FEASIBILITY OF THE INTENSIVE BROILER CHICKEN FEEDING REGIME FOR SOME IMPROVED TROPICALLY ADAPTED BREEDS (iTABs) OF CHICKENS IN SOUTH EAST NIGERIA

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ABSTRACT

This study evaluated the feasibility of using the intensive broiler chicken feeding regime for some improved tropically adapted breeds (iTABs) of chicken by comparing the performance of two iTABs chickens, Sasso and Noiler with Abor Acre strain of broiler chicken. Twenty-one (21), seven-day old Abor acre broiler chickens, Sasso and Noiler each were divided into three replicates of 7 chicks on group weight equalization basis. The birds were randomly assigned to a typical broiler chicken starter diet for four weeks and finisher diet for another 4 weeks in a completely randomized design (CRD) experiment. Data were collected on feed intake, weekly body weight gain, mortality, and feed cost (₦/kg). These were used to calculate feed conversion ratio (FCR), cost of feed consumed (₦), feed cost per kg body weight gain (₦) and protein efficiency ratio (PER). Means of data obtained were analysed using Analysis of variance (ANOVA) and descriptive statistics, mainly means and percentages. Differences were separated using the Least Significant Difference (LSD). Results obtained indicated that similar ($p>0.05$) body weight gain, feed conversion ratio, protein efficiency ratio and feed cost per kg body weight gain were obtained for Abor acre broiler and Sasso chickens. Feed intake and cost of feed consumed were significantly ($p<0.05$) higher for Abor acre broiler chickens than other groups. It cost 63.45% and 25.84% more to produce a kg of Noiler and Sasso chicken, respectively than Abor acre broiler chicken. The haematological and serum biochemical indices as well as dressed and organ weights were generally similar ($p >0.05$) among the groups. It is therefore, recommended that the intensive broiler chicken feeding regime can only be contemplated for Sasso and Noiler chickens within the first 9 weeks of age where feed cost is extremely low. However, Sasso chicken could be offered broiler chicken feed with relatively better results.

Keywords: Broiler chicken, feeding regime, improved, tropically adapted breeds, iTABs

INTRODUCTION

In Nigeria, poultry production, is significantly contributing to animal protein and farmers keep several kinds of birds for different purposes, mostly for meat and egg production (Ajala *et al.,* 2021). Broilers on the other hand are kept mainly for meat production while pullets are kept for egg production. Cockerels and pullets can also serve as meat source but cannot be compared to broilers in terms of production time and quantity of meat produced. Indigenous breeds of poultry still contribute meaningfully to poultry meat and egg production and consumption in most developing countries, where they make up significant percentage of the total poultry population. All over the developing world, low-input, low output poultry-husbandry systems are an integral component of the livelihood of most rural, peri-urban, and some urban households and are likely to continue to meet this role for the foreseeable future (Pymi *et al*., 2006; Besbes, 2009; Akinola, and Essien, 2011). With the increasing population in Nigeria, there is the need to fast track the process of poultry production especially for meat and egg with a low-cost feed input breed and increased output to meet the market demand and protein requirement of the rapidly growing population.

A couple of years ago, the African Chicken Genetic Gains (ACGG) project, a livelihood intervention programme funded by the Bill and Belinda Gates Foundation introduced and tested six strains of chicken in some parts of Nigeria namely, Sasso, Noiler, FUNAAB Alpha, Shika brown, Fulani Ecotype and Kuroiler (ACGG, 2016; Alabi *et al*, 2020). These chicken strains referred to as improved tropically adapted breeds (iTABs) were mostly dual purpose and capable of thriving under different production systems (ACGG, 2016; Bamidele, 2016; Alabi *et al*, 2020, Bamidele *et al*, 2020). Sasso was reported to be the best in body weight gain and most preferable in the Southeast part of Nigeria. However, Noiler appears to be most prevalent due to its sustained marketing by a commercial producer (Yakubu *et al.*, 2019). The performance of iTABs as a meat type chicken under intensive broiler type feeding regime has not been covered in the available reports particularly, in Southeast Nigeria. The cost benefit or otherwise of the best performing Sasso and, predominant Noiler has not also been established under intensive broiler feeding regime in Southeast Nigeria**.**

