IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372.Volume 7, Issue 1 Ver. II (Jan. 2014), PP 46-52
www.iosrjournals.org

Nutritional Evaluation Of Toasted White Sesame Seed Meal *Sesamum Indicum* As A Source Of Methionine On Growth Performance, Carcass Characteristics, Haematological And Biochemical Indices Of Finisher Broiler Chickens

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***Abstract**: One hundred and fifty (150) Anak-2000 day-old broiler chicks were used to investigate the effect of toasted white sesame seed meal (TWSSM) as a source of methionine on growth performance, carcass characteristic, haematological and biochemical indices of broiler finisher chickens. The chicks were randomly assigned to five dietary treatments consisting of three replicates of ten chicks per replicate in a completely randomized design. The dietary treatments were TWSSM at 0, 4, 8, 12 and 16% representing treatments 1, 2, 3, 4 and 5 respectively. For eight weeks, data were collected on feed intake, weight gain and feed conversion ratio. At the end of the experiment, 6 birds were randomly selected from each treatment and slaughtered to determine the effect of TWSSM on carcass characteristics and internal organs weight. Blood samples were also collected from 6 birds in each treatment for haematological and biochemical studies. Results from growth performance revealed that all the growth parameters were not significantly (P>0.0) affected by the levels of TWSSM supplementation except feed intake which was significantly (P<0.05) higher in treatment 1 (0%). The values for carcass characteristics and internal organs weight also did not show any significant difference (P>0.05) across the treatments. Significant (P<0.05) variation was however observed in the values of abdominal fat which increased with increasing level of TWSSM. Supplementation level of TWSSM did not affect the haematological parameters while biochemical indices such as protein, urea and glucose were significantly influenced by the treatment diets. It appears therefore that supplementation of TWSSM at 18% did not affect the performance and blood profile of broiler finisher chickens.*
***Key words:** white sesame, performance, broiler, carcass, haematology, methionine*

I. Introduction

In Nigeria, the population growth rate and demand for food is over 3% while growth rate in food production is between 1.0 – 1.5% leaving a short fall of 1.5 – 2% in annual food supplies. There is also the imbalance in food supplies, between plant and animal sources. Plant sources contribute over 75% of Nigerian total food supplies and animal sources accounts for only 25%. Nigeria still remains among the least animal protein consumers in Africa. The average animal protein intake for Africa is 11 g/head/day while the average value for Nigeria is 7.5g/head/day (Lamorde, 1998). This has been attributed to high and rising cost of feeds which accounts for more than 85% of the total cost of production (Umeh and Udo, 2002). Feeds formulated with synthetic methionine which is not always accessible to rural farmers' accounts for 60-75% cost of raising commercial poultry (Adejoro, 2004). In recent years, the cost of synthetic methionine has kept increasing in Nigeria with a resultant increase in the cost of the finished feed (Diarra and Usman, 2008). Essien *et al.* (2005) observed that when a diet is supplemented with synthetic methionine at 0.5% supplementation level, it represents up to 10.26% of the total cost of producing feed in Nigeria. This apparently makes it difficult for rural farmers to be self engaged in commercial poultry business.

Several researchers have advocated for the use of alternative sources of synthetic methionine that is readily available and cheaper (Aduku, 1992; Oluyemi and Roberts, 2000; Ngele et al., 2011). One of the vegetable plant sources that can supplement synthetic methionine is sesame seed. Sesame (*Sesamum indicum* L.) otherwise known as *sesamum* or benniseed, member of the family *Pedaliaceae*, is one of the most ancient oil seed crop known to mankind. The major producing areas of sesame in Nigeria are Nasarawa, Jigawa, Benue, Yobe, Niger, Kano, Katsina, Kogi, Gombe, Plateau and Taraba States (NAERLS, 2010). Sesame seed is rich in protein and minerals like potassium, phosphorous, magnesium, calcium and sodium. The protein content has been reported by many workers; 18-25% (Bonchani et al., 2010), 20% (Nzkou et al., 2009), 22.30% (Olomu, 2011) and 22-25% (Tunde-Akintunde et al., 2012). The protein is rich in essential amino-acids which include leucine, arginine and methionine but is low in lysine (Banerjee, 1998). Sesame seeds are also good sources of minerals and vitamins such as manganese, copper, calcium, vitamin B1 and vitamin E (Biswas *et al.,* 2001;

Ojiako *et al.,* 2010) and in addition to the highly absorbable spectrum of vitamin E, they increase its bioactivity in the body (Cooney *et al.,* 2001).

