, maize offal and palm kernel cake. The broilers fed ipil- ipil *(Leucaena leucocephala)* leaf meal up to ten percent (10%) level had the best performance, with the highest feed intake, lowest feed conversion ratio and highest body weight gain. The significantly lower feed intake at fifteen percent (15%) level of ipil- ipil *(Leucaena leucocephala)* could be the result of the decrease in palatability and increased fibre content as the level of ipil- ipil *(Leucaena leucocephala)* increased. The average feed intake correlates with the body weight gain that increased up to ten percent (10%) level and is similar to the growth response under the control before it declined with further increase in the inclusion level. This could be attributed to reduction in metabolised energy value as observed in the feeding of wild sunflower (Odunsi and Akinola, 2006). The final weight which increased up to ten percent (10%) level of Leucaena and which was similar to the final weight in the control diet also correlates with the decreased dry matter intake. This may have resulted from antinutritional factors implicated in the ipil- ipil *(Leucaena leucocephala)* leaves (Bindon and Lamond, 2006).

Coconut (*Cocus nucifera*) meat

Sundu et al. (2011) stated that the low quality protein of coconut (*Cocus nucifera*) meat, coupled with high fibre content, leads to limited use of this agricultural by-product in the poultry diet. Attempts to maximize the amount of coconut (*Cocus nucifera*) meat included in the broiler feed have been made through amino acids supplementation, enzyme addition and pelleting coconut (*Cocus nucifera*) meat. Among these feed technologies and manipulation, pelleting coconut (*Cocus nucifera*) meat appears to be more powerful in promoting the growth of broiler chickens. The reasons for the improvement of broiler growth due to pelleting coconut meal have not been established yet. The mechanisms of improved growth of birds might be through increased feed intake, less energy spent and increased bulk density. Coconut (*Cocus nucifera*) meat contains a high concentration of mannose – based polysaccharides or mannan. This substance has long been believed to have prebiotic properties due to its capability to bind certain species of pathogenic bacteria in the digestive tract of birds. Surprisingly, mannose-based polysaccharides from coconut behave like yeast mannan. A number of current studies indicated that mannose-based polysaccharides improved body weight gain and feed digestibility. The growth of birds was negatively impacted when the birds were challenged against pathogenic bacteria of E. coli. Wet droppings and diarrhea incidences were not found in E. coli-challenged birds when the diets were supplemented with coconut mannan. In conclusions, coconut meal can be used as a feed ingredient for poultry unless the coconut (*Cocus nucifera*) meat was pelleted or enzymatically treated. Mannose based polysaccharide from coconut was effective to promote growth and acted as prebiotic.

The use of pelleting technology in cocot (*cocus nucifera*) meat has been reported for more than 6 decades since Patten et al. (2008) published a report on the use of pelleted diets. The efficacy of this technology to improve the feeding value of the diets has been well documented. This improvement becomes evident when the poultry was feed by a low bulk density diet. The improved broiler performance due to pelleting the diets might be through a number of mechanisms, namely: increased feed intake, increased feed digestibility and less energy spent. Pelleting coconut (*Cocus nucifera*) meat can be a way to improve its quality as this agricultural byproduct is bulky. Sundu et al. (2011] pioneered a study of inclusion pelleted coconut (*Cocus nucifera*) meat in broiler diet. They found that the growth performance of broiler chickens increased to the same level of the growth of broiler chickens fed the corn-soy diet. These findings could be an indication that the main problem of using coconut (*Cocus nucifera*) meat in poultry diet might be related to its physical properties rather than chemical contents. Interestingly, when the pelleted coconut (*Cocus nucifera*) meat was reground and offered to broiler chickens, there was an acceptable growth performance of the chickens.

Corn (*Zea mays*) Cob

Corn (*Zea mays*) cob is commonly regarded as a waste product in agricultural processing because of its high cellulosic nature. In Africa, it is usually abandoned on farm lands after the corn pocessing, or used as a source of cooking fuel in rural areas where it generates a lot of smoke, thus constituting a source of environmental pollution (Lohlum et al., 2014).

Locally, corn (*Zea mays*) cob posesses an environmental challenge, as it is usually disposed of improperly, littering the environment and blocking drainages in urban areas after consumption. In the rural areas, it is used as a source of firewood fuel for cooking thereby producing smoke which results in poor air quality and respiratory illness caused by carcinogenic haze. This is most prominent in women and children who are usually around the cooking fire as reported by Ezzati and Kammen (2012); Desai, (2014); Shrestha, (2015). Unfortunately, the production and end use of such biomass as fuel is done under suboptimal conditions, contributing enormously to the greenhouse gas burden, which is of consequential effects to us all, and the future of the earth as our habitat.

The major factors militating against the utilization of corn (*Zea mays*) cob in poultry nutrition are its cellulosic nature, high fibre content, low protein as well as lipid and mineral value (Chen, 2010). Corn (*Zea mays*) cob consists of cellulose, hemicellulose, and lignin (Chen, 2010). Cellulose is a polymer of glucose molecules linked by beta 1,4 bonds. Cellulose is difficult to hydrolyze due to two main reasons. First of all, cellulose is insoluble in water and forms crystals. Secondly, cellulose of practical interest is rarely pure, but coexists with lignin and hemicellulose in well-defined anatomical structures. Also, lignin forms a physical seal around cellulose, which makes it very resistant to efficient degradation by acid hydrolysis (Chen, 2010). Lignin also reduces the accessibility of cellulose to cellulase enzymes. Poultry animals cannot use cellulose as an energy source because they lack cellulase: the enzyme that hydrolyses the beta 1,4 linkages.

Inspite of the odds, utilization of agricultural wastes should be encouraged since recycling of wastes can minimize environmental pollution and enhance the income of farmers by creating new products from wastes, such as animal feed.

The composition of corn (*Zea mays*) cob is affected by stage of maturity, cultivar, climate, soils and production methods (Szyszkowska et al., 2007). Mature cobs have higher NDF, ADF, DM and lower CP and starch than less mature cobs. Szyszkowska et al. (2007) reported that DM content in cobs was positively correlated with the content of starch, and negatively with the content of NDF and ADF fractions. The cultivars tested in the afore-mentioned study did not differ in ADF, NDF, and starch content in corn (*Zea mays*) cob. The mineral composition depended on the cultivar, effective temperature sum and the farm type. Corn (*Zea mays*) cob separate into nutritionally distinct, different sized particles comprising of a hard or woody fraction and a soft fraction consisting of glumes, core, grain clippings and fine dust when ground. Božović et al. (2004) reported that 1-mm-sized corn (*Zea mays*) cob had higher CP and ether extract and lower cellulose, hemicellulose, ADF and NDF than 3 and 2 mm particle sized corn (*Zea mays*) cob.

