Response of West African Dwarf goats fed guinea grass grown with different organic manure

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ABSTRACT

Background and Objectives: An adequate forage supply for ruminants has become imperative in nutrition. This is due to the nature of their gastrointestinal tract for efficient nutritional utilization and optimum performance. Also, one of the cheapest ways of growing nutritive forage species for ruminants is through organic manure, which, in most cases, is often difficult to dispose of, constituting environmental pollution. This study was conducted to determine the response of West African Dwarf goats fed a basal diet of guinea grass grown with different organic manure.

Methodology: Four different plots laid out in a randomized complete block design were used to grow the guinea grass with different organic manure: plot 1 (guinea grass grown without organic manure), plot 2 (guinea grass grown with poultry manure), plot 3 (guinea grass grown with swine manure), and plot 4 (guinea grass grown with cattle manure). The feeding trial consisted of a total of sixteen growing West African female goats of 5–6 months with an average weight of 6.50 ± 0.25 kg were used for the feeding trial. They were randomly assigned to four dietary treatments with four animals per treatment in a completely randomized design in a factorial arrangement. The diets were T1 (60% guinea grass grown with no manure + 40% concentrate), T2 (60% guinea grass grown with poultry manure + 40% concentrate), T3 (60% guinea grass grown with swine manure + 40% concentrate), and T4 (60% guinea grass grown with cattle manure + 40% concentrate).

Main Results: Nutrient compositions of the grass were significantly ($P < 0.05$) influenced by organic manure application while dietary group fed guinea grass with cattle manure application had significantly ($P < 0.05$) higher forage intake (5,697.19 ± 55.97 g) and weight gain (1.06 ± 0.30 kg) than other groups whereas hemoglobin (8.05 ± 0.58 g/dL) and red blood cell ($2.92 \pm 6.17 \times 10^{12}$/L) were significantly ($P < 0.05$) higher for goats fed guinea grass fertilized with poultry manure.

Conclusions: It can be concluded that the use of poultry manure and cattle dung application in growing guinea grass as a basal diet has the potentials to boost performance and hematological indices of goats.

Keywords: Performance, blood, forage, grass, organic, goats

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INTRODUCTION

Ruminant production plays a pivotal role in the supply of animal protein for human consumption. Not only that, providing employment sources for livelihood sustenance and regular cash flow for farmers are also benefits often obtained by raising goats at smallholder and commercial levels, aside from goats being a multipurpose animal supplying meat, milk, fiber, and manure. Alikwe *et al.* (2011) affirmed that out of all these products being produced by goats, meat has been the major product usually consumed in Nigeria. More so, Odeyinka (2000) in their view opined that goat meat often receives higher demand than beef, especially in rural areas. Small ruminants, particularly goats, play a very important role in the life of small-holder farmers through their anatomical-physiological ability to convert low-cost feed resources to high-value products such as meat, milk, and skin. The goat is one of the most important, adaptable, and geographically widespread livestock species, which provides a good source of meat, milk, and other by-products and is therefore referred to as a poor man's cow. This appellation arises from the fact that goats and their products are more affordable to the common man than cattle.

The West African Dwarf (WAD) goat breed is an important indigenous goat breed that is well adapted to humid and sub-humid regions. It is associated with Tsetse flies that cause trypanosomiasis. In most tropical countries, ruminant animals are maintained on native pastures, crop residues, and agro-industrial by-products as their main source of nutrients (Udo, 2015). Hence, the use of pasture grass and legumes has been advocated for small ruminant animal production as they readily serve as feed sources.