In poultry nutrition, sesame seed has been used to supplement synthetic methione in laying hens (Diarra and Usman, 2008) and broilers (Agbulu et al., 2010), but there is paucity of information on the use of white toasted sesame seed as a supplement for synthetic methione in broiler finisher diets. This study therefore was aimed at evaluating toasted white sesame seed meal, *Sesamum indicum* as a source of methionine on growth performance, carcass characteristics, haematological and biochemical indices of broiler finisher chickens.

II. Materials and methods

Experimental site

The experiment was conducted at the Poultry Teaching and Research Farm of the Federal University of Technology, Yola. Yola lies between latitude 7^o and 11^o N and longitude 11^o and 14^{o}E. Temperature in this climatic region is high in February to April because of high radiation, which is evenly distributed throughout the year. Maximum temperature in the state can reach up to 40^{o}c particularly in April, while minimum temperature can be as low as 18^{o}c between December and January. Mean monthly temperature range from 26.7^{o}c in the South to 27.8^{o}c in the North Eastern part of the state (Adebayo, 1999).

Processing of white sesame seed

White Sesame seed was obtained from a rural market in Girei, Adamawa state, North-Eastern Nigeria. The seeds were screened, winnowed and cleaned to remove dirt, sand, stones and other foreign particles. Using fire wood as a source of heat, 5kg of Sesame seeds were placed in a wide open aluminum pan and toasted for about 15 minutes by stirring continuously with an aluminum spoon to prevent the burning of the seed coat and to enhance even distribution of heat. The toasting was arrested when *pop* sound was produced and the seeds slightly turned brown.

Experimental birds, management and design

One hundred and fifty (150) day old (*Anak, 2000*) white strain unsexed broiler chicks were purchased from a commercial poultry farm in Otta, Ogun state, South Western Nigeria. The birds were managed on a deep litter throughout the period of the experiment. Brooding was done at the first one week of the experiment and the chicks were fed on commercial broiler starter feed. Thereafter, the birds were randomly allotted to the five dietary treatments of 30 birds per treatment and were replicated three times with 10 birds per replicate in a completely randomized design. The birds were vaccinated routinely as described by Oleyemi and Roberts, (2000).

Experimental diets

Five dietary treatments were formulated with toasted white sesame seed meal (TWSSM) to replace synthetic methionine at 0.00, 4.00, 8.00, 12.00 and 16.00% in treatments 1 (control), 2, 3, 4 and 5 respectively (Table 1). The control treatment contained synthetic methionine while TWSSM was used in place of methionine in the other treatments. The TWSSM was analyzed for proximate composition and amino acid profile. The birds were fed the experimental diets and clean drinking water *ad libitum* for a period of 8weeks.

Table 1: Composition of Broiler finisher diets

Ingredients	supplementation level of toasted white sesame seed meal				
	T1	T2	T3	T4	T5
Maize (White)	56.13	53.82	51.54	49.31	46.93
Groundnut Cake	30.77	29.08	27.36	25.69	24.07
Maize Offal	10.00	10.00	10.00	10.00	10.00
TWSS	0.00	4.00	8.00	12.00	16.00
Methionine	0.20	0.00	0.00	0.00	0.00
Bone Meal	2.50	2.50	2.50	2.50	2.50
*Premix	0.25	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10	0.10
Common Salt	0.25	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**	**100**
Calculated Analysis					
ME (Kcal/Kg)	2954.86	3031.66	3108.74	3188.80	3264.97
Crude Protein (%)	20.00	3108.74	19.98	20.00	20.00

