Sudan Journal of Science and Technology (2015) 16(2):24-33

Sudan Journal of Science and Technology
Journal homepage: http://jst.sustech.edu/

Performance and Vital Internal Organs Weight of Chicks Fed on *Moringa oleifera* Leaves in Sudan

Shamseldein H. Ahmed[1], Osman S. Ali[1] and Shadia A. Omer[1]

[1]Sudan University of Science and Technology, College of Veterinary Medicine, Khartoum, Sudan.
*Corresponding E-mail: shamshahmed@yahoo.com, shamsaldeinhassaballa@sustech.edu

ARTICLE INFO

Article history
Received:15.12.2014
Accepted: 22.12.2014
Available online:01.10.2015

Keywords:
broiler chicks,
Moringa oleifera leaf,
performance

ABSTRACT

This experiment was conducted to assess the effects of graded levels of *Moringa oleifera* leaves diets on growth performances, and vital internal organs weight. A total of ninety six, -day old, unsexed Hubbard breed broiler chicks were used. Chicks were weighed individually and assigned randomly into four equal groups and each treatment group consisted of three replicates of 8 chicks. Four diets were formulated to be iso energetics and isonitrogenous (A, B, C, and D). Diets A as Control with no added leaf moringa. The diets were Starter (8-28 d), Grower (29-42 d). Moringa leaves added to the diets A, B, C and D at 1%, 3% and 5%, respectively. Parameters measured were live body weight, body weight gain, weakly growth rate, feed intake, feed conversion ratio, and mortality rate. The results revealed that, no significant difference ($P \leq 0.05$) between the four diets in live body weight, body weight gain, weakly growth rate, feed intake, feed conversion ratio, and mortality rate. Result obtained showed that addition 1% of leaf moringa improved significantly ($P<0.05$) the feed conversion rate. The study showed that obtained responses due to substitution diets containing graded levels of leaf of moringa to have a potential in poultry feeding. This is exhibited through its protein content, relatively low fibre and higher mineral contents. It concluded that, for better efficiency 5% inclusion of moringa level is optimal for broiler performance.

INTRODUCTION

Moringa oleifera Lam (syns. *Moringa pterygosperma*, family Moringaceae) is native in Himalaya but is currently spread almost world-wide. Moriga grows in all types of soil from acid to alkaline and at attitude from sea level to 1300 m (Duke 1983). The proximate analysis of moringa leaves reveal the presence of high crude protein (17.01% ±0.1) and carbohydrate (63.11% ±0.09). The leaves also contained appreciable amounts of crude fibre (7.09%

±0.11), ash (7.93% ± 0.12), crude fat (2.11% ±0.11) and fatty acid (1.69% ±0.09). The total ash content showed it contained minerals, Ca (1.91% ±0.08), K (0.97% ±0.01), Na (192.95±4.4), Fe (107.48±8.2), Mn (81.65±2.31), Zn (60.06±0.3) and P (30.15±0.5) parts per million (ppm). Magnesium (0.38% ±0.01) and copper (6.10±0.19) were the least. Ogbe *et al.* (2011). The dry matter (DM) value of the Moringa leaves was of 93.7% 87.20% and (96.79%). respectively (Olugbemi *et al.* (2010) Mutayoba et al. (2011) and Olugbemi et al. (2010). Mutayoba et al. (2011) reported much higher (30.65%) crude protein in *Moringa oleifera* leaves. Moringa leave and green fresh pods are used as vegetables by humans and are rich in carotene and ascorbic acid, iron and with two amino acids generally deficient in the feed methionene and cystine (Makkar and Becker 1996). Moringa leave powder can be added to any food or beverage and has impact on those who are malnourished children, pregnant or lactating women, children at weaning and the elderly. Moringa leave s are reported to be very palatable to ruminants and have appreciable crude protein levels (Sutherland et al 1990, Sarwatt et al 2002, Kimoro 2002).Many trails had been done to use moringa leaves as source of protein to improve body weight in goat (Areghore, 2003) and milk yield in dairy cows (Nadir, 2005).