However, adequate and quality production of goats for its meat and other products may not be achievable without the required forage supply for optimum production. One of the essential forages usually relished by ruminants is guinea grass. It is no news that during the dry season, natural grassland, post-harvest crop residues, and agro-industrial by-products often become feed resources for ruminants. However, these feed resources are often deficient in required nutrients for better productivity. Thereby leading to reduced weight gain, reproductive wastage, and reduced resistance to disease infections. To forestall these losses, there is a need to grow grass material such as *Panicum maximum* to serve as a forage resource with concentrate supplementation during the dry season. *P. maximum* is one of the common forage plants in the tropics, and animals often enjoy it. It is important in animal production because of its persistent growth and quality when managed properly (Olanite *et al.,* 2014). Guinea grass is one of the most important fodder crops in the tropics, application of specific amounts of required nutrients at a particular time in order to maximize yield and quality is a necessity. Forage yields are typically reduced when soil fertility is low.

As a result, farmers in conventional agriculture use chemical fertilizers to boost forage productivity. Relying solely on chemical fertilizers may deplete soil micronutrients, and excessive application of these fertilizers has resulted in environmental issues (Veeramani and Subrahmaniyan, 2011). Chemical fertilizers alone may have negative environmental consequences, and they need to be refilled every planting season because synthetic fertilizers are rapidly lost by evaporation or leaching, resulting in harmful environmental pollution, as reported by Aisha *et al*. (2007). More so, commercial fertilizers are becoming expensive and unaffordable for poor farmers. As a result, the application of organic manure can boost both the physical and biochemical properties of the soil (Esmaelian *et al.,* 2012), thereby increasing forage output and nutritional value, according to Adenawoola (2005). As a result, organic manure fertilization of fodder land fits nicely into the context of nutrient recycling and environmental conservation. According to Olasupo *et al.* (2018), applying organic manure directly to the soil helps maintain an acceptable quantity of organic matter, which is an important component of soil fertility and production. Organic manure application to sandy soil not only benefits crop growth, but also improves coarse soil qualities (Uzoma *et al.,* 2011), and reduces groundwater contamination caused by leaching of soil nitrogen.

Furthermore, the use of swine manure in forage fertilization has been given little or no consideration despite previous research conducted on pasture establishment and forage fertilization. Therefore, this study was conducted to investigate the growth performance and hematology of growing WAD goats fed *P. maximum* grown with different organic manures.

MATERIALS AND METHODS

This study was conducted at the Sheep and Goat Unit of the Prince Abubakar Audu University Livestock Teaching and Research Farm, Anyigba. Anyigba lies between 7°5' N and 7°21' E of the equator and longitude 7°11' N and 7°32' E of the Greenwich meridian with an altitude of about 420 m above the sea level. The zone is characterized by 6 to 7 months of average annual rainfall of about 1,600 mm and daily temperature range between 25 and 35°C (Ifatimehin *et al.,* 2009). Four different experimental plots were cleared and plowed, after which organic manures were applied by broadcasting at 200 kg/ha N. Plot 1 (guinea grass without organic manure), plot 2 (guinea grass with poultry manure), plot 3 (guinea grass with swine manure), and plot 4 (guinea grass with cattle manure). Each plot was replicated thrice in a randomized complete block design. Required agronomic practices were carried out for 12 weeks before harvesting for feeding experimental animals.

Experimental Animals and Management

A total of sixteen growing WAD female goats of 5 to 6 months with an average weight of 6.50 ± 0.25 kg were used for the 60-day feeding trial. They were sourced from goat markets around Anyigba environs. The pen was cleaned, washed, disinfected, and fumigated two weeks before the arrival of the goats. Prophylactic treatments were given to all the goats: they were de-wormed and vaccinated against common ruminant animal diseases. Thereafter, the animals were tagged and randomly assigned to four dietary treatments in a completely randomized design (CRD) in a factorial arrangement under an intensive management system. The animals were kept in their individual pens of 2.5 m × 2.0 m with a height of 2 m/head. Each treatment consisted of four goats with four replicates, each goat serving as a replicate. 60% *P. maximum* grown without organic manure + 40% concentrate was allotted to control (T1), 60% *P. maximum* grown with poultry droppings + 40% concentrate was allotted to T2, 60% *P. maximum* grown with swine manure + 40% concentrate was allotted to T3, 60% *P. maximum* grown with cow manure + 40% concentrate allotted to T4, respectively (Table 1). The goats were fed daily on 5% body weight, and the experiment lasted for 60 days.