Crude Fibre (%)	4.62	3.74	4.07	4.41	4.73
Calcium	0.97	1.01	1.05	1.09	1.12
Phosphorus	0.78	0.80	0.81	0.82	0.84
Methionine	0.46	0.27	0.30	0.30	0.32

*Vitamin-Mineral premix (Bio-mix) provides per Kg the following: Vitamin A500iu; Vitamin D_3, 888,000iu; Vitamin E, 12,000mg; Vitamin K_3, 15,000mg; Vitamin B_1, 1000mg; B_2, 2000mg; Vitamin B_6, 1500mg; Niacin, 1200mg; Pantothenic acid, 2000mg; Biotin, 1000mg; Vitamin B_{12}, 3000mg; Folic acid, 1500mg; Choline Chloride; 60,000mg, Manganese, 10,000mg Iron, 1500mg; Zinc, 800mg; Copper, 400mg; Iodine, 80mg; Cobalt 40mg; Selenium, 8000mg.
TWSS = Toasted white sesame seed

Data collection

Data were collected on feed intake, weight gain, carcass and internal organs characteristics, haematological and biochemical indices. Feed intake was determined as the difference between the left over and the quantity of feed offered the previous day. Similarly, weight gain was determined as the difference between the final weight and initial weight. Feed conversion ratio was measured as an index of feed utilization for each treatment group and was calculated as the ratio of feed intake to weight gain.

Two birds from each replicate were randomly selected for carcass and internal organs measurements. The birds were tagged according to their replicates and fasted for 8hours to reduce the gastro-intestinal contents (Yakubu *et al*., 2012). The birds were individually weighed and slaughtered. The slaughtered birds were defeathered completely and the carcasses were plucked and the heads, necks and legs were removed and eviscerated weights were measured. The internal organs were carefully removed and weighed to determine their fresh weights. The internal organs weight was expressed as proportion of their body weight.

Blood samples for haematological and biochemical indices were collected from randomly selected birds from each of the replicates using sterile syringe into sterile bottles containing anti-coagulant (EDTA- ethylene diamine tetra-acetic acid) and another blood samples were collected without ant-coagulants for the determination of serum biochemical indices. The blood samples were analyzed for red blood cells (RBC), packed cell volume (PCV), haemoglobin (Hb), and white blood cells (WBC). The coagulated blood samples were also subjected to standard serum separation for total protein, globulin, albumin, urea, creatinine and, cholesterol. The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and Mean corpuscular haemoglobin concentration (MCHC) were also determined as described by Sirios, (1995).

Proximate analysis

Proximate composition of the sesame seed and amino acid profile were analyzed according to the procedures described by AOAC (1990)

Statistical analysis

Data generated from for all the parameters measured were subjected to one way analysis of variance as described by Steel and Torrie (1980) and Duncan Multiple Range Test (Duncan, 1955) was used to separate treatment means.

III. Results

The results of proximate composition and amino acid profile of TWSSM are presented in Tables 2 and 3. Results showed that the seed contained 20.26% crude protein and 53.27% ether extract. The values for ash and crude fibre were 4.37 and 9.38% respectively. Nitrogen free extract was found to be 6.30% and total dry matter was 93.66%. Amino acid profile of TWSSM as presented in Table 3 showed that it contained methionine 6.24, lysine 3.23, valine 3.27, and arginine 8.93g/100g concentration. Other amino acids include leucine, 5.37, phenylalnine, 7.81, glycine, 7.31 and threoline, 4.25g/100g concemtration.

Table 2: Proximate composition of toasted white sesame seed

Nutrient	Percentage
Crude protein	20.26
Ether Extraction	53.27
Ash	4.37
Crude fibre	9.38
Nitrogen Free Extract	6.38
Moisture	6.34
Dry matter	93.66

Table 3: Amino acid profile of toasted white sesame seed

Amino Acid	g/100g concentration
Arginine	8.93
Glycine	7.31
Histidine	3.02
Isoleucine	3.92
Leucine	5.37
Lysine	3.23
Methionine	6.24
Phenylalanine	7.81
Proline	3.20
Serine	5.48
Threoline	4.25
Valine	3.27

