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Nutritional evaluation of *Moringa oleifera* pod meal for white New Zealand rabbits

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Abstract

The study was to find out the appropriateness of 15% replacement of concentration through Moringa oleifera pod meal in non-lactating female White New Zealand Rabbit production for semi-arid reasons. The non-lactating female White New Zealand Rabbits (N=12) were randomly divided the two groups, viz. control (3.25±0.20 kg) and test group (3.20±0.18 kg). Concentrates made of HAC cafeteria left-over were given to the experimental animals to meet their daily DCP and ME requirements. Alfalfa as green fodder was offered ad-lib to the animals. In the control group, the animals received 100% concentrate, whereas in the test group, 85% concentrate and 15% moringa pod meal on a fresh basis. During the experiment, an eight-day adaptation period was followed by a five-day digestibility cum behaviour experiment. Digestibility cum behaviour experiment continued for consecutive 120 hours and dived into 24 slots of 5 hours each. The animals were offered the weighed amount of feed at the start of the slot. The refusals of feed and faeces were weighed and sampled at the end of the slot. For comparing results on two feeds 'paired t-test for the difference in means was used. The findings of the research work included that the intake of dry matter (DM), organic matter (OM), crude protein (CP), nitrogen-free extract (NFE), and total carbohydrates (TCHO) was non-significant in two groups and CF and EE were increased in the test group. The coefficients of apparent digestibility of DM, OM, CP, NFE, TCHO, and GE remained non-significant and EED increased in the test group. DMI, DOMI, DCPI, and DEI remained non-significant and DEEI significant between two treatments.

Keywords: Feed utilization, *Moringa oleifera*, non-ruminant nutrition, Rabbits, White New Zealand

Introduction

In most developing countries, the population is depending on agriculture. Agricultural production is almost low and is not efficient to support the population. There are several factors contributing to low production i.e., less rainfall, infertile soils, desertification, rugged topography, and lack of awareness and technological equipment. The poverty and lack of space for livestock especially in high population density areas are the big challenges in most developing countries. In such countries, malnutrition is very common and its consequences can be very serious, especially for children (NRC 1991). As in most developing countries and especially in those located in semi-arid Africa like Eritrea. Animal protein is usually scarce and too expensive. The majority of the population may not afford it. The development of mini-farms like intensive animal farming remains only a key solution to fight against animal protein malnutrition.

Protein supplementation is often vital to enhance animal performance, and it needs to be done concerning the requirement of the animals in addition to the balance of other nutrients available in the feed. Soybean meal and fish meal have been widely and successfully used as conventional protein sources for livestock. The issues have been generated due to the increasing competition between humans and livestock for these protein ingredients as food. The cost of such type of protein supplements for the animals is again a big challenge in Eritrea. The prices of protein sources have been escalating continuously in recent times, whilst availability is often erratic. According to Odunsi (2003), the fast-growing human and livestock population created increased requirements for food and feed in developing countries, need that alternative feed resources must be identified and tested.

There is a need, therefore, to explore the use of locally available non-conventional feed resources that can yield the same output for the animals as conventional feeds, at cheaper rates. Hence, a nonconventional feed resource that has similar or high protein ingredients and can substitute conventional protein supplements like soybean meal or fishmeal partially or completely is highly desired. This strategy may be helpful to reduce the cost of production and ensure cheaper meat production. Therefore, the economization of feed costs using cheaper and unconventional feed resources is an important aspect of commercial animal production (Vasanthakumar et al 1999, Bhatt and Sharma 2001, Muriu et al 2002).

Under these circumstances, rabbit production on moringa feed supplement seems a timely need in Eritrea. Rabbit production is widely practiced all over the world and has proved to be rewarding for both producers and consumers. The rabbits provide good quality meat and require small capital and space. Protein supplementation remains the greatest topic of interest when dealing with rabbit production. This is an interesting fact that in the utilization of moringa (*Moringa oleifera*), commonly known as horseradish tree or drumstick tree, as a protein source for livestock (Makker and Becker 1997; Sarwatt et al 2002). Moringa tree leaves have quality attributes that mark them a potential replacement for soybean meal or fish meal in non-ruminant diets. Moringa crop can easily be grown and established in the field, has a good land coping ability, as well as good potential for forage production. Furthermore, there is the possibility of obtaining large amounts of high-quality forage from this tree without any expensive inputs due to favorable soil and climatic conditions for its growth. Sarwatt et al (2004) reported that moringa tree leaves are a potential inexpensive protein source for livestock feeding. The benefits of using moringa leaves and pods as a protein resource are numerous and include the fact that it is a perennial plant. The fodder can be harvested several times in one growing season and also has the potential to reduce feed expenses. *Moringa oleifera* is in the group of high-yielding nutritious browse herbs with every part having unique feeding importance (Duke 1998).