Feeding is the most important aspect of chicken rearing and adequate nutrition can ensure maximum growth and optimum returns on investment. The improved tropically adapted breeds (iTABs) of chicken have so far been raised under varied management conditions in view of their slower growth and adaptation to low-input systems (Bamidele, 2016; Ganpule, 2018). It is imperative therefore, that its genetic potential be tested on a highly intensive

feeding regime to determine its performance in terms of growth and economic returns as used for conventional broiler chickens. This study therefore evaluated the performance of Sasso and Noiler strains of improved tropically adapted chickens under intensive broiler feeding regime; determined the cost benefit or otherwise of raising Sasso and Noiler chicken under the intensive broiler feeding regime; determined some hematological and serum biochemical indices of improved tropically adapted breeds of chicken under intensive broiler chicken feeding regime and determined the carcass and internal organ weights of Noiler and Sasso chicken relative to Abor acre broiler chickens.

MATERIALS AND METHOD

Experimental site: This study was carried out in the Poultry Unit of the School of Agriculture and Agricultural Technology (SAAT) Teaching and Research Farm, Federal University of Technology, Owerri. Owerri is the capital of Imo state, Nigeria and is located in the Southeast agro ecological zone in the rainforest belt of Nigeria. Imo state lies between Latitude 5^0 4′ and 6^0 3′ N and longitude $6^0$15′ and 7^0 34′ E. The agro ecological characteristic of the area is as reported by Okoli (2003). The mean annual rainfall, temperature, and relative humidity of 2500 mm, 26.5-27.0 °C and 70 - 80 %, respectively. The duration of the dry season (number of months with less than 65 mm of rainfall) is 3 months and the annual evapo-transpiration is 1450 mm. The soil is sandy loan with an average pH of 5.5.

Sources of experimental birds and other materials: The broiler chicken feed materials were procured from Ceekings Farm and Feed Mills Ltd., Egbu, Owerri. Day -old Abor acre broiler chicks which served as the control and Noiler were procured from Amo Farm Sieberer Hatchery Nigeria Ltd, Owerri while Sasso were obtained from the stocks donated to the Department of Animal Science and Technology, Federal University of Technology, Owerri by the African Chicken Genetic Gains (ACGG) Project.

Experimental diets: Standard experimental starter and finisher broiler chicken diets were formulated using the following ingredients: Maize, soya bean meal, palm kernel cake, fish meal, bone meal, oyster shell, common salt, vitamin and mineral premises for starter and finisher broilers, lysine and Methionine. The gross and calculated compositions of the feeds are presented on table 1.

Table 1: Composition of experimental broiler chicken diets

Ingredients	Broiler chicken diets (%)	
	Starter diet	**Finisher diet**
Maize	50.00	60.00
Soybean meal	32.00	24.00
Palm kernel cake (PKC)	10.00	8.00
Fish meal	4.00	4.00
Bone meal	2.00	2.00
Oyster shell	1.00	1.00
Common Salt	0.25	0.25
Vitamin/Mineral premix*	0.25	0.25
Lysine	0.25	0.25
Methionine	0.25	0.25
Total	**100.00**	**100.00**
Calculated nutrient composition of experimental diets		
Metabolisable Energy (Kcal/kg)	2875.00	2947.08
Crude protein	23.28	20.00
Calcium	0.22	0.20
Phosphorus	0.49	0.46
Lysine	1.23	1.03
Methionine	0.25	0.26

*Starter and finisher broiler premixes contained the following per kg: Vitamin A, 500000, Vitamin D3, 100000, Vitamin E, 1600, Vitamin K3, 80, Vitamin B1 120, Vitamin B2, 220, Niacin, 2200, Calcium pantomenate, 460, Vitamin B6, 200, Vitamin B12, 1, Choline Chloride, 20000, Folic Acid, 40, Biotin, 3.2, Manganese, 4800, Iron, 4000, Zinc, 3200, Copper, 340, Iodine, 60, Cobalt, 12, Selenium, 4.8, Anti-Oxidant 4800.

