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Effect of *Moringa oleifera, Leucaena leucocephala* and *Telfairia occidentalis* on Growth Performance and Nutrient Digestibility of Grasscutter (*Thryonomys swinderianus* Temminck 1827)

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ABSTRACT
The inclusion of plants with high protein content in the diets of animals have been known to improve their growth and development. This study was carried out to determine the effects of *Moringa oleifera, Leucaena leucocephala* and *Telfairia occidentalis* on growth performance and nutrient digestibility of grasscutter. Sixteen (16), two months old grasscutters with average mean weight of 559±230.50 g were used for this experiment. The animals were acclimatized for two weeks and thereafter allotted into four different treatments comprising four animals per treatment for a period of sixteen weeks. Four experimental diets (T_1, T_2, T_3 andT_4) were formulated. T_1 served as the control containing 0% *Moringa oleifera*, *Leucaena leucocephala* and *Telfairia occidentalis*, Diets T_2, T_3, and T_4 contained 5% each of *Moringa oleifera*, *Leucaena leucocephala* and *Telfairia occidentalis*. Collected data were subjected to a one way analysis of variance. Differences among means were separated using Duncan Multiple Range Test. The experimental diets did not significantly ($p>0.05$) affect the final weight and weight gain. Feed conversion ratio showed a significant difference ($p<0.05$) with control having the least value of 0.51 and *Leucaena leucocephala* having the highest value of 0.71. The highest value of 91.06 was observed in the nutrient digestibility of grasscutters fed with *Moringa oleifera* diet, while *Telfairia occidentalis* had the least value of 85.95. It was concluded that higher level inclusion of these plants into the diet of grasscutter could be adopted since the 5% inclusion level did not show significant difference in the weight of the animal.

Keywords: Nutrient digestibility, Feed conversion, Grasscutter, Plants, Growth, Weight.

Introduction

The grasscutter (*Thryonomys swinderianus* Temminck) is an herbivorous animal with a wide nutritional intake. It is a wild rodent species of high nutritional value which has potential as a healthy source of animal protein (Okon *et al*., 2008). It holds promise for peasants who cannot afford the high cost of protein from conventional livestock sources, but who can afford to raise grasscutters at subsistence level on feeds that are cheap and easily available. Such feedstuffs, which include roughages and others with high fibre content, are utilized by microorganisms in the caecum of the grasscutter during digestive processes that are similar to those of rumen microbes (Michalet-Doreau, 2002). In order to satisfy the growing demand for grasscutter meat as well as ensure quality control and

sustainable supply, it is essential that the production of grasscutter is planned (Opara, 2010). The feed of grasscutters in captivity must be well balanced in nutrients to ensure their good health and maximum in terms of growth and productivity. Berepubo *et al*. (1995) and Alawa and Oyarole (2004) reported that marked improvement were obtained in production indices by varying the roughage to concentrate ratio on the performance of growing rabbits. The major part of its diet is composed of grasses with fairly high crude fibre content. It can apparently tolerate a certain level of tannin found in leaves and bark as well as cyanogenic glycosides present in green maize, sorghum and Manihot (Ewer, 1969). Under-altered condition, the grasscutter is able to adapt itself to another diet. They always prefer grasses with lots of moisture and soluble carbohydrate (Agbelusi, 1992; Onadeko, 1996; Ajayi and Tewe, 2008).

Moringa oleifera is a good source of vitamins and amino acids and has medicinal uses (Makkar and Becker, 1999; Francis *et al.*, 2005). *Moringa oleifera* possesses hypocholesterolemic properties (Olugbemi *et al*., 2010) and could substitute conventional feedstuffs as it possesses useful characteristics (Sarwar *et al*., 2002). Foidl and Paull (2008) reported that the protein content of its leaves is high (20–35% on a dry weight basis) and most important is that the protein is of high quality having significant quantities of all the essential amino acids. Murro *et al*. (2002) reported that the leaves are highly nutritious containing significant quantities of Vitamins A, B and C, calcium (Ca), iron (Fe), phosphorus (P) and protein. However, the high nutrient content of *Moringa oleifera* has not found much use as human food and feed for animals compared to other known fodder trees (Adegun *et al*., 2011).

