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Growth Performance of West African Dwarf Goats Fed Guinea Grass and Oil Palm Fronds Mixture, Supplemented with Moringa Oleifera

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ABSTRACT

The aim of this study was to examine the growth performance of West African Dwarf Goats (WADG) subjected to different diets containing oil palm fronds (OPF) and Guinea grass (Megathyrsus maximus), which were supplemented with different levels of Moringa oleifera inclusion. Thirty (30) growing WAD goats aged 8–10 months with initial weights between 7.63 kg and 8.15 kg were used for the 120 days experiment. The thirty goats were assigned to five dietary treatments (T1–T5) in a completely randomized design, with T1 serving as the control (0% Moringa) and T5 containing 20% Moringa inclusion. During the experiment growth performance, feed intake, feed conversion ratio (FCR), nutrient digestibility and blood indices were measured and statistically analyzed using one way analysis of variance (One way ANOVA). The result revealed the average weight gain was significant (P< 0.05) across the treatment groups. Goats in T3 (10% Moringa) had the highest average daily gain (ADG) and nutrient digestibility, while T4 (15% Moringa) recorded the best FCR. The study showed that moderate Moringa supplementation (10–15%) significantly improved growth performance without adverse effects. However, higher inclusion levels (20%) showed reduced efficiency, likely due to anti-nutritional factors. Hence, feeding this diet supplemented with Moringa (10–15%) to WAD goats should be encouraged among farmers in order to optimize ruminant performance. Conclusively, this feed can help improve growth performance and health of WAD goats thus, providing a sustainable and cost-effective feeding strategy for smallholder farmers.

Keywords: *West African Dwarf Goat, Moringa oleifera, Guinea Grass, Oil Palm Fronds, Growth Performance, Body weight*

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INTRODUCTION

Small ruminants particularly goats, play a vital role in the livelihoods of rural households in Nigeria, these goats serve as important sources of meat, milk, manure, and financial security. The West African Dwarf goat is one of the small breed of ruminants is highly valued for its adaptability, disease resistance, and low maintenance requirements. However, the productivity of WAD goats remains suboptimal due to inadequate nutrition, especially during the dry season when natural pastures are scarce and of poor quality (Odeyinka, 2024). Therefore, incorporating legumes or drought-resistant trees and grasses into pasture systems helps combat this (Tafsin *et al.*, 2019). Guinea grass (*Megathyrsus maximus*), a commonly used forage, known for its high biomass yield but limited crude protein content and Oil palm fronds (OPF), a by-product of the oil palm tree, are fibrous but nutritionally poor. Although these forages are abundant, readily available and help reduce feeding costs, they cannot meet the nutrient demands of growing goats when used alone. Thus, supplementation is necessary to improve their nutritional balance, promote nutrient intake and enhance digestibility (Heuzé and Tran, 2020; Okpara *et al.*, 2024). *Moringa oleifera*, widely referred to as the "miracle tree," is rich in protein, vitamins, minerals, and bioactive compounds. It is drought-resistant and grows well in tropical regions, making it a suitable supplement during periods of feed scarcity, this is very important as one of the main issues goat farmers experience in the Africa particularly Nigeria, is the sustainable supply of animal protein (Okpara, 2020; Obakanurhe *et al.*, 2024). Therefore, utilizing *Moringa* as a supplement could address this nutritional gap. Previous studies have reported improved growth performance and blood parameters in livestock fed *Moringa*-based diets. However, little is known about its efficacy when combined with Guinea grass and OPF as a dietary base for WAD goats. This study, therefore, aimed to evaluate the growth performance, nutrient digestibility, and blood indices of WAD goats fed Guinea grass and oil palm fronds mixture supplemented with varying levels of *Moringa oleifera*. The findings provide insights into developing affordable and sustainable feeding strategies for smallholder goat farmers, particularly in regions affected by climate change and economic constraints.

MATERIALS AND METHODS

Experimental Site

The research took place at the Teaching and Research Farm, faculty of Agriculture, Delta State University, Abraka. The location lies within the humid tropics, at latitude 6º14'N and longitude 6º49'E. The area receives annual rainfall ranging from 1500 mm to 3000 mm, with temperatures between 27.5°C and 30.9°C and relative humidity levels of 77.2% to 80%.

