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COMPARATIVE STUDY BETWEEN LOCAL AND IMPORTED CONCENTRATES ON THE PERFORMANCE OF BROILER CHICKS

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ABSTRACT

This study was carried out to evaluate the effect of feeding locally-made concentrate and imported concentrate on the performance of broiler chicks. A total number of 120 broiler chicks (Hubber) were used. Birds were distributed randomly into 12 pens (10/pen) as replicates in completely randomized design. The two experimental diets were formulated to be iso-caloric and iso-nitrogenous. Feed intake, feed conversion ratio, body weight, and weight gain were measured weekly, while the carcass weight, dressing percentage, and weight of the internal organs (liver, spleen, heart and abdominal fat) were determined at the end of the experimental period. The results showed that the replacement of local concentrate with the imported concentrate significantly decreased ($P \leq 0.01$) feed intake which was found to be 2446.1(g) and 4116.2 (g) respectively. Life weight and carcass weight were also reduced ($P \leq 0.05$) by using local concentrate. The replacement of locally made concentrate with the imported concentrate resulted in better (FCR) which was found to be 2.14 and 2.64 respectively, while the dressing % was not affected. A higher ratio ($P \leq 0.05$) of the internal organs was found when using local the concentrate at the expense of the imported concentrate. The total cost of production of a diet congaing local concentrate was found to be 10.63 comparing to 14.31 for chicks fed diet containing imported concentrate. This results proved that it is possible to formulate a successful local concentrates which was nutritionally optimal and economically feasible for feeding broiler chicks.

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INTRODUCTION

Feeding cost amounts to about 70% or more in the poultry industry. Optimal rations should satisfy the nutrient requirements of birds and be economically feasible. In broiler's ration grains constitute 50–60% of the ration together with 15–25% plant protein supplements such as soybean meal groundnut cake, and sesame cakes. Grains are rich in energy but deficient in protein. Today the poultry industry, in Sudan facing a feed crisis because of the high cost of production which is attributed to the price of cost of feed ingredients mainly imported concentrates Mukhtar *et al.,* (2010). Plant protein concentrates although rich in protein but deficient in essential amino acids such as lysine methionine, tryptophan, and others McDonald, *et al.*, (1981). The deficiency in some of the essential amino acids and the amino acids imbalances all result in poor growth. To overcome these imbalances in amino acid, usually, commercial broiler concentrates, containing animal proteins, synthetic essential amino acids, vitamins, and trace minerals are added to the basal local ration ingredients containing grains and plant proteins.

Usually, these commercially imported broiler concentrates are added at a level of about 5% of the total ration. They promote good and efficient growth of broilers. Now there were many attempts from by nutritionists to replace the imported concentrate with different locally available protein sources Omer (2001). In Sudan Huge quantities of fish offal, estimated as more than ten thousand tons, could be produced. Good local concentrate mixtures can be formulated from local plant proteins (sesame, groundnut cake), supplemented with animal protein (fish), imported synthetic essential amino acids (such as lysine and methionine) and vitamin premixes. The objective of this study is to evaluate the complete substitution of imported concentrate with locally produced one on the performance of broiler chicks and cost of production.

MATERIAL AND METHODS

Experimental House: The experiment was carried out in an open sided poultry house (15 sq. M), with a height of three meters, corrugated iron sheet roof. The house extended east-west. It was

divided into 12 pens one square meters. Each pen was divided into units hosting (10) chicks. Each unit was provided with a feeder and rounded drinker. Natural light during the day and artificial light at the evenings.

Management and Medication: Chicks are weighted and distributed randomly into two treatments A and B, each treatment with 6 replicates, (10 birds/ replicate). with average of 41(g) initial weight. The experiment lasted for 42 days. On arrival, chicks were unpacked inside the deep litter experimental house, during this period they received a dose vaccine of in drinking water and sugar solution 5% concentration to reduce transportation stress. A commercial pre-starter diet was offered to the birds for seven days as an adaptation period. Birds were visually inspected for health and vigor, weak and under-weight chicks were excluded from the experiments. Based on a local vaccination program Chicks in all groups were vaccinated against Newcastle disease and infections Bronchitis were done in the hatchery, ND+IB spray at One day old and vaccinated against Gumboroo disease (IBD) 78 at 12day old. Vitamin ADEs were used in drinking water. The dosage was then repeated at 21 and 28 days of age for Newcastle disease and Gamburoo, respectively.