The high price of protein supplement and its scarcity have initiated the search for possible source of protein for livestock and poultry production .The possibility of using moringa leaves as a source of protein in place of conventional feedstuffs and concentrates appear to be potentially of great importance, in addition, recently there is a marked shift to words the consumption of chicken meat in the Sudan.

The objective of this study was to investigate the effects of substituting different levels of moringa leaves on performance and growth of Hubbard breed broiler

MATERIALS and METHODS

Collection and processing of sample:

Moringa oleifera leaves were harvested from farms located in Khartoum state (Buri and Soba) during the Winter season (November – February, 2012 2013). Stems and branches were cut from Moringa trees and spread out under the shade at 35^{o}C for 3-5 days. The leaves were and powdered by using a locally made Miller machine.

Experimental birds and their management

The experimental birds were bought from Ommat Company (Khartoum).A total of ninety six one-day old, unsexed Hubbard breed broiler chicks were used. All birds were vaccinated against Newcastle. Thereafter, on day7 birds were randomly assigned into four groups (A, B.C and D). Each group was further subdivided into 3 replicates each of 8 birds. Each replicate was placed in a separate pen of approximately 4m x 4m x 1.5m. Sunlight was used as a source of light during the day and fluorescent tubes were used to illuminate the pens at night. The birds were kept under deep litter management system and saw dust was used as litter materials to cover the floor.

Diets:

Diets were formulated to be iso energetics and isonitrogenous (A, B, C, and D). All nutrients were calculated to meet the USA National Research Council Requirements (NRC, 1994). Birds in each replicate were fed prestarter diet for 7 days (Nutrestar, Netherland) and water was provided daily *adlibitum*. At the age of 7 days , group A chicks served as control and fed untreated starter ration, while group A, B, C, and D given the starter control diet containing 1, 3, and 5% moringa leaves respectively. Feeding continues till day 28 (Table 1).

Thereafter, starter diet was replaced by grower diet during the period 29 – 42 day. Group A fed untreated grower diet, while groups B, C, and D consumed grower diets containing 1, 3, and 5% moringa leaves respectively (Table 2). Birds were provided with ration once daily in the morning, and feeding continues for another 5 weeks.

Table 1: Feed ingredients used in the starter diets

Component%	A (0%)	B (1%)	C (3%)	D (5%)
Sorghum	60.75	60.5	60.5	60.75
Groundnut seed cake	30.31	28.60	28	27.60
Limestone	0.71	0.60	0.60	0.2
Lysine	0.46	0.4	0.4	0.4
Superconcentrate*	12.08	6.65	5.94	7
Salt				
Methionine				
Plant oil	0.5	0.21	0	2
	0.04	0	0	0
Moringa leaves	3.75	1.77	1.60	3.13
	0	1	3	5
Antioxidant	0.2	0.3	0	0.2
Total	**100**	**100**	**100**	**100**

= 0% no moringa addea, 1% moriga leaves, 3% moriga leaves and 5% moriga leaves

* Handerix concentrate Handerix Compony.France

Table 2: Feed ingredients used in the grower diets on broilers

Component%	A(0%)	B(1%)	C3%	D(5%)
Sorghum	69	69	67.7	66
Groundnut seed cake	21	21	19.9	19
Limestone	1	1	0.7	1
Lysine	0	1	0.5	1
Superconcentrate*	4	4	4.4	4
Salt				
Methionine				
Plant oil	1	1	1	2
	0	0	0	0
Moringa leaves	2	1	1.7	1
	0	1	3	5
Antioxidant	1	1	**1**	2
Total	**100**	**100**	**100**	**100**

= 0% no moringa addea, 1% moriga leaves, 3% moriga leaves and 5% moriga leaves

* Handerix concentrate Handerix Compony.France

Data collection procedure:

Feed intake, body weight, weight gain and feed conversion ratio were recorded weekly for the individual replicate of each dietary, mortality rate also recorded. at the end of experimental period were starved over night and six birds per treatment were randomly selected, weighted and slaughtered. Carcass hot, liver, heart, lung and spleen were separated and weighted

Statistical analysis

The data for feed intake, , weight gain, were subjected to Analysis of variance (ANOVA) according to Snedecor and Cochran (1992)

using general linear model (GLM) procedures of Statistical Analysis System (SAS) Inc, (1998). Values were considered significant at $P<0.05$.

RESULTS

Condition of experimental birds

Generally all birds remained healthy for the entire experimental duration. Yellow coloration of body parts was observed in birds fed 5% after slaughter.

Chemical composition of ingredients and experimental diets

The chemical composition of different ingredients used in the formulation of dietary treatments is shown in Table 3 and 4 .The CP and ME contents for all diets were almost similar (23% and 3199 Cal /kg DM respectively).Ca , Crude fibre, and phosphorous contents did not vary in dietary treatments

Table 3: Chemical composition and metabolizable energy of starter diets

Item	A(0%)	B(1%)	C3%	D(5%)
DM %	93.26	92.14	90.86	86.99
CP	23	23	23	23
CF	4.9	5.1	4.9	5.1
Ca	1.07	1.02	1.01	1.07
P	0.45	0.433	0.40	0.46
ME Cal /kg DM	3197.82	3199.25	3197.82	3199.97

0% no moringa addea, 1% moriga leaves, 3% moriga leaves and 5% moriga leaves

Table 4: Chemical composition and metabolizable energy of grower diets

	A(0%)	B(1%)	C3%	D(5%)
DM %	92.66	92.12	89.8	88.82
CP	20.01	20	20	20.03
CF	3.86	4	4.31	4.61
Ca	0.908	0.902	0.9	0.9
P	0.3	0.302	0.306	0.304
ME Cal /kg DM	3195.43	3196.63	3195.43	3197.34

A0% no moringa added, B1% moriga leaves, C3% moriga leaves and D5% moriga leaves

Feed intake: Table 5 shows weekly average feed intake of broiler chickens fed with different levels of moringa leaves. There was no significant effect of dietary treatment on feed intake during week three, four and five,. However, significant and progressive increases in feed intake were observed on birds' fed 5 % levels in the diet (Table 9).

Weight gain: The results of weight gain are summarized in Table 9. There was no significant effect of dietary treatment on weight gain noted in birds fed up to 3% moringa leaves, however, weekly average weight gain of broiler chickens fed with different levels of moringa leaves shows a significant different between the diets specially in the last weeks. (Table 7)

Feed conversion ratio (FCR): Table 7 shows weekly average feed conversion ratio of broiler chickens fed with different levels of moringa leaves, however, there was a significant different between the different levels of inclusion of moringa throughout the period of experiments, with the high FCR in the fifth week.(Table 9).

Mortality rate %: Diet contains moriga level 1% and 3% shows no death among the chicks, however, moriga level up to5% causes a death of more than 1% of chicks.

Table 5: Weekly average feed intake of broiler chickens fed with different levels of moringa leaves.

Period	M±STD %0	M±STD %1	M±STD %3	M±STD %5	Sig
First week	1751.67±149.53[b]	1996.67±412.56[a]	2013.33±440.80[a]	1520.± 150.99[c]	*
Second week	3685±254.61[a]	2503.33±235.28[d]	3190±598.27[c]	3025±342.75[bc]	*
Third week	4146.67±482.22	3676.67±408.18	4498.33±191.39	4413.33±515.13	N.S
Fourth week	5553.33±331.52	5070.± 648.44	5570.± 378.91	5418.33±77.51	N.S
Fifth week	6653.33±285.72	6503.33±222.62	6488.33±1301.79	6503.33±222.62	N.S

0% no moringa addea, 1% moriga leaves, 3% moriga leaves and 5% moriga leaves

Table 6: Weekly average weight gain of broiler chickens fed with different levels of moringa leaves.

