EFFECT OF *MORINGA OLERIFERA* LEAF AND SEED EXTRACT ON THE LIVER QUALITY OF TURKEY TOMS.

[1]Onyinye C. Ogbu, [2] Cecilia N. Okafor. and [1]Beatrice N. Ajakemo
[1]Department of Agricultural Technology, Federal Polytechnic Oko Anambra state Nigeria.
[2]Department of Agricultural Engineering Technology and Bio-environmental,
Federal Polytechnic Oko Anambra state Nigeria.
[#] Corresponding author; ogbuonyinyac@gmail.com

Abstract

Various alternative nutrient sources have being in existence for years now, all geared towards reducing production cost in the animal agriculture without assessing its impact on the internal organs of the animals. This study therefore determined the impact of *Moringa olerifera* as an alternative nutrient source on the liver qualities of 36 turkey toms. These turkeys were separated into four treatment groups. Treatment one (T1) which had no leaf and seed extract thus served as control. The treatment two (T2) had 1% Moringa seed weight in volume (w/v). Treatment three (T3) were with 0.5 % seed and 0.5% leaf extract w/v. While Treatment four (T4) were 1% leaf extract w/v. Blood samples were collected at 36 weeks of age from each treatment group. The total protein, Albumin, cholesterol, Bilirubin, Urea, Alanine transaminase (ALT) and Aspartate transaminase (AST) all differed significantly ($P< 0.05$).These differences did not take a definite pattern that could be attribute to the detrimental to the health status of heritage turkey toms' liver; rather they improved the liver qualities of these turkeys through the indicators examined.

Introduction

Considering the present economic situation in Nigeria, there is a clarion call to improve the animal agricultural sector, to achieve protein sufficiency and also boast the nation's economy. Animal feeds costs about 60-80% (Urom et al., 2018) of the total production has been a serious threat. Even the poultry sector is currently experiencing some boost due to several economic and agricultural policies and reforms which include the removal of import duties on poultry products (Fasina et al., 2007) and a ban on the importation of processed poultry meat. To curtail cost, farmers have used so many alternative nutrient sources, one of which was *Moringa olerifera*. This is aimed at reducing the production cost and providing turkey meat in surplus quantity not just to serve the populace but for export purposes.

Moringa is rich in protein, carbohydrates, fat and oil (Aja *et al.*, 2013). *Moringa* is a good source of minerals (phosphorous, chloride and calcium) and vitamins C (Abdukarim *et al.*2007). It is also rich in antioxidant properties like lutein, alphaorotine, beta-carotene, xanthine and chlorophyll (Fuglie, 1999). Muanya (2017) has reported that *Moringa* fruits can be used to boost sperm count in men thus increasing their chances of fertilizing eggs. Serrano-Vega *et al,* (2008) used it to increase sperm count in male mice

when a 1% concentration of *Moringa* ethanoic leaf extract was administered. Cajuday and Pocsidio (2010) also observed that mice given high and medium doses of the plant extract had enhanced spermatogenesis. *Moringa* (leaves) have also been used in broiler chick diets, and there were improvements in the general performance of the broiler birds (Abdulsalam *et al.,* 2015). Its effect has also been checked in rabbit does by Adeyemi *et al.,* (2014) and in weaning pigs by Oliver *et al.,*(2015). Besides all these useful qualities of most plants to achieve good growth, effects (either positive or negative) on internal organ (liver) function must be emphasized. Since the liver regulates most chemical levels in the blood and excretes a product known as bile, it is therefore very essential the quality of the liver is top-notch irrespective of any material fed to the animals.

Hence the need to determine the effect of Moringa leaf and seed extracts on the health status of turkey toms' liver quality has become imperative.

Materials and Methods

The experiment was carried out in the poultry section of Chirex Farms Abakuru under the supervision and approval of the research and supervisory counsel of Micheal Okpala University of Agriculture, Umudike Abia state.

Collection and Preparation of Sample Materials

The experimental material for the study was *Moringa oleifera* leaf and seed extracts. The freshly harvested leaves and seeds of *Moringa* were collected from homesteads within the Owerri metropolis.