The objective of the study was to find out the suitability of 15% replacement of concentration through moringa pod meal in non-lactating female White New Zealand Rabbit production for a semi-arid reason.

Materials and Methods

The field trial was conducted at Rabbit Farm, Hamelmalo Agricultural College (HAC), Hamelmalo, Keren, Zoba Anseba. The farm is located at an altitude of 1286 m above sea level. It has a semi-arid climate with an annual mean rainfall of 440 mm and an average annual temperature of 24^0C. The experiment was conducted in April and May 2018.

For the experimental purpose, 12 non-lactating female White New Zealand Rabbits were randomly selected and divided into six pairs based on their body weight. One animal from each pair was allotted to one of the two groups, viz. control (3.25±0.20 kg) and test group (3.20±0.18 kg). The animals were housed in the indoor cage system i.e., in separate individual cages. During the experiment, they were not allowed for routine exercise. Concentrates made of HAC cafeteria left-over were given to the experimental animals to meet their daily DCP and ME requirements (Cheeke 1987, Maertens 1992). Alfalfa as green fodder was offered *ad lib* to the animals. Each animal also received 3 g of common salt daily. In the control group, the animals received 100% concentrate, whereas in the test group, 85% concentrate and 15% moringa pod meal on a fresh basis (Table 1).

During the experiment, an eight-day adaptation period was followed by a five-day digestibility cum behaviour experiment. During the experiment, feed, leftovers, and feces were sampled for proximate analysis.

Digestibility cum behaviour experiment continued for consecutive 120 hours, dived into 24 slots of 5 hours each. The animals were offered the weighed amount of feed at the start of the slot. They had free access to drinking water round the clock. The refusals of feed and faeces were weighed and sampled at the end of the slot. The samples were preserved for proximate analysis (AOAC 2000). Gross energy was estimated by using the formula given by Kearl (1982). The intake and digestibility coefficients of different nutrients were determined using standard calculation (McDonald 2005).

For comparing results on two feeds 'paired t-test for the difference in means (Snedecor and Cochran 1994) was used. For comparing the behaviour of animals two-way ANOVA with replication technique was implemented. The data were statistically analyzed using a data analysis pack of MS Office excel 2007 (MS Office 2006).

Table 1 Experimental diet (g)

Pairs		Concentrate			Moringa pod meal			Alfalfa green	Common Salt	Water
		Fresh	Ratio (%)	DM	Fresh	Ratio (%)	DM			
1	Control	480	100	349.6	0	0	0.0	*Ad lib*	3.0	*Ad lib*
	Treatment	408	85	297.1	216	15	100.8	*Ad lib*	3.0	*Ad lib*
2	Control	480	100	349.6	0	0	0.0	*Ad lib*	3.0	*Ad lib*
	Treatment	408	85	297.1	216	15	100.8	*Ad lib*	3.0	*Ad lib*
3	Control	480	100	349.6	0	0	0.0	*Ad lib*	3.0	*Ad lib*
	Treatment	408	85	297.1	216	15	100.8	*Ad lib*	3.0	*Ad lib*
4	Control	480	100	349.6	0	0	0.0	*Ad lib*	3.0	*Ad lib*
	Treatment	408	85	297.1	216	15	100.8	*Ad lib*	3.0	*Ad lib*
5	Control	480	100	349.6	0	0	0.0	*Ad lib*	3.0	*Ad lib*
	Treatment	408	85	297.1	216	15	100.8	*Ad lib*	3.0	*Ad lib*
6	Control	480	100	349.6	0	0	0.0	*Ad lib*	3.0	*Ad lib*
	Treatment	408	85	297.1	216	15	100.8	*Ad lib*	3.0	*Ad lib*

Results and Discussion

The chemical composition of feed materials used in the experiment has been presented in Table 2. The crude protein content in moringa pod meal was higher than the literature values, which could be due to the presence of seed in the meal. Booth and Wickens (1988) and Bosch (2004) have valued the content of crude protein on a fresh basis whereas, in the present case on a dry matter basis. Further, the variation in the content of other nutrients could also be because of the same reason. The variation may also be attributed to other factors like the genetic background of the plant, agro-climatic conditions, age and season at harvest, and pod collection and handling methods.