Water Hyacinth (*Eeichhornia crassipes)*

(Keller and Lodge 2009) stated that water hyacinth (*Eichhornia crassipes*) is popular for both water gardeners and aquarists because it is one of only a few floating aquatic plants. However, it is also considered invasive aquatic weed plants in tropical and subtropical regions, and many attempts have been made to eradicate or control these plants. A feeding trial was conducted to explore the potential of water hyacinth meal (WHM) on growth performance, economic viability, and cell-mediated immunity of broiler chickens in a 42-day feeding trial. Sixty-one-day-old broiler chickens were randomly allotted to 4 treatment groups: (T1) zero percent (0%) WHM, (T2) two-point five (2.5%) WHM, (T3) five percent (5.0%) WHM and (T4) seven-point five percent (7.5%) WHM, replicated thrice with five birds each replication arranged in a Completely Randomized Design (CRD) experimental set-up. Results revealed no significant difference (P>0.05) on the bi-weekly body weight gain (BWG), average daily gain (ADG), and feed conversion ratio. Numerically, Treatment 2 showed the highest final body weight (1545.33± 36.37 g/bird), while the control showed the lowest value (1076.00±109.23g/bird). A significant effect ($P<0.05$) was observed on the voluntary feed intake (VFI), and cell-mediated immunity of broiler chicken fed diets containing WHM. Moreover, the highest gross return results in T2 leads to the highest overall return input cost per chicken, and experimental birds without WHM had the lowest income generated. In conclusion, a noxious water weed could be incorporated into the diet with no adverse effect on broiler production performance.

Water hyacinth (*Eichhornia crassipes*) is popular for both water gardeners and aquarists because it is one of a few floating aquatic plants (Keller and Lodge 2009). However, some treated it as the world's worst aquatic weed plant (Indulekha et al., 2019), proliferating in most tropical countries (Adeyemi and Osubor, 2016). It was estimated that ten plants could produce 600,000 seeds during an eight-month growing season and completely covered 0.4 hectare of a natural freshwater surface (Vymazal 2008). With this, certain approaches have been tried to control and eradicate the weed in collaborated efforts. Unfortunately, the plants invasive behavior and fast expansion rate brought them unsuccessful (Anteneh et al., 2014). However, another method was considered to maximize its potential. An alternate option is to utilize water hyacinth for various purposes, such as animal feed (Jafari, 2010). A careful biochemistry and physiology analysis of water hyacinth (*Eichhornia crassipes*) recommends its potential as a raw material in some industries. These plants are utilized for animal consumption because of its availability and nutrient value (Simpson and Sanderson 2012). Its proximate analysis revealed that water hyacinth is constituted of 50% protein and 33% carbohydrates, while the remaining nutrients are made up of fat, ash, and fiber (Adeyemi and Osubor 2016). Moreover, water hyacinth (*Eichhornia crassipes*) leaf protein concentrate

(WHPLC) may be used as food supplements due to the high protein content and sufficient content of xanthophylls, carotenes, unsaturated fats, starch, and essential minerals such as calcium, phosphorus, and iron (Kateregga and Sterner 2007). Seventeen out of twenty (7 out of 20) amino acids were detected in the water weed without asparagine, glutamine, and tryptophan (Adeyemi and Osubor 2016). Several studies reported different amounts of crude protein in water hyacinth (*Eichhornia crassipes*): thirty-two point nine percent (32.9%) (Wolverton and Mcdonald 2008), twenty-three point eighty-two percent (23.82%) (Alkassar and Al-Shukri, 2010), fifteen-point swenty seven percent (15.27%) (Okoye et al., 2011), and eighteen-point seven percent (18.7%) (Monsod, 2018). The various results might be caused by the difference in the potential biotic and abiotic factors present in the water where they grow. Evidence from the study of Adeyemi and Osubor (2016) stated that levels of all heavy metals were found to be within the safe limit, which disclosed the water hyacinth (*Eichhornia crassipes*) to be acutely nontoxic. However, literature was inadequate in terms of profound details and further studies with the extraction of these water weeds in edible form. Hence, to utilize the abundant water weeds in the community, this study was conducted to evaluate the growth performance, economic viability, and the cell mediated immunity of broiler chickens fed with water hyacinth (*Eichhornia crassipes*) meal.

A study predominantly on the comparative, characterization and nutritional assay of the stem and leaf of water hyacinth extracts through phytochemical screening, elemental and proximate analysis to elucidate the potential applications. From the results, the ethanol extract of the leaves (EL) revealed the presence of phenol, steroids and saponin owing to the affinity of the solvent for hydrophilicity, while the hexane extract of the leaves (HL) shows the presence of flavonoids and steroids. Also the ethanolic extract of the stems (ES) shows the presence of phenol, steroids and saponin for the same reason, while the hexane extract of stems (HS) shows the presence of flavonoids and steroids. The proximate analysis of the leaf reveals appreciable percentages of protein, fibre and moisture content while that of stem shows higher percentages for carbohydrates and crude lipids. The leaf and stem show equal percentages for the ash content. The Elemental analysis shows that heavy metal concentrations of the leaf and stem are within threshold limits. This evident research substantiates the potential application of water hyacinth for human and livestock consumption. The presence of secondary metabolites for pharmacological and therapeutic utilization such as anticancer, antimicrobial, antioxidant, antidandruff, antiproliferative activities and provides a potential source of animal feed due to the higher percentage of carbohydrates, crude protein and crude fibre (Gabriel, 2018).

CHAPTER II

MATERIALS AND METHODS

This chapter presents the methods, research design, treatments, materials, experimental procedure, data gathering instrument and statistical analysis used in the study.

Materials

A. Broiler
   1. 90 one-day old cobb500 male broilers

B. Housing
   1. 5 cages with 3 openings/pens of the same sizes (6.2 sq. ft. per pen).
   2. 15 feeding containers
   3. 15 waterers (each waterer contains 1L of water)
   4. 15 pcs – 50 watts electric bulbs
   5. Cleaning materials such as brush and clean cloth
   6. Disinfectants and antibacterial soap

C. Recording and Identification
   1. 1 electronic weighing scale
   2. 108 nylon zip ties with 5 different colors (each treatment will be given different colors and numbers of zip tie)
   3. 1 record book

D. Feeds

1. Commercial chick booster feeds for 2weeks
2. Commercial starter feeds used on the 15th day to 45th day of the broilers.
3. Sundried and powdered Ipil-ipil leaves
4. Sundried and powdered Coconut meat
5. Sundried and powdered Corn cob
6. Sundried and powdered Water hyacinth

Methods

Research Design

This is an entirely experimental study and used a Completely Randomized Design (CRD). Treatment doses or combinations are given to experimental units at random in a completely randomized approach. This is usually accomplished by creating a list of treatment levels or treatment combinations and assigning each one a random number. We randomly select order of treatment application to experimental units by sorting on a random integer. This method is a scientific and systematic approach to research in which the researcher manipulates one or more variables while controlling and measuring any changes in other variables. This strategy will be utilized since it yields the most powerful and reliable results.

