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Assessing the blood profile of grower pigs as affected by dietary supplementation of dried Guinea hen weed (*Petiveria alliacea*) leaf meal

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Abstract: To investigate the serum and haematological parameters of growing pig fed diets supplemented with Guinea hen weed leaf meal (GHWLM), thirty-six unsexed (Large white x Land race) grower pigs were allotted to four dietary treatments with nine pigs per treatment having three replicates of three pigs in a completely randomized design. Four experimental diets were formulated, where GHWLM was incorporated at 0% (Control, no GHWLM, C), 0.5% (T1), 0.75% (T2) and 1.0% (T3). Feed and water were offered *ad-libitum* throughout the experimental period. On the 70th day, blood was collected from a pig per replicate into plain and EDTA bottles for serum and haematological assay. Data collected were subjected to one-way analysis of variance and significant means were separated using Duncan multiple range test. The results showed that groups of pigs fed T1 diet had the highest average final weight (AFW), average total weight gain (ATWG) and average daily weight gain (ADWG) ($P<0.05$). Feed conversion ratio (FCR) was better for pigs fed T1 diet compared to other treatments ($P<0.05$). The pigs fed T2 and T3 diets had the highest serum total protein and globulin ($P<0.05$). Least creatinine was recorded for pigs fed T3 diet ($P<0.05$). Least value of alanine transaminase (ALT) was recorded in pigs fed T2 diet ($P<0.05$). The highest value of haemoglobin 14.85g/dl and red blood cell (RBC) 7.80 $x10^{12}$/L were obtained for pigs fed T3 diet ($P<0.05$). The mean corpuscular haemoglobin (MCH) was increased in pigs fed T2 diet ($P<0.05$). It was concluded that 1.0% of GHWLM can be supplemented in the diet of growing pigs for increased performance and better health status.

Keywords: growing pigs; Guinea hen weed; blood chemistry parameters

INTRODUCTION

To achieve better performance of most livestock in recent times requires nutrient supplementation, because most feedstuff used in the formulation of pig's diet, are no longer capable of providing the adequate nutrient required by the livestock (Alikwe et al., 2013). The harsh economic situation in Nigeria have made major suppliers of feed ingredients to embark on crooked means at maximising their profit. Some of these crooked means involved harvesting weevilled grains, poor quality legumes and deteriorated fibrous feed ingredients. The adverse effect of these manipulated activities is the surge of diseases in the livestock industry, which calls for the administration of antibiotics in most livestock ventures (Ayeni et al., 2022). The incorporation of some of the synthetic antimicrobial agents have been implicated in some human diseases because of their hazardous residual effect (Suthathip et al., 2016).

Recent biotechnological advancement has evolved with the use of herbs (root, leaf, seed, and bark of plants) (Ayoola et al., 2008; Hashemi and Davoodi, 2011) and their extracts (Mafimidiwo et al., 2021) as alternatives to the synthetic antimicrobial feed additives (Adesanya et al., 2024; Kumar, 2018). Guinea hen weed (GHWLM) is an herb of multi-purpose functionality, which includes incapacitation of worm eggs (Adebayo et al., 2022), enhancement of tissue accretion (Sobayo et al., 2018; Odetola et al., 2019), flattening of inflamed cell or tissues and act as anti-cancer in human and animals (Muhammad et al., 2018). The exhibited functionality of GHWLM, such as lipoprotein reduction capacity in broiler chicken (Obadimu, 2023), have been attributed to high content of bioactive compounds which include saponin, alkaloids, oxalate and flavonoids present in GHWLM.

The serum parameters have been adjudged the major indices for examining the response of animals as a reflection of the nutrient quality of the feed consumed by livestock (Sharma et al., 2015), while the haematological parameters help in the determination of the health status, production potential, and environmental adaptability of livestock (Adenkola et al., 2011). An investigation of the serum and haematological parameters of growing pigs fed diet supplemented Guinea hen weed leaf could reveal the efficacy of Guinea hen weed leaf. Therefore, this study is designed to investigate the performance, serum and haematological parameters of growing pigs fed diet supplemented Guinea hen weed leaf.