Table 2 Chemical composition of feed ingredients

Nutrient	Unit	Concentrate	MP Meal	Alfalfa
CP	(%)	12.0	16.8	18.8
CF	(%)	0.9	30.9	28.1
EE	(%)	0.6	6.0	0.6
NFE	(%)	85.2	37.7	42.2
Ash	(%)	1.8	8.7	10.4
OM	(%)	98.2	91.3	89.6
TCHO	(%)	85.6	68.6	70.3
NFE	(%)	84.7	37.7	42.2
GE	K cal/g	4.2	4.2	3.9

The intake of DM, OM, CP, NFE, and total carbohydrates (TCHO) was non-significant (P>0.05) in the two groups (Table 3). The reason for the same may be the content of DCP (13.58±0.23 & 13.38±0.06%) and DE (4.05±0.00 & 4.08±0.00 Kcal/g) in the two diets was almost similar. The intake of crude fibre and ether extract was significantly higher (P<0.05) in the test compared to the control group. Because of the inclusion of moringa pod meal in the treatment diet, contents of CF and EE were increased and resulted in increased respective nutrient intakes. The intake values in the present study were higher than the values reported by Nuhu (2010) which could be due to the initial body weight of the experimental animals which was very much variant. The literature is scanty to confirm the present findings in terms of intake of crude protein and other nutrients.

Table 3 Nutrient intake (per Kg body weight)

Nutrient	Unit	Control	Treatment	P Value
DMI	(g)	194.08±14.82	194.22±12.74	0.49
OMI	(g)	181.88±13.90	181.31±11.90	0.47
CPI	(g)	30.30±2.29	30.40±2.00	0.47
CFI	(g)	30.34±2.17	35.30±2.21	0.00
EEI	(g)	1.16±0.09	2.86±0.18	0.00
NFEI	(g)	120.18±9.39	112.82±7.55	0.15
TCHOI	(g)	150.52±11.54	148.12±9.74	0.38

The apparent digestibility data of different nutrients have been presented in Table 4. The coefficients of apparent digestibility of DM, OM, CP, NFE, TCHO, and GE remained non-significant (P>0.05) in the two groups. The DCP content in the two diets was almost similar which could be the reason for similar apparent digestibility in the two groups. El-Badawi et al (2014) and Nuhu (2010) reported increased apparent DMD moringa dry leaves powder may be because of the reason that moringa dry leaves powder could have some digestion-promoting effects (El-Badawi et al 2014). However, in the present study, moringa pod meal was nutritionally analyzed; as such, the present findings could not confirm the studies. The EED was higher in the test group compared to the control, which may be due to the higher content of digestible ether extract in the treatment group (5.33±1.69) compared to that in the control group (3.72±0.90).

The digestible nutrient intake data have been presented in Table 5. DMI, DOMI, DCPI, and DEI remained non-significant between two treatments. It could be due to the reason of the insignificant difference between intake and apparent digestibility coefficients of various nutrients, respectively. The same patterns were also observed for CF, NFE, and TCHO might perhaps be because of the same reasons. However, the intake of DEE was higher in the test group compared to the control. The apparent digestibility coefficients and intakes for this nutrient were also recorded in the present study and could not be compared as the literature is lacking information in this regard.

Table 4 Apparent nutrient digestibility (%)

Nutrient	Control	Treatment	P Value
DM	84.33±1.79	85.14±0.36	0.32
OM	84.81±1.74	85.27±0.36	0.39
CP	86.96±1.49	85.47±0.35	0.16
CF	57.68±4.91	66.26±0.83	0.06
EE	73.88±2.99	88.92±0.28	0.00
NFE	91.24±1.00	91.09±0.22	0.44
TCHO	84.46±1.78	85.15±0.36	0.35
GE	84.92±1.73	85.79±0.34	0.30

Table 5 Digestible nutrient intake (per Kg body weight)

Nutrient	Unit	Control	Treatment	P Value
DDMI	(g)	163.76±12.89	165.52±11.38	0.43
DOMI	(g)	154.33±12.13	154.75±10.64	0.48
DCPI	(g)	26.36±2.02	26.01±1.79	0.41
DCFI	(g)	17.51±1.91	23.45±1.67	0.01
DEEI	(g)	0.86±0.07	2.55±0.16	0.00
DNFEI	(g)	109.69±8.64	102.83±7.07	0.16
DTCHO	(g)	127.20±10.04	126.25±8.70	0.45
DEI	K cal	668.42±52.27	680.23±46.52	0.38

Bibliography

AOAC. 2000. Official methods of analysis, 17th edition. Association of Official Analytical Chemists.