Fraenkel (2009) viewed that experimental research method is one of the most powerful research methodologies. He further says, of the many types of research, it is the best way to establish cause and effect relationships between variables.

The inclusions of varying amount of Alternative Organic Feeds were used in evaluating its effect to the growth performance and carcass characteristics of the broilers. Five treatments were used with the following concentrations:

T_0: One hundred percent (100%) Commercialized Feeds (CF);

T_1: Seventy-five percent (75%) Alternative Organic Feeds (AOF) and twenty-five percent (25%) Commercialized feeds (CF);

T_2: Fifty percent (50%) Alternative Organic Feeds (AOF) and fifty percent (50%) Commercialized Feeds (CF);

T_3: Twenty-five percent (25%) AOF and seventy-five percent (75%) Commercialized Feeds (CF)

T_4: One hundred percent (100%) AOF.

Sampling

The sampling was conducted on a total of 90-one day old cobb500 male broilers. The broilers were distributed in 15 equally measured pens; 1 treatment with 3 replications (6.2 sq. ft. per pen). Each cage contained 6 broilers, a total of 18 broilers in 1 treatment. The weight of the broilers was taken every week starting on their 15th day after the acclimatization period to see the changes on their growth performance. Percentage was also used in weight identification of the broilers.

To make sure that no broiler chickens were repeatedly measured, each broiler were given an identifying tag placed on their leg using different colored nylon zip-tie based on the treatment they belong, the following were the color and number coding:

Treatment 0

Replicate 1– 1 Red zip tie on the right leg

Replicate 2 – 2 Red zip ties on the right leg

Replicate 3 – 3 Red zip ties on the right leg

Treatment 1

Replicate 1 – 1 Blue zip tie on the right leg

Replicate 2 – 2 Blue zip ties on the right leg

Replicate 3 – 3 Blue zip ties on the right leg

Treatment 2

Replicate 1 – 1 Yellow zip tie on the right leg

Replicate 2 – 2 Yellow zip ties on the right leg

Replicate 3 – 3 Yellow zip ties on the right leg

Treatment 3

Replicate 1 – 1 White zip tie on the right leg

Replicate 2 – 2 White zip ties on the right leg

Replicate 3 – 3 White zip ties on the right leg

Treatment 4

Replicate 1 – 1 Black zip tie on the right leg

Replicate 2 – 2 Black zip ties on the right leg

Replicate 3 – 3 Black zip ties on the right leg

Broiler's Healthcare

Ethical Handling of Animals

Before conducting the experiment, the researcher had a webinar and acquired a certification about the standard protocols in raising poultry animals which was used in the study. The webinar talked about Animal welfare, Institutional Animal Care and Use Committee (IACUC) and Bureau of Animal Industry (BAI) guidelines.

Procurement

When purchasing broilers, the researcher made sure he followed all applicable international, federal, and state regulations and institutional procedures, particularly those concerning transportation and animal health. Broilers must be purchased and obtained legally. Before purchasing broilers from a known supplier, the researcher worked with a veterinarian to set documented procedures for assessing the animals' health (broilers). A control system and method for broiler acquisition should also be in place to ensure resource coordination and prevent birds from arriving before adequate housing, nourishment, and a safe environment have been established.

Acclimation and Stabilization

Newly arrived broilers required a period of 14 day of acclimation. Acclimation refers to a stabilization period before animal use, which permits physiological and behavioral adaptation to the new environment. The veterinarian established general acclimation guidelines for the broilers. Any modifications to the general program were discussed with the veterinarian before animals were shipped.

In the 14 days of the broilers, they were fed with Commercial chick booster feeds. This allowed the broilers to adapt since they have small guts to digest food.

Veterinary Care

There was a person in charge of the animal care program who has the necessary credentials and authority. A veterinarian or a researcher knowledgeable in the right care, handling of the broilers was directed with the housing, feeding, and nonmedical care of such animals. The broiler's health care program was overseen by a certified veterinarian.

In the research, there was an access to a veterinarian who has experience in the care of agricultural animals especially broilers. This veterinarian should be provided access to all research and teaching animals and to any related documents including health care records. Veterinary involvement helped ensure broiler's health and welfare. Trained non-veterinary staff may administer treatments according to standard operating procedures approved by the program veterinarian.

Preventive Medicine

Adequate agricultural animal health care in research and teaching involves a written and implemented program for disease prevention, surveillance, diagnosis, treatment, and endpoint resolution. The objectives of such a program are to ensure animal health and welfare, minimize pain and distress, utilize animal production practices, prevent zoonosis, assist investigators on study-related animal health issues, and avoid contaminants or residues in animal products. A mechanism for direct, frequent, and regular communication must be established among researcher who is responsible for daily animal care and observation, animal users, and the program veterinarian. This will help ensure that timely and accurate animal health information is effectively communicated.

Sick, Injured, and Dead Animals

Sick and injured animals should be segregated from the main group to protect them and the other animals, observed at least once daily, and provided with veterinary care as appropriate. When animals are separated, a mechanism should be in place to communicate to staff the status of the animals and to ensure proper daily, weekend, holiday, and emergency care. In some circumstances, segregation is not feasible or may disrupt the social hierarchy, cause additional stress to the animal, or adversely affect research. The advantages of segregation should be weighed against its disadvantages, especially for mild illnesses or injuries that can be easily managed. Care should be taken to minimize spread of pathogens from ill animals to healthy animals by observing appropriate biocontainment measures. Incurably ill or injured animals with unrelievable pain or distress should be killed in the most humane way as soon as possible by trained personnel and/or veterinarian. Unexpected deaths should be reported to the veterinarian. Dead animals are potential sources of infection and should be disposed of promptly by a commercial rendering service or other appropriate means (e.g., burial, composting, or incineration), following applicable state and local ordinances and regulations. Postmortem examination of fresh or well-preserved animals may provide important animal health information and research data, and can aid in preventing further losses. When warranted and appropriate, waste and bedding removed from a site once occupied by a dead animal should be made inaccessible to other animals and the site disinfected appropriately.

