

Some clinico-pharmacological studies on *Moringa* plant in rabbit

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ABSTRACT

The experiment was conducted to study the effect of *Moringa oleifera* on hematological, biochemical parameters and the growth performance of young post-weaning rabbits. Twenty white New zealand rabbits freshly weaned, one month aged and a body weight of 650-700 g. They divided into two groups one control (G1) and the other experimental (G2). The control group was provided with balanced ration whereas the experimental group was fed with both fresh leaves of *moringa oleifera* (2.5g/ kg of body weight) and balanced ration for 5 weeks. The results showed significant increase ($p>0.05$) in white blood cell (WBCs), red blood cell (RBCs), haemoglobin (Hb), packed cell volume (PCV) and platelets (PLT) in G2. Non-significant ($p>0.05$) influence of moringa leaves on some biochemical parameters except glucose, total cholesterol, calcium (Ca) and iron (Fe) there were significant difference. The best results of growth performance were obtained with *Moringa* supplement. The results suggest that *moringa oleifera* leaves possess good dietary protein quality for optimal growth of rabbits without any detrimental effects on the haematology and serum biochemistry of growing rabbits.

INTRODUCTION

Rabbit meat production has been on the increase in Egypt in recent years. The rabbit is the most productive meat producing among all domesticated animals. The feeding habits offer no appreciable competition with man. This is because it can subsist on green feed as basal diets. In addition to this, rabbits have a number of other characteristics that might be advantageous to subsistence farming system, such as their small body size, short generation interval with a relatively short gestation period of 30-31days. Medicinal herbs as a whole were reported to be used against a wide range of health problems such as cough, cold, stomach, cataract, constipation and many other ailments (**Jimenez et al., 2003**). Recently, there has been interest in the utilization of *Moringa* (*Moringa oleifera*) commonly called horse radish tree or drum stick tree, as potential inexpensive protein source for livestock feeding (**Sarwatt et al., 2002**). *Moringa oleifera* is an edible plant. A wide variety of nutritional and medicinal virtues have been attributed to its roots, bark, and leaves, flowers, fruits, and seeds (**Ramachandran et al., 1980; Anwar et al., 2007; Kumar et al., 2010**). Phytochemical analyses have shown that its leaves are particularly rich in potassium,

calcium, phosphorous, iron, vitamins A and D, essential amino acids, as well as such known antioxidants such as β -carotene, vitamin C, and flavonoids (**Bennett et al., 2003; Aslam et al., 2005; Manguro and Lemmen, 2007; Amaglo et al., 2010; Gowrishankar et al., 2010**).

The plant *M. oleifera* as one of these herbs was reported to prevent effectively, morphological changes and oxidative damage in lens of rats by enhancing the activities of anti-oxidant enzymes, reducing the intensity of lipid peroxidation and inhibiting generation of free radicals (**Sreelatha and Padma, 2009**). In addition, blood parameters namely: PCV, WBC counts, differentiation of WBC, hemoglobin (Hb) and platelets (PLT) were also found to be positively affected by using this plant (**Chinwe and Isitua, 2010**).

On the Internet, *M. oleifera* is variably labeled as Miracle Tree, Tree of Life, Mother's Best Friend, God's Gift to Man and Savior of the Poor. In many regions of Africa, it is widely consumed for self-medication by patients affected diabetes, hypertension, or HIV/AIDS (**Dieye et al., 2008; Kasolo et al., 2010; Monera and Maponga, 2010**).

Many of developing countries are located in the tropical and sub-tropical regions of the world where *M. oleifera* grows and is cultivated. If validated by medical science, dietary consumption of this plant could be advocated in these and other countries as an inexpensive prophylactic strategy against diabetes mellitus and cardiovascular disease (**Majambu., 2012**)

MATERIALS AND METHODS

Plant:

Moringa oleifera fresh leaves obtained from agriculture collage were given by dose of 2.5 g /kg of body weight (**Hisham et al., 2012**).

Experimental design:

The study was conducted on twenty white New zeland rabbits freshly weaned, one month aged and a body weight of 650-700 g. The rabbits were kept in stainless steel wire mesh cages under sanitary hygienic condition. Blood and fecal samples were collected from rabbits to confirm that they were free from any parasites. The rabbits were divided into two groups, one control (G1) and the other experimental (G2). The control group was provided with balanced commercial pellets whereas the experimental group was fed with both fresh leaves of *m. oleifera* and balanced commercial pellets for 5 weeks.