Period	M±STd 0%	M±STd 1%	M±STd 3%	M±STd 5%	Sig
First week	89.08±9.81[a]	80.42±23.76[a]	80.75±23.62[a]	40.00±11.67[b]	*
Second week	228.96±35.54	194.58±22.984	177.29±59.40	207.53±15.18	**N.S**
Third week	207.15±37.63[a]	383.69±22.72[a]	227.2±47.53[c]	295.71±121.50[b]	*
Fourth week	421.51±72.86	472.86±64.71	409.37±75.64	590.05±118.26	*
Fifth week	326.67±15.27[a]	298.67±10.06[a]	300.6±10.07[b]	339.00±68.51[a]	*

Table 7: Weekly average feed conversion ratio of broiler chickens fed with different levels of moringa leaves.

Period	M±STD %0	M±STD %1	M±STD %3	M±STD %5	Sig
First week	2.69±.120[c]	3.21±.69[b]	3.21±.63[b]	4.93±.94[a]	*
Second week	2.25±.49[a]	1.62±.17[b]	2.43±.88[a]	2.10±.23[a]	*
Third week	1.47±.27[b]	.48±.61[c]	.74±1.06[c]	2.93±1.95[a]	*
Fourth week	1.93±.31[a]	1.67±.31[b]	1.83±.42[ab]	1.50±.00[c]	*
Fifth week	2.91±.15[b]	2.86±.37[b]	2.41±.97[c]	3.63±.49[a]	*

0% no moringa addea, 1% moriga leaves, 3% moriga leaves and 5% moriga leaves

Table 8: Weekly average live weight of the broiler chickens fed with different levels of moringa leaves.

Period	M±STD %0	M±STD %1	M±STD %3	M±STD %5	Sig
First week	267.71±11.08[a]	260.00±28.45[a]	261.88±21.73[a]	211.04±16.56[b]	*
Second week	496.61±34.33	454.58±38.43	439.17±53.13	418.57±30.10	N.S
Third week	904.76±68.59[a]	838.28±17.85 [ab]	793.96±86.85[b]	714.28±145.39[c]	*
Fourth week	1323.33±55.08	1244.67±47.34	1203.33±77.67	1316.67±5.77	N.S
Fifth week	1680±110	1543.33±47.26	1590±65.57	1633.33±60.28	N.S

0% no moringa addea, 1% moriga leaves, 3% moriga leaves and 5% moriga leaves

Table 9: Overall average weight, feed intake, weight gain, g/, feed conversion ratio and mortality rate of the broiler chickens fed with different levels of moringa leaves

	Treatments				Significant
	M±STD %0	M±STD %1	M±STD %3	M±STD %5	
average weight	1680.0 ±110.0	1543.3±47.2	1590.0±65.5	1633.3±60.2	N.S
feed intake, g/bird	3080.8±124.2[a]	2260.0±320.9[a]	2471.7±614.3[a]	3370.6±596.7[b]	*
weight gain, g/	1472.43±71.12	1363.75±49.92	1408.87±64.79	1452.29±52.37	N.S
Feed conversion ratio, kg	2.25±.13[b]	1.96±.26a[d]	2.12±.39[cb]	3.02±.66[a]	*
Mortality rate	.67±.58	.00±.00	.00±.00	1.33±1.53	N.S

Carcass and some internal organs weight: Carcass and some internal organs weight were summarized in table 10, there was no significant different in carcass weight, heart liver, and spleen weight and the fat weight shows variation among the diets.

Table 10: Carcass and some internal organs weight/g of the broiler chickens fed with different levels of moringa leaves.