MATERIALS AND METHODS

The research was carried out at the Teaching and Research Farm of Yaba College of Technology, School of Agriculture, Epe, Lagos State. Epe is situated on latitude 6.65°N, longitude 3.99°E (Google Earth, 2023). It is 42m above sea level along the Epe-Ijebu ode road. Epe lies in the low land rain forest, Vegetation zone within the savannah agro-ecological zones of the south Nigeria.

The feed ingredients were sourced from a reputable feed milling industry around Ilara area of Epe, Lagos State while the GHWLM was collected from Odoragunshin town within Epe Local Government Area of Lagos State. The leaf was air-dried for 5 days, and later oven dried at 65°C for 30 minutes and then milled using 2mm sieve. The milled product was then bagged until when needed for incorporation into the diet. The proximate and some phytochemical composition of GHWLM was also determined according to standard procedures (Table 1). Four experimental diets were formulated (NRC, 2012) as shown in Table 2 where GHWLM was incorporated at 0% (Control; C), 0.5% GHWLM (T1), 0.75% GHWLM (T2) and 1.0% GHWLM (T3).

A total of thirty-six unsexed grower pigs of about 9-10kg body weight originated from a reputable farm within Epe were used in the experiment. The pigs were treated for endo and ecto-parasites using recommended veterinary drugs which was administered appropriately and

Table 1. Proximate and phytochemical composition of dry Guinea hen weed

Parameters	Quantity
Moisture (%)	17.60
Dry Matter (%)	82.40
Crude Protein (%)	10.51
Crude fibre (%)	3.24
Ether Extract (%)	7.00
Nitrogen Free Extract (%)	57.69
Ash (%)	3.96
Energy (Kcal/g)	407.12
Saponin (g/100ml)	0.503
Tannin (g/100ml)	0.286
Alkaloid (g/100ml)	1.291
Phytate (g/100ml)	0.097
Oxalate (g/100ml)	0.048
Flavonoid (g/100ml)	1.067

Table 2. Ingredients and composition of experimental diets (100g/Kg DM)

Ingredients (%)	C	T1	T2	T3
Maize	30	30	30	30
Soybean meal	12	12	12	12
Palm kernel cake	15	15	15	15
Wheat offal	39	38.50	38.25	38.00
Guinea hen weed	0	0.5	0.75	1.0
Bone meal	2.0	2.0	2.0	2.0
Limestone	1.4	1.4	1.4	1.4
Premix*	0.1	0.1	0.1	0.1
Salt (Nacl)	0.3	0.3	0.3	0.3
Lysine	0.1	0.1	0.1	0.1
Methionine	0.1	0.1	0.1	0.1
Total	100	100	100	100
Analyzed composition (%)				
Dry matter	88.12	86.78	89.11	86.14
Crude protein	16.36	14.34	14.28	14.23
Crude fiber	5.64	6.14	5.54	5.88
Ether extract	19.80	19.80	22.77	20.79
Ash	4.95	8.82	5.94	7.07
Nitrogen free extract	41.37	37.18	43.58	39.17
Energy (Kj/Kg)	10669.2	10660.83	10644.1	10627.36

**Premix: Vit. A. 5,500,000 (iu), Vit D3. 1500,000 (iu), Vit E. 10,000 (mg), Vit.k3 1,500 (mg), Vit. B1, 1,600 (mg), Vit. B2 24,000 (mg), niacin 20,000mg, pantothenic acid 5,000mg vit B6 1,500mg, Vit. B12 10mg, folic acid 500mg, Biotin H2 750mg, chlorine chloride 175,500 mg, cobalt 200mg, copper 300mg, iodine 1,000mg, iron 20,000mg, manganese 40,000 (mg), selenium 200mg, zinc 30,000mg, anti- oxidant 1,250mg.*

