EFFECT OF THE REPLACEMENT OF SESAME SEED FOR METHIONINE IN BROILER PRODUCTION

BY

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DECLARATION

I declare that this research was done in its original form by Gyau, Aaron Matureh of the Department of Vocational Education, Federal University of Technology Yola, Nigeria.

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APPROVAL PAGE

This thesis titled, Effect of Replacement of Sesame for Methionine in Broiler Production by Gyau, Aaron Matureh (M.Tech/VE/06/0142) meets the regulations governing the award of degree in Masters of Technology in Agricultural Technology Education, Federal University of Technology, Yola and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to my beloved wife, Mrs, Eunice Aaron Gyau, my children and parents.

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Abstract

The study was conducted to determine the effect of replacement levels of sesame seed for synthetic methionine on growth performance, carcass yield and internal organ characteristics, haematology and biochemical indices and economic of production of broiler chickens. Five diets were formulated using sesame seed to replace methionine at 0%, 3%, 6%, 9% and 12% in treatments 1, 2, 3, 4 and 5 respectively. One hundred and fifty (150) day-old Anak 2000 broiler chicks were randomly allotted to the five dietary treatments with ten (10)

birds per replicate and the diets were replicated three times in a completely randomized design. Result from the study showed that feed intake was not significantly (P > 0.05) affected by the replacement levels of sesame seed for synthetic methionine. The daily weight gain and feed conversion ratio were significantly (P < 0.05) affected at the starter phase while at the finisher phase they were similar across the treatments. Carcass characteristics and internal organs were significantly (P < 0.05) affected except live weight, plucked weight, eviscerated weight dressing percentage, wings, liver, heart, gizzard. The haematological indices, red blood cells, white blood cells, mean corpuscular haemoglobin concentration and biochemical indices, cholesterol, creatinine, globulin were not significantly (P > 0.05) affected by the replacement levels except mean corpuscular volume, mean corpuscular haemoglobin and protein, urea and albumin. The economic analysis of feed showed that D1 (control) and D2 (3%) sesame seed had the least cost, the highest cost was D5 (12%) sesame seed. Base on the findings of this research, farmers were recommended to substitute sesame seed for methionine at 3% level and if they are accessible to synthetic methionine, it should be used.

CHAPTER ONE

INTRODUCTION

.1 Background of the Study

Poultry is the quickest source of meat and its production involves the least hazardous and arduous process in relation to other livestock enterprises. Moreso, it is relatively free from the many pathological, ecological and economical constraints which affect the commercial productions of other breeds and classes of live-stock in Nigeria, (Obioha, 1992).

Scott (1974) reported that, the protein, amino-acid and vitamin values of poultry meat and eggs go hand in hand with an improvement in the health, happiness and progress of a country. These proteins supplement the food values of rice, maize, wheat and other staples in such a way as to build strong bodies and strong minds in the children of the country. Aguilera, Cuca and Pino (1974) stated that serious malnutrition is widespread because of the deficiency of protein, particularly animal protein, in human diets. The poultry industry has a key role as a most economical source of protein. Ikeme (1990) observed that poultry products are widely accepted by all races, culture and religion, and the eggs contain high protein since the need to provide sufficient protein for the populace is of paramount concern to animal scientists and veterinarians. Protein from livestock is needed for physical and intellectual development as well for developing immunity against diseases.

Oluyemi and Roberts (2000) stated that poultry meat used to be derived predominantly from spent layers in the developing countries but there is an increasing shift to broilers. They pointed out that broilers are fast growing birds which reach market weight of 1.8kg to 2.5kg in 8 – 10 weeks. Olomu (1978) and Adejoro (2004) pointed out that feed alone accounts for 60 – 75% and to 76% respectively the cost of raising commercial poultry. Hence, the need for sourcing locally available raw materials for formulating feeds. In formulating feeds, the requirement for any nutrients must be supplied in the ration to meet the needs of the birds. The nutrients required by the poultry include water, carbohydrate, protein, vitamin and minerals.

Methionine is a sulphur containing amino acid necessary in energy and nitrogen metabolism and is the first limiting amino acid in practical poultry diets (Shim and Chen, 1990). Menkin, Podkolzina, and Agalstova (1998) in their study on the effect of methionine supplementation on performance of chickens concluded that methionine deficiency had an adverse effect on the live weight of chickens.

Sesame seed (*Sesamun indicum*) is an old cultivated crop and thought to have originated in Africa. Its fruit is an oblong, mucronate, pubescent capsule containing numerous small, oval and yellow, white, red, brown or black seeds. It is also considered as one of the major world oil crop grown by small farmers in developing countries. The low production of sesame may be attributed to its shattering characteristics (Ram, Catlin, Romero and Cowley, 1990). Olomu (1995) pointed out that sesame seed has an oil content of about 40% and average crude protein content of 22%. The seed is useful to man for its oil. The sesame meal (by-product of oil extraction from the sesame seed) has crude protein content of about 46% and medium energy value. It is deficient in Lysine but has higher content of methionine than most plant protein supplements.

Carcass composition refers to the proportion of lean meat, bone and fat obtained after dressing the birds. A high quality carcass is one with large amount of muscle and small amount of bones and fat.

Tewe, Steinbach and Smith (1991); Church, Judd, Young, Kebay and Kim (1984), and Onifade (1993) stated that Haematological indices are good ways of assessing the health status of an organism by distinguishing normal state from state of stress which can be nutritional, environmental or physical.

.2 Statement of the Problem

Synthetic methionine is an essential amino acid that is usually added in the formulation of poultry diets. This synthetic methionine is found in towns and cities which is not always accessible to the rural farmers (Turaki, 2005). Hence the need for sourcing available local substitute such as sesame seed.

Sesame seed (benniseed) is produced locally and is a good source of proteins and has appreciable amounts of methionine, (Aduku, 1992). Sesame seed meal has a higher content of methionine than most plant protein supplements. When used in the right proportions together with soyabean meal which has a higher content of lysine, a balanced diet with respect to lysine and methionine will result (Olomu, 1995).

Wethli and Paris (1995) conducted an experiment on the use of raw materials which were maize (*zea mays*), sorghum (*sorghum vulgare*), sesame (*sesamun indizum*), cowpea (*vigna unguiculata*) and the leaves of sweet potato (*Ipomea batatas*) cultivated in Mozambique in the feeding of growing chickens. Cowpea and sesame were chosen because of their relatively high contents of methionine and lysine, respectively. The inclusion level of sesame was 181,291 and 294g/kg in locale 1, 2 and 3 an attempt was made to keep these as simple as possible while trying to satisfy the minimum requirements for methionine and lysine.

Turaki (2005) in his experiments using sesame seed meal to replace synthetic methionine in broiler diets. The inclusion level of the sesame seed was at 0, 2.5, 5, 7.5 and 10%. It is in this regard that sesame seed is used in the study.

1.3 Purpose of the Study

The purpose of this study was to determine the effects of replacement of sesame seed meal for methionine in broiler diets. The specific objectives were to:

i) determine the growth performance of broilers fed diets containing different replacement levels of sesame for methionine.

ii) determine the effects of substituting synthetic methionine with sesame seed meal on carcass yield, and internal organ characteristics of broiler chickens.

iii) to analyze the cost effectiveness of substituting synthetic methionine with sesame seed meal in broiler chicken's diets.

iv) to determine the effect of the test diets on haematological and serum indices of broiler chickens.

