



Evaluation of Growth, Blood Parameters and Carcass Quality in WAFD Goats Fed Graded Amount of Concentrate Diets

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Abstract | The research examined the impact of feeding varied concentrate diet on the performance, carcass qualities, and blood indices of West African Dwarf (WAFD) goats. Forty-five (45) grower WAFD goats aged 4-5 months with initial weights ranging from 4.70-5.0 kg were used for this 16-week experiment. The goats were allotted randomly to five treatments, each with three replicates. Experimental diets were such that Diet T1 was fed 3.2% of their body weight, 3.4% bodyweight (T2), 3.6% bodyweight (T3), 3.8% bodyweight (T4) and 4.0% bodyweight (T5). The average live weight gain was significant ($P < 0.05$) across the treatment groups, with T5 having higher values. Blood samples from four goats per treatment were taken after the experiment to assess the following blood indices: Packed Cell Volume (PCV), Haemoglobin, Red Blood Cell (RBC), White Blood Cell (WBC), Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH), MCH Concentration (MCHC), Lymphocyte, Monocyte, Eosinophil, Neutrophil and Basophil. Serum parameters determined were Globulin, Total Protein, Albumin, Creatinine and Urea. Except for Basophil, all of the haematological indicators studied indicated ($P < 0.05$) differences between treatments. For carcass parameters, significant ($P < 0.05$) differences were obtained across treatments except for weights of whole internal organ, shank, tail and kidney. Hence, feeding concentrate diets to WAFD goats should be encouraged among farmers in order to optimize ruminant performance. Conclusively, feeding 3.8% and 4.0% bodyweight of concentrate diet resulted in better performance and blood profile of WAFD goats.

Keywords | Blood profile, Bodyweight, Concentrate diet, Performance, Serum biochemistry, WAFD goats

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INTRODUCTION

The main issue facing Nigeria's livestock enterprise has been the supply of animal protein on a sustainable basis (Okpara, 2020; Obakanurhe *et al.*, 2024). Thus, significant efforts need to be made to boost animal protein

intake, especially in Nigeria. Several authors have penned that Nigeria's consumption of animal protein could be higher since livestock products are expensive due to the significant rise in most feeds (Kolawole and Mustapha 2023; Obakanurhe *et al.*, 2025). Maximizing the livestock nutrition plan can enhance animal productivity while reducing

costs (Balehegn *et al.*, 2020; Obakanurhe *et al.*, 2025). This has necessitated an aggressive strategy for farmers to focus on small ruminant animals (such as goats) to improve livestock meat products which are currently in short supply in Nigeria. Goats are small ruminant animal species whose meat is appreciated mainly because of its outstanding flavour, high meat yield, and protein quality. According to Tella and Chineke (2022), goats are Nigeria's second most prominent livestock species, accounting for over 24% of the country's total meat supply. Also, the main husbandry system employed in Nigeria is the traditional feeding system which allows the animals to graze freely on natural rangelands for their food (Scano and Caboni, 2021). However, Nigerian goats experience severe nutrient depletion during harmattan (dry season) due to the seasonal variations in the quality and availability of natural pastures, as shown by their low production, poor reproductive performance, sluggish development rate, and heightened vulnerability to pests and diseases. Scientists have recommended feeding goats with dietary concentrates to increase these animals' productivity during harmattan (Okpara, 2020; Pagliari *et al.*, 2020).

According to Niepes and Bestil (2023), concentrate refers to high-quality, low-fiber foods such as grains and milling by-products. There have been many outstanding assessments of concentrate as supplements in intensive production systems, including one by Grilli *et al.* (2016) who penned that the dietary inclusion of high-grain-diet resulted in the decrease of rumen fluid pH compared to the goats on forage feed. Concentrate feeds encourage ruminants to gain weight, decrease ruminal methane generation and improve propionate production, which lowers energy losses and boosts nutrient utilization efficiency.