The results of final weight, average daily feed intake (ADFI), average daily weight gain (ADWG) and feed conversion ratio (FCR) are presented in Table 4. The initial weight range between 95.66g -100.00g while the final weight was between 1000.74g-1144.17g and they were all similar (P>0.05) across the treatments. There was a significant difference (P<0.05) in ADFI between the treatments with birds in treatment 1 having the highest (78.43g) feed intake and lowest (65.99g) in treatment 5. Result of ADWG was not significant and it range from 23.23 in treatment 5 to 27.76g in treatment 1. Similarly, FCR were not influenced by the dietary treatments as they were all similar across the treatments.

Table 4: Effects of TWSSM supplementation on growth performance of broiler finisher chickens

	supplementation t levels of toasted white sesame seed meal					
Parameters	1	2	3	4	5	SEM
Initial weight (g)	95.66	99.33	99.66	100.00	97.66	4.53^{ns}
Final weight (g)	1144.17	1043.12	1089.28	1021.84	1000.74	44.16^{ns}
ADFI (g)	78.43^{a}	72.56^{ab}	75.23^{ab}	69.16^{b}	65.99^{b}	1.96*
ADWG (g)	27.76	25.38	26.49	24.44	23.23	1.28^{ns}
FCR	2.82	2.85	2.84	2.83	2.84	0.10^{ns}

a, b, Mean values on the row with different superscripts are significantly different (P<0.05) ADFI =Average daily feed intake, ADWG = Average daily weight gain, FCR = Feed conversion ratio, SEM = Standard error of mean

The results of carcass characteristics and internal organs weight are presented in Table 5. There were no significant differences (P<0.05) in all the parameters measured for both carcass characteristics and internal organs weight except for the abdominal fat which was significantly (P<0.05) higher in treatment 5. Numerically, carcass weight was higher in Treatment 1 (1403.33g) and lowest in treatment 4 (1106.44g). The dressing percent range was between 68.89% in treatment 2 to 64.44% in treatment 4.

Table 5: Effect of TWSSM supplementation on carcass characteristics and internal organs weight of broiler finisher chickens

	supplementation levels of toasted white sesame seed meal					
Ingredients	T1	T2	T3	T4	T5	SEM
Live weight (g)	2043.33	1936.33	2044.66	1690.00	1700.00	142.13^{ns}
Slaughtered Weight (g)	1919.66	1924.33	1848.33	1587.00	1629.00	121.18^{ns}
Plucked weight (g)	1837.33	1753.33	1804.66	1537.66	1576.33	129.42^{ns}
Eviscerated Weight (g)	1530.00	1440.33	1452.66	1200.00	1238.66	99.56^{ns}
Carcass weight (g)	1403.33	1334.00	1317.33	1106.66	1121.33	94.71^{ns}
Dressing %	68.54	68.89	64.44	65.28	66.07	1.37^{ns}
Internal Organs (%)						
Liver weight (g)	1.57	2.09	1.74	1.62	1.80	0.11^{ns}
Heart weight (g)	0.49	0.52	0.47	0.62	1.80	0.11^{ns}
Lungs weight (g)	0.64	0.69	0.69	0.61	0.75	0.05^{ns}
Gizzard weight (g)	1.68	1.70	1.78	2.05	1.07	0.19^{ns}
Kidney weight (g)	0.01	0.02	0.01	0.02	0.01	0.00^{ns}
Pancreas Weight	0.15	0.17	0.14	0.12	0.14	0.01^{ns}
GIT length (cm)	175.36	180.53	190.53	165.80	162.33	9.70^{ns}
GIT weight (g)	2.50	3.36	3.29	3.31	3.31	0.30^{ns}
Caecal length (cm)	35.13	35.76	36.60	31.20	34.83	1.28^{ns}
Caecal weight (g)	0.34	0.45	0.42	0.33	0.37	0.07^{ns}
Abdominal fat weight (g)	2.58^{b}	2.70^{b}	2.62^{b}	3.11^{b}	5.20^{a}	0.45^{*}