Experimental Diets: The diets were formulated from the local feed ingredients commonly used for poultry feeding in Sudan and an imported super-concentrate was incorporated in all the diets at an inclusion rate of 5%. Both groups will receive the basal diet that contains sorghum and ground cake. Group A will receive a basal diet with Local concentrate which will be the control. and group B will receive basal diet with Imported concentrate. The calculated ingredients percent compositions and the chemical analysis of the local concentrate was shown in table (1). The composition calculated and chemical analysis of the diet offered to the chicks containing local and imported concentrate were illustrated in table (2).

Table 1. Composition, calculated and chemical analysis of the Local Concentrate

Ingredients	Percent%
Fish meal	52%
Ground nut cake	18%
Seamsm cake	3.5%
Bone meal	1%
Vitamin Premixes	10%
Lysine	9%
Methionine	3%
Organic Acid	3%
Salt	0.5%
Total	100
Calculated chemical analysis	
DM	95.28
CP	33.69
CF	5.48
EE	3.78
ASH	6.29
NFE	46.03

Table 2. Composition, calculate and chemical analysis of the diet containing local and imported concentrate

Ingredients	Diet A (local Concentrate)	Diet B (Imported Concentrate)
Sorghum	64%	64%
Ground nut cake	28%	28%
Concentrate	5%	5%
Limestone	1.5%	1.5%
Salt	0.3%	0.3%
Dai calcium phosphate	0.5%	0.5%
Vitamin permix	0.2%	0.2%
Laysine	0.2%	0.2%
Coline	0.1%	0.1%
Anti Toxin	0.2%	0.2%
Total	100%	100%

Parameters Measurement: Throughout the experimental periods the birds, house equipment, health, lighting, watering, feeding and other similar management activities were under observation and control. Any abnormal signs observed, were corrected and recorded. Performance data were collected daily or weekly throughout the experimental periods which included:

Feed Intake: The feed intake was determined by weighing feed on weekly basis added to the feeding troughs in two dosages. At the end of each week, the residual was reweighed and recorded for estimation of average feed intake on grams per bird per (g/b/d) bases.

Body Weight and Weight Gain: Body weight was measured once a week and the weekly weight gain in each age interval was calculated for each chick in gram/ bird bases.

Feed Conversion Ratio (FCR): The feed conversion ratio was obtained by dividing the total grams of feed consumed during the experimental period by the number of grams of weight gain (g feed/ g gain).

Statistical analysis: Statistical Analysis System (SAS) software program version (9.1) used for analysis of variance for data using t test procedure and accedes significantly when ($P<0.05$).

RESULTS AND DISCUSSION

Feed intake: The differences in feed intake as a result of feeding either locally-made concentrate or imported concentrate is shown in table (4.1). A highly significant difference was obtained between treatments. In all weeks the highest feed intake was recorded for the birds fed imported concentrate. This result is likely to be related to better availability of nutrients from the protein of the imported concentrate in the digestive tract of broiler chickens.

Table 4.1. Effect of Feeding local or Imported concentrate on feed Intake (gram)

Weeks	Treatments		Sig
	A	B	
W1	100.00±0.00^{a}	100±0.00^{a}	-
W2	145.00±3.99^{b}	181.50±2.77^{a}	0.000
W3	245.00±3.99^{b}	281.50±2.77^{a}	0.000
W4	202.85±11.95^{b}	491.08±2.48^{a}	0.000
W5	443.50±20.97^{b}	579.92±2.80^{a}	0.001
W6	499.17±12.02^{b}	698.58±13.94^{a}	0.000

Different letters (a and b) on mean in row indicates significance different at($P<0.05$) whereas same latter no significant.A: Local concentrates, B: Imported concentrates

Table 4.2. Effect of Feeding local or Imported concentrate on Body weight (gram)

Weeks	Treatments		Sig
	A	B	
W1	124.92±0.55^{a}	124.00±0.53^{a}	0.260
W2	186.75±3.76^{b}	223.33±4.72^{a}	0.000
W3	422.5±15.8^{a}	413.5±14.4^{a}	0.683
W4	491.5±7.84^{b}	684.67±4.41^{a}	0.000
W5	739.67±28.8^{b}	1064.8±35.7^{a}	0.000
W6	978.33±29.1^{b}	1354.8±37.9^{a}	0.000

Different letters (a and b) on mean in row indicates significance different at ($P<0.05$) whereas same latter no significant. A: Local concentrates, B: Imported concentrates, B: Imported concentrates.

