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COMPARISON OF EFFECT OF FULL FAT SOYBEAN AND NON FAT SOYBEANS MEALS IN BROILER DIETS ON THEIR GROWTH PERFORMANCE

***Abdullahi, J., Elechi, U. J. and Uduma, F. C.**

Department of Agricultural Technology, Federal Polytechnic Akanu Ibiam Unwana, Afikpo, Ebonyi State

*Corresponding author: jibriljaj@gmail.com +2348065357055

ABSTRACT

Study was conducted to compare the effect of full fat soybean and non-fat soybeans meals in broiler diets on their growth performance. A total of one hundred and twenty (120) day old mixed sex chicks purchase from a reputable farm were used for this study, which lasted for eight weeks. The birds were reared on deep litter floor pens using wood shavings as litter material. The birds were brooded in the same pen for two weeks and randomly divided into two (2) groups of 60 birds per group. Data collected were subjected to General Linear Model procedure of the statistics analysis system SAS statistical package. Statistically significant means were compared using Duncan Multiple Range Test (DMRT) Duncan. The results of the experiment carried out on the assessment of weight gain on broiler fed full - fat soybean showed that the final body weight, weight gained, average daily weight gain, total feed intake per bird and feed conversion ratio (FCR) of the birds increases significantly ($p<0.01$) across the treatments. The final body weight in T3 (4005.00g) was similar to T4 (4140.00g), which were higher than treatment T1 (3510.00) and T2 (3600.00g). The cost price per kg in T3 (47270.75±0.00) N/kg and T4 (7519.06±0.00) N/kg were similar and higher, followed by T2 (6525.84±0.00) N/kg whereas the least cost price per kg was observed in T1 (6360.29±0.00) N/kg. Further studies should be carried out to find other possible ways to influence the real performance of broiler on full fat and non - fat soybean meal so as to increase maximum performance of the broiler birds.

Keywords: statistics analysis system, statistically significant, General Linear Mode, and Duncan Multiple Range Test

INTRODUCTION

The poultry industry, more specifically, the broiler industry plays a key role in the delivery of High quality protein and lipids to chicken meat of both developed and underdeveloped nations increased greatly from 1995 through 2005 (Scanes, 2007). This was, in part, because unlike red meats, there are no religious or cultural constraints associated with poultry meat consumption. Nevertheless, some degree of success has been achieved but one of the major problem which have persisted till date is the problem of feed and the feeding in terms of cost and availability of the feed raw materials. Soybean meal is an excellent source of protein in diets for poultry (Petterson and Pontoppidian, 2013). However, in addition of the fluctuation in supply and seasonal scarcity in some parts of the world, the price of soybean meal has been increasing over the years (Shi *et al.*, 2012; Petterson and Pontoppidian, 2013). The problem with raw soybean meal, however, is the concentration of anti-nutritional factors (Chen *et al.,* 2013). The nutritive value of full-fat soybean is negatively affected by the presence of anti-nutritional factors (Liu *et al.,* 2000), especially by trypsin inhibitors and lectins (Chummei, 2010). Various scholars (Liu *et al.*, 2013, Chummei, 2010), have reported that feeding soybean meal with high levels of trypsin inhibitors and lectins negatively affects pancreatic functions, the growth of birds and feed efficiency. Similarly, ASA (2014) reported that diets based on raw beans reduces feed consumption and live weight, and decreased the feed conversion indices by 14, 35 and 53% respectively. Soybean proteins have a high biological value and high fat content and unsaturated fatty acids (Leeson and Summers, 2005). The protein of soybean can be comparable to that of an animal protein sources such as meat and milk (Fabiyi and Hamidu, 2011). Metabolizable energy of 2800 to 3200k/cal/kg was reported in soybean (Leeson and Summers, 2005). Full fat soybean contains antinutritional factors that reduce the digestibility, bioavailability of nutrients and utilization of amino acids in monogasgtric and immature ruminants (Anderson and Hafermann *et al*., 1992, Maidala *et al*., 2011). The aim of the study is to compare the effects of full -fat soybean and non-fat soybean meals in broiler diets on their growth performance.