Items	A (0%) M±STD	B(1%) M±STD	C(3%) M±STD	D(5%) M±STD	Sig
Carcass weight/g	1121.33±48.35	980.83±110.8	1000.36±89.66	1059.67±11.24	NS
Heart weight/g	11.74±1.25	10.47±.81	10.60±1.29	9.53±4.32	NS
Liver weight/g	42.09±2.52	41.67±2.01	48.77±4.48	44.90±1.31	NS
Fat weight/g	14.80±5.20[b]	17.38±2.10[a]	14.14±2.19 [b]	7.99±1.99 [c]	*
Spleen weight/g	1.88±.63	2.09±.36	1.52±.32	1.76±.66	NS

0% no moringa addea, 1% moriga leaves, 3% moriga leaves and 5% moriga leaves

DISCUSSION

Good healthy status of experimental birds observed during the entire period of the present study, suggest use of moringa leves up to3% level in the diets have negligible amount of toxic materials already reported in other leaf meals.

The results were in contrast with various reports on fodder tree and shrub leaves. Though, Makkar and Becker (1997) observed some traces of anti-nutritional

factors in *Moringa oleifera* but had no influence in this study. On the other hand, yellow coloration of body parts observed was mainly attributed to the presence of xanthophylls and carotenoid pigments in *Moringa oleifera* as in other tree and shrub leaf meals (Austic and Neisheim 1990). The chemical composition of moriga leaves observed in the present study compare well with the values reported by (Marker and Becker 1997). The similarities in chemical composition with other studies indicate that environmental factors such as season, geographical location and stage of maturity play a minor role in determining nutritive value of moriga leaves. Further, values of chemical composition were close to those reported in other leaf meals such as *Leucaena leucocephala*, *Sesbania sesban* and *Gliricidia sepium.* This suggests the potential of moriga leaves as animal feed agree with other leaf meals from nutritional point of view.

The chemical compositions of other feed ingredients used in the formulation of experimental diets were within the ranges reported by (NRC 1994; McDonald et al 1995 and Mellau 1999).

Results obtained in this study in feed and dry matter intake demonstrate that moriga leaves is palatable and highly preferred by chickens. These findings were inconsistent with those reported in other leaf meals by (Vohra 1972; Ravindran et al 1986; Osei et. al 1990 and Bhatnagar et. al 1996) who observed a depression in intake when chickens were fed diets containing various levels of *Leucaena leucocephala* (LLM.). These variations probably suggest lower anti-nutritional factors and toxic materials in moriga leaves (Makker and Backer 1997) than in other leaf meals. On the other hand, lower energy associated with lower digestibility of energy in CF component of moriga leaves as in other plant leaves (Tangendjaja et al 1990) could be a contributing factor to higher intake observed when moriga leaves was higher in the diet. The increase in feed intake is usually associated with compensatory mechanism to energy demand (Smith 1999).

From the results obtained in the present study, it was also evident that the chicken fed 5% moriga leaves moderately influenced negatively live body weight and Carcass and some internal organs weight. The moderate depression of moriga leaves on live body weight and Carcass and some internal organs weight observed in this study, most probably was associated to low digestibility of energy and CP and bulkiness when moriga leaves was higher in the diet that contributed to low energy and CP availability to broiler.

In the present study, it was observed that feed utilization was high in birds fed 5% in the diet. Though, moriga leaves maintained better Kg feed/Kg weight gain. These findings suggest that inclution of moriga leaves up to 5% have no any influence on Kg feed/Kg weight gain.simillar results were reported by Banjo, ,(2012) and Kakengi (2007).

The inclusion of moriga leaves at 5 % levels in the diet showed a positive effect on body weight gain but the reason of this could not be explained although probably might be associated with higher sulphur containing amino acids reported in Moringa leaves. (North (1990) reported a positive influence of sulphur containing amino acids on egg weight. However, inclusion of moringa significantly enhance the weight gain of broiler at 2% of inclusion and did not affect feed intake and feed conversion ratio ,(Banjo, 2012). Kakengi (2007) However, for better efficiency 3% inclusion level is optimal. Moreover, Olugbemi (2010) reported a reduction in performance of broiler chicks fed moringa beyond 5%.