In addition to that, the amino acid balance and mineral concentration which was found in the imported concentrate allow for it to be more palatable than the locally made concentrate. This result was supported by khalid and Elhag (2015) who stated that chicks fed on a diet containing local concentrate consumed less total feed (3324 g), when compared to the chicks fed on a diet with imported concentrate (3569

g). same results were obtained by Dousa et al (2011) who reported that the broiler chicks fed diets containing plant concentrates significantly (p<0.05) reduced feed intake, they attributed this to the palatability of those diets which may be affected by tannins in leguminous grain.

Table 4.3. Effect of Feeding local or Imported concentrate on Body weight (gram)

Weeks	Treatments		Sig
	A	B	
W1	79.917±0.55[a]	79.00±0.53[a]	0.260
W2	61.83±3.79[b]	99.33±4.84[a]	0.000
W3	235.75±17.60[a]	190.17±13.79[a]	0.068
W4	69.00±14.03[b]	271.17±14.25[a]	0.000
W5	248.17±25.49[b]	380.08±36.27[a]	0.013
W6	238.67±16.08[a]	290.08±43.67[a]	0.295

Different letters (a and b) on mean in row indicates significance different at (P<0.05) whereas same latter no significant. A: Local concentrates, B: Imported concentrates, B: Imported concentrates.

Table 4.4. Effect of Feeding local or Imported concentrate on Feed Conversion ratio of the Broiler Chicks

Weeks	Treatments		Sig
	A	B	
W1	1.25±0.00[a]	1.26±0.00[a]	0.308
W2	0.42±0.01[b]	0.54±0.02[a]	0.005
W3	1.07±0.08[b]	1.52±0.10[a]	0.008
W4	3.97±1.20[a]	1.83±0.09[a]	0.107
W5	1.84±0.13[a]	1.59±0.13[a]	0.223
W6	2.14±0.16[a]	2.64±0.33[a]	0.212

Different letters (a and b) on mean in row indicates significance different at (P<0.05) whereas same latter no significant. A: Local concentrates, B: Imported concentrates, B: Imported concentrates.

Table 4.6. Internal Organ Percentage from Carcass weight as Affected by local or Imported concentrate

Traits	Treatments		Sig
	A	B	
Liver %	4.48±0.14[a]	4.31±0.23[a]	0.558
Gizzard %	4.43±0.37[a]	3.99±0.23[a]	0.320
Heart %	0.76±0.04[a]	0.75±0.04[a]	0.952
S intestine %	11.53±0.50[a]	10.44±0.51[a]	0.146
Fat %	1.54±0.13[a]	1.45±0.16[a]	0.673
Spleen %	0.47±0.02[a]	0.39±0.01[b]	0.025
Dressing %	67.15±1.33[a]	67.79±0.58[a]	0.662

(a and b) letter on mean in row indicates to significance different at(P<0.05) whereas same latter no significant.
A: Local concentrates.
B: Imported concentrates.

In the same line, Mukhtar *et al.* (2014) revealed that the chicks fed a diet containing 5% local concentrate consumed significantly (P<0.05) low feed compared with those fed on 5% imported concentrate. The results obtained in this study were not on the line of Nana et al (2019) who illustrated that, replacing fish meal with either soybean meal or poultry by-product meal in broiler diets significantly ($P \leq 0.05$) influenced feed intake. Feeding birds with soybean diets improved ($P \leq 0.05$) feed intake throughout the study as compared to birds fed fish meal diets

Table 4.7. Effect of feeding local or Imported concentrate on overall

Traits	Treatments		Sig
	A	B	
Feed intake(g)	2446.13[b] ±32.5	4116.21[a] ±36.7	0.000
Life weigh	1143.3±30.50[b]	1553.3[a] ±30.54	0.000
Carcass weight	770.00[b] ±30.99	1053.1[a] ±22.39	0.004
Feed conversion ratio	2.14±0.16[b]	2.64[a] ±0.33	0.042
Dressing %	67.15[a] ±1.33	67.79[a] ±0.58	0.56