Leucaena (*Leucaena leucocephala*) is a drought-resistant, leguminous tree found throughout the tropics and subtropics (Devendra, 1993). Leucaena leaves are readily consumed and nutritious. *Leucaena leucocephala* tree has a high annual biomass yield with a high protein content, which makes it one of the forages with a high potential for feeding non-ruminant in tropical countries (Whiteman, 1980).

Fluted pumpkin (*Telfairia occidentalis*) is a popular tropical vine grown mainly in West Africa for its abundant nutritional and medicinal potentials and is also rich in protein content (Akpan *et al*., 2011). The economic and nutritional values of the plant in West Africa features prominently in trans-border trade especially among Nigeria, Cameroon and Benin Republic (Giami *et al*., 2003). Recent studies have shown that *Telfairia occidentalis* leaf is rich in minerals, iron, potassium, sodium, phosphorus, calcium and magnesium), antioxidants, vitamins (thiamine, riboflavin, nicotinamide and abscorbic acid) and phytochemicals such as phenol (Kayode and Kayode, 2010). The leaves contain essential oils and vitamins but its root contains cucubitacine, sesquiterpene, lactones (Iwu, 1983).

This study was carried out to determine the effects of *Moringa oleifera*, *Leucaena leucocephala* and *Telfairia occidentalis* on growth performance and nutrient digestibility of grasscutter.

MATERIALS AND METHOD

Site location

The experiment was carried out at the Domestication Unit of the Department of Forestry and Wildlife Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria

Management of Research Animals

The research was conducted on sixteen (16) weaned two months old grasscutters with average mean weight of 559±230.50g which were purchased from a

reliable farmer. The grasscutters were individually housed in clearly-labelled well constructed housing units measuring 150 x 75 x 35cm (length x width x height). The housing was provided with only one opening (35 high x 45cm wide) into the cell in order to eliminate cross-ventilation because grasscutters are susceptible to pneumonia. The animals were conditioned for a period of two weeks, during which they were fed with the same diet used from place of purchase. The control diet was then introduced gradually to minimize any stress that can result from the change in diet and the physiological effect of post weaning. Clean water for drinking was also provided *ad libitum*. The animals were provided with anti-stress in drinking water during the conditioning period. Temperatures in the cells were controlled to be within the range of 28 – 33 ^{o}C during the experimental period.

The grasscutters were divided into four treatments (based on diets) of four animals in each treatment (i.e. four replicates per treatment). The animals were weighed with a top load kitchen scale at the beginning of the experiment to determine their initial weight and were also weighed weekly to determine their average weight gain throughout the duration of the study. All cells were cleaned daily in order to ensure adequate sanitation. The grasscutters were tried for a period of sixteen weeks.

Source and processing of experimental diet

The *Moringa oleifera* and *Telfairia occidentalis* leaves used in this study was purchased from a reliable source within Abeokuta, Ogun State, while the *Leucaena leucocephala* was obtained from stands within the premises of the Federal University of Agriculture, Abeokuta, Ogun State. The obtained *Moringa oleifera* and *Telfairia occidentalis* leaves were air dried at room temperature for 2 weeks to a constant weight while retaining their greenish colouration, while *Leucaena leucocephala* was sun dried in other to reduce the mimosin content in the leaf (Hammond, 1994). In a mortar, the dried leaves were powdered to a suitable form that was incorporated into the standard diet which was milled.

Experimental Diets

Four experimental diets were formulated such that diet T_1 which served as the control contained 0% *Moringa oleifera, Leucaena leucocephala* and *Telfairia occidentalis*, while diets 2, 3, and 4 contained 5% *Moringa oleifera, Leucaena leucocephala* and *Telfairia occidentalis* designated as T_2, T_3 and T_4 diets, respectively (Table 1).