1.4 Research Questions

i. Why replacement of sesame seed for synthetic methionine at different levels?

ii. Does the replacement of sesame seed at different levels have any effect on growth performance of broilers?

iii. What is the cost implication in substituting synthetic methionine with sesame seed in broiler chicken's diet?

iv. Does replacement of sesame seed for methionine has any effect on the mortality of the broiler birds?

1.5 Hypotheses

1. There is no significant difference in replacement levels of sesame seed for methionine on feed intake.
2. There is no significant difference on the daily weight gain between the control (treatment one) and treatments two, three, four and five.
3. There is no significant difference on the economic of using sesame seed for synthetic methionine.

1.6 Significance of the Study

It is expected that the results of this study will help rural farmers who are distant from towns or cities and who cannot have access to synthetic methionine, can use sesame seed meal at 3% level of inclusion in the diets at starter and finisher phases.

The result of this study will serve as a guide to other researchers. For this result to have much impact to the farmers, workshops and seminars will be organized to the rural farmers on how to use both sesame seed and synthetic methionine in formulation of their poultry diets.

Finally, this will help to keep them in the poultry production business even when they cannot have access to the synthetic methionine.

1.7 Assumption of the Study

It is hope that at the end of this study the growth performance of broiler fed diets containing sesame seed meal will be equivalent to those fed on synthetic methionine.

It is expected that at the end of this study, a recommended level of sesame seed meal will be obtained for inclusion in the poultry diets without adverse effect on the performance of the birds.

1.8 Operational Definitions of terms

(i) Sesame seed (*Sesamun indicum*) its Hausa name is Ridi. It is an oil crop rich in protein and oil. It has high amount of methionine than most plant protein supplements. Its seed colour ranges from white, yellow, brown and black. Sesame seed is consumed by humans and its cake used in supplementing protein for livestock. Its high methionine content makes it a good substitute for synthetic methionine.

(ii) Synthetic methionine – is a commercially manufactured amino acid which is used in formulating livestock feeds.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter is presented under the following sub-headings: – Conceptual framework; Nutrient requirements of broiler chickens; Haematology of Poultry; Effects of methionine supplemented diets on the performance of broilers, Utilization of sesame seed; Effect of sesame seed meal/oil seeds on haematological and biochemical indices and on carcass and internal organs characteristics. Review of Related empirical studies and Summary of the Literature reviewed are also presented.

2.1 Conceptual Framework

The experiment was done based on the concept of Wethli and Paris (1995) who used raw materials such as maize, sorghum, sesame seeds, cowpeas and sweet potato leaves, all produced in many areas of Mozambique, in feeding growing chickens. They said, that a large part of the raw materials used in balanced commercial feeds for monogastric animals had to be imported. This results in foreign exchange drain and transportation problem so that even local ingredients such as bran and the oil seed cakes were often unavailable in the remote rural areas. Hence, it was clear that unless locally available feeds could be used, there was little possibility of improving the nutrition of rural poultry. They also pointed out that their choice of sesame and cowpea was because of their relatively high contents of methionine and lysine respectively.

McDonald, Edwards, Greenhalgh and Morgan (1998) stated that sesame meal is rich in leucine, arginine and methionine but is relatively low in lysine. In using it for feeding pigs and poultry, it should be combined with feeds rich in lysine.

Rama (2004) stated that the protein of sesame is rich in arginine, leucine and methionine but low in lysine. Since the sesame meal is deficient in lysine its combination with soya bean meal appears to be useful. The meal can be included in poultry diets up to 15% in combination with other lysine rich oil cakes.

2.2 Nutrient Requirements of Broiler Chickens

The requirement for any nutrient is the amount of that nutrient which must be supplied in the ration to meet the needs of the normal healthy bird. Such a level of nutrient must be capable of meeting requirements for maintenance and productive performances of the bird (Olomu, 1995).

Oluyemi and Roberts (2000) stated that the physiological fates of the nutrients form the basis for formulating the nutritional requirements of the birds. To meet this requirement, the diets must be properly balanced. In this regard, it is helpful to consider the relationship among the different classes of nutrients in the diet. Turaki (2005) observed that the nutrients requirements for broilers are mainly based on the assessment of energy and protein, which are the two major components of the diet. A number of other nutrients are required in smaller amounts that, however, are very essential to ensure optimum growth.

Water Requirements: Oluyemi and Roberts (2000) reported that cold water should be given to the poultry birds. Warm water (35°C) reduces water intake, while water is refused if it is at a high temperature above 44.5°C. The water provided must be free from excess salt which have laxative effect. They said, the quality and quantity of water determines the efficiency of feed utilization. Adejoro (2004) opined that the best environmental temperature which influences the feeding habit of the birds ranges from 21°C – 26°C. McDonald, *et al*. (1998) stated that water is vital to the life of the organism that the water content of the body be maintained – an animal will die more rapidly if deprived of water than if deprived of food. They further observed that water functions in the body as a solvent in which nutrients are transported about the body and in which waste products are excreted. Obioha (1992) reported that feed stuff fed to chickens contains water (metabolic water) but the substantial amount is given through drinking water. He agrees with (Oluyemi and Roberts, 2000) that water helps in feed utilization.

Carbohydrate Requirements: The main function of carbohydrate in the diet is to provide energy to animal. Cereal grains and their by-products are excellent source of starch and thus constitute a bulk of poultry ration (Banerjee, 1992). Obioha (1992) stated that carbohydrates are compounds made up of carbon, hydrogen and oxygen. He observed that they are the most widely distributed compounds in nature and constitute at least 70% of poultry diet.

Carbohydrates are organic compounds and a source of energy for poultry (Canadian poultry consultant, 2007). They also observed that simple carbohydrate are made up from sugars, glucose from maize, lactose from milk, sucrose from sugar cane or sugar beets and in smaller amounts in many plants in their fruits, seeds or roots are disaccharides. Complex carbohydrates (polysaccharides) are made up from combinations of sugars. Some like starch (from cassava, maize and wheat) can be digested by chickens, while cellulose, a structural carbohydrate cannot because animals do not have the enzymes to breakdown (hydrolyse) cellulose so that it can be absorbed. This digestion is done by bacteria and protozoa in herbivores. Oluyemi and Roberts (2000) pointed out that carbohydrate is required for energy, body heat maintenance and the synthesis of fat stored in the body as a structural component and in the egg. Carbohydrate deficiency in the diet results in poor growth rate of the chicks. Carbohydrates that are useful to poultry are hexose, sucrose, maltose and starch. Cellulose, a complex carbohydrate is not digested by poultry.

Protein Requirement: Banerjee (1992) stated that protein is important for compensating the broken tissues of the adult body and for production of eggs. He said, on a dry weight basis the carcass of an 8 weeks old broiler is more than 65 percent protein and the egg contents are about 50 percent protein. Typical broiler ration will contain from 22 to 24% protein and in layers ration the amount varies between 16 – 17%. Olomu (1995) reported that proteins are important in the life of animals since they are essential components of the protoplasm. They are needed for growth and developments of hormones and enzymes. The important amino acids needed in diet formulation are methionine, cystine, lysine and tryptophan. Methionine is the first limiting amino acid and lysine the second. He also pointed out that the protein requirements of broilers are 20 – 24% and 16 – 20% for starters and finishers respectively. While Onibi, Owoyemi and Akinyemi (1999) recommended 21% crude protein for broiler starter with 3030kcal/kg, ME level. Protein is incorporated in the poultry diet to meet the amino acid requirement of the birds at a defined energy level intake (Nelson, 1982).