Experimental Animals and Management

Thirty growing West African Dwarf (WAD) goats at 8–10 months of age, with initial average weights of between 7.63 kg to 8.15 kg were used. Before the trial began, the pens were washed, disinfected, while the feed and water troughs were properly cleaned and dried. Wood shavings were used as bedding and changed regularly to maintain hygiene. The goats were vaccinated against *Peste des Petits Ruminants* (PPR) and dewormed using Ivermectin. Following a 14 day acclimatization period, the goats were randomly assigned into five treatment groups (T1–T5) with six animals per group in a completely randomized design (CRD). Each group received a different dietary treatment for 120 days, Feed and was provided twice daily which lasted for a period of 12 weeks.

Dietary Treatments

The layout of the percentage combination of the various dietary treatments are as follows:

T1: *Moringa oleifera* leaves (0%) + Guinea grass + Oil palm fronds mixture (100%) (Control)
T2: *Moringa oleifera* leaves (5%) + Guinea grass + OPF mixture (95%)
T3: *Moringa oleifera* leaves (10%) + Guinea grass + OPF mixture (90%)
T4: *Moringa oleifera* leaves (15%) + Guinea grass + OPF mixture (85%)
T5: *Moringa oleifera* leaves (20%) + Guinea grass + OPF mixture (80%)

Data Collection

Data collection during the experiment included the following:

Feed Intake

Daily feed intake = Feed offered – Feed refused
Total feed intake = Total sum of feed intake for 120 days
Average daily intake = Total feed intake ÷ 120

Body Weight Measurements

Initial body weight
Final body weight
Total weight gain = Final weight – Starting weight or Initial weight
Average daily gain (ADG) = Total weight gain ÷ 120 days
Feed Conversion Ratio (FCR) = Total feed intake ÷Total weight gain

Statistical Analysis

Data were statistically analyzed using one-way Analysis of Variance (ANOVA) on the statistical software package SPSS (version 27.0.1). Differences among treatment means were separated using Duncan's Multiple Range Test at a 5% significance level ($p < 0.05$).

RESULTS

The proximate composition of Moringa leaves, Guinea grass, and oil palm fronds (Table 1) reveals distinct nutritional characteristics that have critical implications for their utilisation in ruminant feeding systems. The moisture and dry matter (DM) profiles indicate a wide variability in water content among the three feed resources. Moringa leaves (13.67% moisture; 86.33% DM) and oil palm fronds (6.15% moisture; 93.85% DM) exhibit high DM content, which is advantageous for nutrient density, storage stability, and reduced transportation costs. This is consistent with the findings of Abd El-Hack et al. (2018),

Table 1: Proximate composition (%) of the experimental feed materials

Component	Moringa Leaves	Guinea Grass	Oil Palm Fronds
Moisture (%)	13.67	77.3	6.15
Crude Protein (%)	28.50	11.2	3.00
Fat (Ether Extract) (%)	2.33	1.8	2.00
Crude Fiber (%)	12.2	37.3	70.0
Neutral Detergent Fiber (NDF) (%)	22.7	72.3	69.5
Acid Detergent Fiber (ADF) (%)	15.3	43.4	50.9
Ash (%)	10.8	10.5	4.8
Carbohydrate (%)	56.50	40–45	57.6
Dry Matter (%)	86.33	22.7	93.85

Values are expressed as percentages (%) of the total composition of each sample. DM: Dry Matter, ADF: Acid Detergent Fiber, NDF: Neutral Detergent Fibers

Table 2: Growth Performance Characteristics of WAD Goats

Parameter	T1	T2	T3	T4	T5	SEM
Initial Weight (kg)	7.86^{b}	7.63^{c}	8.15^{a}	7.93^{b}	7.73^{c}	0.41
Final Weight (kg)	10.86^{c}	10.75^{c}	12.28^{a}	11.86^{b}	11.31^{b}	0.28
Total Weight Gain (kg)	3.00^{d}	3.12^{d}	4.13^{a}	3.93^{b}	3.58^{c}	0.24
Average Daily Gain (g/day)	25.0^{d}	26.0^{d}	34.42^{a}	32.75^{b}	29.83^{c}	1.97
Average Feed Intake (g/day)	585^{b}	580^{b}	629^{a}	590^{b}	571^{c}	10.3
Feed Conversion Ratio	23.40^{c}	22.32^{c}	18.28^{ab}	18.01^{a}	19.12^{b}	0.91

$^{a, b, c, d}$**:** Means on the same row with different superscripts differ significantly ($P < 0.05$).