C = Control diet (0% GHWLM), T1= 0.5% GHWLM, T2= 0.75% GHWLM, T3= 1.0% GHWLM

the pigs were allowed to stabilize for seven days before the commencement of the feeding trial. They were provided with diets and cool clean water *ad-libitum* throughout the ten weeks of the experiment. Twelve pens of 1.5x2.0 metre size with concrete floor were washed and disinfected to accommodate the pigs during the feeding trial. The pigs were then allotted in a completely randomized design (CRD) on weight equalization basis into four dietary treatments. Each treatment had nine pigs, consisting of three replicates having three pigs in each.

At the commencement of the experiment, initial weight of pigs was measured and it was divided by the number of pigs in each replicate to obtain the average initial weight (AIW) while subsequent weight was measured weekly to determine the final weight (FW) while the average final weight (AFW) was calculated by dividing the FW by the number of pigs per pen. The average total weight gain (ATWG) was determined by the difference between the AFW and AIW while average daily weight gain (ADWG) was also calculated. A measured quantity of feed was given to the pigs and the left over was measured to obtain the average total feed intake (ATFI) while the daily feed intake was also calculated. The feed conversion ratio (FCR) was calculated as the ratio of ATFI to the ATWG.

At the end of the experiment, blood samples were collected from a pig per replicate. The blood samples for haematological parameters were collected from the jugular vein into bottles containing ethylene diamine tetra acetate (EDTA) as anticoagulant, while blood samples for serum biochemical indices were collected into plain sample bottles (without anti-coagulant).

Packed Cell Volume (PCV) was determined using Wintrobes micro-haematological method (Baker et al.,1985). Hemoglobin (Hb) and red blood cell (RBC) concentration were determined by cyanomethaemoglobin method (Benjamin, 1978). Total leukoycte counts were also determined. Biuret method of total serum protein determination was employed in this study as described by Kohn and Allen (1995). Serum albumin was determined using Bromocresol Green (BCG) method as described by Peter et al. (1982). The serum globulin concentration was obtained by subtracting albumin concentration from the total serum protein. Serum creatinine (SC) was determined using the principle of Jaffe reaction while serum urea was determined using commercial kit as described by Wootton (1964).

All data generated were subjected to one-way analysis of variance (ANOVA) in a completely randomized design using Statistical Analysis System software (SAS, 2000), while differences among significant means were separated using Duncan multiple range test (Duncan,1955) and significance was considered at P<0.05

RESULTS

Table 3 shows the performance of grower pigs fed diets with varying supplementation level of GHWLM. Pigs fed T1 diet had the highest AFW and those fed T2 and T3 diet had the lowest while those fed control diet was intermediate (P<0.05). The ATWG and ADWG followed same the trend with AFW. Pigs fed control diet had the highest ATFI and ADFI and those fed T1 diet had the lowest but it was intermediate for the group of pigs fed T2 and T3 diets (P<0.05). The FCR was better for pigs fed T1 diet compared to other treatments (P<0.05).

Table 4 shows the serum indices of grower pigs fed diet with varying supplementation level of GHWLM. There was significant difference among the treatment means across the parameters measured except for cholesterol and AST affected by the dietary treatment (P<0.05). Pigs fed control diet had the highest values for albumin (3.10 g/dl), followed by those fed T2 diet, while those fed T1 and T3 diets had the lowest albumin content (P<0.05). Total protein and globulin were significantly increased in grower pigs fed T2 and T3 diets while they were reduced in grower pigs fed control and T1 diets (P<0.05). Pigs fed T2 diet had the highest serum creatinine while those fed T3 diet had the lowest creatinine content (P<0.05). Supplementation of 0.75% GHWLM in