Complete rations or concentrate feeds can supplement roughage-based diets during the drought season, when pasture for goat consumption is sparse, and the available forage has a low nutritional value (Tian *et al.*, 2021). According to Amundsen and Sánchez-Hernández (2019), concentrate feeds are frequently not fed due to their unavailability and high cost. However, commercial ruminant animal producers use concentrate feed most of the time because of the scarcity of forage during drought season and the roles it performs in the ruminant feeding systems. Also, Total Mixed Rations (TMR)/concentrate feed are well established for improving nutrient utilization by stabilizing ruminal fermentation through balanced intakes of concentrates and roughage (Haloi *et al.*, 2022). Complete feed consumption ensures improved ammonia utilization, decreases fermentation loss, and prevents the rumen from stabilizing (Bhatt *et al.*, 2019).

However, there may be disparities in the amount of concentrate feed needed by goats to meet the daily require-

ments and for optimal production. Thus, studying how varied levels of dietary concentrate affect the growth performance, metabolic condition, and meat quality is critical for developing sustainable and optimal production in intensive feeding systems. By explaining these linkages, we can find nutritional solutions that increase growth and productivity while simultaneously ensuring WAFD goats' general health and well-being, hence addressing the increasing demand for quality chevon products both nationally and globally. This experiment was done to assess the growth parameter, carcass quality, haematological, and serological indices of WAFD goats fed various concentrations of concentrate food.

MATERIALS AND METHODS

EXPERIMENT SITE

The project was conducted at the goat unit of the Teaching and Research Farm Department of Animal Science, Dennis Osadebay University, Asaba, from April to July, 2024. It is located in Nigeria's humid tropics between latitudes 49° and 66° North and longitudes 6° and 8° East. It features a mean yearly rainfall of 1500-1849 mm and a moderate climate with very high temperatures during harmattan (December-February), with its mean annual precipitation and temperature of 117mm and 28°C ± 6°C, respectively (Asaba Metrological Station, 2024).

EXPERIMENTAL ANIMALS, FEED AND MANAGEMENT

Forty-five (45) WAFD goats of both sexes with a live weight (4.70–5.0 kg) were used at 4–5 months of age. The WAFD were housed in a 3 x 2m pen/replicate throughout the experimental period under similar conditions. The feeding project lasted for 16 weeks, after seven (7) days of acclimatization to the control diet and the environment. They were treated with ivermectin injection against endoparasites and ectoparasites (Subcutaneously). Oxytetracycline (long-acting antibiotics) and multivitamins (intramuscularly) were also administered. Panicum maximum was used as the basal feed. The WAFD goats were allotted randomly to one of five treatments. The goats were replicated three times, with each having three (3) goats and the experimental animals were fed based on different percentage body weights (3.2%, 3.4%, 3.6%, 3.8% and 4.0%) per treatment. Lastly, they were given access to water, and experimental diet was provided ad libitum.

DATA COLLECTION

GROWTH PERFORMANCE: Data for each animal's feed consumption was recorded daily, and leftover feed was weighed and deducted from the total amount supplied to determine feed intake (daily). The mean feed intake (daily) was obtained by dividing the total feed intake by the experimental days. Animals were weighed before the

trial began and again weekly in the morning before feeding to measure weight increase. The FCR was calculated by dividing feed intake by body weight gain on a daily basis.

HAEMATOLOGICAL INDICES: Blood samples were collected at the conclusion of the 16-week experiment. The samples were attained from each goat's jugular vein with sterile needles and syringes and placed into sterilized vials containing ethylene diamine tetra acetic acid (EDTA) for the haematology. The blood for serum biochemistry was collected into a universal bottle, and the serum was separated by centrifuge at 2300 rpm for 10 minutes. The RBC counts and total WBC counts were reviewed by haematocytometer using an electric microscope, haemoglobin (Hb) concentration was assessed via colorimeter, protein plasma (PP) was determined with a refractometer, differential count (DC) was determined by staining with genna stain using an electric microscope and PCV parameters were estimated by micro-haematocrit centrifuge technique. Blood constants (MCH, MCV, and MCHC) were obtained using appropriate formulae as described by [Helen et al. \(2020\)](#) as follows:

$$MCV\% = \frac{PCV}{RBC} \times 10$$

And it's expressed in thousands per cubic millilitre

$$MCH\% = \frac{Hb}{RBC} \times 10$$

It's expressed in pictograms (Pg)

$$MCHC = \frac{Hb}{PCV} \times 100$$

Serum parameters, the total protein (g/d), cholesterol (CHO), albumin (ALB) and creatinine (CREA) were obtained via a 721 visible spectrophotometer. The albumin concentration was subtracted from the total protein content to get the globulin concentration.

CARCASS CHARACTERISTICS

After the trial period, three (3) animals per treatment group were fasted for 24 hours, weighed and humanely slaughtered. Following slaughter, the carcass was subjected to open fire to remove the fur and thoroughly washed with portable water. After that, the Warm Carcass Weight (WCaW) was determined. Then, the carcass was eviscerated to extract the internal organs (kidney, stomach, intestine, etc.). The WCa was split into two along the vertebral axis and separated into different wholesale parts using a sharp implement. The wholesale parts included the hind, foreleg, loin, flank, breast, tail, shoulder, rack, and neck.

ETHICAL APPROVAL

The Senate Council for Research and Development,

through the subcommittee on Animal research at Dennis Osadebay University, Asaba, Delta State, Nigeria, authorized all aspects of the research that required ethical approval.

DATA ANALYSIS

The resulting data on the growth parameters, blood parameters and carcass components were analyzed using the Statistical Software Package-Statistical Package for Social Sciences (SPSS) version 26. Analysis of variance (ANOVA) was used to compare treatment means, and the Duncan multiple range test distinguished differences between treatment means.

RESULTS

The nutrient compositions of the concentrate administered to WAFD goats is presented in [Table 1](#). The moisture content, crude protein, ether extract, ash, and crude fiber content of the complete ration, as displayed in [Table 2](#), were 6.00%, 16.10%, 3.56%, 8.35%, and 12.02%, respectively. The diet had a crude protein of 16.10% which fall between the 12-18% recommended for growing ruminants in tropical regions.

Table 1: Nutrient composition of the experimental diet (%).

Feed Ingredients	Percentage composition
Cassava peels	25
Brewers dry grain	30
Rice Bran	10.3
Offal	3
P.K.M	15
S.B.M	3
Urea	1.5
Limestone	5
Premix	1
Molasses	1.2
Total	100.00
Total crude protein	16.10
Total metabolizable energy(Kcal/Kg)	2175.60

The proximate analysis of experimental meals was performed using the A.O.A.C (2015) standard approach.

Table 2: Chemical composition of the experimental diet.

Parameters	Percentage (%)
Moisture content	6.00
Crude protein	16.10
Ash	8.35
Ether extract	3.56
Crude fibre	12.02

[Table 3](#) showed the performance characteristics of grower WAFD goats fed varied percentages of the diet. The feed-

ing regimens significantly ($P < 0.05$) influenced all the initial and final weight, total weight gain, total feed intake, daily feed intake, daily weight gain and FCR. T5 recorded the highest weight gain (4.30 kg) followed by T4, T3, T2 and T1 (4.01 kg, 3.62 kg, 3.04 kg and 2.95 kg, respectively). Thus, the result showed a steady increase in weight gained across the treatments. Furthermore, the total feed intake also followed a similar pattern with an increase across the dietary treatments and values ranging from 21.51-29.52 kg. The highest daily feed intake and daily weight gain (264.30 g and 38.13 g, respectively) was recorded by animals fed with T5 while the lowest feed intake (daily) and weight gain (daily) (191.42 g and 26.27 g, respectively) was recorded in T1. Lastly, T4 had the optimal Feed Conversion Ratio.

Table 3: Performance characteristics of growing (WAD) goats fed concentrate diet.