The freshly harvested leaves and seeds were sorted to remove contaminants sand particles and dead matter. They were shade dried in an open well ventilated room for about one week at room temperature. The seeds and the foliage were ground separately into powder and stored in separate clean dry containers. Treatment one (T_1) was the control group with no *Moringa* powder. One gram of the seed powder was diluted in 1000mls of clean water, sieved with cheesecloth and served as drinking water for treatment two (T_2). Treatment three (T_3) had 0.5g of leaf powder and 0.5g of seed powder diluted with 1000mls of clean water sieved with cheesecloth and served as drinking water. One gram of the leaf powder was diluted in 1000mls of clean water, sieved with cheesecloth and served as drinking water for treatment four (T_4).

Experimental Animals and their Management

Thirty-six (36) local male strains of turkeys of white, black and lavender plumage averagely of eight (8) weeks old were used for the study.

The local turkeys were procured from a reputable farm, A – Z farms Ikenga Aguata Local Government Area in Anambra State. Before the commencement of the experiment, the local turkeys were quarantined and allowed to acclimatize for 14 days in the Poultry unit. During the acclimatization period, the turkeys were given routine management practices which included deworming with Ivermectin solution (1%w/v) against endo and

ectoparasites. Vaccinations suitable for their age were also given before the commencement of the experiment.

The 36 male turkeys were randomly assigned to treatments. There were four (4) treatments in all with nine (9) turkeys per treatment. Each treatment group was replicated three times to contain three (3) turkeys per replicate.

The treatment groups were administered 0 gram of *Moringa* (T_1), 1 gram of *Moringa* seed alone as (T_2), a combination of 0.5g of *Moringa* seed and 0.5gram of *Moringa* leaf (T_3) and lastly 1 gram of *Moringa* leaf alone (T_4). Experimental material was given to the male turkeys at 10 weeks of age. The treatment was administered to the turkeys via drinking water between the hours of 7 am to 10 am after which they were given clean drinking water throughout the rest of the day. The turkeys were given commercial feed during the first 14 weeks of the experiment. From 24 weeks of age formulated ration (Table 1) was used. The feed sample was determined to ensure quality assessment (Table 1) by livestock feeds Plc with the aid of the apparatus; DA1650 near an infra-red Spectrophotometer.

Table 1: Feed Formula for the Experimental Diet

Ingredients		**(%)**
Groundnut		21.00
Fish meal		2.00
Maize		35.00
Wheat offal		37.00
Bone meal		2.50
Oyster shell		1.50
Methionine		0.25
Lysine		0.25
Salt		0.25
Vitamin Mineral	Premix	0.25
Total		100
Determined values		
Crude protein	-	19.85
Crude fibre	-	7.44
Fat	-	5.01
Moisture	-	8.28
Ash	-	6.99
Energy	-	3018.8 kcal/kg

Vitamins and trace mineral declaration: 2.5kg of premix contains.

Vitamin A (Iμ) 12,500.00, Vitamin D_3 (iμ) 2,500,000.00, vitamin E (mcg) 40,000.00, Vitamin K_3 (mg) 2,000.00, vitamin B (mg) 3,000.00, vitamin B_2 (mg) 5,500, vitamin B6 (mg) 5,000, Niacin (mg) 55,000.00, calcium pantothenate (mg) 11,500.00, Vitamin B_{12} (mg) 25,000, Chlorine

Chloride (mg) 500,000.00, Folic acid (mg) 1,000.00, Biotin (mg) 80.00, Manganese (mg) 120,000.00, Iran (g) 100,000.00, Zinc (mg) 80,000.00. Copper (mg) 8,500.00, Iodine (mg) 1,500.00, Cobalt (mg) 300.00, Selenium (mg) 120.00, Antioxidant (mg) 120,000.00.

Data Collection

Blood for serum biochemical properties which included total protein biochemistry was collected through the wing vein of the male local turkeys using sterile needle and syringe and was analyzed within 2 hours of collection. The blood serum levels of total protein (TP), albumin, globulin, cholesterol, creatinine, urea, aspartate transaminase (AST), and Alanine transaminase (ALT) were determined following standard procedures (Evans, 1996).

Data Analysis

This was performed using one-way ANOVA (SAS, 2015) with dietary treatments (T_1, T_2, T_3, T_4) as independent variables, while all data obtained on serum liver indicator levels were regarded as dependent variables. Duncan HSD test was used the testing the difference of means. The treatment effect was considered significant if P- values were less than 0.05.