Medical Records

An important component of an agricultural animal health program is maintaining records that can be used to monitor animal health events, both physical and behavioral, as well as outcomes and levels of production. Group health records may be appropriate for animals that are kept as cohorts just like the broilers, particularly because the animals undergo daily observation or evaluation by trained individuals. The researcher, in cooperation with the veterinarian, should determine the method(s) by which medical records are maintained. Oversight of medical records is the responsibility of the principal investigator, the program veterinarian, and the IACUC.

Facilities and Environment

Husbandry

Broilers are social species and should be maintained in groups when possible. However, social environments in which birds exhibit aggression are stressful to poultry and should be avoided. Aggressive behaviors are influenced by group size (Estevez et al., 2009) and genetics, with broiler breeder male chickens exhibiting higher levels of aggression than layer-strain males (Millman et al., 2000). Fighting can lead to injury or worse (death). Based on BAI, five (5) is standard number of broilers in a cage and to avoid aggressive interactions, sexually mature male broilers are housed separately from hens (female broilers). Reports on bird condition should include a statement on injuries and overt aggression.

Housing and Environment

The lighting, feed, water and ventilation were planned and implemented for each stage of a broiler's life, from day 1 -14, day 15-28, and 29-45. The housing environment and all equipment utilized in the house was thoroughly cleaned and sanitized before broiler placement. Housing was secured to limit exposure of chicks to vermin, wild birds, and disease, and to maintain satisfactory temperatures for chicks.

For the housing, five pens were utilized with three divisions (three replicates for each treatment measuring 6.2 sq. ft. each). Electricity was provided for heating purposes (50-watt bulb) since there will be no hens to provide heat to the broilers until they can sustain their own body heat on their 14^{th} -21^{st} day. This varies on the health of the boilers (Solomon, 2010). Lighting and ventilation were subjected to change depending on the weather condition. A removable cover was also used at night to enclose the cages to secure the broilers from insect bites for them to totally rest.

Flooring

Broilers were placed and raised on fresh bedding or litter materials such as pine or hardwood shavings or rice hulls. At placement and brooding, ensure the litter is evenly spread to a depth of 7.5 to 10 cm (3 to 4 in). The condition of the litter is very important to the well-being of growing broilers. The litter should be as free of contaminants as possible.

Brooding Temperature

Supplemental heating was provided for chicks for the first 2 weeks of life. Broilers require supplemental heat for the first few weeks (“brooding”). Without supplemental heating, mortality may be greatly increased. Two common brooding methods are conventional and whole-room brooding. In both cases, temperatures are lowered gradually as the broilers age. The living space should be preheated before the broilers arrive to ensure the floor or litter is warm and the air is at the goal temperature when the broilers are placed. Minimum ventilation rates should be applied from the day before the chicks arrive. Environmental temperature should always be maintained for bird comfort in accordance with the recommended temperature guide for bird age. In addition to measurement of actual temperature, broilers; behavior and flock distribution should be evaluated daily to assess their comfort. If broilers are too cold, they will huddle. If chicks are too hot, they will move away from the heat source and will pant. Broilers that are comfortable should be evenly distributed throughout the brooding space and should exhibit a variety of normal behaviors (e.g., eating, drinking, resting, actively moving) while the lights are on.

Feeding

Broilers were fed three times a day at the same time to avoid bias. The feeding containers were designed in which feed particles will not be thrown away.

Water

Water was sourced from a potable water supply if possible. Water was provided ad libitum each day at least when lights are on. If there are concerns about water spillage and broilers playing in water, water can be restricted or turned off when the lights are off, because broilers are not generally active during this period. The height of the drinker should be adjusted for bird height to ensure easy access at all times and reduce spillage. When possible, daily water consumption should be recorded as a standard welfare and good management practice. Substantially reduced or limited water intake will negatively affect bird welfare and well-being, and growth.

Commercialized Feeds

The broilers were fed with Commercial chick booster feeds in their 1st day to 14th day. On their 15th day, the feed meal was changed to Commercial starter feeds. It was the feed meal that will be mixed to the AOF based on their following concentrations.

Preparation of the Alternative Organic Feeds (AOF)

1. The plant materials were gathered at Becques, Tagudin, Ilocos Sur.
2. The ipil-ipil leaves, corn cob, coconut meat and water hyacinth were sundried 5 – 10 days or until the desired texture and appearance was met.
3. When plants were totally dried, it underwent the process of powderization. The plant materials were processed in a powdering machine to ensure that they're completely powerderized before combining them all together.
4. When all the plant materials were powderized, they were mixed thoroughly before putting into the pellet maker machine to form the Alternative Organic Feeds (AOF).

Data Gathering

Proximate Analysis

The Alternative Organic feeds (AOF) that was given in the entire duration of the study was prepared one time to avoid discrepancies in the results.

The Alternative Organic Feeds (AOF) underwent a process to determine its nutrient contents such as Moisture content, Ash Content, Crude Protein, Crude fat, Crude fiber, Phosphorus and Calcium. It was conducted at the Department of Agriculture- Sta. Barbara, Pangasinan.

Crude Fat Analysis

The Crude Fat analysis was conducted at the Department of Science and Technology (DOST) – Don Mariano Marcos Memorial State University- City of San Fernando, La Union. The Crude Fat analysis was tested to determine the level of Saturated, Monounsaturated and Polyunsaturated fat present in the abdomen of the carcass.

Body weight and Weight gain

The broilers were individually weighed at their 15th day after their acclimation period. At their 45th day in the cages, broilers were again weighted to check their final average weight. Hence, it is how to compute their final weight gain, subtracting the final weight of the broilers from their initial weight from their 15th day.

Broiler’s Weight Gain (BWG) = Final Weight of Broiler – Initial Weight of Broiler

Total Feed Consumption

This is the difference between the total weight of feed given and left over from day 15 to 21, 22 to 28, 29-35 and day 36 to 45 respectively.