Performance characteristics

The grasscutters were weighed at the beginning of the experiment (8th week of age) and then weighed on a weekly basis and this was usually done in the morning before feeding them with feed and water. They were fed *ad libitum* thrice a day (morning, afternoon and evening). The initial feed and the leftovers were measured and the following parameters were determined: Feed intake, Feed Conversion ratio, Average feed consumed, Average weight, Average weight gained, Growth Rate and Apparent digestibility (Perez *et al*., 1995).

Statistical Analysis

The experiment was arranged in a complete randomized design. The Statistical analysis of the data was carried out using one-way analysis of variance (Steel and Torrie, 1980). Duncan Multiple range Test was used to separate the means.

Table 1: Composition (%) of experimental diet

Ingredients	Control	*Moringa oleifera*	*Leucaena luecocephala*	*Telfairia occidentalis*
Maize	45	45	45	45
Soy bean meal	16	16	16	16
Palm kernel cake	5	5	5	5
Wheat offal	30	25	25	25
Bone meal	2	2	2	2
Limestone	1.5	1.5	1.5	1.5
Salt	0.5	0.5	0.5	0.5
Moringa oleifera	-	5	-	-
Leucaena luecocephala	-	-	5	-
Telfairia occidentalis	-	-	-	5
Total	100	100	100	100
Determined analysis				
Ether extract	9.29	10.16	10.78	10.29
Ash content	5.62	7.12	6.38	5.92
crude firbe content	10.02	11.63	10.89	10.14
Crude protein content	15.98	21.67	24.67	21.92
Nitrogen free extract	46.59	39.81	39.04	42.71
Metabolizeable energy (KJ/Kg)	2989.31	3039.03	3172.97	3161.77

*Metabolizeable energy (Kcal/Kg) = 37 × %Cp + 81.1 × %EE + 35.5 × %NFE (Wogar, 2011).

RESULT

Effect of *Moringa oleifera, Leucaena luecocephala* and *Telfairia occidentalis* on the growth performance of grasscutter.

The result on the effect of *Moringa oleifera, Leucaena luecocephala* and *Telfairia occidentalis* on the growth performance of grasscutter is shown in Table 2. It was observed that there was significant ($p<0.05$) difference only in feed conversion ratio with control having the least ($p<0.05$) value of 0.51, while the highest ($p<0.05$) value was *Leucaena luecocephala* (0.71). It was also observed that the performance in terms of weight gain per week of grasscutter fed with control diet was better when compared with other experimental diets (Figure 1).

Table 2: Effect of *Moringa oleifera, Leucaena luecocephala* and *Telfairia occidentalis* on the growth performance of grasscutter

Parameter	Control	*Moringa oleifera*	*Leucaena luecocephala*	*Telfairia occidentalis*
Initial weight	600.00±54.01	560.00±35.59	570.00±63.64	572.50±101.44
Final weight	2143.8±114.28	1863.80±207.32	1312.50±443.65	1863.80±87.50
Total weight gained	1543.8±89.78	1303.8±175.83	742.00±483.60	1215.00±34.28
Feed intake	782.5±15.48	768.00±33.61	590.50±31.02	848.8±14.91
Feed conversion ratio	0.51±0.04[b]	0.61±0.06[ab]	0.71±0.09[a]	0.70±0.02[a]
Mortality (%)	0.00±0.00	0.00±0.00	25.00±25.00	0. 00±0.00

[a,b,c]: Means in the same row by factor with different superscripts differ significantly ($p<0.05$)

Table 3: Effect of *Moringa oleifera*, *Leucaena luecocephala* and *Telfairia occidentalis* on the digestibility of grasscutter