Body weight: The effect of feeding either local or imported concentrate on body weight of the broiler chicks is shown in table (4.2). A highly significant difference (P≤0.01) was recorded between treatments. The imported concentrate secured the highest body weight in all six weeks except week one. This result may be attributed to the lower feed consumption thus leading to a deficiency in essential amino acids, in addition to imbalances of these amino acids in plant protein compared with amino acids in the control group which contributed by animal protein, this feature could also be attributed to the influence of a high concentration of anti-nutritional factors as phytic acid inhibits the absorption of calcium and phosphorus through the small intestine. This result is similar to the result obtained by Flaih et al., (1998) who stated that final body weight at the point of slaughter significantly decreased (p<0.05) decreased by increasing level of plant concentrate. Moreover, these results may be comparable to the results obtained by khalid and Elhag (2015) who found that body weights were similar and not significantly different in the chicken fed the diet with the local concentrate compared to the imported concentrate. Also, comparable results were obtained by Al-Mhsenawi et al. (2012) who noted that there was no significant difference of the use of local manufactured protein concentrate on the carcass traits (carcass weight, dressing percentage, relative weight of main cuts, and abdominal fat). Moreover, Sahraei *et al.* (2012), indicated that there were no significant differences in the carcasses weights and the relative weight of the main cuts (breast and thigh) when used the poultry slaughterhouse waste powder as a source of protein in broiler diets. Contradicting results were obtained by Mukhtar et al (2014) how found that Chicks with diets containing 5% or 7.5% local concentrate had significantly (P<0.05) higher body weight and average body weight gain, in addition to that, Nana et al (2019) reported that weekly mean live weights of broilers increased gradually due to gradual increase of protein percentage in the diets.

Wight gain: Table (4.3) noted the effect of feeding local or imported concentrate on the weight of the broiler chicks. A highly significant difference (P≤0.01) was recorded between treatments. non-significant differences were found in weeks one and three while significant differences were obtained in weeks two, four, five, and six. Almost in all weeks the chicks fed imported concentrates outnumbered the chicks fed local concentrate except in week three. The high weight gain found in this study could be attributed to the high feed intake which was found in the same weeks. This result is similar to the result obtained by Flaih *et al*., (1998) who stated that the weight gains at the point of slaughter significantly decreased (p<0.05) decreased by increasing the level of plant concentrate. Same results were also observed by Ahmed and Islam (2018) who found that the different live weight gain among different treatment groups was highly significant (P<0.01). Contrary, in a study conducted in Cameron Teguia and Beynen (2015) noted that the replacement of meat meal in the starter diet of broiler chickens by meals of common black bean (*Phaseolus vulgaris*), Bambara groundnut (*Voandzeiasubterranean*) and cowpea (*Vignaung uiculata*) induced deteriorating effects on growth rate.

Feed Conversion Ratio (FCR): The data on the feed conversion ratio (FCR) of broiler chicks as affected by feeding local or imported concentrate is illustrated in table (4.4). The results showed that there was no significant difference for FCR among all weeks except in weeks two and three which showed a significant difference (P<0.05). Almost for all weeks locally made concentrate had a better value of feed conversion ratio, which ranged between 0.42 in week two to 2.14 in week six. The low value of FCR of birds fed local concentrate may be a reflection of poor feed intake noticed in this study. This result was comparable to that obtained by Gonzalez (1986). Wherein, Feed conversion ratio was 2.6 and 2.8 for the local and control group and changes in feed conversion ratio in chicks relate mainly to the type of diet rather than the breed, age and sex. Moreover, Ahmed and Islam (2018) reported that the effect of increasing the level of slaughterhouse residues in broiler feed had a significant (P<0.01) difference. There was gradual decrease of FCR in treated group.

Table 4.8. Cost of production (SDG) of 1 kg live weight of broiler chicks fed on the experimental diets

Items	A (Local Concentrate)	B (Improted Concentrate)
Feed intake/g/ bird	2446.13 [b] ±32.5	4116.21 [a] ±36.7
Life weigh(g)	1143.3±30.50 [b]	1553.3 [a] ±30.54
Feed cost/ kg(g)	4.97	5.4
Carcass weight (g)	770.00±30.99	1053.1±22039
Cost of production(kg) life weight)	10.63	14.31
Cost of production(kg) carcass weight	7.1221	9.5877

Contradicting results were obtained by Ene-Obong, (1995) who found that during the grower period the feed conversion ratio FCR was poor ($p<0.05$) for diets contained plant concentrate in comparison to the imported concentrate, this result may be due to an imbalance of essential amino acids that affected the protein synthesis.