Feed Consumed (FC)= Total weight of feed given – leftover

Weekly Feed Consumption

Week 1-14

Feed consumed (kg) X no. of times broilers are feed X total no. of broilers (90) X 7 (days in a week)

Week 15-45

Feed consumed (kg) X no. of times broilers are feed X no. of broilers per treatment (18) X 7 (days in a week)

Feed Efficiency (FE)

This refers to the amount of feed required to produce a kilogram gain in weight and will be determined by dividing the total feed consumed by the total weight gain of the broilers at the end of the feeding period.

$$\text{FE} = \frac{\text{Total Feed Consumption}}{\text{Total Weight Gain}}$$

Return of Investment (ROI)

This is the objective estimate of the net profit that will be earned from the research experiment.

$$\text{ROI} = \frac{\text{Net Profit}}{\text{Cost of Investment}} \text{ X100}$$

Treatment of Data

The obtained data was used to calculate the growth performance in weight and the survival rate of the broilers. The formula that used was taken from the study of Rash N. et al., (2014)

$$\% \text{ Survival} = \frac{\text{Final Total Number Of Broilers}}{\text{Initial Total Number Of Broilers}} \text{X } 100$$

Statistical Analysis

To determine the significant differences between and among the treatments that will be done, MANOVA using SPSS was used.

Experimental Procedure

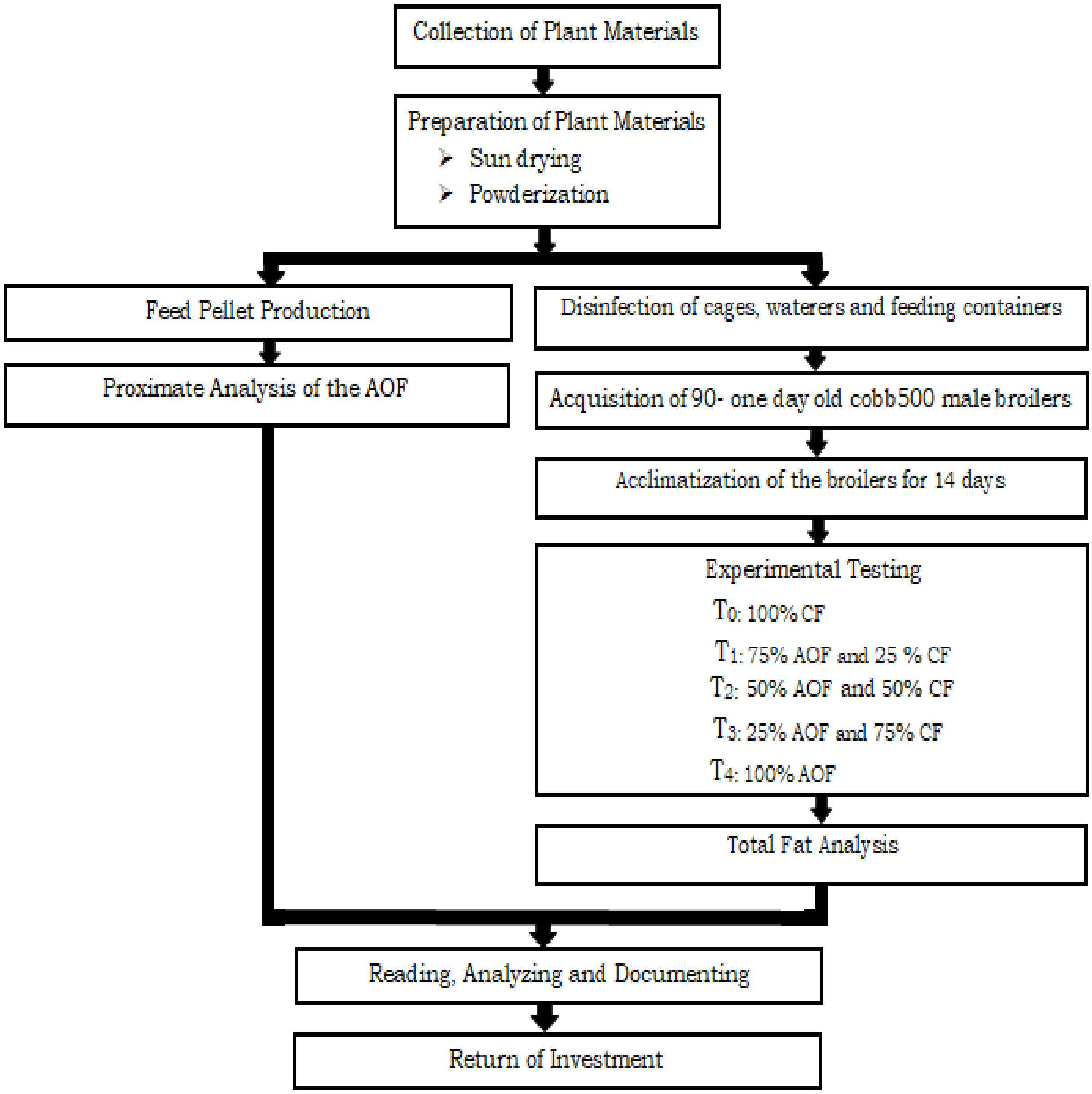

Figure 1.1. Flowchart of the Methodology

CHAPTER III

RESULTS AND DISCUSSIONS

This chapter presents, analyses, interprets, and discusses data gathered pertinent to the specific problems raised in this study.

The Formulation of Alternative Organic Feeds

The plant materials were gathered at Becques, Tagudin, Ilocos Sur. The ipil-ipil leaves, corn cob, coconut meat and water hyacinth were sundried 5 – 10 days or until the desired texture and appearance was met. When plant materials were totally dried, they were placed in a powdering machine to ensure that they were completely powerderized for the organic feeds to compact and to have a smooth texture. The powderized mixture was placed in pelletizer machine to form the Alternative Organic Feeds (AOF).

The economic importance of poultry feed, becomes apparent when it is realized that 60-70% of the total production cost of poultry production is feed. For this reason, the efficient utilization of feed is extremely important in broiler production. Milanovic, (2012) stated that a major advantage of pelleted feeds compared to mash feed is increased feed intake. Mash diets give greater unification of growth, lower mortality and require lower use of energy than pelleted feed, making it more economical. Poultry has preferences for bigger particles size, so pelleted feed increases feed intake relative to mash. Pelleted feed also results in lower percentage of waste in feeding, has a better impact on animal respiratory system health, and is also easier to handle, transport and store.

The Proximate Analysis of the Alternative Organic Feeds (AOF)

Table 1. Proximate Analysis Alternative Organic Feeds (AOF

Description	**Lab Code**	**Moisture Content (10-14%)**	**Ash Content (5-8%)**	**Crude Protein (10-20%)**	**Crude Fat (6-8%)**	**Crude Fiber (5-8%)**	**Phos-phorus (0.6%)**	**Calcium (0.8-1%)**
Alternative Organic Feeds	FTL-2022-8017	10.3±0.1	6.9±0.2	3.6±0.5	8.4±0.3	5.3±0.2	0.3±0.1	< 0.05

Analyses of these were done at the Laboratory Department of Agriculture- Main Office, Sta. Barbara Pangasinan.

