EFFECT OF SUPPLEMENTATION OF LIQUID MORINGA LEAF MEAL ON SERUM LIPID PROFILE AND LIVER FUNCTION ENZYMES OF GROWING YANKASA RAMS.

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ABSTRACT

Moringa leaf meal supplementation in livestock diets improves feed intake and weight gain but has paucity of information on serum lipid profile and liver function enzymes, especially in small ruminants. This study investigated the effects of different levels of supplementation of liquid moringa leaf meal (LMLM) on serum lipid profile and liver function enzymes of growing Yankasa rams at 0, 4, 8, and 12 g kg^{-1} dry matter (DM) intake. Sixteen (16) growing Yankasa rams, eight to nine months old with average body weight of 16.59 kg were allotted into four dietary treatments in a Complete Randomised Design. The rams were fed a total mixed ration at 5% live body weight. Fresh moringa leaves were shed dried, milled into powder and reconstituted into solution by dissolving 250 g of the moringa leaf powder in 1 L of water for oral administration. From the mixture of moringa powder, an equivalent amount (0, 4, 8, and 12 g) of moringa leaf meal was administered orally to the rams. The results showed that dietary supplementation of growing Yankasa rams with LMLM at 4, 8, and 12 g per kg DM intake had no effect (P>0.05) on the serum lipid profile, liver function enzymes such as aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, and gamma-glutamyl transferase compared to the rams on the control group. Although, there was an increase (P<0.05) in the level of lactate dehydrogenase in growing Yankasa rams supplemented with LMLM at 8 g kg^{-1} DM intake, the values are all within the acceptable reference range for healthy animals, signifying no adverse effect on the rams. Hence, this study concludes that dietary supplementation of LMLM up to 12 g kg^{-1} DM intake has no adverse effect on the serum lipid profile and liver function enzymes of growing Yankasa rams, despite its nutritional benefits on livestock species.

Keywords: Moringa leaf, Serum lipid, Liver enzymes, Yankasa rams

INTRODUCTION

The use of natural feed additives in animal nutrition has gained significant interest due to their potential benefits in enhancing animal health and productivity. One such additive, *Moringa oleifera* (MO), commonly known as the 'drumstick tree', has been extensively studied for its rich nutritional profile and medicinal properties. MO leaves are particularly noted for their high protein content, vitamins, minerals, and bioactive compounds, making them a promising supplement in animal feed (Gopalakrishnan *et al*., 2017). Research on the dietary inclusion of Moringa leaf meal in animal feed has shown promising results in improving growth performance, nutrient digestibility, and health parameters across various species of animals, including ruminants (Su and Chen, 2020; Amad and Zentek, 2023). The use of synthetic additives and supplements can cause environmental and health risk, hence necessitating the need for natural and sustainable alternatives. Previous studies have suggested that Moringa can enhance growth performance and improve health parameters in various livestock species (Anjorin *et al.,* 2010; Ibrahim *et al*., 2022). However, Kholif *et al*. (2019) reported that dietary MO leaf extract up to 20 ml dose in basal diet enhanced milk yield and fatty acid profile of a dairy cow. In a study by Ben Salema and Makkarb (2009), MO defatted seed meal supplemented at 2, 4, and 6 g DM per lamb/day had no effect on lamb performance while in another trial, supplementation of male Barki sheep with MO seeds at 4 g DM per lamb/day increased body weight (Amad and Zentek, 2023). Liver function enzymes are critical indicators of metabolic and health status in animals, while lipid profiles are essential for understanding the nutritional and health impacts of dietary interventions (Yakubu *et al.,* 2015). Liver function enzymes, such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP), are critical indicators of liver health and metabolic status in animals. Any alteration in the levels of these enzymes can signify metabolic disturbances or liver damage, making them valuable biomarkers for assessing the impact of dietary interventions (Gowda *et al.,* 2009). According to Kaur *et al.* (2014), lipid profiles are essential parameters for evaluating the nutritional and health impacts of dietary supplements. Lipids play a crucial role in energy storage, cell membrane structure, and signaling pathways. The inclusion of dietary supplements can influence lipid metabolism, potentially improving the lipid profile and overall health status of the animals (Kaur *et al*., 2014). Understanding the impact of Moringa leaf meal on serum lipid profile and liver enzymes is crucial for assessing its effectiveness as a feed additive. Therefore, this study aimed to explain the knowledge gap by investigating the effect of different supplementation levels of LMLM on serum lipid profile and liver function enzymes in growing Yankasa rams.