Nutrient Composition of Experimental Diets

Samples of experimental diets and forage (*P. maximum*) were analyzed for chemical composition according to AOAC (2011).

Data Collection for Performance Evaluation

Data collected for performance characteristics include weight gain, feed intake, average daily gain, forage intake, concentrate intake, total feed intake, average daily forage intake, average daily concentrate intake, average daily feed intake, and feed conversion ratio. Weight gain was measured by subtracting the final weight from the initial weight of the goats. The average daily gain was estimated as the difference between final and initial weights divided by the number of experimental days. Forage intake was estimated as the quantity of grass consumed by the animals during the experimental period. The same method applies to concentrate intake. Total feed intake was estimated as the total of forage and concentrate intake. The feed conversion ratio was estimated as the quantity of feed consumed divided by the weight gained.

Table 1 Gross composition of experimental diet

Treatments	T1 (60:40)	T2 (60:40)	T3 (60:40)	T4 (60:40)
Forage (60%)	*Panicum maximum* + No manure	*Panicum maximum* + Poultry manure	*Panicum maximum* + Swine manure	*Panicum maximum* + Cattle manure
Concentrate (40%)				
Cassava peel	20.0	15.0	19.5	10.5
Maize bran	10.0	15.0	10.5	19.5
BNW	4.0	4.0	4.0	4.0
Palm kernel cake	5.0	5.0	5.0	5.0
Limestone	0.5	0.5	0.5	0.5
Salt	0.5	0.5	0.5	0.5
Total	100	100	100	100

Note: BNW = Bambara nut waste, T1 (60:40) = *P. maximum* grown without organic manure + concentrate, T2 (60:40) = *P. maximum* grown with poultry manure + concentrate, T3 (60:40) = *P. maximum* grown with swine manure + concentrate, T4 (60:40) = *P. maximum* grown with cattle manure + concentrate.

Data Collection for Hematological Evaluation

Blood samples were collected from the jugular vein of the goats at the end of the experiment from two goats per treatment in the morning before feeding. Blood samples were collected into EDTA sample bottles and analyzed for packed cell volume (PCV), hemoglobin concentration (Hb), red blood cells (RBC), white blood cells (WBC), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), neutrophils, and lymphocytes according to Taiwo and Ogunsanmi (2003).

Data Analysis

Data collected was subjected to analysis of variance (ANOVA) with the aid of the Statistical Package for the Social Sciences (SPSS 20) computer software package. Means that were significantly different were separated using Duncan's new multiple range test at a 5% level of significance.

RESULTS AND DISCUSSION

Proximate Composition of Concentrate Diets

The dry matter values for the concentrate diet ranged from 95.95 to 97.08%, with T2 having the highest values (Table 2). The dry matter content in this study was higher than 86.06% reported by Eyoh *et al*. (2019) in their study with WAD goats fed processed guinea grass and concentrate supplements. Crude protein content ranged between 12.67% and 14.11% in T3 and T1, respectively. The values were within the range of 10 to 16% reported by Yusuf *et al.* (2013) in their study involving growing WAD goats fed broiler litter waste and urea-based diets. Values of crude fiber content ranged from 10.15 to 12.17%. These values were higher than 4.45 to 6.34%, as reported by Ajagbe *et al.* (2020) in their study on rumen parameters of WAD goats fed cassava peels-poultry manure concentrate supplements. Ether extract content varied between 2.12% and 3.09%. These values were lower compared to 9.17% reported by Adebayo *et al.* (2017). Ash content values of 8.15 to 9.02% in this study were lower than 11.18 to 13.97% reported by Ibhaze *et al.* (2021) in their study on the blood profile of WAD goats fed *P. maximum* supplemented with *Myrianthus arboreus* leaf meal. Nitrogen-free extract values of 71.75 to 72.95% in this study were lower than 72.29 to 86.12% reported by Ajagbe *et al.* (2020). Variations in nutrient compositions of experimental diets might be attributed to different feed ingredients, processing methods, and soil conditions from which the feed materials used were harvested. Other factors, such as the location's climatic factors, can be contributory factors.