Ns = Not significant *** = P<0.0**5, SEM = Standard error of means, GIT = Gastro intestinal tract

The effects of TWSSM as a source of methione on haematological and biochemical indices are presented in Table 6. Packed cell volume (PCV), red blood cells (RBC), and haemoglobin (Hb) concentration was not affected by the supplementation of TWSSM for methione. The white blood cells (WBC) however, were significantly (P<0.05) different across the treatments as treatment 5 (123.23) had significantly higher value than the other treatments. The mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were not affected by the treatment diets. Similarly, neutrophils, monocytes and lymphocytes were also similar across the treatments. Significant differences were observed in values for protein, urea and glucose. The value for protein (34.00) and urea (2.06) in Treatment 1 was significantly higher than the other treatments, whereas glucose was significantly higher in treatments 4 (12.40) and 5 (12.13).

Table 6: Effects of TWSSM supplementation on haematological and biochemical indices of broiler finisher chickens

Parameters	supplementation levels of toasted white sesame seed meal					
	T1	T2	T3	T4	T5	SEM
PCV (%)	20.72	20.53	21.70	22.06	21.69	1.43^{ns}
RBC ($\times10^{12}$/L)	1.86	1.18	1.90	1.94	1.84	0.13^{ns}
WBC ($\times10^{9}$/L)	103.00^{b}	112.16^{ab}	111.20^{ab}	111.16^{ab}	123.23^{a}	4.27*
Hb (g/dl)	12.13	11.80	12.83	12.60	12.70	0.89^{ns}
MCV (fl)	111.33	113.33	113.67	113.33	118.33	1.45^{ns}
MCH (pg)	65.10	65.20	67.33	64.90	69.00	1.78^{ns}
MCHC (%)	58.46	57.50	59.06	57.16	58.43	1.26^{ns}
Neutrophils (%)	9.16	5.26	4.63	5.26	7.40	2.84^{ns}
Monocytes (%)	20.60	21.23	16.33	17.23	22.36	2.13^{ns}
Lymphocytes (%)	70.06	73.56	79.03	77.36	70.23	3.88^{ns}
Biochemical indices						
Protein (Mg/dL)	34.00^{a}	29.33^{b}	29.33^{b}	33.33^{ab}	30.66^{ab}	1.19*
Albumin (g/dL)	22.36	17.43	17.29	19.80	19.56	1.48^{ns}
Cholesterol (Mg/dL	135.71	135.71	130.95	123.80	121.23	9.13^{ns}
Creatinine (µMol/L)	79.55	53.03	50.09	47.14	55.98	0.84^{ns}
Urea (Mmol/L)	2.06^{a}	1.28^{b}	1.48^{b}	1.37^{b}	1.48^{b}	0.19***
Glucose (Mmol/L	10.53^{bc}	10.40^{c}	11.46^{b}	12.40^{a}	12.13^{a}	0.31***

a, b, c means on the same row with difference superscripts are significantly different * = P<0.05, *** = P<0.001, ns = Not significant, SEM = Standard error of mean, PCV = Packed cell volume, RBC = Red blood cell, WBC = White blood cell, MCV = Mean corpuscular volume, MCH = Mean corpuscular haemoglobin, MCHC = Mean corpuscular haemoglobin concentration

IV Discussion

The chemical composition of TWSSM revealed that it has high protein (CP) content of 20.26% which was similar to 20% reported by Nzikou *et al.* (2009) in Northern Congo, 20.94% by Agbulu *et al.* (2010) for black sesame seed in the middle belt of Nigeria and 18-23.18% reported by Unal and Yalcin (2008) for Turkish sesame. Tunde-Akintunde et al., (2012) however reported a much lower value of 18-19% CP. These values were however; lower than 25% reported by Bonchani *et al.* (2010) for white Sudan sesame seed. The CF content of 9.38% reported in this study was lower than 18.79% reported by Agbulu *et al.* (2010). Several other workers (Nzikon *et al.* 2010; Warra, 2011; Onsaard, 2012) also reported lower values for CF. Essential amino acid content (EAA) was higher than that reported by NRC (1984), and Cheva-Isaraku and Tangtaweeipiat (1993) in Thailand. It appears therefore that ecological conditions, processing methods and analytical procedures are likely to influence the chemical composition of sesame seed.