Experimental design and management birds: One hundred and twenty-one (121), day old Abor acre broiler chickens, Sasso and Noiler chickens were raised for one week together on the formulated starter broiler chicken diet. Brooding was achieved using charcoal stoves and lanterns in open sided poultry house covered with polythene. At seven days of age, a total of 63 birds made up of twenty one Abor acre broiler chickens, Sasso and Noiler chickens each were selected. Each group was replicated three times with seven chicks per replicate on group weight equalization basis. Each replicate was placed in an experimental brooder unit measuring 1 m x 1 m on deep litter. The Abor acre broiler chicken group served as the control while Noiler group and Sasso group made up the test groups. Each group was

randomly assigned to the standard experimental starter broiler chicken diet in a completely randomized design (CRD) experiment. The starter phase lasted 28 days. At the end of the starter phase the feed was changed to finisher broiler chicken diets. This phase also lasted 28 days. Feed and water were offered *ad libitum* throughout the duration of the experiment. Routine medication and vaccination schedules were observed as recommended for broiler chicken in South east Nigeria.

Haematological and Serum biochemical indices: Nine birds (3 birds per treatment) were selected at the end of the feeding trial and bled by the jugular vein using a needle with syringe. The blood was carefully drained into two differently labelled bottles for haematological and serum metabolites investigation. The blood samples for haematological parameters were collected into bottles pre-treated with Ethylene Diamine Tetra Acetic Acid (EDTA), an anticoagulant. Blood samples for biochemical indices were also collected into another sample bottles containing no EDTA.

Dressed and internal organ weights: At the end of the feeding trial when the birds were nine weeks old, three birds, one each per replicate whose weight were closest to the average in each group were selected. The selected birds were starved of feed overnight after which their live weight was taken and recorded. The birds were slaughtered and thoroughly bled, scalded, de-feathered and eviscerated. The eviscerated and dressed weights were also taken. The internal organs such as; gizzard (full), gizzard (empty), liver, spleen, heart and abdominal fat were also weighed and recorded.

Data collection and analysis: Means of data generated were subjected to analysis of variance (ANOVA) and where significant treatment effects are detected, means were compared using Least Significant Difference (LSD)**.** The SAS application software was used for this statistical analysis (SAS, 2016).

RESULTS AND DISCUSSION

The results of the study are presented in the tables 2, 3 4, 5 and figures 1 and 2.

Performance of iTABs chickens on intensive broiler chicken feeding regime: Abor acre broiler chickens recorded the highest (2017.77 g) body weight gain while Noiler chickens recorded the least body weight gain (976.62 g) within the eight weeks feeding period. However, Abor acre and Sasso chickens recorded similar ($p>0.05$) body weight gains which were significantly ($p<0.05$) different from values for Noiler chickens. The body weight gain results indicated average daily weight gain of 38.60%, 21.83% and 26.42% for Abor acre, Noiler and Sasso chickens, respectively (Fig. 1) which follows the pattern reported by Abegaz *et al* (2019) and Bamidele *et al* (2020) for Noiler and Sasso. Final weights of Sasso and Noiler at eight weeks were well above the 416.82 g reported by Yakubu and Ari (2018) under free range system. The result also indicated a disparity with the report of Ajayi *et al* (2020) which indicated that Noiler males showed superiority in growth over the other five breeds including Sasso from 6 to 14 weeks.

Feed conversion ratio and protein efficiency ratio followed the same trend as the body weight gain. Feed intake of Sasso, however, was the lowest while Abor acre broiler chickens recorded the highest feed intake (Table 2). Noiler and Sasso chickens recorded similar ($p>0.05$) feed intake. The performance of both Sasso and Noiler chickens where however, above the values obtained under scavenging or semi intensive feeding regime. This similar performance in some parameters agrees with the outcome of field trials of birds in the African Chicken Genetic Gains project (Bamidele, 2016; Yakubu and Ari, 2018; Alabi *et al*, 2020). Mortality was not recorded among the iTABs chicken but the Abor acre broiler chickens recorded 14.29% mortality. Bamidele *et al* (2020) reported up to 13.5 and 23.7% mortality for Noiler and Sasso, respectively which according to them was significantly affected by location and perhaps rearing system.