Indices for evaluation of growth performance (Wanger et al., 1993)

Body weight (g)

The animals were weighted individually at the beginning of the experiment to obtain the average initial body weight and then body weight was recorded every week for calculation the average body weight development in each group.

Feed consumption (g)

Feed consumption for each group was calculated daily during the experimental period (g/ rabbit).

Body weight gain (g)

Body weight gain = W2- W1

W1= the initial weight (g)

W2= the body weight at the end of every week (g)

Feed conversion ratio (FCR)

$$\text{FCR (gm \%)} = \frac{\text{Amount of feed consumed /g/ animal/ week consumption} \times 100}{\text{Body weight gain/ g/ animal/ week}}$$

Blood sample collection

After 21 and 37 days of the experiment, blood samples were taken from rabbits. Blood samples were collected into labeled Ethylene-deamine tetra-acetic acid (EDTA) treated tubes for haematological analysis and into tubes without anticoagulant for serum biochemical evaluation.

The hematological studies

The erythrocytic count, hemoglobin concentration, packed cell volume and erythrocytic indices were carried out by using automatic cell counter (Sysmex XT-2000iv).

Biochemical studies

Test kits were used for colorimetric estimation of the following parameters using spectrophotometer. The liver transferases (alanine aminotransferase "ALT" and aspartate aminotransferase "AST") activities were estimated according to **Murray (1984)**. The serum urea was determined according to **Chaney and Marbach (1963)** and the serum creatinine was estimated according to **Henry (1974)**. Total cholesterol level was carried out according to **White et al (1970)**, while serum triglycerides were measured according to **Stein and Myers (1995)**. Serum glucose was measured

according to **Trinder (1969)**. Serum calcium was determined according to **Tietz (1970)**, serum iron was determined according to **Nutall and klee (2001)**. Total protein was measured according to **Henry (1964)**. Electrophoretic analysis was carried out for determination of serum albumin, alpha, beta and gamma globulins according to the technique described by **Davis (1964)**.

Statistical analysis

The data obtained from this investigation were statistically analyzed by T-test according to **Tamhane and Dunlop (2000)**.

RESULTS AND DISCUSSION

M. oleifera is cultivated widely around the world and used for various purposes one of which is as a feed supplement to livestock (**Martin, 2007; Fadiyimu et al., 2010**). In this study, rabbits were used to test the nutritional values of *M. oleifera* via its effect on blood and biochemical parameters as well as on changes in the animals' body weights

Blood parameters in rabbits are shown in table (1). WBCs, RBCs, Hb, PCV and Platelets were significantly increased in G2 especially at 5 weeks. Whereas the other blood parameters remained more or less unchanged. Dietary components of *M. oleifera* were reported to have measurable effect on blood constituents (**Church et al., 1984**).

Terzungwe et al (2013) reported that increase RBCs values were associated with high quality dietary protein and disease free animal. The author found that Hb values of rabbits supported by moringa were numerically higher than control one. The increase in the hemoglobin concentration of rabbits might be due to the fact that moringa oleifera is rich in amino acids, vitamins and minerals particularly iron (**Subadra et al., 1997 and Faye et al., 2011**).

Hisham et al (2012) found that the mean values of PCV, PLT, and RBCs were significantly higher than the same parameters in control group of rabbits provided with fresh leaves of *M. oleifera* for 21 days. Also **Ibrahim et al., 2014** found that RBCS count, Hb and MCHC levels increased in rabbits fed 2, 4 g of *moringa peregrine* seeds.

This increase in RBC's, WBC's counts and hemoglobin may indicate the role of *moringa* as contain strong antioxidants such as vitamin C which preventing reduction of oxygen consumption in rabbits through its action on the thyroid gland or protects leukocytes from auto-oxidation (**Morsy 2007**).

The effect of *moringa oleifera* leaves on serum biochemical parameters of rabbits were presented in table (2). AST, ALT, urea, creatinine and triglycerides levels

were non significantly changed while the glucose and total cholesterol were significantly decrease in G2 after 5 weeks. Calcium and iron show significant increase in G2 after 5 weeks.

Terzungwe et al (2013) investigated the effect of *M.oleifera* leaf meal on serum biochemical parameters of weaner rabbits and obtained that there is no significant changes. **Makonnen et al (1998)** found that *moringa stenopetala* extract lower blood glucose concentration in non-diabetic rabbits which observed to increase with time and with an increase in the dose of the extract.