Protein is mainly useful for the synthesis of body tissues for growth, for body repairs and also for egg formation (Oluyemi and Roberts, 2000). They also observed that, rather than the intact protein itself, it is its component parts, the amino acids that are of greatest nutritional importance. They stated that a range of 23 – 25% crude protein and 2,800kcal/kg (Metabolizable energy) was about optimum for the growth of started chicks in the tropics. Kekeocha (1984) recommended crude protein levels for broiler starter and finisher to be 23 and 20% respectively, while the metabolizable energy he recommended 2,889kcal/kg for both the starter and the finisher.

Vitamin Requirement: Vitamins are organic compounds not synthesized by the body but essential for growth. An animal may get enough of other elements but may not grow or reproduce unless it is supplied adequately with vitamins. Diets must therefore contain vitamins even though they are required in small amount (Obioha, 1992).

Oluyemi and Roberts (2000) observed that vitamins are organic compounds not synthesized by the body tissues and are required in very small amounts in diets. They function as co-enzymes or regulators of metabolism. They stated that the thirteen vitamins required by poultry are partly the fat-soluble ones, namely, vitamin A, D, E and K and water soluble ones, namely, thiamine, riboflavin, nicotinic acid, pyridoxine, B_{12} and choline. Olomu (1995) reported that deficiency in vitamins results in weakness, ataxia, anorexia, retarded growth, eye lesions and ruffled feathers in poultry. These requirements are met by fortifying the diets with premix.

Mineral Requirements: Minerals are crystalline nutrients which are needed by the chicken for skeletal and structural maintenance of bones and part of hormones in the body (Adejoro, 2004).

The major minerals are calcium, phosphorus, sodium, potassium, magnesium and chlorine and are likely the deficient ones (Oluyemi and Roberts, 2000). Olomu (1995) pointed out that in view of the role calcium and phosphorous played in egg formation, its recommended levels for commercial layers and breeders are 3.5% and 0.85% respectively. Oluyemi and Roberts (2000) pointed out that sodium and chlorine could be added in the feed in the form of common salt or sodium chloride at the level of 0.30 – 0.35% which will take care of all classes of chickens.

Canadian poultry consultant (2007) noted that minerals are not organic but are chemical elements. Those required in small but significant amount (calcium, phosphorous, sodium, magnesium and chlorine) are major minerals. Essential trace minerals are iodine, cobalt (as colabamin), iron, copper, zinc, selenium and molybdenum. Most minerals must be added to the diet for good growth and egg production. Laying hens need a ration with 3% calcium to make egg shells. This can be supplied free choice as small piece of bone-meal, coral, sea-shell or limestone. Plant phosphorous is partially available because of the presence of phytate. McDonald *et al*. (1998) stated that the mineral elements are classified as essential which comprise of major elements (calcium, phosphorous, potassium, sodium, chlorine, sulphur and magnesium) and the micro or trace elements (iron, iodine, copper, manganese, zinc, cobalt, selenium and molybdenum). They observed that the classification of the elements depend upon their concentration in the animal or amounts required in the diet. Elements such as sodium, potassium and chlorine have electrochemical function and are concerned with the maintenance of acid-base balance and the osmotic control of water distribution within the body, while calcium and phosphorous have structural function and are essential components of skeleton and sulphur is necessary for the synthesis of structural proteins.

2.3 The Effect of Sesame Seed Meal/Oil Seeds on Haematological and Biochemical Indices

Swenson (1970) reported that there are three classes of blood cells mainly red blood cell (RBC), white blood cell (WBC), and thrombocytes. He also indicated that blood volume if determined helps to interpret packed cell volume (PCV), haemoglobin (HB), Red Blood Cell (RBC) counts, plasma protein concentration and other haematological values. The mean values and ranges of each parameter are shown in Table 1.

Table 1: Heamatological Values of Chickens; Mean Values and Ranges

Component	Values
Red Blood Cell (RBC) count	2 – 4 x 10^6/mm^3
Haemoglobin concentration (HB)	7 – 13g/100ml
Packed cell volume (PCV)	25 – 45%
White Blood Cell (WBC)	9 – 31 x 10^3/mm^3

Source: Anon (1980)

The mean corpuscular volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC) are calculated values which are parameters used in measuring the size of haemoglobin content of red blood cells (RBC). The values may be used in diagnosing various anaemic conditions. Swenson (1970) and Sturkie (1965) explained that MCHC value can reflect anaemia and the capacity of the bone marrow to produce RBC of normal size and metabolic capacity. The MCV, MCH and MCHC have been values referred to as RBC indices. These values may be very important in understanding the health status of the animal.

The purpose of investigating blood composition is to have a way of distinguishing normal states from a state of stress in an animal. Such stress factors can be inadequate nutrition, poor management, environmental or physical stress (Tewe *et al,* 1991). Veulterinora (in Adeyemo and Longe, 2007) stated that diets have been reported to have significant influence on heamatological variables. Mitruka and Rawnsely (in Adeyemo and Longe, 2007) said the PCV values normal range is (31 – 33.5%) for broilers after six weeks of age and also said low PCV values are taken to indicate anaemia. They also observed that total serum protein concentration was not adversely affected by replacement level of up to 75% cotton seed cake for soyabean cake protein in the diets. Beyond this replacement level a depression in the utilization of protein was observed.

Al-Harthi and El-Deek (2009) stated that the cholesterol level reduced as dietary sesame meal increase in comparison to the control diet which has no sesame meal. Eggum (1970) stated that the serum metabolites (albumin, globulin, creatinine and urea) are indicators of adequacy of protein in terms of quality and quantity in the diet. These parameters show whether there are protein malnutrition, alterations in the dietary intake of protein and pattern of utilization, and possibly the extent of muscle wastage and subsequent degradation of muscle phosphorous creatinine to form creatinine.

2.4 Effects of Methionine Supplemented Diets on the Performance of Broilers

Methionine is a sulphur containing amino-acid necessary in energy and nitrogen metabolism. It is generally the first limiting amino acid in practical poultry diets (Shim and Chen, 1990).

Babatunde (1976) suggested that the calculation of the methionine levels in diets found to be adequate in terms of crude protein is 0.93% methionine plus cysteine while Olomu (1978) suggested between 0.74 and 0.84% methionine for optimum performance of broiler chicks.

The effect of methionine supplementation on growth and immune response as studied by (Lin Yihfwu, Chen and Tianfuh, 1996), they found out that feed conversions efficiency was best with higher amounts of methionine. Immune response in chickens was enhanced with higher amounts of methionine, however, methionine requirement for maximum anti body response was greater than that for maximum growth. Menkin, Podkolzina and Agalstova (1998) in their study on the effect of methionine supplementation on performance of chickens concluded that methionine deficiency had an adverse effect on the live weight of chickens.

Chickens fed on high available methionine consumed more feed per unit body weight compared with those on low and normal available methionine diets (Anadem, Gillani and Khan, 1999). Mamputu and Buhr (1995) did not record significant difference in egg weights, egg mass, egg production, daily feed intake and daily weight gain between the control and other diets when they replaced benniseed meal with Soya bean meal to feed layers. Scott (1974) stated that, methionine should be omitted if 60kg good quality sesame meal can be economically substituted for 60kg groundnut cake.

Al-Harthi *et al* (2009) in their work observed that, live body weight and body weight gain of 6 – weeks old broiler chicks fed the control diet were significantly ($P < 0.05$) higher than those of all the other dietary treatments. However, body weights and body weight gains of broilers fed diet containing 50% of either sesame meal or soyabean meal were significantly lower than those of the control diet. They also noted that broiler fed diets containing 100% and/or 75% sesame consumed less feed as compared with that of the control diet of 87.61, 79.91 and 95.08 respectively. They stated that the reasons for huge variation in all performance criteria might be due to the sesame meal dietary levels used were very high and caused a poor performance as a result of higher dietary sesame meal in conjunction with the poor amino acids quality in sesame meal (El-Husseiny, Abdallah, and El-Baz, 2001 and National Research Council, 1994).