Results and Discussions

The total protein level of male turkeys fed *Moringa oleifera* extract differed significantly among the treatment groups (Table 2). Total protein levels were higher ($P<0.05$) among the *Moringa*-treated groups (Table 2). The serum protein levels are usually affected by the presence of severe liver damage or prolonged dietary protein deficiency (Johnson *et al*., 2001) or even dehydration (Ashraf, 2017). These abnormalities were not witnessed in this study. Rather *Moringa* extract boosted the serum protein levels of the turkeys, with the leaf extracts being the best. The serum protein levels of turkeys in the *Moringa* administered group were close to the reported ranges of 30.2 – 37.8g/l as reported by Damaziak *et al*. (2017) and 3.60 – 3.80g/dl on turkeys by Etuk *et al*. (2012) on turkeys. All the treatment groups were in conformity with the reported range of 2.4 -5.2g/dl of Grey (2014) and Miesle (2018) on avians and 2.32 – 4.68g/dl (Priya and Gomathy 2008) on turkeys. The findings from the study collaborate with the observations of Abdulkarim *et al*. (2015)

The albumin which is part of total protein increases in cases of dehydration and decreases when the protein quality in the diet is poor leading to poor clotting ability of the blood of the animal (Robert *et al.*, 2003). The albumin level in the study was in line with the findings of Grey's (2004) report on avians. The ALT which is a good mirror of the overall body enzymatic and metabolic processes (Schonidt *et al.,* 2009) differed ($P<0.05$) significantly among the treatment groups. The *Moringa*-administered group had higher values than the control (Table 2).

The AST aids in the diagnosis of acute myocardial infaraction (Martin *et al*., 2010) also differed significantly ($P<0.05$) among the treatment groups. The ALT and AST ratios are used as clinical biomarkers for liver health. The AST level was significantly higher within the *Moringa* extract

administered group than in the control. The AST, as well as ALT levels, were within the same range of 117.5 – 230 iu/L and 10 – 21.00 iu/L respectively reported by Ajuonuma *et al.,* (2013) on turkeys. They were also within the range of 109 – 305 iu/L (AST) in avian (Grey, 2004).

A high level of ALT in the blood is usually associated with the intake of substances like omega -3- acids, and ethylesters (Koski, 2008). *Moringa* is rich in omega – 3 – acids (O'Byne, 2015). This could be the cause of the elevated ALT levels founds among the *Moringa* extracts groups.

The total serum cholesterol (mg/dL) was very essential for the synthesis of steroid hormone, vitamin D and bile acids (Bounous *et al*., 2000). The cholesterol levels of turkeys exposed to *Moringa* leaf extract were significantly higher (P<0.05) than the levels observed in *Moringa* seed extract groups (Table 2). Avian cholesterol levels are affected by heredity, nutrition and liver activities (Coles, 1986). The high levels of cholesterol in the study contradict the report of Mehta *et al*., (2003) that *Moringa* leaf extract is capable of lowering cholesterol levels. This lower level of cholesterol among the *Moringa* seed-exposed male turkeys and control affirms the report of Gilbert (1971) that low cholesterol levels are due to an increase in steroid hormone in birds, while the leaf-exposed group may have had too many steroidal properties from the leaf that their cholesterol levels were not hampered by steroid hormone production.

The levels of bilirubin a yellowish compound in the normal catabolic pathway, plays an essential role in the catabolism and waste clearance from the body, differed significantly (P<0.05) among treatments. *Moringa* extracts administered groups were higher than the control groups. These high levels of bilirubin may be of health benefit to the male turkey if there are no liver diseases than low bilirubin level (Sedlak and Snucler, 2004). This study report is in line with the reported levels in turkeys 0.21±0.10 to 10.50±20mg/dl (Black *et al*., 2013) and Damaziak *et al*.(2017) reported a range of 0.34-0.55mmol/L in turkeys. This study, therefore, affirms that high levels of bilirubin are more a health benefit. The study results collaborate with the findings of Raji *et al*. (2016) on *Moringa* use on goats.