MATERIALS AND METHOD

Study Site and Preparation of Moringa Leaf Meal

The research was conducted at the small ruminant unit of the Department of Animal Science teaching and research farm Ahmadu Bello University, Zaria. Fresh and clean moringa leaves were shed dried for five days, milled using 1 mm sieve and stored in an air tight polythene sack. The moringa leaf meal was reconstituted in clean water by dissolving 250 g of dried moringa powder in 1 L of water to produce the Liquid Moringa Leaf Meal (LMLM). An equivalent amount of 0, 4, 8 and 12 g kg^{-1} the LMLM were drench to the rams as treatments.

Experimental Animals and Design

Sixteen (16) growing Yankasa rams, 8 to 9 months old with average body weight of 16.59 kg were randomly allotted into four groups with four replicates per treatment. They were individually housed and adapted to the pens for two weeks; a control diet and clean drinking water were given to the rams during the adjustment period. At the beginning of the trial, the rams were weighed and randomized into four treatments to balance for body weight. The rams were fed a total mixed ration as presented in Table 1. Each animal was fed twice daily a total of 5% live body weight with a fourth nightly adjustment according to the new body weight taken. A daily drenching of 0, 4, 8 and 12 g per kg DM intake of LMLM was done at 7:30 am before feeding for a period of 85 days.

Chemical Analysis of Moringa and Experimental Diet

The milled moringa sample and the experimental diet were analysed according to the method of AOAC (2005) for dry mater, crude protein, crude fibre, ash, ether extract and nitrogen free extract. The acid detergent fibre (ADF), neutral detergent fibre (NDF) and lignin were analysed according to Van Soest (1991). The oxalate, phytate and tannin contents were also analysed using the calometric method (AOAC, 2005).

Serum Lipid and Liver Function Enzymes Analyses

A 3 ml of blood was collected from the jugular vein around the neck using a 10 ml sterilized gauge needle of 2 inches long, into a sterilized EDTA free bottle for triglycerides, high-density lipoprotein, and low-density lipoprotein analyses while another 3 ml of blood was taken into sterilized EDTA bottles for determination of AST, ALT, ALP, lactate dehydrogenase (LDH), and Gamma-glutamyl transferase (GGT) using standard procedure (Lamb, 1981).

Data Analysis

The data collected were subjected to statistical analysis using a General Linear Model procedure of SAS (2002) and significantly different means were compared using the Duncan Multiple Range Test (Duncan, 1955) as outlined in the SAS package.

RESULTS AND DISCUSSION

Ingredients and Chemical Composition of Dietary Treatment alongside with Chemical Composition, Mineral profile and Phytochemicals of *Moringa oleifera* Leaf

Table 1 presents the ingredients and chemical composition of dietary treatment alongside with chemical composition, mineral profile and phytochemicals of MO leaf used in this study. The single dietary treatment fed to all the growing Yankasa rams consisted of 11.56% crude protein, 31.43% crude fibre, and 50.70% soluble carbohydrate. The MO leaf had 28.41% crude protein, 21.14% crude fibre, and 45.16% soluble carbohydrate. The MO leaf contained high amount (in mg kg^{-1}) of calcium, potassium, phosphorus, sulfur, and iron; with relatively higher amount of phytate (10.43 mg/100 g) compared to other phytochemicals studied. Research has shown that *M. oleifera* leaves have high crude protein contents, making them suitable for improving the protein level in livestock diets (Makkar *et al*., 2018). The mineral profile of *M. oleifera* leaf in this study revealed its richness in essential minerals like calcium (6917 mg kg^{-1}), phosphorus (5365.58 mg kg^{-1}), and sulfur (5583.63 mg kg^{-1}), which are crucial for bone development, energy metabolism, and protein synthesis, respectively (Fahey, 2005; Tolba *et al* 2018). Potassium levels (3500 mg kg^{-1}) are beneficial for maintaining electrolyte balance, while the significant iron content (5087.75 mg kg^{-1}) could enhance blood health in animals, reducing anemia risk. The presence of trace elements like manganese, copper, and zinc further enhances its role in boosting overall animal health and immunity (Tolba *et al* 2018). The phytochemicals in *M. oleifera* such as tannin and saponin offer potential health benefits but has to be managed properly to avoid adverse effects in livestock diets (Anwar *et al.,* 2007).