Parameters	T1	T2	T3	T4	T5	SEM
Initial weight (kg)	4.87 ^{ab}	4.81 ^b	4.96 ^a	4.82 ^b	4.92 ^{ab}	0.02
Final weight (kg)	7.83 ^d	7.85 ^d	8.60 ^c	8.82 ^b	9.22 ^a	0.11
Total weight gain (kg)	2.95 ^d	3.04 ^d	3.62 ^c	4.01 ^b	4.30 ^a	0.11
Total feed intake (kg)	21.51 ^d	22.86 ^c	25.72 ^b	26.84 ^b	29.52 ^a	0.60
Daily feed intake (g/d)	191.42 ^d	204.30 ^c	230.00 ^b	240.00 ^b	264.30 ^a	3.84
Daily weight gain (g/d)	26.37 ^d	27.14 ^d	32.36 ^c	35.80 ^b	38.13 ^a	6.76
FCR	7.30 ^b	7.50 ^a	7.10 ^{bc}	6.70 ^d	6.90 ^{cd}	0.07

^{a, b, c}: Means on the same row with different superscript differ significantly ($P > 0.05$).

BLOOD INDICES OF WAFD GOATS FED VARIOUS CONCENTRATE DIETS LEVELS

Table 4 showed how different level of concentrate diet affected the haematological parameters of the WAFD. From the Table 4, we can see that the experimental diet significantly ($P < 0.05$) affected all the haematological parameters except for Basophil. The PCV, Haemoglobin, RBC and WBC values for the treatments ranged from 28.40-31.30%, 9.40-10.80 g/dl, 4.50-5.90 $\times 10^6$ /mm, and 10.90-11.90 $\times 10^3$ /mm, respectively. T3 recorded the highest MCHC and MCH values of 33.50 and 38.60, respectively.

The experimental animals' blood serum results are displayed in Table 5. The serum biochemical parameters investigated (total protein, globulin, creatinine Urea and albumin) were all significantly ($p < 0.05$) influenced by the varied levels of concentrate diet. Total protein (TP) ranged between 6.70g/dl to 8.30g/dl, with the least value (6.07g/dl) obtained from T1, while the best value (8.30g/dl) was obtained from T5.

Albumin varied between 2.96g/dl to 3.40g/dl; the lowest value (2.96 g/d) was recorded on T2, while the best value (3.40g/dl) was recorded on T4. Globulin ranged between 3.40g/dl and 5.20g/dl; T4 recorded the lowest value of 3.90g/dl, while T5 recorded a superior value of 5.20g/dl. Creatinine ranged between 0.60 to 1.10mg/dl; the lowest value (0.80) was obtained from T4, while T2 had the best value of 1.10.

Table 4: Haematological parameters of West African Dwarf (WAD) goats fed various concentrate diet levels.

Parameters	T1	T2	T3	T4	T5	SEM
PCV (%)	28.40 ^c	30.50 ^{ab}	30.60 ^{ab}	31.30 ^a	29.30 ^{bc}	0.29
Haemoglobin (g/dl)	9.40 ^c	10.20 ^{abc}	10.60 ^{ab}	10.80 ^a	9.70 ^{bc}	0.18
RBC ($\times 10^6$ /mm)	4.50 ^b	5.60 ^a	5.90 ^a	6.20 ^a	4.90 ^b	0.20
WBC ($\times 10^3$ /mm)	11.30 ^{bc}	10.90 ^c	11.60 ^{ab}	11.90 ^a	11.60 ^{ab}	0.11
MCH	35.60 ^{bc}	34.30 ^c	38.60 ^a	37.30 ^{ab}	37.30 ^{ab}	0.48
MCHC	33.60 ^a	34.20 ^a	33.50 ^a	32.10 ^b	33.70 ^a	0.17
Lymphocyte (%)	60.00 ^d	67.50 ^b	64.30 ^c	70.20 ^a	65.45 ^c	0.93
Monocyte	0.25 ^b	0.00 ^c	0.40 ^a	0.50 ^a	0.00 ^c	0.05
Eosinophil (%)	0.00 ^a	0.50 ^b	0.30 ^b	0.00 ^a	0.30 ^b	0.14
Neutrophil (%)	39.10 ^a	33.20 ^c	32.00 ^c	29.60 ^d	35.00 ^b	0.86
Basophil (%)	0.00	0.00	0.25	0.00	0.25	0.03

Table 5: Serum biochemical parameters of West African Dwarf goats fed various complete ration.