The inclusion of sesame meal in duck diets at level greater than 15% of the diet significantly reduced body weight and feed conversion ratio. This may be due to low net protein utilization of sesame as well as low lysine and high phytic acid content (El-Husseiny *et al,* 2001 and Ravin dran and Blair, 1992).

Sesame meal may provide an acceptable alternative to soyabean meal in broiler ration when fed at 15% of the diet or less (Bello *et al,* 1990 and Pan *et al,* 1992). Nadeem *et al* (1999) stated that chickens fed on high available methionine consumed more feed per unit body weight compared, with those on low and normal available methionine diets.

2.5 Utilization of Sesame Seed

Jefferson Agricultural Institute (2005) reported that sesame has high attraction for baking because of its high fat (50%) oil and high protein content (up to 25% protein by weight). Sesame oil caries a premium relative to other cooking oils and is considered more stable than most vegetable oils due to antioxidants in the oil. The remaining meal after oil is extracted from the seed is a high protein material suitable for feeding to livestock. The oil has potential for a variety of industrial uses, as do must vegetable oils.

Sesame seed has an oil content of about 40% and average crude protein content of 22%. The seed is useful to man for its oil. It can be used to thicken soup as soya bean. The sesame meal is the by-product of oil extraction from the sesame seed. It has crude protein content of about 46% and medium energy value (Olomu, 1995). He also observed that the sesame meal is deficient in lysine but has higher content of methionine than most plant protein supplements. When used in the right proportions, together with Soya beans meal which has higher lysine content, a balance diet with respect to lysine and methionine appears to result. It is used in poultry and a swine diet is only limited by its availability.

Sesame seed meal is rich in leucine, arginine and methionine but is relatively low in lysine. The meal therefore needs to be combined with feeds rich in lysine when fed to pigs and poultry as pointed out by (McDonald *et al,* 1998). They also observed that the meal has a high content of phytic acid which makes much of it phosphorous unavailable: rations containing the meal may also need extra supplementation with calcium. Furthermore, the hulls of sesame seeds contain oxalates and it is essential that meals should be completely decorticated in order to avoid toxicities.

Morris (2002) stated that about 70% of the world's sesame seed is processed into oil and meal. Total annual consumption is about 65% for oil extraction and 35% for food. The food segment includes about 42% roasted sesame, 12% ground sesame, 35% washed sesame, and 10% roasted sesame with salt. People generally, consume more than twice as much white sesame as black sesame. Sesame flour has high protein, high levels of methionine and tryptophan, and 10% to 2% sesame oil. Sesame seeds contain three times more calcium.

2.6 The Effect of Sesame Seed Meal/Oil Seeds on Carcass Yield and Internal Organs

Carcass composition refers to the proportion of lean meat, bone and fat obtained after dressing the birds. A high quality carcass is one with large amount of muscle and small amount of bones and fat (Devendra and Fuller, 1979).

Brake, Havenstein, Scheideler and Rive (1993) observed the yields of body components of female and male broilers change with increasing age and body weight. So also the percentage edible components increased when the data are “expressed” on percentage body weights. They further observed that the percentage offal decrease with increasing age and body weight.

Sizemore and Seizel (1993) found a high percentage of fat carcass after feeding high energy starter diet to commercial female broiler crosses.

Al-Harthi *et al* (2009) in their experiment on the evaluation of sesame meal replacement in broiler diets with phytase and probiotic supplementation showed that parameters of blood, feather and heart percentages were not affected by either the inclusion level of sesame meal, phytase and/or probiotic supplementation to the soyabean meal control diet. In their second experiment, they noted that increasing sesame meal dietary levels upto 15% resulted in a numerically reduction in breast weights. This they said, is in line with findings of El-Husseiny et al (2001) who reported that percentage breast meat was significantly decreased when ducks were fed 30% sesame diet compared with that obtained from the groups fed the control diet. Furthermore, spleen percentage significantly increased as sesame meal inclusion level increased upto 15% plus phytase as compared to all other dietary treatments. Similarly to these observations, Kaneko, Yamasaki, Tagawa, Tokunaga, Tobisa and Furuse (2002) reported reduction in relative weight of breast, thigh meat, abdominal fat and fat content in breast meat with an increase in sesame meal level in broiler, reduced food efficiency and possibly poor utilization of dietary protein (as seen in serum protein concentration) in broilers receiving sesame meal as a total substitute for soyabean meal might be responsible for low muscle protein accretion.

In an experiment using different plant proteins conducted by (Ojewole and Ewa, 2005) stated that, the highest value observed in birds fed one of the treatment diet to others could be attributed to the low dietary energy value of the diet, hence, the birds increased their feed consumption presumably in an effort to overcome the energy deficiency. They also pointed out that the significantly lower body weight gain of some treatments when compared with others and numerical difference when compared with others can be attributed to residual anti-nutritional factors such as tannin and trypsin inhibitors which have been reported to have negative effect on weight gain (Aletor and Fasuyi, 1997; Amaefule and Obioha, 2001; Akinmutimi, 2004). Ojewole *et al* (2005) stated that high live weights also lead to high dressed weights. They further said that the differences in the values of the different parts of the birds could be attributed to different abilities of the test diets to differently induce tissue lay down for the said cut-parts. They observed differences in values for kidney among the treatments. Those with higher values can be attributed to the increase in activity of the kidney enzymes to detoxify the available anti-nutritional factors present in the ingredients.

2.7 Review of Related Empirical Studies

Wethli and Paris (1995) conducted an experiment on the use of raw materials which were Maize (Z*ea mays*), Sorghum (*Sorghum vulgare*), Seasame (*Sesamum indicum*), Cowpea (*Vigna unguiculata*), and the leaves of sweet potato (Ipomoea batatas) cultivated in Mozambique in the feeding of growing chickens. Cowpea and sesame were chosen because of their relatively high contents of methionine and lysine, respectively. The inclusion level of sesame was 181,291 and 294g/kg in local 1, 2 and 3 an attempt was made to keep these as simple as possible while trying to satisfy the minimum requirements for methionine and lysine.

At the end of the experiment, the control birds had significantly heavier final weights than those on any other treatment. There were no significant difference in either final body weight or weight gain among treatments Local 1 – 3 (Wethli and Paris, 1995).

Turaki (2005) in his experiment using benniseed meal to replace synthetic methionine in broiler diets. The inclusion level of the benniseed was at 0, 2.5, 5, 7.5 and 10%. The crude protein contents of 23% and 20% and energy densities of 2927.80 to 3034.40 kcal/kg were used for the starter and finisher phases respectively.

At the end of the experiment, the birds fed on diet A (control) and diet E (10% benniseed inclusion level) consumed significantly (P. < 0.001) more feed, achieved significantly more weight gain and utilized feed more efficiently than those on diet diets B, C and D at starter phase. Birds fed diet E with 10% benniseed inclusion level and those in the control had better carcass and live weights respectively. He also observed that the lowest feed cost per kilogram was obtained in diets with benniseed inclusion levels than in the control where synthetic methionine was used. He noted that three mortalities were recorded at the starter phase, while two were recorded at the finisher phase, which also indicates benniseed meal is safe for feeding broilers.