Table 3. Growth performance of grower pigs fed diets supplemented with dry GHWLM

Parameters	C	T1	T2	T3	SEM	P-value
Average initial weight (kg)	10.10	9.85	9.86	9.98	0.24	0.341
Average final weight (kg)	65.44^{ab}	70.98^{a}	59.25^{b}	60.24^{b}	0.72	0.017
Average total weight gain (kg)	55.34^{ab}	59.23^{a}	49.39^{b}	50.26^{b}	0.35	0.010
Average daily weight gain (kg)	0.74^{ab}	0.79^{a}	0.66^{b}	0.67^{b}	0.02	0.006
Average total feed intake (kg)	38.96^{a}	32.60^{c}	37.13^{b}	37.91^{b}	0.21	0.024
Average daily feed intake (kg)	0.52^{a}	0.43^{c}	0.50^{b}	0.51^{b}	0.01	0.001
FCR (kg/kg)	0.70^{a}	0.55^{b}	0.75^{a}	0.75^{a}	0.13	0.002

^{a,b}Means in the same row with different superscript are significantly different (P < 0.05)

FCR = Feed conversion ratio

C = Control diet (0% GHWLM), T1= 0.5% GHWLM, T2= 0.75% GHWLM, T3= 1.0% GHWLM, SEM: Standard error of mean, GHWLM: Guinea hen weed leaf meal the diet of grower pigs resulted in highest serum urea content, pigs fed control and T1 diets had the lowest urea content, and pigs fed T3 diet had intermediate urea content (P<0.05). The serum ALT was highest in grower pigs fed T1 and T2 diets while it was lowest in pigs fed control and T2 diets (P<0.05).

Table 5 shows the haematological parameters of grower pigs fed varying levels of GHWLM supplemented diets. There was a significant difference in Hb, RBC, neutrophils, lymphocyte, eosinophils, monocytes and MCH while other parameters were not significantly affected (P<0.05). The supplementation of 1% GHWLM

Table 4. Serum indices of grower pigs fed diets supplemented with dry GHWLM

Parameters	C	T1	T2	T3	SEM	P-value
Total protein (g/dl)	4.45^{b}	5.60^{ab}	6.60^{a}	6.60^{a}	0.31	0.012
Albumin (g/dl)	3.10^{a}	2.65^{b}	2.95^{ab}	2.70^{b}	0.07	0.036
Globulin (g/dl)	1.35^{ab}	2.95^{b}	3.65^{a}	3.90^{a}	0.35	0.009
Cholesterol (mg/dl)	169.15	129.60	161.25	155.00	8.18	0.392
Creatinine (mg/dl)	2.04^{b}	2.03^{bc}	2.10^{a}	1.99^{c}	0.01	0.001
Urea (mg/dl)	45.50^{b}	44.40^{b}	63.30^{a}	50.80^{ab}	2.97	0.062
Aspartate transaminase (iU/L)	177.00	130.00	167.50	121.00	15.12	0.538
Alanine transaminase (iU/L)	75.50^{b}	88.00^{a}	92.00^{a}	75.00^{b}	2.44	0.001

^{a,b,c}Means in the same row with different superscript are significantly different (P < 0.05)

C = Control diet (0% GHWLM), T1= 0.5% GHWLM, T2= 0.75% GHWLM, T3= 1.0% GHWLM

SEM: Standard error of mean, GHWLM: Guinea hen weed leaf meal

Table 5. Haematological parameters of grower pigs fed diets supplemented with dry Guinea hen weed leaf meal