Parameters	T1	T2	T3	T4	T5	SEM
Total Protein(g/dl)	6.70 ^d	7.60 ^b	7.10 ^c	6.80 ^{cd}	8.30 ^a	0.18
Albumin (g/dl)	3.01 ^{bc}	2.96 ^b	3.30 ^{ab}	3.40 ^a	3.10 ^{abc}	0.06
Globulin (g/dl)	3.69 ^c	4.64 ^b	3.80 ^c	3.40 ^c	5.20 ^a	0.18
Creatinine (mg/dl)	0.80 ^{ab}	1.10 ^a	0.86 ^{ab}	0.60 ^b	0.80 ^{ab}	0.14
Urea (mg/dl)	37.30 ^a	32.60 ^{bc}	32.60 ^{bc}	30.10 ^c	35.0 ^{ab}	0.70

CARCASS CHARACTERISTICS OF WAFD GOAT FED GRADED LEVELS OF CONCENTRATE DIET

The results on carcass qualities of goat showed significant differences on the live weight, bleed weight, fluck weight, head, neck, drumstick, back and front thighs, body rumen, lungs, heart small and large intestine and pancreas, Table 6.

DISCUSSION

EFFECTS OF FEEDING VARIED QUANTITIES OF CONCENTRATE DIET ON THE PERFORMANCE OF GROWING (WAFD) GOATS

Concentrates can be used in intensive production systems to increase output. Forages are frequently restricted, particularly in subtropical and tropical areas. As a result, a huge quantity of concentrate is given to the animals to meet production demands, sometimes without ensuring proper

Table 6: Carcass characteristics of WAD goat fed varying levels of concentrate diet.

Parameters	TREATMENTS					SEM	P value
	T1	T2	T3	T4	T5		
Live weight(kg)	7.83 ^c	7.85 ^c	8.60 ^b	8.82 ^{ab}	9.22 ^a	4.35	0.04
Bleed weight (kg)	6.75 ^c	6.80 ^c	7.40 ^b	7.75 ^{ab}	8.70 ^a	3.83	0.03
Fluck weight (kg)	4.45 ^b	5.24 ^a	5.10 ^{ab}	5.40 ^a	5.48 ^b	0.25	0.01
Whole internal organs (kg)	2.33	3.05	2.75	3.10	3.40	0.45	0.00
Head (g)	626.44	658.23 ^c	663.56 ^c	766.42 ^b	820.07 ^a	42.03	0.01
Shank (g)	291.12	250.44	247.16	238.81	287.43	23.22	0.15
Back Shank (g)	150.56	131.32	125.33	124.66	145.60	18.65	0.25
Front Shank (g)	141.22	118.28	122.47	111.15	142.40	15.12	2.45
Neck (g)	560.50 ^a	422.62 ^c	462.36 ^b	381.44 ^d	575.22 ^a	34.11	0.03
Tail (g)	45.10	35.23	40.37	38.31	38.24	5.33	1.54
Drumstick(g)	80.05 ^a	55.11 ^b	50.22 ^b	55.15 ^b	77.24 ^a	6.66	0.04
Back Thigh (g)	846.32 ^a	624.15 ^c	620.17 ^c	756.54 ^b	874.33 ^a	44.67	0.02
Front Thigh (g)	790.10 ^a	710.34 ^c	748.23 ^b	678.22 ^c	820.62 ^a	42.83	0.04
Body (kg)	1.82 ^a	1.30 ^c	1.31 ^c	1.80 ^b	2.30 ^a	0.38	0.00
Rumen(g)	2.06 ^a	1.15 ^b	1.18 ^b	1.20 ^b	2.04 ^a	0.23	0.00
Lungs (g)	109.10 ^a	82.13 ^c	75.65 ^d	74.15 ^d	97.25 ^b	7.25	0.03
Heart (g)	59.13 ^a	43.18 ^b	35.24 ^c	47.15 ^b	56.24 ^a	5.21	3.22
Kidney (g)	37.15.	37.06	39.10	43.27	36.22	8.42	1.45
Large and Small (g)	508.45 ^b	545.12 ^a	542.36 ^a	490.22 ^c	532.46 ^{ab}	36.11	0.02
Large Intestine (g)	289.25 ^b	295.10 ^a	300.14 ^a	286.16 ^b	274.28 ^c	24.93	0.00
Small Intestine (g)	219.20 ^c	250.02 ^a	242.22 ^b	204.06 ^c	258.18 ^a	25.11	0.01
Pancreases (g)	18.25 ^b	13.33 ^c	21.44 ^a	12.06 ^c	18.30 ^b	4.52	0.01
Bile (g)	9.05	9.15	9.41	10.14	8.43	3.04	3.22