The blood urea nitrogen which comes from broken down proteins in the liver is an indication of dehydration level in the body (Comtois *et al.,* 1990) (Table 2). A high level of urea also indicated oxidative stress leading to the generation of more oxygen-reactive forms in the body (Landmesser and Drexler, 2002). The significant (P<0.05) difference among the treatment group examined for urea did not take a definite trend that can be attributed to *Moringa* extracts although the leaf extracts group was significantly (P<0.05) highest. The studied turkey urea levels were within the observed range of 0.62 – 0.74mmol/dl in turkeys by Ognik and Wertecki (2012). Variations among the treatment groups can only be attributed to being affected by *Moringa* leaf extracts increased the urea level while the seed extracts lowered the urea levels and combined seed and leaf extracts gave a balanced effect just as in the control.

In conclusion, the *Moringa olerifera* leaf and seed extracts were not detrimental to the health status of heritage turkey toms' liver;

rather they improved the liver qualities of these turkeys through the indicators examined. Future studies on liver histology will help to buttress these facts.

Table 2: mean values of liver quality indicators of male turkeys administered aqueous *Moringa olerifera* seed and leaf extracts.

Parameters	T_1	T_2	T_3	T_4
Total Protein (g/dl)	**2.34±0.09^{c}**	**3.10±0.20^{b}**	**3.26±0.14^{b}**	**3.93±0.09^{a}**
Albumin (g/dl)	1.16±0.05^{c}	1.68±0.04^{b}	1.79±0.14^{b}	2.47±0.10^{a}
Cholesterol(mg/dl)	67.84±2.58^{b}	74.67±2.46^{ab}	104.19±19.32^{a}	104.35±1.16^{a}
Bilirubin (mg/dl)	0.50±0.01^{b}	0.570±0.02^{a}	0.44±0.05^{ab}	0.59±0.02^{a}
Urea (mg/dl)	11.03±0.83^{b}	13.72±0.10^{c}	13.81±0.09^{b}	16.43±0.83^{a}
ALT (µ/L)	13.33±0.89^{b}	15.00±0.58^{ab}	15.00±0.058^{ab}	17.00±0.58^{a}
AST (µ/L)	17.00±0.58^{c}	19.00±0.58^{b}	19.00±0.58^{b}	21.00±0.58^{a}

Means with different superscripts $^{a, b, c}$ or ^{d} on the same row are significantly different (P<0.05).

References

Abdulkarim, A., Muhammad, U., Ahmad, U., Oluwaseyi, O. and Hamman, H. (2015). Influence of *Moringa olerifera* seed meal on haematology, serum biochemistry of broiler chickens. *Int. J of Livestock Research*, **12**(2): 17 - 37.

Abdulsalam, S., Yahaya, M. S. and Yaksai, M. A. (2015). Performance of broiler chickens fed *Moringa oleifera* leaf meal supplemented poultry feed. *Nigeria Agricultural Journal*,**46:** 1.

Aja, P. M., Ibiam, U. A., Uroku, A. J., Orji, O. U., Offor, C. and Nwadi, B. U. (2013). Comparative proximate and mineral composition of *Moringa oleifera* and serel. *Global Advanced Research Journal of Agricultural Science*,**2**(5): 137 - 141.

Ajuonuma, C. O., Egahi, J. O., Zekeri, O. and Ukwenya, S. O. (2013). The influence of palm kernel cake on haematology and blood chemistry of mixed domesticated turkeys (*Meleagris gallopavo*). *Journal of Agriculture and Veterinary Science*,**2**: 1 - 3.

Ashraf, M. (2017). How to increase protein levels in your blood. www.livestrong.com.

Black, P. A., Macek, M. Tieber, A. and Weber, M. (2013). Reference values for Haematology, Plasma Biochemical analysis, plasma protein electrophoresis and Aspergillus Serology in Elephant – crested Tinamou (Eudromia elegans). *Journal of Avian Medicine and Surgery***1**: 1 - 6.

Bounous, D.I., Wyatt, R.D., Gibbs, P.S., Kilburn, J.V. and Quist, C.F. (2000). Normal Hematological and serum biochemical reference intervals for Juvenile wild turkeys. *Journal of Wildlife Diseases*,**36**(2):393-396.

Cajuday, L.A. and Pocsidio, G. (2010). Effect of *Moringa olerifera* Lam. On the reproduction of male Mice (*Mus musculus*). *Journal of Medicinal Plant Research,***4**(12): 1115- 1121.

Comtois, R., Bertrand, S., Beauregard, H. and Vinay, P. (1990). Diagnostic value of the determination of blood urea in dehydrated patients with and without central diabetes insipidus. *Union Medicine in Canada,***119**(6): 317 - 321.