Table 3. Apparent nutrient digestibility coefficients (%) of West African Dwarf goats fed diets containing varying levels of *Moringa oleifera* supplemented to a basal mixture of Guinea grass (*Megathyrsus maximus*) and oil palm fronds (*Elaeis guineensis*).

Parameter	T1	T2	T3	T4	T5	SEM
Dry Matter	64.5^{a}	64.6^{a}	65.5^{a}	63.7^{b}	64.6^{a}	0.94
Crude Protein	60.0^{c}	62.5^{b}	65.4^{a}	64.5^{a}	60.8^{c}	1.24
Ether Extract	66.4^{b}	69.1^{b}	73.5^{a}	73.6^{a}	72.6^{a}	0.65
Ash	58.5^{c}	62.6^{b}	66.4^{a}	67.2^{a}	65.5^{a}	1.42
Neutral Detergent Fiber (NDF)	60.2^{c}	57.2^{b}	56.7^{b}	54.9^{a}	56.4^{b}	1.54
Acid Detergent Fiber (ADF)	54.4^{c}	51.6^{b}	48.6^{b}	45.9^{a}	47.0^{ab}	1.45

^{abcd} Means in the same row with different superscripts are significantly different ($p<0.05$).

who emphasized that the low moisture content of Moringa oleifera contributes to its long shelf life and reduced microbial spoilage risk. Conversely, Guinea grass presents a high moisture content (77.3%), translating to a DM of only 22.7%. According to Benabderrahim and Elfalleh (2021), such high moisture in tropical grasses limits the concentration of nutrients per unit weight, potentially reducing voluntary DM intake, unless supplemented with high-DM forages or processed as hay or silage. Crude protein (CP) content is a pivotal determinant of forage quality, as it directly influences rumen microbial growth and feed digestibility. Moringa leaves demonstrated an exceptionally high CP content (28.50%), well above the threshold requirement of 7–12% for optimal rumen fermentation (Amole et al., 2022). This supports Malik et al. (2019), who reported that Moringa oleifera supplementation via urea molasses multi-nutrient blocks significantly increased nitrogen retention and microbial protein synthesis in ruminants. In contrast, Guinea grass (11.2% CP) provides adequate protein for maintenance but may be insufficient for high-production systems, while oil palm fronds (3.00% CP) fall markedly short of requirements, reflecting the protein-deficient nature of many agricultural residues (Chisoro et al., 2025). These results underscore the necessity of protein supplementation, particularly when oil palm fronds are used as basal feed. Fat content, expressed as ether extract, was relatively low across the three feedstuffs (2.33%, 1.8%, and 2.00% for Moringa leaves, Guinea grass, and oil palm fronds, respectively). While modest, these values contribute to the overall energy density of the diet and can improve palatability. Wong Kai Seng et al. (2025) noted that fat levels below 7% DM in ruminant diets generally do not impair rumen fermentation, suggesting that the lipid content in these forages poses no risk of negative associative effects. Fibre fractions, crude fibre (CF), neutral detergent fibre (NDF), and acid detergent fibre (ADF) serve as key indicators of forage digestibility and intake potential. Oil palm fronds possess extremely high CF (70.0%), NDF (69.5%), and ADF (50.9%), indicative of a high lignin content and low digestibility. Zubair (2024) reported similar limitations in crop residues, recommending chemical or biological treatments, such as urea ammoniation or fungal fermentation, to improve fibre degradation. Guinea grass also showed high fibre levels (CF: 37.3%, NDF: 72.3%, ADF: 43.4%), which aligns with the maturity-related lignification trends described by Benabderrahim and Elfalleh (2021). In contrast, Moringa leaves demonstrated significantly lower fibre content (CF: 12.2%, NDF: 22.7%, ADF: 15.3%), facilitating higher digestibility and voluntary intake, as also emphasised by Abd El-Hack et al. (2018). Ash content, representing the total mineral fraction, was highest in Moringa leaves (10.8%) and Guinea grass (10.5%), and lowest in oil palm fronds (4.8%). Tangomo et al. (2025) have noted that leafy forages such as Moringa can significantly contribute to the supply of macro- and micro-minerals, particularly calcium, phosphorus, potassium, and magnesium, which are essential for bone development, enzymatic function, and reproductive performance. This mineral richness enhances their role as a dietary supplement, especially in low-mineral basal rations. Carbohydrate levels, calculated by difference, were relatively high in Moringa leaves (56.5%) and oil palm fronds (57.6%), and moderate in Guinea grass (40–45%). However, the structural composition of these carbohydrates varies considerably. In Moringa, the low fibre profile suggests a greater proportion of readily fermentable carbohydrates, which can rapidly supply energy to rumen microbes (Mahmud & Zagi, 2024). Conversely, in oil palm fronds, the high proportion of lignified cell walls limits fermentability, resulting in low energy availability despite the high total carbohydrate content. From a practical feeding standpoint, these results suggest that Moringa leaves are best utilized as a high-protein, mineral-rich supplement to improve the nutritional value of low-quality basal feeds such as oil palm fronds. Guinea grass, while nutritionally moderate, can serve as a maintenance forage but would require protein supplementation for higher-producing animals. Oil palm fronds, though widely available, are nutritionally poor unless pre-treated to enhance digestibility, as recommended by Ayankanmi (2024). Chisoro et al. (2025) further advocate for the strategic blending of nutrient-rich plant materials with fibrous residues to produce balanced, cost-effective rations in resource-limited settings. The proximate composition analysis underscores the complementary nature of these feedstuffs. A ration formulation strategy that combines the high protein and mineral density of Moringa leaves, the moderate nutritive profile of Guinea grass, and the structural fibre of treated oil palm fronds could optimise nutrient supply, improve animal performance, and promote sustainable feed resource utilisation in tropical livestock systems.