^{a,b,c}: Means on the same row with different superscript differ significantly (P>0.05).

ratios. To enhance performance, it is critical to precisely measure the results obtained with certain feed allowances by developing a deeper grasp of the nutritional content of concentrate feeds while also considering the account that can be tolerated by the experimental animals.

The research revealed that the dietary treatment significantly impacted the parameters examined. All research diets gave rise to positive weight increases, but the changes were more significant as food ration levels increased. The growth rate (daily weight gain) obtained in this experiment ranged from 26.37 to 38.13g/d and exceeded 10.60 to 24.60 g/d reported by [Ocheja et al. \(2021\)](#) for WAFD goats that were fed varying levels of cashew nut shell with feed concentrates. They also exceeded the 14.88 to 21.43 g/d range reported by [Asaolu et al. \(2012\)](#) for WAFD goats fed dry moringa, gliricidia, and Leucaena leaves as supplements to a base diet of cassava peels. However, the values obtained in this research were below the 46 – 56g/d range reported by [Min and Solaiman \(2018\)](#) for WAFD goat-fed Panicum maximum-based diets augmented with lablab, Leucaena and gliricidia foliages. The observed differences

in growth rates may stem from variations in diet composition, feed quality, sample size, or environmental conditions. The superior weight gains exhibited by animals on T5 over other treatments may be attributed to their high feed intake and feed utilization.

The WAFD had adequate feed intake, ranging from 191.42 to 264.30g/d across the treatments. The Daily Feed Intake (DFI) of goats ranged from 3-4% of their body weight as expressed in kg of dry matter/head/day ([Gebremariam, 2019](#)). Dry matter intake (DMI) in goats has been ascribed to be affected by body mass, the proportion of dry matter in the supplied feed (12-35% for forages, 82-92% for hay and concentrates), palatability, physiological stage (pregnancy, lactation, and growth), and breed ([Okpara et al., 2014](#)). Generally, goats'dry matter intake does not exceed 3% of their body mass over time ([Okpara and Akporhualo, 2017](#)). However, larger feed intakes have been reported in certain circumstances, such as red sokoto goats ingesting up to 9% of their bodyweight ([Otaru et al., 2011](#)). [Tilahun et al. \(2014\)](#) penned that goats may consume more than 3% dry matter of their bodyweight when fed with high-qual-

ity feed. This study is similar to findings of Roy and Rana (2024), who penned that goat can consume dry matter of up to 3-5% of its body weight when high-quality feed is offered to them.

The FCR showed feed utilization efficiency in favour of goats fed 3.8% bodyweight (6.80) over those on other treatments, although it did not differ from those on T5 (6.90). Goats subsisting on treatment 5(4% bodyweight) consumed averagely more feed than those on T4 (3.8% bodyweight), which supported relatively higher weight gain but had a comparable FCR (6.90), did not differ ($P>0.05$) significantly. Factors that influence FCR, among others, include breed, nutrition, age and sex of animals, and environment.