This decrease in glucose level of rabbits fed Moringa leaves is in agreement with the findings of **Jaiswal et al. (2009)**, who reported that blood glucose level decreased after administration aqueous leaf extract of *Moringa oleifera* to rats. This may suggest that *moringa* may have an insulin-like effect on peripheral tissues either by promoting glucose uptake and metabolism or by inhibiting gluconeogenesis. It is likely that the *moringa* has some effect of increasing the tissue utilization of glucose (**Jabeen et al., 2008 and Luqman et al., 2012**) by inhibiting hepatic gluconeogenesis or absorption of glucose into the muscles and adipose tissues (**Kamanyi et al., 1994 and Desta et al., 2011**).

Majambu (2012) reported that in normal rats *M. oleifera* treatment lowered Fasting Plasma Glucose at all doses in time and concentration dependent manners.

The decrease in blood cholesterol level is in agreement with the study reported for *Moringa oleifera* leaf extract that showed hypocholesterolemic activity (**Ghasi et al., 2000 and Pari and Kumar, 2002**). It was reported that the mechanism of cholesterol reduction is thought to be through the lowering of plasma concentrations of LDL by B-sitosterol, the bioactive phytoconstituent isolated from *Moringa oleifera*.

Mehta et al (2003) said that *moringa oleifera* increase the excretion of fecal cholesterol so it possesses a hypolipidaemic effect. **Chumark et al. (2008)** said that *M.oleifera* leaves have therapeutic potential effect on dyslipidemia induced in rabbits.

The significant increase in Ca and Fe attributed to the mineral composition of leaves and pods of *Moringa oleifera*. The contents K, Ca, in the leaves and pods of *Moringa oleifera* were found to be 19732-24397 and 1839-2097 mg/kg respectively. The concentration of Fe was found to be 205-573 mg kg (**Maida et al., 2005**). *M.oleifera* is rich in amino acids, vitamins and minerals particularly iron (**Subadra et al, 1997; Faye, 2011**).

The non-significant effect of *Moringa oleifera* on alanine aminotransferase, aspartate aminotransferase, urea, creatinine and triglycerides are indication that the fed rabbits with Moringa have no untoward effect on the health status of the rabbits

(Teshome et al., 2001) and/or this might be an indication of the non-toxic action of *Moringa* on the body metabolism of the rabbits (Ibrahim 2014).

Concerning the proteinogram finding, our results revealed non-significant change in the serum total protein, albumin, alpha, beta, gamma and total globulin table (3) in G2 all over the experimental periods. Since total protein, albumin and globulin are generally influenced by the quantity and the quality of protein intake (Onifade and Tewe 1993), the values obtained in our study indicate nutritional adequacy of dietary protein. These results are in agreement with (Ewuola et al., 2012; Odetola et al., 2012; Terzungwe et al., 2013 and Ibrahim et al., 2014).

Our results recorded a significant increase in body weight and body weight gain in G2 in the last three weeks and a significant decrease in feed consumption and feed conversion rate at the end of 5th and 6th week of experimental period in G2 comparing with the control group as showing in table (4). This improving of FCR in G2 may be due to improving in the utilization of protein in rabbit diet. The higher weight gain in rabbits fed *moringa* leaves may be partly due to a better protein quality, possibly arising from a higher methionine and lysine supply (Zarkadas et al., 1995). Vitamin A is important for rabbit growth. *Moringa* leaves is reported to have a high level of vitamin A (Grubben and Denton, 2004; Fuglie, 2005). Regarding the increase in protein digestibility with the addition of *moringa* leaves, (Fahey et al., 2001) mentioned that *moringa* contains highly digestible protein. Our results agree with (Bouatene et al., 2011; Abbas, 2013).

Conclusion

The results of this study showed that *moringa oleifera* leaves will support a high nutritional value for rabbits through its positive effect on some blood, biochemical parameters and body weights of experimental rabbits therefor it can be conveniently used as good ingredient in feeding rabbits

Table1: Mean values of blood parameters in rabbits provided daily with fresh leaves of *M. oleifera* (2.5 g/kg of body weight).