Proximate Analysis stands for a method, which determines the values of the macronutrients in food samples.

The result in Table 1 indicates that the Alternative Organic Feeds has 10.3% Moisture content. The moisture content significantly affects the physical and chemical aspects of the feed, which relates its freshness and stability for the storage of the feed over a long period of time. Therefore, it is advisable to formulate feed with low moisture content for feeding poultry birds to keep deterioration in the feed to a minimum during storage (Oyeyode et al., 2021). The normal value for the Moisture content ranges from 10% -14%. Thus, the Moisture content of the Alternative Organic Feeds (AOF) is acceptable.

As for the Ash content, the Alternative Organic Feeds has 6.9% which is in the range. Too much ash in a poultry diet may cause crystals that are being formed within the urinary-tracts, excluding the kidneys, and the bladder, specifically in poultry faunas that ensure kidney diseases, also excess ash content causes the bone and joint problems in growing poultry birds. Nevertheless, the feeds with high ash-content are co-operative in monitoring the urinary-tract complications, literature have not recorded that feeds that are high in ash-content are beneficial to poultry birds that are being raised for meat production (Oyeyode et al., 2021). Therefore, the AOF's formulation is acceptable considering its low ash content.

The level of crude protein in the AOF is 3.6% which is below the typical percentage unlike in Commercial feeds which has 10-15% of crude protein. The crude protein that was not digested up at the end of the small intestine can potentially be fermented by putrefactive bacteria in the caecum. Putrefaction produces many harmful and toxic compounds like amines, indoles, phenols, cresol and ammonia, which is high in concentrations, may have adverse effects on chicken growth and performance (Apajalahti and Vienola, 2016). With this, the Alternative Organic Feeds is still safe for broilers' consumption due to its low crude protein content. However, the growth rate of the broilers fed with 100% Alternative Organic Feeds (AOF) has a lower weight gain due to its low crude protein content.

The Alternative Organic Feeds has a good amount of crude fat which is 8.4%. A crude fat level of at least 5% in broiler diets is highly recommended. The maximum amount is defined more by technical reasons than by nutritional ones, as diets of up to 8.5% of crude fat are excellent for broilers. This has been proven in different circumstances and climates all around the world.

Robert Pottgueter (2016) stated that crude fat must be present in the poultry diet in order to absorb the fat soluble vitamins A, D, E and K. In addition to its role in nutrition, fat is added to feed to reduce grain dust and to bind the fine particles in the feed (premix, amino acids and minerals) to the coarser particles. Fat also improves the palatability of feed, especially in mash feed. If there is a shortage of fat (fatty acids), the liver, which is the most important organ in the highly prolific layers of today, will have to provide fat and fatty acids for the body metabolism. This is a big challenge for the health of the liver, as the liver needs to provide fatty acids by lipogenesis – basically from carbohydrates. The digestion of protein and carbohydrates as basic sources of energy causes a high level of metabolic heat (heat increment) in comparison to crude fat, which will ultimately reduce daily intake under heat stress circumstances. Therefore, replacing energy provided from carbohydrates with crude fat is a beneficial way of supporting the metabolism of broilers in a heat stress situation. The good amount of crude fat of the AOF is reflected to the broilers in terms of the survival rate (100%).

Moreover, poultry feeds high in crude fiber should be discouraged due to the adverse effects on nutrient, utilization, and performance such as a decrease in body weight gain and feed conversion (Sunusi et al., 2021). Therefore, any poultry farmer that is breeding poultry birds raised for meat production should ensure that the poultry-mix feeds should be low in crude fiber and these shows why AOF is an ideal poultry feed considering its low crude fiber content (5.3%). (Johnson et al., 2011) stated that the maximum amount of crude fiber must be 5.50 % to increase the growth performance of broiler chickens. Therefore, AOF is a good source of Crude fiber.

The Alternative Organic Feeds contain 0.3% Phosphorus and < 0.05% of Calcium. Phosphorus is an essential mineral for broilers and plays an important role in soft and hard tissues of the body (Underwood & Suttle, 2009). Phosphorus requirements in poultry are affected by innumerous factors, including the dietary level of calcium (Rao et al., 2006).

Phytate is the major form of phosphorus storage in plants and its utilization by poultry is highly variable.

Rao et al. (2006) indicated that both calcium and phosphorus co-exist in many biological functions, but the dietary requirement of these minerals is interdependent. Excess of calcium in the diet reduces the absorption of phosphorus due to the formation of insoluble complexes in the intestinal lumen. Moreover, a very low level of calcium is insufficient for bone mineralization, leading to an increase in the excretion of phosphorus. Therefore, instead of only absolute levels, the calcium: phosphorus ratio in diets should be considered.

Table 2. Treatment effect of varying amount of Alternative Organic Feeds (AOF)

Treatments	**Mean weight gain**	**Mean Feed Consumption**	**Mean Feed Efficiency**	**Carcass Fat Content**	**Survival Rate**
T_0	912.5	17215.42	117.503	34.11g/100g	100%
T_1	599.72	17062.15	87.693	11.77g/100g	100%
T_2	669.16	17126.67	102.73	13.39g/100g	100%
T_3	760	17125.42	113.403	12.39g/100g	100%
T_4	582.95	17061.25	77.013	8.21g /100g	100 %

Table 2 shows the effect of varying amount of Alternative Organic Feeds (AOF) which states that T_0 has the highest mean weight gain, mean feed consumption and mean feed efficiency among the treatments. Alejandro (2013) stated that the most convenient way of feeding chickens is with a balanced pelleted ration. Most commercial feeds contain corn for energy, soybean meal for protein, and vitamin and mineral supplements. Commercial rations often contain antibiotics and arsenicals to promote health and improve growth, coccidiostats for combating coccidiosis, and sometimes mold inhibitors. Thus, the Commercial Feeds formulated for broiler rations is competitive in terms of raising broilers maximizing their growth performance and health conditions. However, T_0 also ranked the highest in terms of the total carcass fat content with 34.11g/100g. Broiler chickens fed with Commercial feeds has a higher fat deposition compared to the chickens fed with organic feeds (Boekholt et al., 2014). This fact is of economical concern because fat represents an undesirable and uneconomical product. The major goals of the poultry industry are to increase the carcass yield and to reduce carcass fatness, mainly the abdominal fat pad. The increase in poultry meat consumption has guided the selection process toward fast-growing broilers with a reduced feed conversion ratio. Intensive selection has led to great improvements in economic traits such as body weight gain, and feed efficiency to meet the demands of consumers, but modern commercial chickens exhibit excessive fat accumulation in the abdomen area. (Fouad and El-Senousey, 2013).