EFFECTS OF FEEDING VARYING LEVELS OF CONCENTRATE DIET ON THE HAEMATOLOGICAL INDICES OF WAFD GOATS

The PCV values ranged from 28.40 to 31.30% across the treatments. The PCV values were considerably ($P<0.05$) different; the observed value were within the 22-38% range reported by Oni *et al.* (2012) and Jiwuba *et al.* (2016) for normal healthy animals. These values are identical to those reported by Ajagbe (2019) but are dissimilar to the findings of Taiwo and Ogunsanmi (2003) who observed higher values of 36.9% and 35.5% for healthy WAFD goats and sheep, respectively. Going by the reports of Ganong (2001) and Onasanya *et al.* (2015) the PCV values of all animals on varied rations may have an increased tendency to restore PCV to normal levels following infection due to compensatory faster production.

Hb ranged between 9.40 and 10.80 (g/dL) across treatments. The haemoglobin range is between the 7-15 g/dl range mentioned by Daramola *et al.* (2005), but lower than the 5- 6 g/dl values obtained by Belewu and Ogunsola (2010) for goats fed fungi-treated *Jatropha curcas* kernel cake rations. The Hb levels obtained indicate a lack of hypochromic and microcytic anemia due to iron deficiency or improper iron consumption for haemoglobin synthesis. With the considerably higher Hb concentrations discovered, the dietary treatments proved to help promote high capacity to carry oxygen blood in the goats.

RBC values ranged from 4.50 ($\times 10^6/\text{mm}$) to 6.20 ($\times 10^6/\text{mm}$) across the treatment with the highest value observed by T4 animals (6.20 $\times 10^6/\text{mm}$). The RBC were within the 9.2-13.5 g/l range reported by Tambuwal *et al.* (2002), 9.9-18.7 g/l range given by Taiwo and Ogunsanmi (2003), and 10.25-12.851012/l) range reported by Ajala *et al.* (2000). The enhanced RBC recorded for the WAFD in the treatments prevents these goats from being susceptible to anemia-related illness problems. Red blood cell indices aid in the characterization of anemia (Barcelos *et al.*, 2022).

The WBC levels recorded in this experiment ranged from 10.90 ($\times 10^3/\text{mm}$) to 11.90 ($\times 10^3/\text{mm}$), which were within the ranges 6.8–20.1 ($\times 10^3/\text{mm}$) and 6.8–20.1 $\times 10^9/\text{l}$ reported by Okpara *et al.* (2024) and Daramola *et al.* (2005), respectively. The WBC values noticed were comparable to those reported by Hagan *et al.* (2022). WAFD goats are able to provide a potent and rapid defense against many infectious agents, and this is the physiological basis for adapting this species in their ecological zone (Daramola *et al.*, 2005). The recorded MCH and MCHC values were in line with the standard range, as reported by Njidda *et al.* (2013). The MCH and MCHC in this research did not differ significantly ($P>0.05$) and ranged from 34.30 in T2 to 38.60 in T3 and 32.10 in T4 to 33.70 in T5, respectively. The presence of MCHC and MCH measures the haemoglobin level in the erythrocyte for anemia diagnosis (Njidda *et al.*, 2013).

The lymphocytes and neutrophil counts were within Tambuwal and Agele, (2010) stated range of (60–75% for lymphocytes, 17-52% for neutrophils) and Daramola *et al.* (2005) (47–82% for lymphocytes, 17-52% for neutrophils). These figures indicate that the WAFD have a strong immunity with enough antibodies to keep them healthy (Daramola *et al.*, 2005). Rising levels in neutrophils are means a decrease in lymphocytes, and vice versa (Lazzaro, 2001; Ahaotu *et al.*, 2019).