Parameter	Control	*Moringa oleifera*	*Leucaena luecocephala*	*Telfairia occidentalis*
Dry matter (%)	91.49	91.01	65.18	85.66
Fat content (%)	92.67	94.17	66.70	89.71
Ash content (%)	78.15	79.58	49.37	56.63
Crude fibre (%)	90.40	90.25	63.23	79.90
Crude protein (%)	88.81	91.06	67.22	85.94
Carbohydrate (%)	93.97	92.44	66.58	89.99
Nutrient digestibility	88.82±0.35[b]	91.06±9.55[a]	89.62±0.43[ab]	85.95±0.73[c]

[a,b,c]: Means in the same row by factor with different superscripts differ significantly ($p<0.05$)

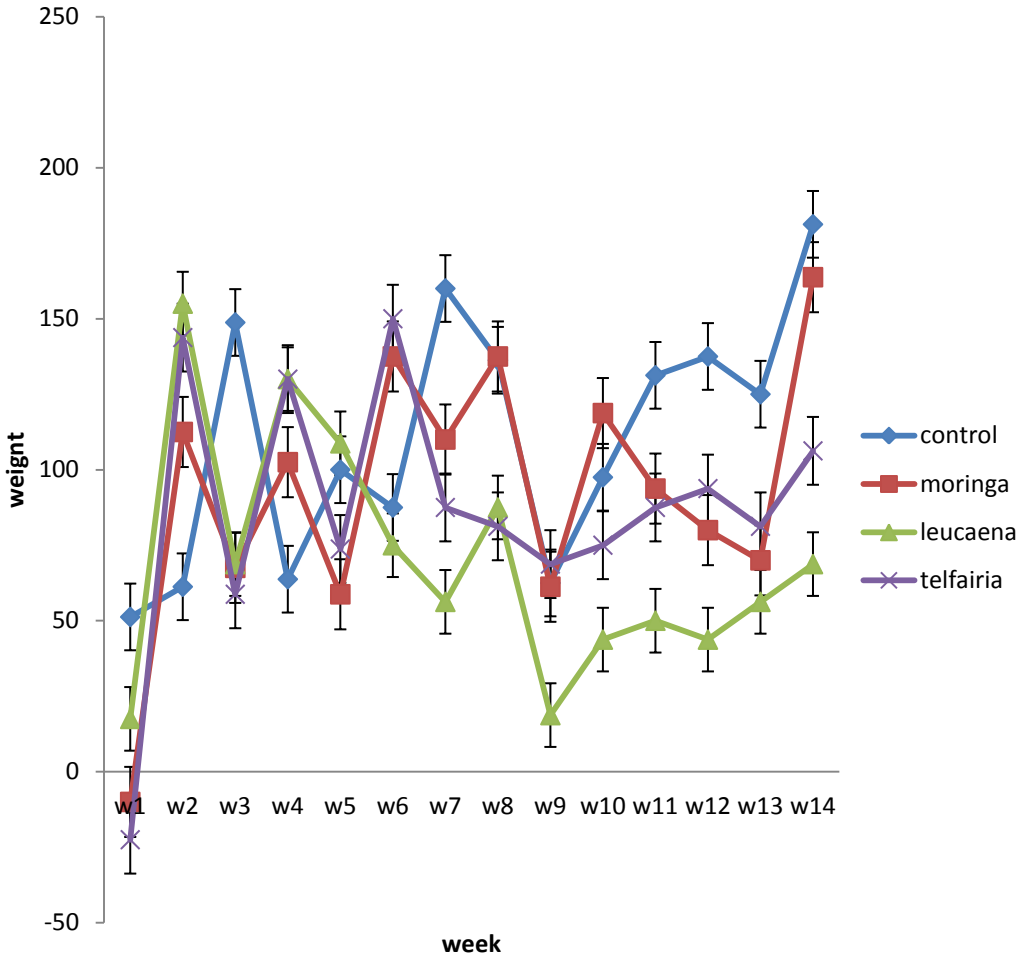

Fig. 1: Change in weight per week of grasscutter fed with *Moringa oleifera*, *Leucaena luecocephala* and *Telfairia occidentalis*

Effect of *Moringa oleifera, Leucaena luecocephala* and *Telfairia occidentalis* on the digestibility of grasscutter.