CONCLUSIONS and RECOMMENDATION

- The study showed that obtained responses due to *Moringa oleifera* to have a potential in poultry feeding. This is exhibited through its protein content, relatively low fibre and higher mineral contents.
- The study using broiler showed that moringa could be used as a source of plant protein since it was highly accepted even at high inclusion levels in the diet.
- So far the study showed highest performance in live body weight production in comparison with other leaf meals already studied. However, for optimum utilization 5% inclusion is recommended.

REFERENCES

Anwar, F. and Rashid, U. (2007). Physicochemical characteristics of *Moringa oleifera* seeds and seed oil from a wild provenance of Pakistan. In *Pakistan Journal of Botany,* vol. 39, p. 1443-1453.

AOAC. (1990). Official methods of analysis, *Association of Official Analytical Chemists,* Washington, D.C., USA. 15th Edition, pp. 807-928.

Jayavardhanan, k.k, Suresh, k, Panikkar, K.R. and Vasudevan, D.M. (1994). Modular potency of drumstick lectin on host defense system. In *Journal of Experimental Clinical Cancer Research,* vol. 13; 205.209.

Mutayoba, S.K, Dierenfeld, E, Mercedes, V.A, Frances, Y. and knight, C.D. (2011). Determination of chemical composition and anti-nutritive components for Tanzanian locally available poultry feed ingredients. In *International Journal of Poultry Science,* vol. 10, no. 5, p. 350-357.

Ogbunugafor, H.A, Eneh, F.U, Ozumba, A.N, Igwo-Ezikpe, M.N, Okpuzor, J, Igwilo, I.O, Adenekan, S.O. And Onyekwelu, O.A. (2011). Physico-chemical and anti-oxidant properties of *Moringa oleifera* seed oil. In *Pakistan Journal of Nutrition,* vol. 10, no. 5, p. 409-414.

Patel, J.P. (2011). Antibacterial activity of methanolic and acetone extract of some medicinal plants used in India folklore. *International Journal of Phytomedicine,* vol. 3, 261-269.

AOAC (1990) Association of Agricultural Chemists Official methods of Analysis, 15th Edition. Arlington, Virginia, USA. pp 807- 809.

Austic R E and Neishem M C 1990 Poultry Production. Lea and Febiger Publisher. pp 260-275.

Bhatnagar R, Kataria M and Verna S V S (1996) Effect of dietary Leucaena leaf meal on the performance and egg characteristics in white leghorn hens. *Indian Journal of Animal Science*, **66** (12): 1291-1294.

Banjo, O.S. (2012) .Growth and Performance as affected by inclusion of Moringa oleifera leaf meal in Broiler chicks diet. Journal of Biology, Agriculture and Healthcare.Vol 2, No 9 (2012)

Kakengi A M V, Shem M N, Sarwatt S V and Fujihara T 2003 Can Moringa oleifera be used as a protein supplement to ruminants? Asian-Australasian. *Journal of Animal Sciences* 18:1:42-47.

Kakengi A M V, J T Kaijage, S V Sarwatt, S K Mutayoba, Shem M N, Sarwatt S V and Fujihara T (2007). Effect of *Moringa oleifera* leaf meal as a substitute for sunflower seed meal on performance of laying hens in Tanzania. *Livestock Research for Rural Development* 19 (8) 2007

Katule A N N (1989) Cross breeding as a tool for genetic improvement of chicken in sub-optimal environment. *Veterinary Journal* **28**: 325-333.

Kimoro B N (2002) Potential of selected Mult-purpose trees as feed for growing goats on maize stover basal diet. MSc. Thesis. Sokoine University of Agriculture, Morogoro - Tanzania..