Table 2: Performance of iTABs chickens on intensive broiler chicken feeding regime

Parameters	Abor Acre (Control)	iTABs chickens		SEM
		Noiler	Sasso	
Initial body weight (g)	93.33^{a}	79.90^{b}	82.38^{c}	0.576
Final body weight (g)	2111.10^{a}	1056.52^{b}	1301.19^{c}	20.810
Body weight gain (g)	2017.77^{a}	976.62^{b}	1218.81^{a}	20.967
Feed intake (g)	5007.62^{a}	3963.43^{b}	3790.45^{b}	78.724
Feed conversation Ratio (FCR)	2.49^{a}	4.07^{b}	3.13^{ab}	0.331
Protein Efficiency Ratio (PER)	0.93^{a}	0.57^{b}	0.74^{ab}	0.109
*Feed cost (₦/kg)	153.67	153.67	153.67	0.00
Cost of feed consumed (₦)	769.52^{a}	609.06^{b}	582.48^{b}	12.576
Feed cost per kg body weight gain (₦)	382.64^{a}	625.44^{b}	481.50^{ab}	52.915
Mortality (%)	14.29	0.00	0.00	

^{abc} Means with different superscripts are significantly different ($p<0.05$)

*Cost as at 2019.

Cost of producing iTABs with broiler chicken diets: Cost of feed consumed expectedly followed the same trend as feed intake with Abor acre broiler chickens recording the highest cost (₦769.32) while Sasso chickens produced the lowest cost (₦582.48) of feed consumed. Cost of feed consumed by Sasso and Noiler were similar ($p>0.05$) but significantly ($p<0.05$) different from that of Abor acre broiler chickens. Savings on cost of feed consumed was highest (24.30%) among the Sasso chickens and lowest (20.85%) among Noiler chickens. Feed intake apart from cost of feed has been reported to influence profitability of poultry production enterprise (Nwogu *et al.*, 2015; Animashahun *et al*., 2022).

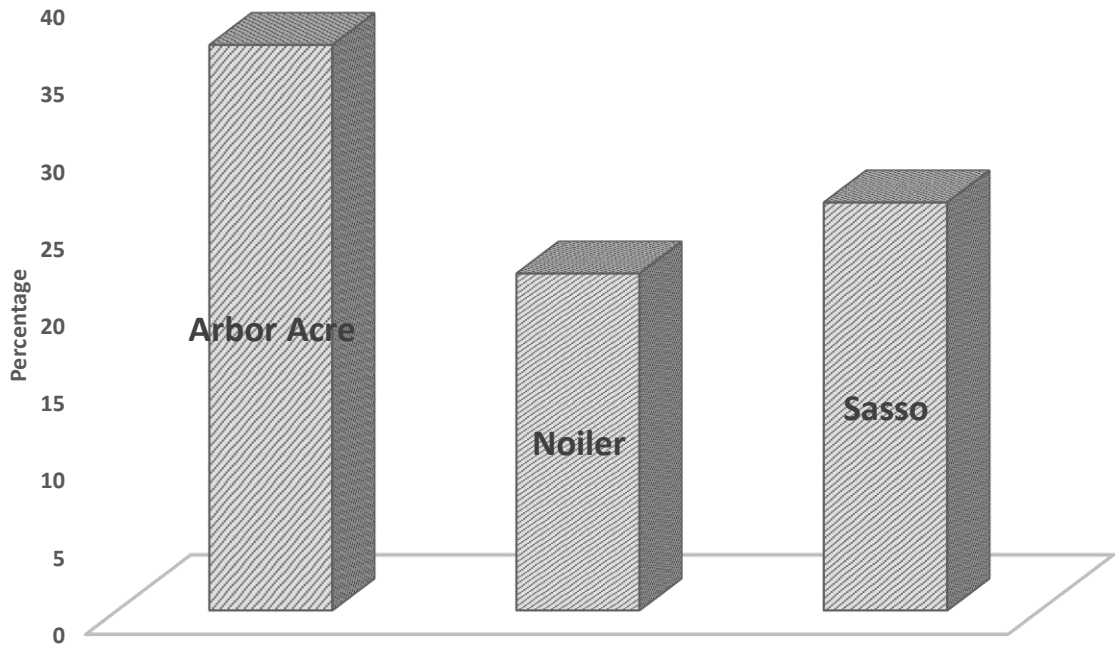

Fig. 1: Averagge daily body weight gains(%)