2.8 Summary of Related Literature Reviewed

In the review of related literature, seven themes were stated and discussed as follows: conceptual framework, nutrients requirements of broiler chickens and effects of methionine supplemented diets on the performance of broilers. It also discusses sesame seed, its utilization both by humans and in livestock feeds. The effect of sesame seed meal/oil seeds on carcass yield and internal organs and on haematological and biochemical indices and empirical studies is discussed.

In the review of related literature, it was seen that different studies were conducted using sesame seed at various levels and it did not show any adverse effect on health of the birds. In this study, it was aimed at increasing the level of the inclusion to see its effects on the performance of the birds.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Experimental Site

The study was conducted at the Poultry Research Farm of the Department of Animal Science, Federal University of Technology Yola, Adamawa State, in 2008. Adamawa is located at the North Eastern part of Nigeria. It lies between latitude 7° and 11°N of the equator and between latitude 11° and 14° E of the Greenwich meridian. It shares boundary with Taraba State in the South and West, Gombe State in its North-West and Borno to the North. Adamawa State has an international boundary with the Cameroon Republic along its eastern border (Adebayo and Tukur, 1999).

3.2 Experimental Diets and Design

Five treatment diets were formulated in which diet one served as the control, while diets 2, 3, 4 and 5 were formulated using sesame seed at 3, 6, 9 and 12% replacement levels respectively as shown in Table 2 and 3. 150 day-old Anak 2000 broiler chicks were purchased from ECWA farms in Bukuru near Jos through its distributor in Jimeta Yola Adamawa State. The birds were randomly allotted to the five dietary treatments replicated three times in a completely randomized design with 10 birds per replicate.

Table 2: Composition of Experimental Starter Diets

	Diets (%)				
Ingredients	**1**	**2**	**3**	**4**	**5**
Maize	47.80	46.40	44.76	42.97	41.06
Groundnut cake (GNC)	38.90	37.50	36.14	34.93	33.84
Maize offal	10	10	10	10	10
Sesame Seedmeal	0	3	6	9	12
Bone meal	2.5	2.5	2.5	2.5	2.5
*** Vitamin-mineral**					
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.00	0.00	0.00	0.00
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100
Calculated Analysis					
Metabolizable energy (Kcal/kg)	2,662.17	3,180.17	2,787.59	2,844.90	2,901.86
Crude Protein (%)	23.00	23.11	22.92	22.96	23.01
Crude fibre (%)	3.82	4.07	4.31	4.55	4.79
Calcium (%)	0.99	1.02	1.04	1.07	1.10
Phosphorous (%)	0.79	0.79	0.82	0.82	0.83

* Vitamin premix contains per Kg the following: Vitamin A, 1,000 000 I.U., Vitamin D_3 200 000 I.U., Vitamin E, 2,300mg, Vitamin K_3, 200mg, Vitamin B_1, 180mg, Vitamin B_2, 500mg, Niacin 2,750mg, Pantothenic Acid 750mg, Vitamin B_6 300gm, Vitamin B_{12}, 1.5mg, Folic Acid, 75mg, Biotin H_2 6mg, Choline Chloride, 30,000mg, Cabalt, 20mg, Copper, 300mg, Iodine, 100mg, Iron, 2,000mg, Manganese, 4,000mg, Selenium, 20mg, Zinc, 3000mg, Antioxidant, 125mg.

Table 3: Composition of Experimental Finisher Diets

Diets (%)					
Ingredients	**1**	**2**	**3**	**4**	**5**
Maize	56.13	54.73	53.10	51.29	49.75
Groundnut cake (GNC)	30.57	29.17	27.80	26.61	25.16
Maize offal	10	10	10	10	10
Sesame Seedmeal	0	3	6	9	12
Bone meal	2.5	2.5	2.5	2.5	2.5
*** Vitamin-mineral premix**					
Premix	0.25	0.25	0.25	0.25	0.25
Methionine	0.20	0.00	0.00	0.00	0.00
Salt	0.25	0.25	0.25	0.25	0.25
Lysine	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100
Calculated Analysis					
Metabolizable energy (Kcal/kg)	2,734.38	2.800.49	2,859.80	2,917.37	2,976.68
Crude Protein (%)	20.01	19.98	19.93	19.96	18.44
Crude fibre (%)	3.73	3.98	4.21	4.46	4.69
Calcium (%)	0.97	1.02	1.03	1.05	1.18
Phosphorous (%)	0.76	0.66	0.68	0.69	0.70

* Vitamin-premix contains per Kg the following: Vitamin A, 850,000 I.U., Vitamin D_3, 150,000 I.U., Vitamin E, 1,000mg, Vitamin K_3, 150mg, Vitamin B_1, 160mg, Vitamin B_2, 400mg, Niacin, 2,000mg, Pantothenic Acid, 500mg, Vitamin B_6, 150gm, Vitamin B_{12}, 1mg, Folic Acid, 50mg, Biotin H_2, 75mg, Choline Chloride, 17,500mg, Cobalt, 20mg, Copper, 300mg, Iodine, 100mg, Iron, 2,000mg, Manganese, 4,000mg, Selenium, 20mg, Zinc, 3000mg, Antioxidant, 125mg.

3.3 Data Collection

3.3.1 Growth Performance

The growth performance of the birds was determined by measuring the rate of feed intake, weight gain, and feed conversion ratio. Feed conversion ratio was computed as the feed intake per unit weight gain.

3.3.2 Carcass Yield and Internal Organ Characteristic

At the end of the experiment, which lasted for eight weeks, the birds were fasted for twelve hours before slaughtering the next day to empty the crop and minimize residual ingesta. Two birds were randomly selected from each of the replicates and weighed before the slaughter in the morning. Data was collected on eviscerated weight, carcass weight, dressing percentage. The internal organs which include the liver, heart, caecum length, kidney, gizzard and pancreas, were measured and expressed as a % of body weight.

3.3.3 Haematology and Biochemical Indices

At the end of the experiment, blood sample was collected from two birds in each treatment group for the determination of the haemotological and biochemical parameters. Blood samples for haematological parameter were collected with an anti-coagulant ethylene diamine tetra-acetic acid (EDTA) while those for serology were collected without anti-coagulant.

The haematological parameters were used to measure the packed cell volume (PCV), Red blood cell (RBC), White blood cell (WBC) and Heamoglobin (HB) concentration. Mean corpuscular volume (MCV), Mean corpuscular haemoglobin (MCH), and Mean corpuscular haemoglobin concentration (MCHC) were calculated using the formula described by Sirios (1995).

Serum Biochemical Indices: The serum biochemical indices was used to measure the levels of protein, urea, creatinine, cholesterol, albumin and globulin.

3.4 Chemical Analysis

The chemical analysis of the experimental diets and sesame seed meal were carried out using the Association of Analytical Chemist Methods (AOAC, 1994).

3.5 Data Analysis

Data generated was subjected to analysis of variance (ANOVA) using SPSS 10 version and treatment means were separated using Duncan's multiple Range Test (Duncan, 1955).

CHAPTER FOUR

RESULTS AND DISCUSSION

This chapter presents the result and discussion of the research carried out.

4.1 Proximate Analysis of Black Sesame (*Sesemun indicum)*

The table below presents the proximate analysis of black sesame seed.