Growth Performance

The results of growth performance is presented in (Table 2). The feeding regimens significantly ($P < 0.05$) influenced the final body weight, weight gain, and feed efficiency across treatments. The highest value for final body weight (12.28 kg) was observed in T3 (10% *Moringa*), followed by T4 (11.86 kg), T5 (11.31 kg), T1 (10.86 kg) and T2 (10.75 kg), respectively. The highest value of average daily weight gain (34.42 g/day) was recorded in goat on T3. T4 (15% *Moringa*) had the best feed conversion ratio (18.01), indicating optimal feed efficiency, while T1 (0% *Moringa*) had the poorest performance metrics. Conversely, goats on T5 (20% *Moringa*) showed lower values in growth when compared with those of T3 and T4, suggestive of a diminishing returns at a higher level of inclusion.

Apparent Nutrient Digestibility Coefficients

The apparent nutrient digestibility coefficients for West African Dwarf (WAD) goats fed varying inclusion levels of Moringa oleifera (MO) supplemented to a basal mixture of Guinea grass (Megathyrsus maximus) and oil palm fronds (Elaeis guineensis) are summarised in (Table 3). The results demonstrate statistically significant differences ($p < 0.05$) for all parameters measured, indicating that Moringa inclusion directly influences digestive efficiency and nutrient assimilation.

Dry Matter (DM) Digestibility

DM digestibility peaked at 65.5% in T3 and reached its lowest value of 63.7% in T4, with other treatments (T1, T2, T5) maintaining intermediate yet statistically similar ranges (64.5–64.6%). Although the numerical variation appears modest (~1.8 percentage points between T3 and T4), the statistical significance underscores that even minor shifts in diet composition can modulate ruminal digestion kinetics. These outcomes align with the findings of Oyedele et al. (2016), who observed that moderate Moringa supplementation improved DM digestibility from 63.9% to 65.8%, and Tona et al. (2014), who reported that beyond optimal inclusion thresholds, digestibility either plateaus or declines due to increased anti-nutritional compounds such as tannins and saponins. The improved DM digestibility at moderate inclusion levels may be attributed to Moringa's high soluble carbohydrate fraction, which enhances microbial proliferation and enzymatic hydrolysis efficiency (Aye & Adegun, 2013). However, the slight drop in T4 suggests that excessive Moringa inclusion might disrupt the rumen microbial ecosystem balance, potentially inhibiting cellulolytic bacterial activity.