Feed costs per kg body weight gain were ₦382.64, ₦625.44 and ₦481.50 for Abor acre, Noiler and Sasso chickens, respectively. Abor acre broiler chickens recorded the lowest while Noiler chickens recorded the highest feed cost per kg body weight gain (Fig. 2). Sasso however, recorded a higher (25.84%) while Noiler recorded the highest (63.45%) feed cost per kg body weight gain than the value for Abor acre broiler chickens. The disparity in cost of production is in agreement with Biazen *et al* (2021) who observed significant differences in cost parameters of Kuroiler, Sasso-R, Koekoek and Horro breeds of chickens.

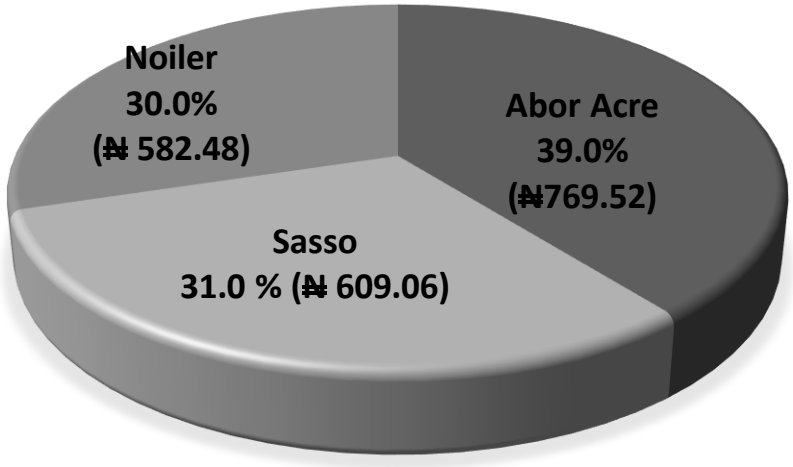

Fig. 2: Cost of feed consumed (₦)

Blood profile of iTABs chicken under intensive broiler chicken feeding regime: Result of the haematological indices of iTABs under intensive broiler chicken feeding regime are shown in table 3. The blood indices measured were similar ($p<0.05$) for Sasso and Noiler chickens except the Mean Corpuscular Haemoglobin (MCH). Earlier reports attributed the variations in avian haematological indices to the physiological condition of the birds (Islam *et al*., 2004; Attia *et al*, 2018). Pack Cell Volume (PCV) was highest (31.47 %) among Abor acre chickens and least among Noiler chickens (21.10 %). The range of the PCV (21.10-31.47%) recorded in this study was slightly within the range (30.0 - 40.0%) reported for chickens (Aiello and Mays, 1998). Red blood cells were highest (3.06 $x10^{12}$/L) for Abor acre broiler chickens and least (2.06 $x10^{12}$/L) for Noiler chickens but within the values reported by Gaspar *et al* (2021) and slightly above the 1.41 – 2.42 $x10^{12}$/L reported by Animashahun *et al* (2022) for Noiler chickens. Olugbemi *et al* (2010), reported that RBC is responsible for the transportation of CO2 and O2 in the blood and also manufactures.

Haemoglobin (Hb) values showed the same trend as PCV and RBC, with the highest value of haemoglobin (10.83 g/dl) observed among Abor acre broiler chickens and the least value (6.67 g/dl) in Noiler chickens. The highest value (1.04 fl) of Mean corpuscular volume (MCV) was in Sasso, and the least value (1.02 fl) in Abor acre broiler chickens. Mean corpuscular haemoglobin (MCH) was highest (61.10 pg) in Noiler but least (58.90 pg) in Abor acre broiler chickens. Jiwuba *et al* (2017) reported that MCH is used as an index of toxicity and its reduction in blood concentration usually suggests the presence of toxic factors like hemagglutinin which has adverse effect on blood formation. The MCH values obtained for all the chicken groups in this study fell above the range reported by Gaspar *et al* (2021) while the Mean corpuscular haemoglobin concentration (MCHC**)** was highest (59.50 g/dl) in Noiler and the least value (57.8 g/dl) in Abor acre broiler chickens, this was far below the values reported by the same authors.