Makkar H P S and Becker K (1996) Nutritional value and an nutritional components of whole and extracted Moringa oleifera leaves. *Animal Feed Science and Technology* 63, 211 - 228

Makkar H P S and Becker K (1997) Nutrient and anti quality factors on different morphological parts of the Moringa tree. *Journal of Agricultural Science* 128: 31.

McDonald P, Edwards R A, Greenhalgh J F O and Morgan C A 1995 Animal nutrition 4th edition. John Wiley and sons, United States. 607 pp.

North M. O (1990). Commercial Poultry Production manual. Westport connection Publishing Company. Inc, USA. pp 299-301.

NRC (1994). Nutrient requirements of poultry. Ninth revised edition. National Academic Press, Washington D.C., USA.155 pp

Ogbe, A.O. and John P. Affiku (2011). Proximate study, mineral and anti-nutrient composition of moringa oleifera leaves harvested from lafia, Nigeria: potential benefits in poultry Nutrition and Health. *Journal of Microbiology, Biotechnology and Food Sciences. 1 (3) 296-308*

Olugbemi. T, S.Mutayoba, S,K and Lekule, F.P. (2010). Effect of Moringa oleiferaInclution in Cassava BasedDietsFed to Broiler Chickens.*International Journal of Poultry Science* 9 (4):363-367

Osei S A, Opuku and Atuahene C C (1990) Gliricidium leaf meal as an ingredient in layer diets. Animal Feed Science and Technology 29:303-308.

Ravindran V, Kornegay E T, Rajaguru A S B, Potter L M and Cherrry J A (1986) Cassava leaf meal as a replacement for coconut oil meal on broiler diets. *Poultry Science* 65(9): 1720- 1727.

Sarwatt S V, Kapange S S and Kakengi A M V (2002) the effects on intake, digestibility and growth of goats when sunflower seed seed cake is replaced with Moringa oleifera leaves in supplements fed with Chloris gayana hay. *Agroforestry systems Volume* 56:241-247

SAS Institute Inc. (1998). SAS/ STAT Users Guide release 6.03 Edition. Carry, Inc., 1028 pp

Smith A J (1999) Poultry. The tropical agriculturist First edition. Macmillan Publishers. Wageningen. 218 pp.

Snedecor G W and Cochran W G (1992) Statistical Methods. 8th Edition. Iowa State.

Tangendjaja B, Rahardjo V C and Lowry J B (1990) Leucaena leaf meal in the diet of growing rabbits: Evaluation and effect of a low mimosine treatment. Animal Feed Science and Technology 29: 63-72.

Sutherland J P, Folkard G K and Grant W D 1990 Natural coagulants for appropriate water treatment: a novel approach, Waterlines, April (4), pp30-32.

Vohra P 1972 Evaluation of metabolizable energy for poultry. World's poultry Science Journal 28: 204-214.

Kimoro B N 2002 Potential of selected Mult-purpose trees as feed for

growing goats on maize stover basal diet. MSc. Thesis. Sokoine University of Agriculture, Morogoro - Tanzania.

Sarwart, S.V.Kaparge, S.S.and Kakengi, A.M.V. (2002). Substituting sunflour seed cake Moringa oleifera leaves as supplement feed in Tanzania.Agro Forestry System, 56:241-247

Kakengi, A.M.V., Shen, M.N., Sarwart, S.V.and Fujihara.T. (2003). Can Moringa oleifera as Protein supplement to ruminant deit .Asian-Austalian journal of animal science, 18(1)

Makkar, H.P.S and Becker, K. (1997).Nutrients and anti quality Factors in different morphogical parts of the Moringa oleiferatree. Journal of Agric. Sci. (Cambridge), 128:311-322

Olugbemi, T.S., Mutayoba, S.K. and Lekule, F.P.(2010b).Effect of Moringa oleifera (Moringa of Inclusion in cassava Based Diets fed to