Table 4: Proximate Composition of Black Sesame Seed

Nutrient	% Composition
Crude protein	20.94
Crude fibre	18.79
Ether extract	31.5
Ash	5.12
Moisture	3.57
Organic matter	91.31
Dry matter	96.43

The result of the proximate composition of black sesame seed is presented in Table 4. The crude protein was 20.94%, crude fibre, 18.79%, Ash – 5.12% and dry matter – 96.43%. This result is similar to the result reported by Olomu (1995) that sesame seed contain crude protein, 22.30%, crude fibre, 10.30%. dry matter, 92% and ash, 5.30%. however, it varies with that of Al-Harthi, et al (2009) which has the following chemical composition moisture, 8.40%, crude fibre, 5.36%, crude protein, 29.52%, ether extract, 11.40%, nitrogen free extract, 40.17% and ash, 5.15% while that of NRC (1944) has moisture, 7.00%, crude protein, 43.80%, ether extract, 6.50%, nitrogen free extract, crude fibre, 7.00% and ash, 0%. The differences observed from the already established values can be attributed to the different sources of the sesame seed, cultivar, method of processing, length of storage and storage condition (Ojewole and Ewa, 2005).

4.2 Amino Acid Profile of Black Sesame Seed

The table below presents animo acid profile of black sesame seed.

Table 5: Amino Acid Profile of Black Sesame Seed

Amino acid	Concentration g/100 protein
Lysine	6.69
Hictidine	3.13
Arginine	8.85
Aspartic acid	10.50
Threonine	4.13
Serine	5.50
Glutamic acid	25.06
Proline	3.19
Glycine	7.19
Alanine	7.19
Cystine	4.89
Valine	3.49
Methionine	3.10
Isoleucine	3.92
Leucine	10.02
Tryosine	6.60
Phenylalanine	7.78

The amino acid profile of black sesame seed is presented in Table 5. The result indicates that black sesame seed has methionine, 3.10g/100g protein, lysine, 6.69g/100g protein. This result differs with that of Kanu *et al* (2007) who also had the following values in g/100g protein. Methionine, 3.6, lysine, 2.6, Threonine, 3.6, Histidine, 2.2, Valine, 4.5, Isoleucine, 3.4, Leucine, 7.1, Phenylalanine, 4.6 and Tryptophan, 2.1. The differences in these results might be due to greater variability in processing temperature during oil extraction from the seeds, Rao *et al* (2008).

4.2 Anti-Nutritive Factors in Black Sesame Seed

The table below presents anti-nutritive factors of black sesame seed.

Table 6: Anti-Nutritive Factors of Black Sesame Seed

Anti-Nutritive Factors	Positive (+) /Negative (-)
Alkaloids	+ positive
Saponins	-
Tannins	- Negative
Phlobatannins	- Negative
Anthraquinones	- Negative
Cardiac Glycosides	+ Positive
Steroids and Terpenes	
Extract with water	- Negative
Extract with ether	+ Positive
Extract with methanol	+ Positive
Carbohydrates with molisch's test	+ Positive

The result of anti-nutritive factors in black sesame is presented in Table 6. The result showed that the seed was negative for saponins, Tannins, Phlobatannins, Anthraquinones, Steroids and Terpenes while it was positive for alkaloids, and cardiac glycosides. Ravindra and Blair (1992) reported that sesame seed has high phytic acid content which affects the performance of birds when sesame meal is included in diets at level greater than 15% of the diet.

4.4 The Effect of Replacement Levels of Black Sesame Seed for Methionine on Feed Intake

Table 7: The Effect of Replacement Levels of Black Sesame Seed for Methionine on the Feed Intake of Broiler Chickens (0 – 4 weeks) Starter Phase

Parameters	Treatments					SEM	Remarks
	1	2	3	4	5		
Daily feed intake(g)	60.15	62.03	59.03	56.65	57.09	1.83	NS
Average daily weight gain (g)	51.04^{a}	42.89^{ab}	40.88^{ab}	40.67^{ab}	35.67^{b}	3.21	*
Feed conversion ratio	1.18^{b}	1.51^{ab}	1.44^{ab}	1.39^{ab}	1.60^{a}	1.14	*
Mortality	1	1					

Means with different superscripts on the same raw are significantly different

* = P < 0.05

NS = Not significant

SEM = Standard error of means

Table 8: The Effect of Replacement Levels of Black Sesame Seed for Methionine on the Feed Intake of Broiler Chickens from (5 – 8 weeks) Finisher Phase

Parameters	Treatments					SEM	Remarks
	1	2	3	4	5		
Daily feed intake(g)	88.57	87.80	83.23	79.72	80.06	4.13	NS
Average daily weight gain (g)	55.72	54.70	49.70	48.49	46.31	3.02	NS
Feed conversion ratio	1.6	1.62	1.68	1.65	1.72	2.82	NS
Mortality				1			

NS = Not significant

SEM = Standard error of means

Table 9 The Effect of Replacement Levels of Black Sesame Seed for Methionine on the Feed Intake of Broiler Chickens When Pooled (1- 8 weeks)

Parameters	Treatments					SEM	Remarks
	1	2	3	4	5		
Daily feed intake(g)	74.36	74.92	71.13	68.19	68.57	2.78	NS
Average daily weight gain (g)	53.38^{a}	48.79^{ab}	45.29^{ab}	44.57^{ab}	40.99^{b}	2.88	*
Feed conversion ratio	1.39	1.56	1.56	1.52	1.66	2.68	*
Mortality	1	1		1			NS

Means with different superscripts on the same raw are significantly different

* = P < 0.05

NS = Not significant

SEM = Standard error of means

The result of feed intake of broilers fed various replacement levels of black sesame for methionine during the starter, finisher and when the intake were pooled is presented in Tables 7, 8 and 9 respectively. There was no significant (P > 0.05) difference on feed intake across the dietary treatments in all the phases of broiler growth. However, on numerical grounds feed intake was higher in treatment 2 at starter phase, higher in treatment 1 at finisher phase and higher in treatment 2 when pooled, while it was lower in treatment 3 and 4 at starter phase and finisher phase respectively and lower in treatment 4 when pooled.

Turaki (2005) in a similar experiment using benniseed at 0, 2.5, 5, 7.5 and 10% observed that birds fed diet A (control) and diet E (10% inclusion level) significantly consumed (P < 0.001) more feed, achieved significant more weight gain and utilized feed more efficiently than those on diets B, C and D at starter phase.

The differences in the rate of feed intake as shown in the various treatments indicates that it was influenced by the amount of methionine present in the diet. Also, the nature of sesame seed (processed or unprocessed) has effect on feed intake. At the starter phase, in this research, treatment 2 which has 3% level of sesame seed had higher feed intake followed by treatment 1 which has synthetic methionine and at the finisher phase, treatment 1 (control) had higher feed intake followed by treatment 2 which had 3% level of sesame seed. Those treatments that had more than 3% level of sesame seed had low feed intake which showed that methionine content in those treatments was not equivalent to that of treatment 1 and 2. This agrees with (Anadem, *et al*, 1999) who reported that chickens fed on available methionine consumed more feed per unit body weight compared with those on low normal available methionine diets. This was also supported by Al-Harthi and El-Edeek (2009) who reported that birds consumed less feed containing high amount of sesame.