Table 2 Proximate composition of concentrate diets

Parameters (%)	T1 (60:40)	T2 (60:40)	T3 (60:40)	T4 (60:40)
Dry matter	96.86	97.08	96.56	95.95
Crude protein	14.11	12.95	12.67	13.46
Crude fiber	10.15	12.17	12.17	11.43
Ether extract	2.12	2.15	3.09	2.17
Ash	8.15	9.02	8.43	8.25
Nitrogen-free extract	72.48	72.95	72.59	71.75

Note: T1 (60:40) = *P. maximum* grown without organic manure + concentrate, T2 (60:40) = *P. maximum* grown with poultry manure + concentrate, T3 (60:40) = *P. maximum* grown with swine manure + concentrate, T4 (60:40) = *P. maximum* grown with cattle manure + concentrate.

Proximate Composition of Guinea Grass Grown with Different Organic Manure

The proximate compositions of the grass were affected by manure type ($P < 0.05$) except for ash content (Table 3). The dry matter content of the grasses as affected by manure type ranged from 95.37 to 96.46%. These values were higher than 92.97 to 94.08% reported by Saheed *et al.* (2019) and 72.28% reported by Adebisi *et al.* (2016). Values for crude protein ranged from 4.76 to 6.03% which was below 9.42% reported by Adegun and Fajemilehin (2018). The values obtained in this study for crude protein content were lower to 10.36 to 12.91%, as reported by Alalade *et al.* (2015) in their study on manure application effects on herbage yield, nutritive value, and performance of WAD sheep fed *P. maximum.* The crude fiber composition of the grasses ranged between 3.86% and 4.13%. The values were lower than 15.17 to 16.17% recorded by Narmhikaa *et al.* (2019). Ether extract of the grasses as affected by manure type ranged from 1.75 to 2.05%. These values were lower than the range of 3.52 to 6.95% reported by the same authors. Nitrogen-free extract values observed were between 85.40% and 86.86%. The values were higher than 44.34% reported by Adegun and Fajemilehin (2018) in their study of growth performance and carcass characteristics of Yankasa rams fed varying levels of *P. maximum* concentrate mix under an intensive feedlot. The values were also higher than 61.56% and 75.73% reported by Eyoh *et al.* (2019). Also, Adebisi *et al.* (2016) reported a nitrogen-free extract of 66.00% for *P. maximum* in their study on the performance and nutrient digestibility of WAD goats fed *P. maximum* supplemented with *Gmelina arborea* leaves mixture. Neutral detergent fiber (NDF) ranged from 26.14 to 32.14%, acid detergent fiber (ADF) ranged from 8.38 to 9.65%, and acid detergent lignin (ADL) recorded in this study ranged between 9.07% and 11.04%. The values obtained for these fiber fractions were lower than values reported by Babayemi (2009) for his study on silage quality, dry matter intake, and digestibility by WAD sheep fed guinea grass (*P. maximum* cv Ntchisi) harvested at 4- and 12-week regrowth. Also, Abegunde *et al.* (2017) reported 65.58, 39.79, and 11.28% for NDF, ADF, and ADL, respectively, for their study on the supplemental value of leaf-based concentrates with *P. maximum* hay on the performance of WAD goats. Variations in nutrient and fiber fractions might be attributed to soil type, climate, soil fertility, agronomic practices, and grass variety. Hemicellulose ranged from 16.49 to 23.76%, while cellulose ranged from 0.32 to 2.66%. Observed values for hemicellulose and cellulose were higher than values reported by Saheed *et al*. (2019) in their similar study on the effects of animal manures and cutting height on the chemical composition of two *P. maximum* varieties (Local and Ntchisi) harvested at different stages of growth.