MATERIALS AND METHODS

Experimental location

The research was carried out at the Teaching, Research and Demonstration Farm, poultry units of the Department of Agricultural technology, Akanu Ibiam Federal Polytechnic,

Unwana, Ebonyi State, Nigeria. Unwana is located in the tropical rainforest zone of Nigeria and has air temperature of 21°C-32°C with the total annual rainfall exceeding 3500mm (Njoku *et al*., 2006).

Experimental materials

Weighing balance (Camry scale), day old broiler chicks, feed ingredients, poultry drinkers (chicks and adult plastic drinkers), poultry feeders (chicks and adult feeders), brooding guard, shovel /spade, brooms and packers, syringe, wood shaving (litter materials), feed bag (sac bag) and heat sources (Electric bulbs and charcoal).

Design and management of experimental birds

A total of one hundred and twenty (120) day old mixed sex chicks purchase from a reputable farm were used for this study, which lasted for eight weeks. The birds were reared on deep litter floor pens using wood shavings as litter material. Before the commencement of the experiment, the pens were thoroughly cleaned, washed and disinfected. The pen has good ventilation with concrete floors and zinc roofing sheet. The birds were brooded in the same pen for two weeks and randomly divided into two (2) groups of 60 birds per group. Each group (full fat soya beans and non-fat soya beans) was assigned to four treatments. Each treatment was replicated to three units with five (5) birds per replicate. Each birds were selected based on their average initial weight and each group of birds was allotted to each of the four treatments diets (1, 2, 3 and 4) in a complete randomized design (CRD). Feed and water were provided *ad libitum* to the birds throughout the experimental period. The birds were vaccinated against Newcastle disease in the first and third weeks using NDV lasota and Gumboro vaccine against infectious bursal disease in the 2nd and 4th weeks.

Experimental diet

The composition and proximate analysis of the experimental diets for full-fat and non-fat soybean fed to broilers starter and finisher phase are presented in tables 1 and 2. A total of four treatment diets were formulated (1, 2, 3 and 4) of broiler starter and finisher phases were formulated. Diet 1 was formulated to contain 50.02% maize (control diet) while diet 2, 3 and 4 were formulated by replacing the percentage of maize in diet 1 with 25%, 30% and 35% levels of soybean inclusion respectively. Diet T1 which serve as the control contained 17.74% of soybean (full-fat and non-fat soybean) while diet 2, 3 and 4 were formulated to contain 25, 30, and 35% inclusion levels of soybean meals with fish meal respectively. Both starter and finisher diet were of equal crude protein (21%) and caloric value of (2937.03kcal/ME/kg). All diets were formulated to meet the nutrients requirement of broilers.

Table 1. Ingredients and nutrient composition (%) of full fat soybean and Non fat soybean diets fed to broilers at starter and finisher phase (0 to 8 weeks)

	Full fat Soybeans				Non fat Soybeans			
Ingredients	**T1 (0%)**	**T2 (25%)**	**T3 (30%)**	**T4 (35%)**	**T1 (0%)**	**T2 (25%)**	**T3 (30%)**	**T4 (35%)**
Maize	50.02	50.02	50.02	50.02	50.02	50.02	50.02	50.02
Wheat Offal	5.56	5.56	5.56	5.56	5.56	5.56	5.56	5.56
Soybean	17.74	13.30	12.42	11.53	17.74	13.30	12.42	11.53
GNC	11.83	16.30	17.15	18.04	11.83	16.30	17.15	18.04
Fish meal	1.92	1.92	1.92	1.92	1.92	1.92	1.92	1.92
PKC	7.88	7.88	7.88	7.88	7.88	7.88	7.88	7.88
Born meal	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100	100	100