4.4.1 Effect of Replacement Level of Black Sesame Seed for Methionine on Average Daily Weight Gain(g) of Broiler Chickens

The average daily weight gain in the starter phase was significantly ($P < 0.05$) higher in treatment 1 (control) than all the other treatments as shown on Tables 7, 8 and 9. The average daily weight gain was significantly ($P < 0.05$) higher in treatment, 1 and 2 and lower in the other treatments in the starter phase. In Table 9, the average daily weight gain when pooled was significantly ($P < 0.05$) higher in treatment 1 and lower in the other treatments. The daily average weight gain was higher in the control diet (treatment) at the starter phase, in treatment 1 and 2 at the finisher phase and in treatment 1 when pooled while it continue to decrease in the subsequent treatments in all the phases as the level of replaceable sesame seed for methionine increases as shown in Tables 7, 8 and 9 respectively. The result showed that replacement level of sesame seed for methionine higher than 3% affects the body weight gain of birds. This may be due to low level of methionine and protein level when included in a higher level. This agrees with (El-Husseiny, *et al* and El-Baz (2001) and NRC (1994) that sesame seed meal had poor amino acids quality. Ravindra and Blair (1992) stated that incorporating sesame meal in duck diets at level greater than 15% significantly reduced body weight and feed conversion ratio. Though the black sesame seed was included at a level lower than the one reported by Ravindra and Blair (1992) and yet, it still caused reduction in body weight, this might be due to the unprocessed sesame seed used.

4.4.2 The Effect of Replacement Level of Black Sesame Seed for Methionine on Feed Conversion Ratio of Broiler Chickens

The feed conversion ratio is presented in Tables 7, 8 and 9 and it ranged from 1.18 in treatment 1, 1.60 in treatment 5 at starter phase, 1.6 in treatment 1, 1.72 in treatment 5 at finisher phase and 1.39 in treatment 1, 1.66 in treatment 5 when pooled. There was no significant difference among the values at the different phases except at the starter phase. However, better feed efficiency was found in treatment 1 followed closely by treatment 2. The reduced body weight and feed conversion ratio may be due to low net protein utilization of sesame as well as low lysine and high phytic acid content (El-Husseiny *et al*, 2001) and (Ravindra and Blair, 1992).

4.4.3 Effect of Replacement Level of Black Sesame Seed for Methionine on Mortality of Broiler Chickens

Mortality was recorded each, in treatment 1 and 2 at starter phase while at finisher phase also one mortality was recorded in treatment 4. At pooled, it showed total mortality of three birds, one each in treatment 1, 2 and 4 was recorded. This indicates that it is safe to use sesame seed in broiler production. If sesame seed was detrimental in the diets, there could have been more mortalities of the birds than recorded. This agrees with Turaki (2005) who reported five mortalities in his result and considered it safe for using sesame seed meal.

4.4.4 Carcass Yield and Internal Organ Characteristics

Table 10: Carcass Yield and Internal Organ Characteristics of Broiler Chickens Fed Various Replacement Levels of Sesame Seed for Methionine

Parameters	Treatments					SEM	Remarks
	1	2	3	4	5		
Live weight (g)	1840	1760.00	1660.67	1746.67	1573.33	106.83	NS
Plucked weight (g)	1686.67	1580.00	1506.67	1513.33	1400.00	89.59	NS
Eviscerated weight (g)	1486.67	1470	1350.00	1376.67	1230	87.36	NS
Carcass weight (g)	1416.67^{a}	1356.67^{ab}	1243.33^{ab}	1296.67^{ab}	1102.67^{b}	85.62	*
Dressing %	5.53	5.53	7.01	7.47	7.47	1.55	NS
Head	52.57^{a}	47.83^{ab}	39.77^{b}	45.53^{ab}	40.13^{b}	2.94	*
Wings	147.97	139.37	142.63	147.97	125.37	11.53	NS
Thorax	268.77^{a}	158.30^{ab}	113.90^{b}	164.20^{ab}	93.33^{b}	35.52	*
Neck	105.07^{a}	102.27^{ab}	89.93^{b}	95.63^{ab}	91.63^{ab}	4.02	
Back	231.90	203.63	224.90	217.90	182.87	18.12	NS
Breast	184.40^{b}	239.13^{ab}	282.33^{a}	231.33^{ab}	159.43^{ab}	23.95 *	**
Thighs	227.23^{a}	184.17^{ab}	157.40^{b}	167.67^{ab}	157.70^{b}	17.53	*
Drumsticks	190.33^{a}	177.97^{ab}	175.43^{b}	167.67^{ab}	157.70^{b}	7.89	*
Shanks	92.63^{a}	78.50^{a}	38.60^{b}	75.93^{a}	60.23^{ab}	9.94	*
Internal organs							
Liver	1.49	1.47	1.22	1.39	1.31	2.98	NS
Heart	.47	.54	.39	.48	.36	1.90	NS
Caecum length	37.00^{a}	38.67^{a}	30.67^{b}	36.67^{a}	29.80^{b}	1.71	*
Caecum weight	1.02^{ab}	1.13^{a}	$.83^{b}$	$.79^{b}$	$.84^{b}$	7.55	*
Small intestine length	65^{ab}	98.93^{a}	73.33^{ab}	58.67^{b}	89.67^{ab}	10.88	*
Small intestine weight	1.05^{b}	1.37^{a}	1.17^{ab}	1.09^{ab}	1.20^{ab}	2.85	*
Kidney	$.29^{c}$	$.56^{a}$	$.35^{bc}$	$.41^{abc}$	$.49^{ab}$	1.89	*
Gizzard	1.52	1.51	1.29	1.39	1.33	2.72	NS
Pancreas	$.15^{b}$	$.23^{a}$	$.14^{b}$	$.14^{b}$	$.15^{ab}$	2.37	*
Lungs	$.64^{ab}$	$.67^{a}$	$.47^{b}$	$.74^{a}$	$.64^{ab}$	1.67	*
Spleen	$.15^{ab}$	$.17^{a}$	9.000E-02^{b}	$.14^{ab}$	$.12^{ab}$	2.11	*

Means with different superscripts on the same raw are significantly different

* = $P < 0.05$, * * = $P < 0.001$

NS = Not significant

SEM = Standard error of means.

The carcass yield and internal organ characteristics is presented in Table 10. There is no significant ($P > 0.05$) difference in the values of the different treatments of the live weight, eviscerated weight, dressing percentage, wings and back. While the carcass weight, head, thorax, neck, breast, thighs, drumsticks and shanks were significantly ($P < 0.05$) affected among the different values of the treatments. The differences could be attributed to the replaceable levels of sesame seed for synthetic methionine. This agrees with Al-Harthi, *et al* (2009) who stated that high live body weight and body weight gain in treatments with different levels of sesame meal was recorded. This is also in agreement with the report of Nadeem, *et al* (1990) who pointed out that chickens fed on high available methionine consumed more feed per unit body weight compared with those on low and normal available methionine diets.

The internal organs such as the caecum length and weight, small intestine length and weight, kidney, pancreas, lungs and spleen were significantly ($P < 0.05$) affected except the liver, heart and the gizzard. The differences in the values of the kidney in the tested diets is attributed to the increase in activity of the kidney enzymes to detoxify the available anti-nutritive factors present in the ingredients (Ojewole and Ewa, 2005).