Table 3 Proximate composition of *Panicum maximum* grown with different organic manure

Parameters (%)	T1 (60:40)	T2 (60:40)	T3 (60:40)	T4 (60:40)	P-value
Dry matter	95.37 ± 0.35^{b}	96.36 ± 0.33^{a}	96.35 ± 0.14^{a}	96.46 ± 0.34^{a}	0.043
Crude protein	5.15 ± 0.95^{b}	5.14 ± 0.95^{b}	4.76 ± 0.51^{c}	6.03 ± 0.49^{a}	0.011
Crude fiber	4.13 ± 2.28^{a}	3.86 ± 0.14^{d}	3.93 ± 4.56^{c}	4.05 ± 2.32^{b}	0.022
Ether extract	1.83 ± 0.25^{b}	2.05 ± 0.25^{a}	2.02 ± 0.25^{a}	1.75 ± 0.33^{c}	0.012
Ash	3.11 ± 0.25	2.76 ± 0.25	2.84 ± 0.25	2.93 ± 0.25	0.050
Nitrogen-free extract	85.87 ± 1.27^{b}	86.59 ± 0.43^{a}	86.86 ± 0.96^{a}	85.40 ± 0.14^{b}	0.032
Neutral detergent fiber	28.86 ± 0.19^{c}	30.14 ± 0.76^{b}	32.14 ± 0.34^{a}	26.14 ± 0.25^{d}	0.022
Acid detergent fiber	9.36 ± 0.25^{a}	8.75 ± 0.28^{b}	8.38 ± 0.28^{b}	9.65 ± 0.54^{a}	0.011
Acid detergent lignin	10.00 ± 0.11^{b}	9.07 ± 0.23^{d}	11.04 ± 0.46^{a}	10.16 ± 0.54^{c}	0.025
Hemicellulose	19.47 ± 0.34^{c}	21.38 ± 0.77^{b}	23.76 ± 0.44^{a}	16.49 ± 0.15^{d}	0.011
Cellulose	0.51 ± 0.36^{b}	0.32 ± 0.22^{b}	2.66 ± 0.74^{a}	0.51 ± 0.55^{b}	0.042

Note: ^{abcd} Means on the same row with different superscripts are significantly different (P < 0.05). T1 (60:40) = *P. maximum* grown without organic manure + concentrate, T2 (60:40) = *P. maximum* grown with poultry manure + concentrate, T3 (60:40) = *P. maximum* grown with swine manure + concentrate, T4 (60:40) = *P. maximum* grown with cattle manure + concentrate.

Growth Performance of WAD Goats Fed Guinea Grass Grown with Different Organic Manure

Weight gain and voluntary feed intake were significantly (P < 0.05) influenced by dietary treatments (Table 4). The WAD goats fed with *P. maximum* fertilized with cattle manure recorded higher values for weight gain, total feed intake, and average daily feed intake. The average daily gain of 21.00 to 22.50 g/day observed in this study was lower than 32.97 to 38.40 g/day reported by Abegunde *et al.* (2017) for WAD goats fed supplemental value of leaf-based concentrates with *P. maximum* hay. Higher weight gain for dietary group fed grass fertilized with cattle manure might be attributed to the higher crude protein content of the grass, as reported in Table 2. Notably, the body condition associated with the growth rate of animals can be improved by increased protein supplementation in animals' diets. Higher voluntary feed intake observed in this study indicated better nutrient content of the feed. Values of average daily forage intake recorded in this study were lower than 271.60 to 303.30 g/day reported by Abegunde *et al.* (2021) and 484.47 to 742.96 g/day reported by Eyoh *et al.* (2019) when they fed different forms of processed guinea grass to WAD bucks. The feed conversion ratio obtained in this study ranged between 8.44 and 9.77. These values fell within 8.15 to 13.63, as reported by Abegunde *et al.* (2021) for WAD goats fed guinea grass ensiled with fermented juice of epiphytic lactic acid bacteria from *P. maximum* (FEJPM).