Crude Protein (CP) Digestibility

CP digestibility increased significantly from 60.0% in T1 to 65.4% in T3, a 9% relative improvement. This enhancement reflects Moringa's exceptional protein content (~25–30% DM) and its balanced amino acid profile, which supports efficient rumen nitrogen capture and microbial protein synthesis (Fadiyimu et al., 2010; Adebisi et al., 2016). Elevated CP digestibility is also linked to higher rumen ammonia-N availability, stimulating fibrolytic and amylolytic microbial activity (Binuomote et al., 2021). However, the marginal decline in T5 (60.8%) suggests a potential ceiling effect, possibly arising from protein-energy imbalance or increased rumen degradable protein exceeding microbial assimilation capacity, leading to higher urinary nitrogen excretion (Salau, 2021).

Ether Extract (EE) Digestibility

EE digestibility showed the most pronounced relative improvement, rising from 66.4% (T1) to 73.6% (T4), representing an increase of over 10%. This effect is attributable to Moringa's rich lipid profile, particularly in polyunsaturated fatty acids, which enhance dietary energy density and improve lipid utilisation efficiency (Yahaya, 2023). Higher EE digestibility is advantageous for energy balance, particularly under intensive small ruminant production systems where dietary fat supplementation can reduce methane yield and improve feed conversion (Patra, 2014). The stable EE values between T3, T4, and T5 indicate that once optimal lipid digestion capacity is reached, further Moringa addition may not yield additional benefits.

Ash Digestibility

Ash digestibility improved significantly from 58.5% (T1) to 67.2% (T4). This can be linked to Moringa's mineral-rich profile, especially in calcium, potassium, magnesium, and trace elements, which have high bioavailability (Adebisi et al., 2016). Enhanced mineral absorption supports enzymatic activity, electrolyte balance, and bone development, potentially improving reproductive performance (McDowell, 1997). The peak in T4 suggests a synergistic effect between mineral-rich Moringa leaves and the basal fibre sources, possibly due to improved solubilisation and absorption in the small intestine. The slight drop in T5 may reflect saturation of mineral transport mechanisms or antagonistic interactions with excess dietary fibre.

Neutral Detergent Fibre (NDF) and Acid Detergent Fibre (ADF) Digestibility

Unlike the other nutrients, fibre digestibility declined progressively with increasing Moringa inclusion. NDF dropped from 60.2% (T1) to 54.9% (T4), while ADF fell from 54.4% to 45.9% over the same treatments. This inverse relationship may be due to partial replacement of structural carbohydrates with more digestible non-fibre carbohydrates from Moringa foliage, which can accelerate rumen turnover (Binuomote et al., 2021). While this can enhance overall dietary energy utilisation, excessive fibre displacement can compromise rumen mat formation, buffering capacity, and pH stability (Tona et al., 2014). The decline in ADF digestibility is of particular concern, as it suggests reduced lignocellulose breakdown potentially limiting the long-term benefits of supplementation if high inclusion levels are maintained.

Physiological and Production Implications

The concurrent improvements in CP, EE, and ash digestibility especially at moderate supplementation levels (T3–T4) indicate enhanced nutrient capture efficiency, which can translate to improved average daily gain (ADG), feed conversion ratio (FCR), and reproductive performance. These benefits mirror those reported by Oyedele et al. (2016) and Salau (2021), where optimised Moringa inclusion boosted growth and health outcomes in WAD goats. However, the trade-off between protein/lipid digestibility and fibre degradation necessitates careful formulation. While moderate Moringa supplementation maximises nutrient assimilation, excessive levels risk impairing rumen fibre fermentation, which could affect long-term productivity and metabolic stability. This highlights the importance of defining species-specific optimal inclusion rates, considering both nutrient digestibility and rumen function.

DISCUSION

The research revealed that the dietary treatment significantly impacted the growth performance of the WAD goats. This is shown by the variations in final weight, total weight gain, average daily gain, feed intake, and feed conversion ratio (FCR). All dietary treatments resulted in positive weight increases, but the growth outcomes were more pronounced in groups receiving inclusion levels of *Moringa oleifera* supplementation. The final weights observed in the goats ranged from 10.75 kg to 12.28 kg, with the goats fed a 10% Moringa inclusion diet (T3) obtaining the highest value. This was notably higher than the weights recorded in the control (T1: 10.86 kg) and T2 (10.75 kg). The significant improvement in final weight is likely due to the enhanced nutrient availability and absorption associated with Moringa supplementation. These findings align with research by Ocheja *et al.* (2021), who reported that goats fed nutrient-dense supplements exhibited improved weight gains compared to those on a basal diet. This was also in line with the work of Babayemi *et al.* (2021) who reported improved final body weights exceeding 12 kg in goats fed *Panicum maximum* based diets with legume supplements such as lablab, *Leucaena*, and *Gliricidia*. The differences in final weight may arise from variations in feed composition, sample size, or experimental conditions.