EFFECTS OF FEEDING VARYING LEVELS OF CONCENTRATE DIET ON SERUM BIOCHEMICAL ANALYSIS OF WAFD GOAT

Serum protein levels differed significantly between treatments at the completion of the investigation, with results ranging from 6.70g/dl to 8.30g/dl which corroborates the findings of Daramola *et al.* (2005). Arif *et al.* (2022) opined that serum proteins play vital roles in immunity, osmotic regulation, and transport of several substances in the animal body. Creatinine had superior value of 1.10 mg/dl in T2 and the lowest value of 0.60 mg/dl in T4. The creatinine values differed significantly ($P<0.05$) across treatments. The values in this research are within the range reported by Oni *et al.* (2012).

The total protein, globulin albumin, and urea values in this research are consistent with the findings of Bawala *et al.* (2007). There was no stress symptoms in the animals' bodies in the experimental groups, as the blood urea levels obtained were equivalent to those reported by Oloche *et al.* (2015).

EXTERNAL OFFAL CARCASS QUALITY OF GOAT FED VARYING LEVELS OF CONCENTRATE DIET

The carcass and organ features of WAFD goats given varied quantities of feed are displayed in Table 6. Fasted live weights bleed weights, and flock weights were 7.83 to

9.22 kg, 6.75 to 8.70 kg, and 4.45 to 5.48 kg, respectively. The results of these parameters did not differ substantially ($P>0.05$) across treatment groups. These findings were consistent with those reported by Ibeawuchi and Ukachukwu (2009) when they gave cassava leaf meal to WAFD goats. The results of the whole and retail parts, namely, tail, head, back shank, front shank, back thigh and front thigh, ranged from 38.24 to 45.10g, 626.44 to 766.42g, 124.66 to 150.56g, 111.15 to 142.40g, 620.17 to 846.32g and, 678.22 to 820.62g respectively. These values were in line with those reported by Omojola and Attah (2006).

CONCLUSIONS AND RECOMMENDATIONS

The study emphasized the importance of varied levels of concentrate diet on the growth performance, carcass traits, and blood profile of WAFD goats. Feeding goats different percentages of dietary concentrates increased their weight gain, feed intake, and FCR, resulting in optimum growth performance. Furthermore, the diet had no deleterious effect on the goats' blood profiles and nutrient utilization. Farmers should be encouraged to feed concentrate diets to WAFD goats to increase ruminant performance. Conclusively, feeding a 3.8% and 4.0% bodyweight concentrate diet improves WAFD goat performance and blood profile.

The study suggests that WAFD goat farmers can include varying levels of concentrate feeds in their goats' diets to improve growth performance, carcass quality, and general health. However, careful dietary monitoring is required to avoid overfeeding and health issues such as rumen acidity. To promote nutrient utilization and general welfare, farmers should provide a well-balanced diet with suitable concentrate and roughages ratios adapted to the unique requirements of WAFD goats. Furthermore, continuous research and monitoring of feeding regimes and their effects on small ruminants is required to discover the optimal dietary levels for optimum productivity and health. Farmers should follow best practices in livestock management, such as proper feeding, regular health check-up, and appropriate housing and care, to maintain long-term output and contribute to Nigeria's animal protein supply.

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NOVELTY STATEMENTS

This study evaluate the effect of feeding concentrates at

varied levels according to the bodyweight of WAD goat. The study also evaluate its impact on the blood indices and carcass characteristics of WAD goats. It was observed that at higher levels of concentrates (3.8% and 4.0%), growth performance, blood indices and carcass qualities were improved.

AUTHOR'S CONTRIBUTIONS

Oghenesuvwe Okpara and Oghenebrorhie Obakanurhe assisted in conceptualization, methodology, writing original draft, Efe Peterson Irikefe- Ekeke, Daniel Akpofure Inweh and Oghenebrorhie Obakanurhe assisted in data collection, Data Analysis and designing of the manuscript. Oghenesuvwe Okpara supervised and evaluated the manuscript content. Oghenebrorhie Obakanurhe and Daniel Akpofure Inweh proof read and drafted the manuscript.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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