The effect of *Moringa oleifera, Leucaena luecocephala* and *Telfairia occidentalis* on the digestibility of grasscutter is presented in Table 3. Significant ($p<0.05$) differences were observed in nutrient digestibility with *Moringa oleifera* having the highest ($p<0.05$) value of 91.06 and the least value was observed in *Telfairia occidentalis* (89.95).

Discussion and Conclusion

The nutrient composition of the diets fed contributed to the successful

performance of grasscutters used for this study. McDonald *et al.* (1992) observed that, well fed farm animals are healthy and are resistant to diseases. Zyl and Meyer (1999) reported that a diet containing crude protein of 4.6% and gross energy of 15.8 MJ/kg dried matter is adequate to meet the maintenance requirement of a mature grasscutter. Several authors have reported different values for total weight gain of grasscutters fed with leaf meal incorporated diets. Annor *et al*. (2008) reported values of 225g, 275g and 625g as total weight gain for grasscutters at the end of an experiment that lasted for 24 weeks. In another study by Obi *et al*. (2008) where performance of grasscutters were assessed when fed four different conventional forage, the total weight gain reported were between 1024g and 1121g. Karikari and Nyameasem (2009) reported values of 650g, 1110g and 1190g as total weight gain for grasscutters fed concentrate diets containing varying levels of guinea grass.

Animals fed with *Leucaena luecocephala* diet had the least feed intake which was similar to the report of Sethi and Kulkarni (1995) who reported that there was reduced weight gain with the increase of *Leucaena luecocephala*. Therefore, the depressed forage intake of the *Leucaena luecocephala* diet may be due to decreased digestibility of roughage and diet. Abriam (1981) reported that feed intake depressed with the increased levels of *Leucaena luecocephala*. The reduction in feed intake may be due to wide range of factors such as appetite inhibiting effect of mimosine (El-Harith *et al*., 1979) and some physical characteristics of the forage, such as dry matter content and particle size (Baumont *et al.*, 1996), these are known to affect ease of pseudo-rumination and thus intake rate and may also be factors that enhanced high mortality rate experienced in the grasscutter fed *Leucaena luecocephala* diet. Other factors such as protein content (Akinloye, 2005), crude fibre and crude protein levels (Annor *et al*., 2008) and metabolizable energy (Adeniji, 2006) of feed can influence *Leucaena luecocephala* intake by the animal.

The better the nutrient digestibility, the better is the feed utilization (McDonald *et al.*, 1992). The better apparent nutrient digestibility recorded for the *Moringa oleifera* diet may be due to the high crude fibre content of the diet. It could be observed that the performance in terms of weight gain of grasscutter fed with control diet (15.98) was better when compared to the other experimental diets.

Though there were positive responses to feed intake and growth performance of the grasscutters fed with the four diets yet there was no observable significant difference in the responses among the treatments. This suggests that growing grasscutters may be relatively insensitive to varying levels of dietary protein supplements. At dietary crude protein levels <15.98 %, growing grasscutters may adjust intake and digestibility to meet nutrient requirements. Rabbits have been reported to adjust feed intake to meet their nutrient requirements (Lebas *et al.*, 1996). Feed conversion ratio tends to be better with increase in the crude protein of the diets. This could be due to increased caecal microbial fermentation in the presence of higher dietary protein and lower dietary fibre (Lebas *et al.*, 1996).

Since *Moringa oleifera* based diet had highest nutrient digestibility and better diet with feed conversion ratio and weight gain when compared with other treated diets aside the control, it is concluded that *Moringa oleifera* be included (5% level) in grasscutter diet as good alternative fibre source for the animal. It is also recommended that higher percentage of level of inclusion of *Moringa oleifera* could

be tried since the 5% inclusion has proved successful and there has been no observed record of adverse effect or mortality on the grasscutters.

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