Table 4 Performance of West African Dwarf goats fed *Panicum maximum* grown with different organic manure

Parameters	T1 (60:40)	T2 (60:40)	T3 (60:40)	T4 (60:40)	P-value
Initial weight (kg)	6.63 ± 0.29	6.73 ± 0.12	6.39 ± 0.19	6.33 ± 0.23	0.651
Final weight (kg)	7.39 ± 0.79	7.76 ± 0.51	7.37 ± 0.64	7.39 ± 0.46	0.672
Weight gain (kg)	0.76 ± 0.15^{b}	1.03 ± 0.53^{a}	0.98 ± 0.37^{ab}	1.06 ± 0.30^{a}	0.051
Average daily gain (g)	21.75 ± 0.47	22.50 ± 1.50	21.00 ± 0.70	22.25 ± 0.94	0.332
Forage intake (kg)	5,024.18 ± 0.10^{c}	5,544.41 ± 0.43^{b}	5,663.05 ± 48.92^{a}	5,697.19 ± 55.97^{a}	0.050
Concentrate intake (kg)	3,225.48 ± 0.12^{c}	3,573.35 ± 14.74^{a}	3,551.94 ± 3.31^{a}	3,511.04 ± 20.95^{b}	0.026
Total feed intake (kg)	8,249.55 ± 0.12^{b}	9,117.74 ± 14.50^{a}	9,212.00 ± 48.45^{a}	9,208.24 ± 39.16^{a}	0.022
ADFI (g)	111.65 ± 0.01^{c}	123.52 ± 0.58^{b}	123.27 ± 0.41^{b}	126.60 ± 1.24^{a}	0.017
ADCI (g)	71.67 ± 0.01^{c}	79.33 ± 0.29^{a}	79.22 ± 0.26^{a}	78.02 ± 0.46^{b}	0.025
Average daily feed intake (g)	183.25 ± 0.01^{c}	202.62 ± 0.32^{a}	204.71 ± 1.07^{a}	204.62 ± 0.87^{a}	0.012
Feed conversion ratio	8.44 ± 0.18^{b}	9.12 ± 0.59^{ab}	9.77 ± 0.27^{a}	9.24 ± 0.34^{ab}	0.022

Note: ^{abcd} Means on the same row with different superscripts are significantly different ($P < 0.05$). T1 (60:40) = *P. maximum* grown without organic manure + concentrate, T2 (60:40) = *P. maximum* grown with poultry manure + concentrate, T3 (60:40) = *P. maximum* grown with swine manure + concentrate, T4 (60:40) = *P. maximum* grown with cattle manure + concentrate, ADFI = average daily forage intake, ADCI = average daily concentrate intake.