T: Treatment

Table 2. Proximate analysis

Ingredients	**T1**	**T2**	**T3**	**T4**
Crude protein	21.00	21.00	21.00	21.00
ME (kcal/kg)	2937.03	2965.63	2994.23	2978.08
Crude fibre	3.50	3.51	3.52	3.51
Ether extract	4.24	4.31	4.35	4.39
Calcium	0.18	0.20	0.22	0.24
Phosphorus	0.21	0.23	0.25	0.26

T: Treatment, Kcal/Kg: Kilo calories/Kilogram

Data collection

The birds were weighed at the beginning of the experiment and weekly thereafter using measuring scale in kilograms. Data collected on initial weight, finial weight, average daily weight gain, feed served and leftover were measured and recorded accordingly using measuring scale, feed conversion ratio (FCR), feed cost per kg and cost of feed per kg and weight gain (N/kg) were calculated using the formula below,

$$\text{Average weight gain} = \frac{\text{Final weight} - \text{initial weight}}{\text{Number of birds}}$$

$$\text{Average feed intake} = \frac{\text{Total feed consumed}}{\text{Number of birds}}$$

$$\text{Feed conversion rate} = \frac{\text{Average feed intake}}{\text{Average weight gain}}$$

Data analysis

Data collected was analyzed using GLM procedure of the statistics analysis system SAS (2004) statistical package as shown in the model below. Statistically significant means were compared using Duncan Multiple Range Test (DMRT) Duncan, (1955). Analysis of Variance (ANOVA) and tested for significant different at ($p<0.05$ and 0.01) level of probability.

Model for the analysis was design as illustrated below

$Y_{ij} = \mu + T_i + e_{ij}$

Where Y_{ij} is the record of observation

μ= population mean

T_i= Effect of i^{th} treatment groups (T1, T2, T3 and T4)

e_{ij}= Residual error

RESULTS AND DISCUSSION

The results of the experiment carried out on the assessment of weight gain on broiler fed full - fat soybean showed that the final body weight, weight gained, average daily weight gain, total feed intake per bird and feed conversion ratio (FCR) of the birds increases significantly ($p<0.01$) across the treatments table 3. The performance of the broiler chickens showed that there are no significant ($p>0.05$) differences in the initial weight gain. The final body weight in T3 (4005.00 g) was similar to T4 (4140.00 g), which were higher than treatment T1 (3510.00) and T2 (3600.00 g). The total weight gain had the highest value (4088.25 g) in T4 whereas the least total weight gain was obtained in T1 (3458.25g). Average daily weight gain of the broiler chickens had the highest value (73.20 g) in T4, compared to the value recorded in T1 (61.75 g), which was the lowest. Similar trend was observed in total feed intake and average feed intake of the broiler chickens. Feed conversion ratio was the highest in T2 (12.12 g) while the least was recorded in T4 (10.83 g). This suggests that the final weight gain, total weight gain, average weight gain, total feed intake and average feed intake of the broiler chickens fed full-fat soybeans meal at (0 - 8weeks) increases significantly across the treatments as their age advances. The results obtained in this study is similar to the findings of Omoikhoje *et al*. (2018) who reported significant increase broiler chickens fed treatment diet. The significant ($p<0.01$) increase in final weight across the treatment observed in this study is not in agreement with the findings of (Liener, 1994 and Hafermann *et al*., 1992) who reported reduced final weight as a result of poor feed intake. An increase in feed intake observed in this study for full fat soybean agreed with the report of (Iheukwumere *et al*., 2008, Abeke *et al*., 2011 and Ari *et al*., 2013) who reported that high feed intake in cooked soybean (67.23g) can be attributed to effective processing of cooked soybean. Similar to the results of this study, poor feed conversion ratio in cooked soybean and salt treated soybean is an indication of poor performance ((Iheukwumere *et al*., 2008). The high average feed intake (11862 g) and total feed intake (790.80 g) in full fat soybean can be attributed to various degree of elimination of antinutritional factor in full fat soybean, which is in line with the findings of Ari *et al*. (2013).