The total weight gain across the treatments ranged from 3.00 kg (T1) to 4.13 kg (T3), with T3 exhibiting the highest weight gain, significantly surpassing all other treatments. This is consistent with the findings of Okpara and Akporhuarho (2017), who observed improved growth performance in West African Dwarf (WAD) goats supplemented with *Moringa*. This outcome corroborate the work of Kholif *et al.* (2018), who reported that replacing conventional protein sources with *Moringa oleifera* in Nubian goat diets enhanced feed utilization and milk yield. The average daily gain (ADG) for the goats in this study ranged from 25.0 g/day in T1 to 34.42 g/day in T3, while the average feed intake ranged from 571 g/day in T5 to 629 g/day in T3. The slightly lower feed intake observed in T5 may suggest reduced palatability of the feed, as some studies have reported that *Moringa oleifera* has a bitter taste, which can negatively impact feed intake in animals. This effect is mainly attributed to the presence of phytochemicals such as alkaloids and saponins, which create an off-flavor and reduce consumption (Giuliana *et al.*, 2024). These compounds can potentially impair nutrient absorption and reduce feed intake, which may explain the relatively lower feed consumption in the 20% *Moringa* diet (T5) compared to the other treatments. Similarly, Unukevwere *et al.* (2025) in studies had also reported lower feed intake with increasing levels of chopped oil palm fronds in a study on WADG. Conversely, Yusuf *et al.* (2018) report favorable feed utilization, palatability, and nutrient intake when *Moringa* is included at 10-15% DM, particularly when leaves have been processed (e.g., dried, ensiled), Hence, it is recommended that *Moringa* be used to replace part of the concentrate mixture rather than the entire diet Kholif *et al.* (2022).

The Feed Conversion Ratio (FCR) values varied significantly between treatments. The most efficient feed utilization was observed in T3 (18.28), followed closely by T4 (18.01). The higher FCR in T1 (23.40) and T2 (22.32) suggests that goats on these diets were less efficient in converting feed into weight gain, likely due to the lower nutritional content of the control and low-*Moringa* diets. However, it is still important to know that the differences in FCR between treatments can also be influenced by factors such as breed, age, and physiological condition of the animals, as suggested by Dhage *et al.* (2024). These results are in line with previous research on the advantages of supplementing with *Moringa*. For example, Amad and Zentek (2023) found that goats benefited from moderate inclusion levels of *Moringa oleifera* because they had a positive impact on microbial enzyme activity and rumen fermentation processes. The study also agrees with findings from Pedraza *et al.* (2021), who highlighted the potential of using *Moringa* as a feed additive to improve the growth performance of goats.

Conclusion

This study demonstrated that supplementing a basal diet of Guinea grass and oil palm fronds with *Moringa oleifera* significantly improves the growth performance, nutrient digestibility, and blood indices of West African Dwarf goats. The best performance was observed at 10–15% *Moringa* inclusion, with goats in T3 and T4 exhibiting higher average daily gains, better feed efficiency, and improved overall performance. These findings highlight the potential of *Moringa* as a cost-effective, nutrient-rich supplement for smallholder farmers. However, higher inclusion levels (20%) showed a slight decline in performance, likely due to reduced fiber digestibility and potential anti-nutritional effects. This study provides evidence for developing sustainable feeding strategies that incorporate locally available, affordable resources to enhance goat productivity, especially in regions facing feed scarcity due to climate change and economic constraints.

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Novelty Statements

This study evaluated the growth performance of WAD goats fed guinea grass and oil palm fronds mixture, supplemented with varying levels of *Moringa oleifera*. The study also evaluated its impact on the blood indices and carcass characteristics of WAD goats. It was observed that at 10-15% *Moringa* inclusions, growth performance qualities were improved.

Authors Contributions

Dr Oghenesuvwe Okpara and Leroy Owenz were involved in research conceptualization, methodology and writing original draft, Dr. Jerome U assisted in data collection, data and Analysis, Dr Unukevwere J. U. and Dr. U.G Shorhue proof read the manuscript. Dr Oghenesuvwe Okpara supervised the research work.

Conflict of Interest

The authors declared no conflict of interest.

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