Bhatt R S and Sharma S R. 2001. Nutrient utilization and growth performance of broiler rabbit fed oat plant meal and tall fescue hay. Asian-Australasian Journal of Animal Science, 14: 1228-1232.

Booth F E M and Wickens G E. 1988. Non-timber uses of selected arid zone trees and shrubs in Africa. FAO conservation guide, Rome, pp. 92-101.

Bosh C H. 2004. USDA National Nutrient Database for standard reference. In: G.J.H. Grubben and O.A. Denton (eds). PROTOA Foundation, Wageningen Netherlands/CTA, Wageningen, Netherlands, pp. 392-393.

Cheeke P R. 1987. Rabbit Feeding and Nutrition. Academic Press, Washington, D.C., USA.

Duke A J. 1998. Moringaceae. Handbook of energy crops. Mc Graw Hill, New York.

El-Badawi A Y, Omer H A A, Abedo A A and Yacout M H M. 2014. Response of Growing New Zealand White Rabbits to Rations Supplemented with Different Levels of *Moringa oleifera* Dry Leaves. Global Veterinaria. 12(4): 573-582.

Kearl L C. 1982. Nutrient requirements of ruminants in developing countries. International Feedstuffs Institute, Utah Agricultural Ec\xperimenta Station, Utah State University, Logan, Utah, 381p.

Maertens L. 1992. Rabbit nutrition and feeding: A review of some recent developments. Journal Applied Rabbit Research. 15:889-890.

Makker H P S and Becker K. 1997. Nutrients and anti quality factors in different morphological parts of the *Moringa oleiferatree*. Journal of Agricultural Sciences. 128:311-322.

McDonald P, Edwards R A, Greenhalgh J F D, Morgan C A, Sinclair L A and Wilkinson R G. 2005. Animal Nutrition. 5th Edition. Prentice Hall, New Delhi.

MS Office. 2006. Microsoft office 2007: Microsoft Excel. New York, Microsoft Inc.

Muriu J I, Njoka-Njiri E N, Tuitoek J N and Nanua J N. 2002. Evaluation of sorghum (*Sorghum bicolor*) as replacement of maize in the diet of growing rabbit (*Oryctolagus cuniculus*). Asian-Australisian Journal of animal science. 15:565-569.

NRC. 1991. Microlivestock: little known small animals with promising economic future. National Academy of sciences Washington, DC., pp. 241-249.

Nuhu F. 2010. Effect of moringa leaf meal (molm) on nutrient digestibility, growth, carcass and blood indices of weaner rabbits. Thesis, M.Sc. (Animal Nutrition), Kwame Nkrumah University of Science and Technology, Kumasi.

Odunsi A A. 2003. Assessment of Lablab (*Lablab purpureus*) leaf meal as a feed ingredient and yolk colouring agent in the diet of layers. International Journal of Poultry Science. 2(1): 71- 74.

Sarwatt S V, Kapange S S and Kakengi A M. 2002. Substituting sunflower seed cake with *Moringa oleiferaleaves* as supplemental goat feed in Tanzania. Agro-forestry systems. 56: 241-247.

Sarwatt S V, Milangha M S, Lekule F P and Madalla N. 2004. *Moringa oleifera* and cotton seed cake as supplements for smallholder dairy cows fed Napier grass. Livestock research for rural Development. 16: 38.

Snedecor G W and Cochran W G. 1994. Statistical Methods, 8th Ed., Ames, Iowa State University Press.

Vasanthakumar P, Sharma K, Sastry V R B and Kumar R. 1999. Effect of graded levels of neem (*Azadirachta* *inidica*) seed kernel cake on carcass characteristics of broiler rabbits. Asian-Australasian Journal of Animal Science. 12: 1246-1250.