Parameters	C	T1	T2	T3	SEM	P-value
PCV (%)	35.00	41.00	43.50	44.50	1.69	0.186
Haemoglobin (g/dL)	11.65^{b}	13.90^{ab}	14.55^{ab}	14.85^{a}	0.54	0.024
RBC ($x10^{12}$/L)	6.20^{b}	7.45^{ab}	7.05^{ab}	7.80^{a}	0.25	0.018
WBC ($x10^{9}$/L)	7.60	8.65	7.25	9.25	0.45	0.411
Neutrophil (%)	40.00^{a}	32.00^{b}	33.00^{b}	34.00^{b}	1.14	0.022
Lymphocyte (%)	58.00^{b}	66.00^{a}	64.00^{a}	63.00^{a}	1.08	0.023
Eosinophil (%)	1.00^{ab}	0.00^{b}	1.50^{a}	1.00^{ab}	0.21	0.058
Basophil (%)	0.00	0.50	0.50	0.00	0.12	0.193
Monocyte (%)	55.86^{b}	54.86^{b}	61.67^{a}	57.05^{b}	0.89	0.005
MCH (g/d L)	18.64^{b}	18.67^{b}	20.63^{a}	19.04^{b}	0.27	0.004
MCHC (g/d L)	33.40	32.78	33.44	33.37	0.16	0.461

^{a,b}Means in the same row with different superscript are significantly different (P < 0.05)

PCV (Packed cell volume), RBC (Red blood cell), WBC (White blood cell), MCH (Mean corpuscular haemoglobin), MCHC (Mean corpuscular haemoglobin concentration)

C = Control diet (0% GHWLM), T1= 0.5% GHWLM, T2= 0.75% GHWLM, T3= 1.0% GHWLM

SEM: Standard error of mean, GHWLM: Guinea hen weed leaf meal in the diet of grower pigs resulted in highest Hb and RBC and those fed control diet had the lowest Hb and RBC, while those fed T1 and T2 diet had intermediate Hb and RBC content (P<0.05). Grower pigs fed control diet had higher neutrophil and lower lymphocyte count compared to other treatments (P<0.05). Eosinophil was highest for grower pigs fed T2 diet and lowest for pigs fed T1 diet while it was intermediate for those fed diets control and T3 diet (P<0.05). The monocyte (61.67%) and MCH (20.63%) counts were higher for grower pigs fed diet T2 diet compared to other treatments (P<0.05).

DISCUSSION

The increased AFW and ATWG obtained for pigs fed T1 diet could be due to the suppressive effect of the GHWLM on harmful microorganism as a result of bioactive constituents of *Petiveria alliacea*. This is similar to the findings of Sobayo et al. (2018), who observed in weight and breast meat weight of broilers fed diet supplemented *Petiveria alliacea* at 500mg/kg diet. Reduced feed intake and improved FCR observed for grower pigs fed T1 diet could be attributed to the activity of phytogenic composition of *Petiveria alliacea* which suppressed the effect of intestinal worm activity and stimulated enzyme secretion for better feed utilisation. This is in agreement with the report of Adebayo et al. (2022), who reported impeding effect of Guinea hen weed leaf extract on faecal worm count of West African dwarf goats. Dietary supplementation with the medicinal plants has beneficial effect on serum and hematological indices in pigs as obtainable from this research work. The increased total protein obtained for pigs fed diets supplemented 0.75 and 1.0% GHWLM suggests improved nutrient assimilation particularly protein due to the positive effect of the phytogenic plant through increased pancreatic enzyme stimulation (Duwa et al., 2020). Improved serum globulin concentration was also observed for the group of pigs which also indicates improved nutrient availability and absorptive capacity. The observed total protein values fell within the reference range of 3.25g/dl to 7.61g/dl as reported by Rajurker et al. (2009), which suggests a stable health status. Reduced albumin observed for pigs fed diets with inclusion of GHWLM when compared with the control may not necessarily mean an alteration in protein utilisation. The obtained values were higher than the lower limit of the normal range of 2.13-3.02g/dl reported by Adeyemo (2008). Sokunbi and Egbunike (2000) stated that a reduction in the values of albumin indicates a change in the typical systemic protein metabolism, that can be attributed to possible interference in the dietary protein utilization, which is not the case in this study. The supplementation of GHWLM in the diet of growing pigs lowered the serum cholesterol value compared to the control diet although it was not significant. The lowering of blood cholesterol observed could be attributed to the presence of active phenolic components present in *Petiveria alliacea* which reduces cholesterol biosynthesis and inhibition of endogenous cholesterol absorption (Oanh et al., 2021). The serum creatinine significantly reduced for pigs fed 1.0% GHWLM supplemented diet, which implies the animal tissues are not depreciating, which can be due to muscle wastage. The creatinine values across treatment reveals that they were within the normal range reported by Brockus et al. (2005) and this shows that there was absence of muscle wastage, which can arise due to inadequate protein utilisation. The increased urea concentration observed for pigs fed 0.75% GHWLM supplemented diet is connected to the increased creatinine observed for the same group of pigs, which could be due to increased protein nutrient availability resulting in increased breakdown to nitrogen due to elevated rate of deamination (Oduguwa and Ogunmodede, 1995). The serum ALT increased for the group of pigs fed diets supplemented GHWLM at 0.5 and 0.75%, which could be associated with the phytochemicals present in the added phytogenic plant, which are detoxified and degraded on ingestion through metabolism in liver. Hence, the increase in serum ALT may not be an indication of liver damage as it is opined that increased serum concentrations of these enzymes are indicative of hepatocellular disruption (Orororo et al., 2014).