Table 3. Growth performance of broiler chickens fed full-fat soybeans meal at (0 - 8weeks)

Parameter	T1	T2	T3	T4
Initial weight (g)	51.75^{a}	51.75^{a}	51.75^{a}	51.75^{a}
Final weight(g)	3510.00^{c}	3600.00^{b}	4005.00^{a}	4140.00^{a}
Total Weight gain (g)	3458.25^{d}	3545.25^{c}	3953.25^{b}	4088.25^{a}
Average daily weight gain (g)	61.75^{d}	63.36^{c}	70.59^{b}	73.20^{a}
Total feed intake (g)	11078^{d}	11526^{c}	11666^{b}	11862^{a}
Average feed intake (g/bird)	738.53^{d}	768.40^{c}	777.73^{b}	790.80^{a}

Feed conversion ratio	11.96[b]	12.12[a]	11.02[c]	10.83[d]
Mortality rate	0.00	0.00	0.00	0.00

T: Treatment, g: gram

The growth performance of broiler chickens fed Non-fat Soybean meal at (0 - 8weeks) are revealed in table 4. The growth performance of broiler chickens fed Non-fat Soybean meal significantly ($p<0.01$) affected final weight, total weight gain, average daily weight gain and feed conversion ratio whereas the total feed intake and average feed intake were however not significantly ($p>0.05$) affected. The broiler chickens fed in T1 (4035.00g), T2 (4260.00 g) and T4 (4130.00) showed similar values for final weight, which were higher than the value obtained in T3 (3810.00). The total weight gain recorded higher values in T2 (4208.10 g) and T4 (4078.10 g) compared to those in T1 (3983.10g) and T3 (3758.00 g). Similar trend was observed for average daily weight gain where T1 (71.13g), T2 (75.15 g) and T4 (72.82) were higher than the value recorded in T3 (67.11 g). Feed conversion ratio showed that T3 (1.74g) was the highest, followed by the values obtained in T1 (1.64 g) and T4 (1.61 g), which were similar whereas T1 (1.55 g) had the least value. The significant increase in some body parameters of the broiler chickens fed Non-fat Soybean meal at (0 - 8weeks) among treatments might be attributable to the fact that the broiler chickens were able to convert feeds efficiently among themselves. An increase in feed conversion ratio will lead to an increase in weight gain. Similar to the report of this study, the overall performance of broilers in feed efficiency was significantly affected (Maidala *et al*., 2019). Birds fed on raw soybean, sprouted soybean and salt treated soybean seeds had poor feed efficiency while birds on cooked soybean seeds had a better feed efficiency (0.46) and this indicate poor utilization (Iheukwumere *et al*., 2008).

Table 4. Growth performance of broiler chickens fed Non-fat Soybean meal at (0 - 8weeks)

Parameter	**T1**	**T2**	**T3**	**T4**
Initial weight (g)	51.90	51.90	51.90	51.90
Final weight(g)	4035 [a]	4260 [a]	3810 [b]	4130 [a]
Total Weight gain (g)	3983.10 [b]	4208.10 [a]	3758.10 [b]	4078.10 [a]
Average daily weight gain (g)	71.13[a]	75.15[a]	67.11[b]	72.82[a]
Total feed intake (g)	6562.5[a]	6562.5[a]	6562.5[a]	6562.5[a]
Average feed intake (g/bird)	437.5[a]	437.5[a]	437.5[a]	437.5[a]
Feed conversion ratio	1.64[b]	1.55[c]	1.74[a]	1.61[b]
Mortality rate	1	1	1	1