Hematological Evaluation of West African Dwarf Goats Fed with Guinea Grass

Hemoglobin, red blood cells, mean corpuscular hemoglobin, and neutrophils were significantly ($P < 0.05$) influenced by dietary treatments (Table 5). The hemoglobin values obtained in this study ranged from 7.07 to 8.20 g/dL across the treatments. These values were within the range reported by Njidda *et al*. (2013) on WAD goats fed on natural rangeland of Northern Nigeria. Also, these values were within 9.98 to 10.88 g/dL, as reported by Ajagbe *et al*. (2019) on WAD goats fed cassava peel with supplemental nitrogen sources. The values obtained in this study indicate the absence of microcytic and hypochromic anemia occasioned by iron deficiency or its improper utilization for the formation of hemoglobin. Red blood cell (× 10^{12}/L) was significantly ($P < 0.05$) influenced by dietary treatments, with a higher value observed for goats fed *P. maximum* fertilized with poultry manure. Red blood cells ranged from 2.07 to 2.92 × 10^{12}/L. The values obtained were within the range of 2.19 to 6.87 × 10^{12}/L reported by Ajagbe *et al.* (2019) for WAD goats fed cassava peels supplemented with nitrogen sources. The values obtained were lower compared to 8.68 to 11.42 × 10^{6}/μL, as reported by Omotoso *et al.* (2017) for WAD goats fed *P. maximum* replaced with untreated cocoa pod meal. Binuomote *et al.* (2020) reported 2.76 to 3.65 × 10^{6}/μL for WAD goats fed *P. maximum* with varying levels of *Gmelina arboreal* leaves. Variations in values obtained can be attributed to the age of the animal used as well as the types of diets used. Also, the mean corpuscular hemoglobin values obtained ranged from 27.90 to 34.32 g/dL. While blood cell differential analysis conducted for neutrophils indicated range values from 60.50% to 74.76%. Observed values for neutrophils showed that higher values were obtained for goat group fed guinea grass fertilized with swine manure. These values were higher than 27.00% to 33.33% reported by Ibhaze (2015). Variantions in the values obtained by different authors might be attributed to nutrient compositions of the feed with which the experimental animals were fed as well as stess conditions of the animals. Higher neutrophils indicated that immune system of the animals was activated to phagocyte any discase infection in the directory group among experimental animals.

Table 5 Hematological indices of West African Dwarf goats fed organically grown *Panicum maximum* and concentrate supplements

Parameters	T1 (60:40)	T2 (60:40)	T3 (60:40)	T4 (60:40)	P-value
Hemoglobin (g/dL)	8.20 ± 0.14^{a}	8.05 ± 0.58^{a}	7.40 ± 0.94^{ab}	7.07 ± 0.33^{b}	0.023
Packed cell volume (%)	27.62 ± 6.39	30.37 ± 4.35	25.37 ± 9.03	20.90 ± 1.38	0.061
White blood cell (×10^{9}/L)	18.10 ± 3.86	19.90 ± 3.11	20.32 ± 5.69	17.67 ± 2.80	0.412
Red blood cell (×10^{12}/L)	2.90 ± 0.23^{a}	2.92 ± 6.17^{a}	2.48 ± 0.43^{b}	2.07 ± 0.18^{c}	0.042
MCV (fL)	67.87 ± 42.52	103.17 ± 8.57	99.75 ± 19.05	100.72 ± 0.18	0.065
MCH (g/dL)	29.90 ± 2.56^{b}	27.90 ± 3.32^{b}	29.92 ± 1.87^{b}	34.32 ± 1.13^{a}	0.015
MCHC (pg)	32.87 ± 7.70	27.90 ± 5.49	31.20 ± 8.02	31.15 ± 2.97	0.271
Lymphocyte (%)	32.50 ± 5.49	34.85 ± 7.04	29.00 ± 2.61	33.00 ± 1.47	0.651
Neutrophil (%)	60.50 ± 1.29^{b}	61.00 ± 8.95^{b}	74.76 ± 1.22^{a}	60.96 ± 3.50^{b}	0.012

Note: ^{abcd} Means on the same row with different superscripts are significantly different ($P < 0.05$). T1 (60:40) = *P. maximum* grown without organic manure + concentrate, T2 (60:40) = *P. maximum* grown with poultry manure + concentrate, T3 (60:40) = *P. maximum* grown with swine manure + concentrate, T4 (60:40) = *P. maximum* grown with cattle manure + concentrate, MCV = mean corpuscular volume, MCH = mean corpuscular hemoglobin, MCHC = mean corpuscular hemoglobin concentration.

CONCLUSIONS

Based on the results obtained from this research study, the application of poultry and cattle manure has the potential to influence the nutritive values of guinea grass (*P. maximum)* for better growth performance and hematological profiles of goats. The use of organic manure in growing improved natural grassland is necessary to be considered as a better option in ruminant production and pasture utilization.

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