4.4.5 Economic Analysis of Using Sesame Seed for Methionine

Table 11: The Economic Analysis of Feeding Broiler Chickens with Sesame Seed as a Replacement for Methionine

Parameters	Treatments					SEM	Remarks
	1	2	3	4	5		
Total Feed intake (g)	2391.00	2345.67	2330.33	2158.33	2241.67	96.86	NS
Cost of feed intake (₦)	45.54^{e}	58.54^{d}	63.87^{c}	74.19^{b}	84.51^{a}	00	
Cost of total feed intake (₦)	1,088.86^{c}	1,392.67^{b}	1,488.38^{b}	1,601.27^{ab}	1,894.43^{a}	94.91	***
Total weight gain	1503.67	1460.67	1391.67	1314.67	1296.67	93.87	NS
Cost of feed/kg naira gain	72.89^{d}	96.38^{c}	107.07^{bc}	122.47^{b}	145.76^{a}	5.73	***

Means with different superscripts on the same raw are significantly different
* * * = P < 0.001
NS = Not significant, SEM = Standard error of means

The economic analysis of feeding broiler chickens with sesame seed as a replacement for methionine is presented in Table 11. The result showed that the lowest feed cost were observed in treatment 1 (control) ₦1,088.86 and treatment 2 (₦1,392.67). The feed cost continued to increase in the subsequent treatments as the level of inclusion of sesame seed continue to increase. The highest cost being treatment 5 (₦1,894.43) with inclusion level of sesame seed of 12%. The reason for the high cost of production incurred in the levels of sesame seed was attributed to the period the sesame seeds were bought. However, the recommended level for using sesame seed in the formulation for good performance without any adverse effect on the birds is 3%. The result of this study disagreed with Turaki (2005) who stated that it is more cheaper to use sesame in formulating the diet than the synthetic methionine. The differences in the cost could be due to the time the studies were done and the seasons of the harvest of sesame seed. However, it supports Igbal, *et al* (1998) who stated that diets containing seed oils like sesame are comparatively costly but net profit is higher.

4.4.6 Haematological and Biochemical Indices of Broiler Chickens Using Sesame Seed for Methionine

Table 12: Haematological and Biochemeical Indices of Broiler Chickens fed Various Replacement Levels of Sesame Seed for Methionine

Parameters	Treatments 1	2	3	4	5	SEM	Remarks
Haematological indices:							
PCV	33.33	30.80	27.77	31.90	30.03	2.04	NS
HB	9.67	9.03	8.27	9.27	8.87	1.98	NS
RBC	2.58	2.31	2.08	2.38	2.13	1.57	NS
WBC	232.33	226.43	216.27	230.85	223.33	7.56	NS
MCV	130.70^{b}	136.50^{ab}	133.13^{ab}	134.23^{ab}	139.37^{a}	2.46	*
MCH	37.60^{b}	39.07^{b}	39.73^{ab}	39^{b}	41.70^{a}	2.51	*
MCHC	29	29.30	29.77	29.03	29.90	4.0	NS
Biochemical indices:							
Protein	40^{a}	36.67^{ab}	35^{ab}	35^{ab}	31.67^{b}	1.9	*
Cholesterol	93.93	90.90	90.90	109.08	87.87	7.29	NS
Urea	1.39	.85	1.49	.85	.64	3.54	NS
Creatinine	31.55	33.65	25.24	23.14	29.45	4.31	NS
Albumin	18.99^{a}	18.75^{a}	16.77^{ab}	16.85^{ab}	13.57^{b}	1.12	*
Globulin	21.01	17.92	18.23	17.98	18.10	2.08	NS

Means with different superscripts on the same raw are significantly different

* = P < 0.05

NS = Not significant

SEM = Standard error of means.

The haematological indices are shown in Table 12. They include packed cell volume (PCV), haemoglobin (Hb) concentration, red blood cell (RBC) counts and white blood cell (WBC) counts. Others are mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC). There were no significant ($P > 0.05$) differences among treatments for all the haematological indices except mean corpuscular volume and mean corpuscular haemoglobin. The range of blood values obtained in respect of PCV (25 – 45%), Hb (7 – 13g/100ml), RBC (2 – 4 x $10^6/mm^3$) were all within the normal limits for broilers (Anon, 1980) except white blood cell (WBC).

The values of the biochemical composition revealed that there was no significant ($P > 0.05$) difference in the cholesterol, urea, creatinine and globulin between the control diet and the treatment diets except protein and albumin. The significant differences in these biochemical indices indicate inadequacy of protein in terms of quality and quantity (Eggum, 1970). This could be the reason for poor performance in the other treatments with higher level of sesame seed which has low protein in conjunction with high phytic acid content (El-Husseiny, *et al* and El-Baz, 2001).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

This research was done on the effect of sesame seed for methionine in broiler production on school farms.

5.1 Summary

Sesame seed meal was used to replace synthetic methionine in the various treatment diets used at the following inclusion level – 0, 3, 6, 9 and 12%. The experiment lasted for eight weeks and was aimed at studying the growth performance, carcass yield and internal organs characteristics, haematological and biochemical indices and the economic of broiler production. All the necessary management practices such as provision of feed, water, vaccine and sanitary measures were given adequate attention. At the starter phase, there was no significant ($P > 0.05$) difference on feed intake across the dietary treatments in all the phases of broiler growth. However, on numerical grounds feed intake was higher in treatment 2 with 3% sesame seed meal inclusion and higher in treatment 2 when pooled followed by treatment 1. Better live weight gain was attained by treatment 1 with synthetic methionine followed by treatment 2 with 3% level of sesame seed inclusion and they had better live carcasses and live weight than the remaining treatments. The lowest feed cost per kilogram was obtained in diets with synthetic methionine followed by the diet with the least (3%) level of sesame seed inclusion. Three mortalities were recorded, two at the starter phase and one at the finisher phase which shows that sesame seed has no adverse effect on broiler.

The summary of the major findings of this research is that farmers in remote areas that cannot have access to synthetic methionine should use sesame seed meal at 3% level of inclusion in the starter and finisher phases of poultry diets. If they can have access to synthetic methionine, it is preferable to go for that due to the cost that may be incurred if the sesame seed is not obtained when it is cheap or cultivated by the farmers.

5.2 Implication of the Findings

The study implies that, agricultural educators can teach students and farmers to substitute synthetic methionine with sesame seed at 3% in broiler starter and finisher diets formulation.

The implication of this finding to farmers especially those in rural areas who do not know synthetic methionine and cannot easily have access to it for feed formulation, can now substitute it with sesame seed at 3%.

An option for poultry formulation is open to the farmers. They can now substitute synthetic methionine with sesame seed at 3% inclusion level.

5.3 Conclusion

The result of this study indicates that unprocessed sesame seed meal can be included at 3% level to replace synthetic methionine in the diet of broilers without adverse effects on the productive performance, blood parameters, carcass components of the birds.

The feed cost in naira per kilogram gain was better in the control diet where synthetic methionine was used than the diets where sesame seed were used. However, the use of sesame seed for methionine at 3% level could be advantageous and economical to the farmers who are distant from the cities where they could not get the synthetic methionine and also when the synthetic methionine is said to be scarce or not available. The production could still thrive successfully with a good weight gain attainable using sesame seed.

5.4 Recommendations

Based on the results of this research, rural farmers who are distant from towns and cities, and cannot have access to synthetic methionine, should use sesame seed meal for methionine at 3% level of inclusion. It is advisable for them to purchase sesame seed meal at harvest time when the commodity is cheap or alternatively grow the crop which could be relatively cheaper. However, when they are accessible to synthetic methionine, it is recommended that farmers use it.

5.5 Limitation of the Study

The limitation of this study was that some birds were tiny and weak, out of which some had spread legs. A doctor from the School Veterinary clinic was called, after his diagnosis on those that had spread legs, he said the problem was right from the hatchery. He said they should be given antibiotics.

The researcher advises that farmers who experience such problems should complain to the supplier through the distributor whom they purchased the birds.

5.6 Suggestions for Further Study

To ascertain the level of unprocessed sesame seed to be used in replacement for methionine, the researcher is suggesting that similar studies could still be done using the black sesame, white or yellow sesame seed (unprocessed).

Also two protein sources could be included in the experimental diets to see the performance as compared with one protein source.

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