T: Treatment, g: gram

Cost benefit analysis of full-fat and non-fat soybean fed to broilers

The cost benefit of broilers fed full-fat and non-full fat soybean meals at (0 - 8 weeks) are shown in tables 5 and 6. The cost benefit of the broiler fed full - fat soybean, the soybean meal showed that the cost of producing a cost of feed per kg weight gain had significant ($p<0.01$) difference across the treatments for full fat soybeans. The cost per kg, cost of feed per bag and feed per 100kg showed non-significant price variation ($p>0.05$) across the treatments. The significant increase in cost of feed per kg might be as the cost price per kg in T3 (47270.75±0.00) N/kg and T4 (7519.06±0.00) N/kg were similar and higher, followed by T2 (6525.84±0.00) N/kg whereas the least cost price per kg was observed in T1 (6360.29±0.00) might be as a result of an increase in feed consumption and utilization of the broiler chickens across the treatments. Similar pattern for cost per kg was also observed in table 6, for non-fat soybean meals (0 - 8 weeks). Treatment T4 (13131.64±0.01) and T2 (13601.84±0.01) N/kg had similar and higher cost per kg compared to T1 (12874.58±0.01) and T3 (12147.31±0.01) N/kg cost per kg, which were also similar. The cost of feed per kg obtained in this study were higher than (307.09) N/kg total feed cost of raw soy bean reported by Maidala *et al*. (2019). The differences observed in the results reported might be attributed to difference in feed constituent or composition. An increase in unit feed cost in full fat soybean could be attributed to increase in additional cost of processing and other feed ingredients. Ayanwale (2006) reported additional cost in salt treated and other alkaline treated soybean. An increase in the cost of feed per kg for full fat soybean across the treatment might be as a result of high feed intake of the broiler birds.

Table 5. Cost benefit of broilers fed full-fat soybean meals (0 - 8 weeks)

Treatments	T1	T2	T3	T4
Cost per kg (N/kg)	183.93±0.00 [a]	183.93±0.00 [a]	183.93±0.00 [a]	183.93±0.00 [a]
Cost of feed per kg weight gain	6360.29±0.00 [c]	6525.84±0.00 [b]	7270.75±0.00 [a]	7519.06±0.00 [a]
Cost of feed per bag (N/25kg)	4598.22±0.00 [a]	4598.22±0.00 [a]	4598.22±0.00 [a]	4598.22±0.00 [a]
Feed cost per 100kg (N/100kg)	18392.88±0.00 [a]	18392.88±0.00 [a]	18392.88±0.00 [a]	18392.88±0.00 [a]

T: Treatment, N/Kg: Naira/Kilogram

Table 6. Cost benefit analysis of broiler birds fed non-fat soybean meals (0 - 8 weeks)

Parameter	T1	T2	T3	T4
Cost per kg(N/kg)	323.23±0.01[a]	323.23±0.01 [a]	323.23±0.01[a]	323.23±0.01[a]
Cost of feed per kg weight gain	12874.57±0.01[b]	13601.84±0.01[a]	12147.31±0.01[b]	13131.64±0.01[a]
Cost of feed per bag(N/25kg)	8080.75 ±0.01[a]	8080.75 ±0.01[a]	8080.75±0.01[a]	8080.75±0.01[a]
Feed cost per 100kg(N/100kg)	32323±0.01[a]	32323±0.01[a]	32323±0.01[a]	32323±0.01[a]

T: Treatment, N/Kg: Naira/Kilogram

CONCLUSIONS AND RECOMMENDATIONS

The growth performance of broiler chickens fed full fat soybean increases significantly across the treatment as their age advances compared to those fed with non-fat soybean meal. The cost effective of feeding broilers with full fat soybeans is lesser than the cost of feeding broiler with non-fat soybean. The full fat soybean and non-fat soybean meal should be included in a higher quantity but not above the ingredients list in formulating broiler finished feed. Further studies should be carried out to find other possible ways to influence the real performance of broiler on full fat and non - fat soybean meal so as to increase maximum performance.

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