Effect of Liquid Moringa Leaf Meal supplementation on the serum lipid profile and liver function enzymes of growing Yankasa rams

The results of serum lipid profile and liver function enzymes (Table 2) of growing Yankasa rams supplemented with LMLM at 4, 8, and 12 g kg^{-1} DM intake showed no significant differences (P>0.05) in all parameters compared to the rams on the control group, except the lactate dehydrogenase (LDH) which increased

Table 1. Ingredients and Chemical Composition of Dietary Treatment alongside with Chemical Composition, Mineral profile and Phytochemicals of *Moringa oleifera* Leaf

Dietary ingredients	% composition	Chemical composition of Moringa Leaf (%)	
Soyabean shell	30.00	Dry matter	93.69
Rice offal	26.00	Crude protein	28.41
Maize offal	20.00	Crude fiber	21.14
Groundnut cake	20.00	Crude ash	3.40
Bone meal	2.50	Ether extract	1.18
Limestone	1.00	Nitrogen free extract	45.16
Common salt	0.50	Acid detergent fibre	24.95
Total	100.00	Neutral detergent fibre	38.46
Chemical composition		Lignin	3.68
Dry matter	92.38	**Mineral profile**	**mg kg^{-1}**
Crude protein	11.56	Calcium	6917.00
Crude fiber	31.43	Magnesium	761.00
Crude ash	5.19	Potassium	3500.00
Ether extract	1.12	Phosphorus	5365.58
Nitrogen free extract	50.70	Sulfur	5583.63
Acid detergent fibre	38.45	Iron	5087.75
Neutral detergent fibre	60.15	Manganese	91.75
Lignin	8.17	Copper	48.75
		Zinc	18.00
		Phytochemicals	**mg/100 g**
		Alkaloid	4.25
		Oxalate	3.28
		Phytate	10.43
		Saponin	3.75
		Tannin	3.29

significantly (P<0.05) in value up to 8 g kg^{-1} DM intake but decreased at 12 g kg^{-1} DM intake supplementation. The increase in LDH at 8 g kg^{-1} DM intake supplementation suggests an enhanced metabolic activity in the muscle or liver tissue. High AST and ALT values are unwanted and are usually associated with death of cells and damage of tissues (Chen *et al*., 2022). This study revealed no significant differences (P>0.05) in AST, ALT, ALP, and GGT observed for the rams supplemented with LMLM compared to the rams on the control group, suggesting that LMLM had no adverse effect on liver function, similar to the findings in other studies. Hussein and Jassim *et al*. (2019) who fed broiler chicken with 2 and 4 g kg^{-1} DM *M. oleifera* leaf meal observed no difference in AST and ALT activities, supporting the notion that moringa leaf does not impair liver function across species.

Table 2. Effect of different supplementation levels of Liquid Moringa Leaf Meal on serum lipid profile and liver function enzymes of growing Yankasa ram

	Liquid Moringa Leaf Meal (g kg^{-1} DM)					
Serum lipids (mg/dL)	**0**	**4**	**8**	**12**	**SEM**	**P value**
Triglyceride	88.2	69.8	74.4	56.4	18.08	0.108
High-Density lipoprotein	52.8	39.6	50.8	55.8	10.9	0.662
Low density lipoprotein	24.0	31.2	40.0	23.2	6.4	0.178
Liver function enzyme (U/I)						
Aspartate aminotransferase	69.25	80.75	73.00	73.50	7.20	0.631
Alanine aminotransferase	11.00	10.75	12.75	10.75	1.47	0.644
Alkaline phosphatase	22.75	17.75	21.75	18.75	3.89	0.689
Lactate dehydrogenase	61.50^{c}	71.75^{b}	82.75^{a}	66.00^{bc}	4.52	0.013
Gamma-glutamyl transferase	28.75	34.75	29.25	39.00	3.75	0.133

CONCLUSIONS

The dietary supplementation of growing Yankasa rams with LMLM up to 12 g kg^{-1} DM intake had no effect on serum lipid profile and liver function enzymes. Although, the LDH value for growing Yankasa rams supplemented with LMLM at 8 g kg^{-1} DM intake was higher compared to the rams on the control group, they are all within the reference range for ruminant animals.

RECOMMENDATION

It is therefore recommended that supplementation of LMLM up to 12 g kg^{-1} DM intake for growing Yankasa rams is safe and has no adverse effect on serum lipid profile and liver function enzymes.

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