Damaziak, K., Michalezuk, M., Zdanowska-Sasiadel, Z., Jozwik, A., Gozdowski, D., Siennieka, A. and Niemiee, J. (2017). Effect of genotype on haematological and serum biochemical response of turkey hens to stress. *Archive of Animal Breeding Journal*,**60**:9-17.

Etuk, E.B., Opara, M.N., Okeudo, N.J., Esonu, B.O. and Udedibie, A.B.I. (2012). Haematological and serum biochemical parameters of local turkey poults fed diets containing two varieties of Sorghum. *Journal of World's Poultry Research,***2**(4): 81-89.

Evans, G. O. (1996). Animal Clinical Chemistry: A Primer for technologists. Taylor and Francis, London.

Fasina, F.O., Wai, M.D., Mohammed, S.N. and Onyekonkwu, O.N. (2007). Contribution of Poultry Production to household income: A case of Jos south local Govt. in Nigeria. *FamilyPoultry*,**17**: 30-34.

Fugile, L.J. (1999). The miracle tree *Moringa oleifera*: Natural Nutrition for the tropic. Church world service, Dakar pp 68, Revised in 2001 and published as the miracle tree: The multiple attributes of *Moringa.*

Gilbert, A. B. (1971). The activity of the ovary in relation to egg production in: Egg formation and production Freeman, B.M and Lake, P.E (ed) Br. Poult Sci. U K pg 299 - 310

Grey, A. F. (2014). Avian Reference ranges: chemistry cpl.med.miami.edu.

Johnson, Q., Veith, W.J. and Mouton, T. (2001). The impact of dietary protein intake on serum biochemical and haematological profiles in vervet monkeys. *Journal of Medical Primatology,***30**(1):61- 69.

Martin, M.P., Wineland, M. and Barnes, H.J. (2010). Selected blood chemistry and Gas Reference Ranges for broiler Breeders i-SATA (R) handheld clinical Analyzer American Association of Avian Pathologists.*Journal of Avian Diseases*,**54**:1016-1020.

Mehta, L.K., Balaraman, R., Amin, A.H., Bafaa, P.A. and Gulatio, D.O. (2003). Effect of fruits of *Moringa oleifera* on the lipid profile of normal and hypercholesterolaemic rabbit. *Journal of Ethnopharmacology*,**86**: 191-195.

Muanya, C. (2017). Ten Nigerian Medicinal Plants oposed by NMC for standardization on health features of *Guardian Newspaper* of 4th May, 2017 pg 1-4.

O'Byrne, A. (2015). The best sources of Omega – 3 fatty acids *Super leaf News* accessed June 14, 2018.

Ognik, K. and Wertelecki (2012). Effect of different vitamin E sources and levels on selected oxidative status indices in blood and tissues as well as on rearing performance of slaughter turkey hens. *Journal of Applied Poultry Research,***21**(2): 259-271.

Oliver, P., Fausto, S.S., Fernandez, F., Idelvi, R. and Barbara, A. (2015). Effect of a liquid extract of *Moringa olerifera* on the body weight of weaning pigs. *International Journal of Livestock Production*,**6**(5): 69-73.

Priya, M. and Gamothy, V.S. (2008). Haematological and blood biochemical in male and female Turkeys of different age group. *Tamilnadu Journal of Veterinary and Animal Science*,**4**(2): 60-68.

Reece, W.O. and Swenson, M.J. (2004). The composition and functions of blood. *In Duke'sphysiology of domestic animal* 12thed pg 26-52.

Schmidt, E. M. D. S., Paulillo, A.C., Martins, G.R.V., Lapera, M.I. and Testi, A.J.P. (2009). Hematology of the bronze turkey: Variation with age and gender. *International Journal of Poultry Science*,**8**:752-754.

Sedlak, T.W. and Snyder, S.H (2004). Bilirubin benefits: cellular protection by a biliverdin reductase antioxidant cycle. *Journal of Pediatrics*,**113**: 6.

Urom, S.M.O.C., Inyang,E.C., Abu, B.E. and Onunkwe, D.N. (2018) Semen characteristics and seminal plasma of Nigerian Indeginous cocks fed diet with graded levels of turmeric (Cucurma longa) in Agriculutural Journal 49:2 202 – 208.