The Survival rate of the study is 100% which means that broiler chicken can adapt to the varying amount of Alternative Organic Feeds (AOF). Feed restriction programs have shown the potential to reduce the incidence of ascites (Julian, 2017; Tottori et al., 2017) and sudden death syndrome (SDS) (Blair et al., 2013; Gonzales et al., 2018). These conditions are more commonly observed in fast growing broilers that are fully fed.

Mortality in broiler flocks represents lost income to growers and integrators alike. Even though mortality is an everyday part of broiler production, growers should tailor management programs to reduce its overall effect on flock performance (Tabler, 2014). Thus, more net income was attained due to 100% survival rate of broiler chicken of the study.

Table 3.1. Significant Difference between and among Treatments in terms of Weight Gain

Number of Days per Treatment	F – Value	P – Value	Decision	Interpretation
Day15	10.085	.002	Reject HO	Significant
Day21	53.755	.000	Reject HO	Significant
Day28	51.402	.000	Reject HO	Significant
Day35	4.889	.019	Reject HO	Significant
Day45	8.464	.003	Reject HO	Significant

The results in Table 3.1. demonstrate that the weights of broilers vary significantly on the number of days in every treatment; day 15 (p=.002), day 21 (p=.000), day 28 (p=.000), day 35 (p=.019) and day 45 (p=.003).

Feed intake was significantly related to bird initial weight, with heavy chickens consuming more feed during the entire experimental period. Pinchasov (2012) asserted that the better performance obtained by the heavy chicks may be related to their higher feed intake. It is also generally assumed that when broiler chickens eat more, they have greater body weights at market age.

Barbato (2014) added that the control mechanisms of feed intake posthatch are related to genetic selection for body weight. The improvement noted in market body weight has been attained due to an increased feed consumption, which is related to genetics (Havenstein et al., 2013) and supported by nutrition. This improvement in body-weight-for-age of modern broiler chickens, due to an increased growth rate and associated higher nutrient supply, has led to more frequent occurrences of metabolic and skeletal disorders (Robinson et al., 2012) and increased fat deposition (Yu and Robinson, 2012).

In addition, because of the nutrient contents of the plants materials, the broilers were able to gain weight. The prebiotic properties of the coconut meat helped in the good digestion of the broilers, the presence of vitamin C in the water hyacinth boosted the immune system of the broilers, the anti-helmintic property of the ipil-ipil leaves protected the broilers against tapeworms that may affect the health of the broilers and the corn cob which consists of high amount of crude protein which enhances the weight of the broilers. All of the plant materials used in the study gave a significant effect on the weight of the broilers.

Table 3.2. Post Hoc Analysis for Weight Gain

Number of Days	T_0	S/NS	T_1	S/NS	T_2	S/NS	T_3	S/NS	T_4	S/NS
Day15	.005	S	.031	S	.996	NS	.996	NS	.005	S
Day21	1.00	NS	.984	NS	.000	S	.000	S	1.00	NS
Day28	.056	NS	.002	S	.000	S	.000	S	.056	NS
Day35	.984	NS	.036	S	.057	NS	.340	NS	.984	NS
Day45	.012	S	.004	S	.008	S	.209	NS	.012	S

Table 3.2. shows where the weight differences lie in every treatment. On day 15, there is a significant variation on the weight of the broiler in treatments To (p=.005), T1(p-value = .031), and T4 (.005); day 21, the weights significantly

vary with T2(p-value = .000) and, T3(p-value = .000); day 28, weights vary in treatments T1(p-value = .002), T2(p-value = .000) and, T3 (p-value = .000); day 35, weights vary in treatment T1(p-value =.036) only and; day 45, weights vary in treatments To (p-value = .012), T1(.004), T2(p-value = .008) and T4(p-value = .012).

Broilers require feed that is formulated specifically to meet their nutritional needs. We have broiler starter, broiler grower and broiler finisher diets. Feed conversion and growth performance have a lot to do with a broiler's diet (Alexander, 2012). The feed and water given to broilers greatly affect their growth rate, feed conversion, and healthiness.

Table 4.1. Significant Difference between and among Treatments in terms of Feed Consumption

Number of Days	F – Value	P – Value	Decision	Interpretation
Day 15-21	7.18	.005	Reject HO	Significant
Day 22-28	1.33	.324	Accept HO	Not Significant
Day 29-35	7.78	.004	Reject HO	Significant
Day 36-45	9.27	.002	Reject HO	Significant

Table 4.1. demonstrates that there is a significant difference on the feed consumption of the broilers on days 15 to 21 (p= .005), days 29-35 (p = .004) and days 36 to 45 (p = .002). There is no significant difference on the feed consumption on days 22-28 (p = .324).

Broilers acclimation period is from day 1 to 14 and as they reach their 15th day, different concentrations of the Alternative Organic Feeds were already given. Day 15-28, as their second and third week of the experimental testing and broilers grow and produce more heat. Thus, heat stress becomes a major problem which affects their feed consumption (Liu, 2020). Higher temperature provides a striking effect on feed intake, particularly at the post-brooding stage / acclimation period. The growing feathers were also a factor affecting the weight gain of the broiler chickens because nutrients go to the feathers, not on the broilers' body (Elanco, 2013).

Table 4.2. Post Hoc Analysis for Feed Consumption

Number of Days	T_0	S/NS	T_1	S/NS	T_2	S/NS	T_3	S/NS	T_4	S/NS
D15-21	.006	S	.028	S	.150	NS	.654	NS	.006	S
D22-28	1.00	NS	.479	NS	1.0	NS	1.0	NS	1.00	NS
D29-35	.218	NS	.005	S	1.0	NS	.161	NS	.218	NS
D36-45	.001	S	.182	NS	.089	NS	.232	NS	.001	S

Post hoc analysis uncovers the specific feed consumption differences of the broiler between number of days and treatments. The result reveals that days 15-21, the feed consumption has a significant differences in treatments To (p=.006), T1(p=.028) and, T4(p=.006); Days 29-35, feed consumption varies in treatment T1(p=.005) only; Days 36-45, feed consumption varies in treatments To(p=.001) and T4(p=.001), lastly, in Days 22-28, there is no significant variation of feed consumption in any treatments.

It has also been reported that feed consumption of broiler chickens are adversely affected by high stocking rate compared to moderate stocking even under conditions of sufficient feeder space. The effect of stocking rate and feed utilization could be attributed mainly to the restricted access to the feed, increased heat stress, increased ammonia level, and prevalence of pathologies Andaya (2022).