White blood cells and lymphocyte produced the same value (1.31 $x10^9$/L and 77.33%, respectively) for Abor acre and Sasso chickens but higher value (1.73 $x10^9$/L and 82.0 %) for Noiler chickens. Monocyte value was highest (0.67%) in Noilers, and none (0.00%) in Sasso chickens while eusinophil value was same for Abor acre and Sasso chickens, and the highest (2.00%), with Noiler recording the least value (1.33%). Platelets values followed a similar pattern with the least value in Noiler chickens. Some of the haematological indices evaluated, fell within the physiological range for apparently healthy broiler chicken reported by Simaraks *et al* (2004) and Jiwuba *et al* (2017).

Table 3: Haematological indices of Abor Acre and some iTABs chicken under intensive broiler chicken feeding regime.

Parameters	Abor Acre broilers	iTABs chickens		SEM
		Noiler	Sasso	
Packed Cell Volume (%)	31.47	21.10	31.03	2.71
Red Blood Cell ($x10^{12}$/L)	3.06	2.06	2.99	0.26
Haemoglobin (g/dl)	10.83	6.67	10.46	0.94
Mean Cell Volume (fl)	102.00	103.00	104.00	0.62
Mean Corpuscular Haemoglobin (pg)	58.90	61.10	60.87	0.44
Mean Corp. Haemoglobin Conc. (g/dl)	57.80	59.50	58.70	0.35
White Blood Cell ($x10^9$/L)	1.31	1.73	1.31	9.70
Lymphocyte (%)	77.33	82.00	77.33	1.59
Heterophils (%)	20.33	16.00	20.67	1.55
Monocytes (%)	0.33	0.67	0.00	0.23
Eosinophils (%)	2.00	1.33	2.00	0.22
Platelets ($x10^9$/L)	25.67	16.00	24.67	2.25

There were no significant differences ($p>0.05$) in the serum biochemical indices measured among the treatment groups (Table 4). The serum protein and glucose values were highest (5.97 g/dl) in Noiler and the lowest (5.57 g/dl) in Abor acre broiler chickens. Similarly**,** the highest value of glucose (2.03 mg/dl) was observed in Noiler but the least value (1.82 mg/dl) was found in Sasso. These values were higher than

those reported by Animashahun *et al* (2022) for unsexed Noiler chickens. According to Attia *et al* (2018) who recorded lower serum biochemical values in broiler chickens than those in this study, physiological conditions could affect the blood indices of chickens. Albumin value was highest (1.53 g/dl) in Noiler, while the least value (1.40 g/dl) was observed in Abor acre broiler chickens. Serum total protein were within the normal range (5.2 - 6.9 g/dl) while Albumin values were slightly lower than the range (2.1 – 3.45 g/dl) reported by Oloruntola *et al* (2019).

Table 4: Serum metabolites of Abor Acre broilers and some iTABs chickens under intensive broiler chicken feeding regime

Parameters	Abor Acre boilers	iTABs Chickens		SEM
		Noiler	Sasso	
Serum Albumin (g/dl)	1.40	1.53	1.47	0.62
Serum Glucose (mg/dl)	1.98	2.03	1.82	7.75
Serum Protein (g/dl)	5.57	5.97	5.87	0.22