Parameters	After 3 weeks		After 5 weeks	
	G1	G2	G1	G2
WBCs×10 ³ /mm ³	3.07±0.22	4.88±0.14***	3.76±0.19	3.72±0.14
RBCs×10 ⁶ /mm ³	5.52±0.19	6.11±0.07*	4.90±0.10	5.99±0.26**
Hb(g/dl)	11.04±0.50	12.3±0.26*	11.18±0.09	12.54±0.39*
MCV (fl)	63.2±0.98	62.8±0.69	65.04±2.07	61.02±1.37
MCH(pg)	20.6±0.44	20.28±0.23	21.84±0.66	20.64±0.18
MCHC%	32.68±0.34	32.44±0.14	33.86±0.29	33.5±0.29
PCV%	34.36±1.29	37.86±0.64*	33.16±0.16	36.28±0.95*
PLT×10 ³ /mm ³	397.2±33.9	547.6±47*	334.4±18	484±19***

*P < 0.05 **P < 0.01 ***P < 0.001

Table 2: Mean values of biochemical parameters in rabbits provided daily with fresh leaves of *M. oleifera* (2.5 g/kg of body weight).

Parameters	After 3 weeks		After 5 weeks	
	G1	G2	G1	G2
AST U/L	64±5.24	63.4±3.24	78.6±0.81	81.2±2.31
ALT U/L	61.8±5.45	70.6±3.57	68.4±2.15	71±2.84
Urea mg/dl	24.8±3.07	27.8±2.22	34.8±1.56	34.6±1.43
Creatinine mg/dl	0.56±0.05	0.6±0.07	0.92±0.03	0.82±0.05
Glucose mg/dl	116.6±1.20	110.4±2.76	120.2±1.01	114±2.11*
Cholesterol mg/dl	136.2±3.38	133.6±2.61	155.2±3.67	133.6±2.61**
Triglycerides mg/dl	57.8±6.50	61.6±5.39	78.2±3.15	75.4±3.04
Ca mg/dl	9.64±0.49	10.28±0.42	9.16±0.15	10.42±0.16***
Fe mg/dl	127.6±6.56	141.4±7.63	129±4.50	155.2±1.46***

*P < 0.05 **P < 0.01 ***P < 0.001

Table 3: Mean values of proteinogram in rabbits provided daily with fresh leaves of *M. oleifera* (2.5 g/kg of body weight).

Non-Significant

Parameters	After 3 weeks		After 4 weeks	
	G1	G2	G1	G2
Total protein(g/dl)	6.34±0.17	6.68±0.10	7.10±0.17	7.64±0.19
Albumin(g/dl)	3.38±0.07	3.64±0.15	3.52±0.19	3.90±0.11
Globulin(g/dl)	2.96±0.11	3.04±0.07	3.52±0.10	3.76±0.13
α-globulin(g/dl)	0.49±0.02	0.50±0.01	0.58±0.01	0.63±0.02
β-globulin(g/dl)	1.10±0.04	1.02±0.05	1.24±0.04	1.25±0.04
γ-globulin(g/dl)	1.37±0.05	1.52±0.04	1.70±0.05	1.88±0.07

Table 4: Mean values of growth performance indices in rabbits provided daily with fresh leaves of *M. oleifera* (2.5 g/kg of body weight).

Parameters		time					
		1 st week	2 nd week	3 rd week	4 th week	5 th week	6 th week
Body Wt. (gm)	G1	730 ±25.50	800 ±35.36	900 ±44.7 2	1020 ±56.1 2	1150 ±50.00	1340 ±43.0 1
	G2	750 ±15.81	830 ±30.00	990 ±45.8 3	1180* ±33.9 2	1405** ±43.59	1680** * ±39.8 4
Feed consumption (gm)	G1	265 ±10.00	290 ±12.75	305 ±21.5 1	395 ±16.5 8	460 ±12.75	505 ±9.35
	G2	270 ±14.57	275 ±11.18	290 ±12.7 5	367 ±18.4 1	400* ±17.68	430** ±20.0 0
B. Wt gain (gm)	G1	50 ±15.81	70 ±12.25	100 ±15.8 1	120 ±12.2 5	130 ±20.00	190 ±18.7 1
	G2	60 ±10.00	80 ±20.00	160 ±29.1 5	190* ±18.7 1	225* ±25.00	275** ±15.8 1
Feed conversion rate/ week	G1	5.30 ±0.62	4.14 ±0.60	3.05 ±0.44	3.29 ±0.24	3.54 ±0.40	2.67 ±0.32
	G2	4.50 ±0.51	3.43 ±1.52	1.81 ±0.39	1.93 ±0.13	1.78* ±0.14	1.56* ±0.08

*P < 0.05 **P < 0.01 ***P < 0.001

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