Table 5. Significant Difference between and among Treatments in terms of Feed Efficiency

Number of Days	**F – Value**	**P - Value**	**Decision**	**Interpretation**
Feed Efficiency * Treatment Group	14.326	.000	Reject HO	Significant

α =.05

Table 5.1. shows the significant effect of feed efficiency to the different treatment groups as evident by the significant p value (.000).

The following concentrations of Alternative Organic Feeds (AOF) on the diet of broilers have significant impact in terms of feed efficiency. Improvement in feed efficiency noted with the use of feed restriction programs is due to reduced overall maintenance requirements. This reduction seems to be due to a transient decrease in basal metabolic rate of feed restricted birds (Zubair and Leeson, 2014) and is linked with a smaller body weight during early growth, leading to less energy needed for maintenance (Marks, 2011). Consequently, there is current interest in the use of feed restriction programs to modify bird growth patterns and decrease their maintenance requirements, which should improve feed efficiency.

Table 6 shows the Return of Investment of the study

Expenditures	**T_0**	**T_1**	**T_2**	**T_3**	**T_4**
Cost of broilers	Php 684	Php 684	Php 684	Php 684	Php 684
Feed Cost	Php 1,068	Php 338	Php 523	Php 803	Php 208
Electric Bill	Php 90	Php 90	Php 90	Php 90	Php 90
Total Expenditure	Php 1, 842	Php 1,112	Php 1,297	Php 1,577	Php 982
Total Income	Php 2, 546.80	Php 2,113.15	Php 2, 128.45	Php 2357.55	Php 2, 046.20
ROI	Php 704.80	Php 1,001.15	Php 831.45	Php 780.55	Php 1, 064.20
Total ROI : Php 4, 382.15					

Table 6 gives the economic result of using the Alternative Organic Feeds in broiler chicken. The total Expenditures for the entire study was Php 7 060.00 which includes the cost of the 90- 1 day old Cobbs 500 male broilers, feed cost and the electric bill. T_0 ranked the highest in terms of total expenditure (Php 2, 546. 80) as well as in the total income (Php 2, 546.80). whereas, T4 has the lowest amount of total expenditure (Php 982) which yields to the highest in Return of Investment (ROI) among all treaments. In total, the ROI of the study is Php 4, 382.15 which shows that broiler chicken fed with Alternative Organic Feeds has a potential in reducing the feed cost hence produce a good return of investment.

Table 7. Survival Rate of Broilers

Treatments	Initial Number of Broilers	Final Number of Broilers	Survival Rate (%)
T_0	18	18	100%
T_1	18	18	100%
T_2	18	18	100%
T_3	18	18	100%
T_4	18	18	100%

The beneficial contents found in the Alternative Organic Feeds (AOF) proved by its proximate analysis, broilers can indeed survive even in different feed concentrations given to them. It can assure 100% survival rate of the broilers.

The advantages of using processed feed have been well documented. Under natural conditions, birds have to deal with different types of feed, which have different energy and protein levels. Broiler chickens naturally adapt to certain changes to feeds rations. Despite domestication and selection for fast growth, broiler chickens adapt to different types of diets (Emmans & Kyriazakis, 2011). It has been suggested that the birds associate the feed physical characteristics with nutritional content, which indicates that the contact perception contributes to the identification of the feed.

Table 8. Carcass Fat Content

	T_0	T_1	T_2	T_3	T_4
Crude Fat Analysis	34.11g/100g	11.77g/100g	13.39g/100 g	12.39g/100 g	8.21g / 100g

Table 8 shows the Carcass Fat Content of the broilers fed with varying amount of Alternative Organic Feeds (AOF).

Analyses of Carcass Fat Content were done at the Department of Science and Technology – Don Mariano Marcos Memorial State University, Mid La Union Campus – City of San Fernando, La union.

As seen on table 8, T_o with 100% Commercial Feeds (CF) has the highest amount of crude fat with 34.11 g/ 100 g while T4 with 100% Alternative Organic Feeds (AOF) has the lowest amount of crude fat with 8.21g / 100g .

Broiler chickens have been genetically improved for increased body weight gain, feed efficiency and growth rate to meet the requirements of consumers (Wang et al., 2012). These selection processes have produced modern commercial chicken lines with a higher growth rate, breast meat yield and better feed conversion rates, and a higher body fat compared with unselected lines (Baéza and Le Bihan-Duval, 2013). However, the excessive fat in modern poultry strains has been one of the major problems facing the poultry industry (Zhou et al., 2016). For example, Choct et al., (2012) found that modern broiler strains contain 15% to 20% fat and >85% of this fat is not physiologically required for body function. In general, excessive fat deposition is an unfavorable trait for producers and consumers because it is considered to be wasted dietary energy and a waste product with low economic value, which also reduces the carcass yield and affects consumer acceptance (Emmerson, 2017).

Abdominal fat deposition was significantly affected by the different concentration of Alternative Organic Feeds (AOF), confirming the results of Santoso et al. (2013), Fontana et al. (2013), Deaton (2015), and Zubair and Leeson (2016), although broiler chickens fed with organic feeds usually had a numerically smaller abdominal fat pad.

Conclusions

Based on the results of the study, the following conclusions were derived:

1. The Alternative Organic Feeds is a sustainable Alternative Organic Feeds (AOF) for broiler chickens *(Gallus gallus domesticus*).

2. The result of the Proximate Analysis of the Alternative Organic Feeds indicates that it contains standard Moisture content, Ash content, Crude Fat, Crude Fiber while the Crude Protein, Phosphorus and Calcium do not meet the specific standard requirements needed for a feed meal for broilers.

3. Broiler chickens can survive in different feed concentrations of the Alternative Organic Feeds (AOF).

4. There is a significant difference between and among the treatments in terms of weight gain, feed consumption and efficiency, carcass fat content and survival rate.

5. The consumption of Alternative Organic Feeds (AOF) has a good economic result which yields to a good return of investment.

Recommendations

In light of the findings and conclusions, the researcher offers the following recommendations:

1. Make use of pelletizer machine with different blade sizes to cater the broiler chicken on their different ages.
2. Search for other plant materials that have a standard amount of Crude protein, Phosphorus and Calcium.
3. Test the Alternative Organic Feeds (AOF) for its shelf-life.
4. Increase the number of broilers per treatment or replication to make more vivid results on their carcass fat content.
5. Use different treatment ratio or concentrations to meet the standard nutrient contents of broiler chicken feeds.
6. Recommend to utilize other different genotypes of chicken.

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