Dressed and internal organs weights of iTABs chicken under intensive broiler chicken feeding regime: The dressed and internal organ weights of iTABs chickens under intensive broilers chicken feeding regime are shown in table 5. The live weight of the birds in this study ranged from 1.37 to 2.27 kg with the iTABs chickens (Noiler and Sasso) recording significantly ($p<0.05$) lower values than Abor acre broiler chickens. Olawumi (2013) reported that there is a positive phenotypic correlation between live weight and eviscerated weight in Arbor acre broiler chicken. The dressed weight was however similar ($p>0.05$) between the broiler chicken and the iTABs chickens which nevertheless differed significantly ($p <0.05$) among the strains. The dressing percentage range was 73.00 – 95.36% with the Abor acre broiler chickens having the highest value and Noiler, the least. These values were above that of the different strains of broiler chickens reported by Egbegbulem *et al* (2022); below that of Adedokun *et al* (2022) except for Sasso but agreed with the findings of McCrea *et al*. (2014), in their study of the performance and carcass characteristics of Delaware chicken and broiler chickens. According to Oyewale *et al* (2021), compared to other iTABs chicken, Noiler and Sasso had the highest dressing percentage (69.2%), this value was way lower than the values obtained in this study. Profitability in broiler chicken production is linked to the higher carcass weight achieved, diets and possibly the strains of chicken (Negari *et al*., 2024).

The breast, full and empty gizzards, spleen, heart and abdominal fat weights were significantly different ($p>0.05$) between Noiler and Sasso chickens while drumstick and liver were similar ($p>0.05$) among all the groups. The wings and thigh were similar ($p>0.05$) between Abor acre and Noiler chickens. Breast, thigh and drumstick are the most valuable carcass part in broilers and dual-purpose chickens kept for meat production and are the prime cuts that reflect carcass meatiness and meat product profitability (Agunbiade *et al*., 2002). Similar to the observation in this study between the dual purpose strains (Noiler and Sasso) and the meat type strain (Abor acre), the average breast and thigh weight for Kuroiler, a dual purpose breed was lower than that reported by Ojedapo, *et al* (2015) for Cobb 500 broiler strain with slightly higher slaughter weight. In another study the Cobb 500 strain which is a meat type chicken also exhibited significantly higher weights of gizzard, liver, and skin compared to the Hubbard strain, while the heart weight showed no significant difference between the two strains (Negari *et al*, 2024).This finding are in agreement with Biazen *et al*. (2021), who observed similar differences in these parameters across chicken breeds, suggesting that breed has significant effect on these parameters.

Table 5 Dressed and internal organ weights of iTABs chicken under intensive broiler chicken feeding regime

Parameters (% live weight)	Abor Acre Broilers	iTABs Chickens		SEM
		Noiler	Sasso	
Live weight (kg)	2.27[a]	1.37[b]	1.51[b]	0.17
Dressed weight	74.89[ab]	73.00[a]	95.36[b]	7.16
Breast	19.82[ab]	15.60[a]	21.19[b]	1.68
Wing	7.93[a]	9.49[ab]	10.60[b]	0.77
Drumstick	10.13	10.22	9.93	0.28
Thigh	11.01[a]	10.21[ab]	9.93[b]	0.32
Gizzard (Full)	3.39[ab]	4.60[a]	3.31[b]	0.42
Gizzard (Empty)	2.38[b]	3.14[a]	2.32[b]	0.26
Spleen	0.09[ab]	0.17[a]	0.07[b]	0.03
Liver	1.85	1.95	2.38	0.16
Heart	0.53[ab]	0.54[a]	0.51[b]	0.009
Abdominal fat	0.59[ab]	0.44[a]	1.03[b]	0.18

[ab] Means within row with different superscripts are significantly ($p<0.05$) different.

CONCLUSION AND RECOMMENDATION

Conclusion: It can be concluded that Noiler and Sasso chickens perform relatively better when raised on intensive broiler chicken feeding regime. However, it cost 63.45% and 25.84%, respectively more to produce each kg of body weight of Noiler and Sasso compared to Abor acre broiler chickens. It can also be concluded that among the iTABs considered in this study, Sasso performed much better than Noiler on some of the productivity indices like body weight gain, feed conversion ratio, feed cost per kg bodyweight gain, and protein efficiency ratio quite similar to Abor acre broiler chickens.

The haematological and serum biochemical indices as well as dressed and organs weight generally were similar in the Arbor Acre broiler chickens, Noiler and Sasso though with numerical variations. However, amng the iTABs chickens, Sasso appear more adapted and performed better than Noiler under the intensive broiler chicken feeding regime.

Recommendations: It is recommended that broiler chicken feed be offered to Noiler and Sasso up to 9 weeks of age where the feed cost low. However, under the current feed cost regime, only Sasso can give reasonable results.

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