Internal Organs: The weight and the percent of the internal organs are shown in tables (4.5) and (4.6) respectively. The weight of the internal organs as illustrated in table (4.5) showed significant differences ($P\leq0.05$) between treatments except for the abdominal fat. The chicks fed feed diet containing Imported concentrate had a higher weight of the internal organs. While in table (4.6) noted the percentage of the internal organs from the hot carcass showed non-significant differences, except for spleen. Although it does not reach the level of significance, the birds fed locally made concentrate outnumbered the birds fed imported concentrate in terms of the percent of the internal organs from the hot carcass. Comparable results were obtained by Ahmed and Islam (2018) who indicated that the abdominal fat, liver, gizzard, heart, spleen, and proventriculus weights were also slight increased under increased addition of SHR in feed. However, statistically, the differences in the abdominal fat, liver, gizzard, heart, spleen and proventriculus weight under different treatment were significant ($P<0.01$).

Overall performance of broiler chicks as affected by feeding of local or imported concentrate: Data on the overall performance of the effect of feeding local or Imported concentrate is noted in table (4.7). It was evidence that the incorporation of local concentrate at the expense of imported concentrate led to a decrease in feed intake and hence reflected on carcass weight and weight gain. The data also showed that dressing percentage was not affected significantly by treatments. These results were consistent by that obtained by Gism Alla (2015) who stated that feeding chicks with locally produce fishmeal tended to decrease feed intake with increased of fish meal dietary levels, this reduction was reflected in terms of reduced body weight and weight gain. Moreover, the results obtained in line with that obtained by Scott *et al*. (1976) who reported that when using fish meal as the sole source of protein, chick's growth was poorer. Also, it may be due to the fact that the nutrient composition of fish meal can vary depending on the type and species of fish used, the freshness of the fish before processing and the processing and preparation methods (NRC,1994), in addition the quality of fish meal is quite uncertain due to the use of different processing technologies in its production and it is often contaminated with other ingredients such as sands, sawdust and fish bones and the use of chemicals for preservation often caused toxicity to poultry birds (Khatun et al. 2003; Khatun *et al*, 2005; Karimi. 2006).

Economic appraisal: The **c**ost of one kg life weight and one kg carcass weight in a diet containing local or imported concentrate is shown in table (4.8). The total cost of production of a diet congaing local concentrate was found to be 10.63 comparing to 14.31 for chicks fed diet containing imported concentrate with total reduction of 25.7 %. These results clearly demonstrated that local concentrate can successfully replace the imported concentrate in the diet of broiler chicks. These results came in the line with the results obtained by (khalid and Elhag, 2015) who demonstrated that the cost of the diet containing local concentrate per kg was 0.764 SDG compared to the imported concentrate which was 0.856 SDG and cost of one kg live weight was 1.985 versus 2.321 SDG, respectively chicks with a reduction in the cost of feed by 11%, and the cost of one kg meat by 14.5. similar results were obtained by Dousa *et al.,* (2011). They reported that the lowest feed cost at the point of slaughter was observed on birds fed 5% plant concentrate when compared to control group. Moreover, Mukhtar *et al*., (2014) illustrated that Chicks fed with a diet containing local concentrate (5% and 7.5%) attained more revenue and profit compared to chicks fed with imported concentrate although, chicks fed with 5% local concentrate observed the highest revenue and profit. This results also are consistent with that reported by Sheppard (2002) and Teguia and Beynen (2015) who illustrated that the cost of producing broiler meat using a diet containing maggot meal was on average lower than when the diet contained fish meal.

CONCLUSION

- Complete replacement of imported concentrate with local concentrate resulted in lower feed intake and poorer growth, but better feed conversion ratio and economic value.
- local broiler concentrates can be made from local feed ingredients, supplemented with fish, vitamins, and trace mineral premixes at relatively lower cost and hard currency saving.

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