Although there was a decrease in average daily weight gain and final weight gain with increased level of toasted white sesame seed meal, the decrease was not significant. This observation agreed with the reports of Agbulu *et al*. (2010) when they fed black sesame seed meal as replacement for methionine in broiler chickens. Similarly, Diarra and Usman (2008) also reported a slight decrease in weight change from 250.05g to 186.40g when they fed graded levels of soaked sesame seed meal as a source of methionine. Feed intake range of 78.43g-65.99g obtained in this study was influenced by replacement levels. These values however, were lower than 160g recommended by Olonu (2011) for finisher broiler chickens. The lower feed intake observed in this study could be attributed to the presence of phytic and oxalic acid content of sesame seed meal (Mamputa and Buhr, 1995) and intensity and or the variety of the sesame seed (Ngele *et al*. 2011). The FCR which is an index of feed utilization was within the range of 2.82-2.85 recommended by Oluyemi and Roberts (2000) for broiler chickens in warm wet climate. It is however inferior to the range of 1.68-2.16 reported by Oko et al. (2011). The possible explanation could be that the level of sesame seed meal has not been reached to replace synthetic methionine in the diet.

There is an indication that toasting of sesame seed has improved the nutritional and subsequent utilization of the diet as observed by (Prince *et al*., 1980). All the parameters measured for carcass weight and internal organs characteristics were similar except the abdominal fat which tends to increase with increased level of toasted white sesame seed. This findings was contrary to the reports of Agbulu *et al.* (2010) that observed a significant (P<0.05) differences in most of the parameters measured for carcass characteristic and internal organs weight. The abdominal fat was observed to increase as the level of sesame seed meal was increased. This could be due to the high content of fat in sesame seed. Sirato-Yesumota *et al*. (2001) reported that high dietary fat content of sesame seed could lead to excess deposition of adipose tissue. All the internal organs were also not affected by the replacement levels of TWSSM. The fact that none of the internal organs showed any significant difference in size, it means that the test diets did not contain any appreciable toxins that could be detrimental to the organs.

Adejumo (2004) reported that haematological traits especially PCV and Hb are correlated with the nutritional status of the animal. The values for PCV and Hb obtained in this study were similar to the values reported by Banerjee (1998). The values for monocytes (16.33-22.36%), lymphocytes (70.06-79.03%) and neutrophils (4.63-9.16%) were however higher than the values reported by Banerjee (1998). The variation in total protein which was significantly higher in treatment 1 shows the superiority of treatment 1 which contains synthetic methionine. Bamgbose *et al.* (2003) reported that total protein and albumin are indicators of the total protein reserve in an animal body. The values for creatinine were not influenced by the dietary treatments and this indicates the adequacy of protein content in all the diets. Banerjee (1998) in his study on sources and types of protein observed significant variations in serum creatinine and uric acid. The higher values of glucose obtained in this study particularly in treatments 1 (12.40) and 5 (12.13) serves as a source of extra energy to the birds (Mayes, 1996). There was a numerical decrease in cholesterol concentration from 135.71mg/dl in treatment 1 to 121.23mg/dl in treatment 5. This finding has agreed with the reports of Al-Harthi and El-Deek (2009) who also observed a decrease in cholesterol level as dietary sesame seed meal was increased in the diets. Yamauchi *et al.* (2006) reported that sesame seed inhibits cholesterol absorption from the intestine and synthesis in the liver. Bamgbose *et al.* (2011) concluded that such mechanism of inhibiting cholesterol absorption from the intestine will reduce cholesterol deposition in poultry and poultry products which in turn reduces the incidences of coronary heart disease in human following the consumption of these products.

V Conclusion

The use of toasted white sesame seed meal at 16% gave similar performance with those broiler chickens on synthetic methionine. It can therefore be concluded that toasted white sesame seed meal at 16% can be used to supplement synthetic methionine without any adverse effect on growth performance broiler chickens.

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