The supplementation with GHWLM irrespective of inclusion level improved the RBC count of growing pigs and this is in line with the observation of Yan and Kim (2013), who reported increased RBC when pig diet was supplemented with fermented garlic, compared to the control diet. The improved RBC implies nutrient adequacy of the diet that may have eliminated any issue of anaemia. The result of Hb shows an increasing value as level of *Petiveria alliacea* supplementation increases, which agrees with the findings of Oanh et al. (2021), who observed improved haemoglobin of pigs fed diet supplemented medicinal plants mixture. The increased Hb observed in this study could be due to increased nutrient utilisation due to the activity of polyphenols present in *Petiveria alliacea,* which has the capacity of stimulating digestive enzymes for improved absorption. Dietary supplementation of GHWLM increased lymphocyte concentrations. This is in agreement with the report of Yan and Kim (2013), who reported that dietary fermented garlic supplementation of in the diet of growing pigs resulted in increased lymphocyte count. Although the increased value obtained for the lymphocyte does not necessarily indicates diseased state but may connotes the boosting of the pigs' immune system. Jeong and Kim (2015) also reported increase in the WBC concentration of growing pigs fed diet supplemented with *Gymura procumbens, Rehmannia glutinosa, Scutellaria baicalensis,* which did not show any adverse effect. Increased MCH was observed for pigs fed diet supplemented 0.75% GHWLM, which suggests good health status of the pigs. This improvement in MCH count obtained for these pigs is similar to the observed value in PCV although not significant, which implies adequate blood flow in circulation. It was observed that the values of MCH and MCHC were within the range 17-24 and 29-34 reported by Merck's Manual (1998). These values generally indicate enough iron in the circulating blood. The MCH and MCHC values are known to be important haematological indices, which tells the anaemic state of animals (Campbell and Ellis, 2007). The non-significant result obtained in the WBC and MCHC may depict the lack of presence of any harmful pathogen in the diets of the pigs thus anticipating a stable health condition for the pigs.

CONCLUSION

Dietary supplementation of GHWLM at the rate of 1.0% in the diet of grower pigs resulted in increased ATWG and better FCR. Improved serum total protein and serum globulin was also achieved with the supplementation of 1.0% GHWLM in the diet of grower pigs. Dietary supplementation of 1.0% dry GHWLM in the diets of grower pigs improved RBC count, haemoglobin and mean corpuscular haemoglobin counts, which are important determinants of health status for better performance. Therefore, it is recommended that 1.0% dry GHWLM can be supplemented in grower pig's diets for better performance and improved animal health status.

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