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Effect of Moringa (*Moringa oleifera* Lam) Seeds on the Performance and Carcass Characteristics of Broiler Chickens

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Abstract
A 6-week study was conducted to evaluate the effects of *Moringa oleifera* seeds powder (MOSP) on the performance and carcass characteristics of broilers (Ross 308). A total of one hundred sixty day old unsexed broiler chicks were assigned into 16 pens of ten chicks each in a completely randomized design. Four experimental iso-caloric and iso-nitrogenous diets were supplied *ad-libitum*. Three experimental diets containing 0.5, 1.0 and 2.0 % MOSP and a control MOSP-free diet were used. Feed consumption, weight gain, feed conversion ratio and carcass quality characteristics were recorded for the individual replicate of each dietary treatment. Addition of MOSP up to 1.5% to broiler chicks diet significantly (P<0.05) showed low weight gain, feed efficiency and body weight during starter period. During finisher and the whole period supplying broiler chicks diet with 0.5% MOSP resulted in significant increase (P<0.05) in feed consumption, but addition of different levels of MOSP showed no significant effects(P>0.05) on weight gain, feed efficiency, final live body weight, dressing percentage, liver weight and heart weight. Reduction in weight gain, feed efficiency and body weight due to addition of 2.0% MOSP to broilers' diet during starter period may be due to the presence of phytate which acts as an anti-nutritional factor. The use of MOSP in the broiler diets has enhanced the performance during finisher and the whole period.

Key words: Broiler chickens s, *Moringa oleifera* , Seeds, Performance and Carcass Characteristics

1. Introduction

The rapid growth of human and livestock population create increasing demands for food and nutrition security in the least developed countries that alternative feed resources must be identified and evaluated (Olugbemi *et al.* 2010). Plant products have been used by humans for centuries as sources of food and traditional medicine to treat diseases. Natural medicinal products originating from herbs and spices have been used as feed additives for farm animals (Guo 2003).*Moringa oleifera* plant is of great potential that could be cultivated as economically profitable crop to contribute in poverty alleviation (Fatima & Muna 2013).

M.oleifera leaves, fruits, immature pods and flowers are integrated into the traditional food of humans in several tropical and subtropical countries (Siddhuraju & Becker 2003 Anhwange *et al.* 2004). Leaves of the Moringa tree are the preferred part for use in animal diets as leaf meal. A series of researches were conducted to study the effect of this leaf meal on the growth performance of layer chicks (Melesse *et al.* 2011), on the productive performance of laying hens (Kakengi *et al.* 2007 Abou-Elezz 2011), on the broilers' performance (Juniar *et al.* 2008 Olugbemi *et al.* 2010) and on the growth, carcass and blood indices of weaner rabbits (Nuhu 2010). Moreover, the effect of *M. oleifera* seeds on broilers' performance was revealed to affect the performance during

starter period (Abbas & Ahmed 2012). *M.oleifera* is a highly valued food plant characterized by a multipurpose use (Anwar *et al*. 2007), and Abbas (2013) reviewed the use of this tree in poultry diets. Moringa trees are scattered in the Sudan where rural women have used its seeds as a substitute for alum to remove turbidity from Nile water (Jahn 1986). A report on *M.oleifera* seeds had shown their antimicrobial effects (Eilert *et al*. 1981). In addition *M.oleifera* and *M.stenopetala* methanol and n-hexane seed extracts could control water-borne diseases as they produced inhibitory effect on *Salmonella typhii*, *Vibrio cholerae* and *Escherichia coli* (Walter *et al*. 2011). Furthermore, *M.oleifera* seeds have been reported as good sources of the main feed ingredients including fats, proteins and minerals (Compaoré *et al*. 2011). *M.oleifera* can play an important role in the economy of poultry industry. Partial substitution of fish meal for *M.oleifera* leaf meal has been found to decrease the feed cost (Zanu *et al.* 2012).

The purpose of this paper was to evaluate the effect of *M.oleifera* seeds powder (MOSP) in the broilers diet on their performance and carcass characteristics.

2. Materials and Methods

2.1 Study Area

This study was conducted at Abu Naama, Faculty of Agriculture, Sinnar University. Abu Naama is located about 400 Km south of the capital, Khartoum and it lies at latitude 12.44˚N and longitude 34.08˚E .The altitude of Abu Naama stands at 445 m. The annual mean rainfall is about 600-800 mm and the temperature ranges between 23.2-26.0˚C minimum and 35.6-43.7˚C maximum.

2.2 Sample Collection and Preparation

M.oleifera seeds were collected from the study area, sorted, cleaned and ground up to powder using grinding machine. These ground up seeds powder were compounded into feed for the feeding experiment at the proportions of 0.0%, 0.5%, 1.0% and 2.0%.

2.3 Experimental House Management

The experiment was carried out in an open system oriented house, located in an east - west direction to avoid solar radiation .The open sides of the house measured 12m × 8m and 2.5m height. The roof was constructed with corrugated iron sheets and the walls were built from cement bricks and wires. Prior to commencing the experiments, the house was cleaned and disinfected using formalin solution. Dry sawdust was used as a litter material with a depth of approximately 6 cm. A total of 16 pens measuring 159 m areas were divided using wire rots as partitions. Each pen was supplied with a clean feeder and a drinker of diameter 40 and 20 cm, respectively. Light was provided for 24 hrs throughout the experiment period.12 hrs on day light and the rest on artificial lighting, using 40 watt bulbs. The electrical bulbs were initially kept at about 15 cm above the ground to provide heat and then raised gradually to 1.75m height towards the end of the experiment period. Chicks immediately after hatching were vaccinated against Marek's disease and Newcastle disease. Moreover, vaccination against Gumboro disease was made 12 days post- hatching. The experiment was conducted for 6 weeks, with adaptation, starter and finisher periods of 1, 3 and 2 week(s) each, respectively. Temperature (˚C) and relative humidity(%) were recorded at the mid-day using a normal thermometer and hygrometer, respectively.

2.4 Experimental Chicks and Design

160 day-old, unsexed commercial broiler chicks (Ross 308) were assigned into 16 pens (four groups) of ten chicks (replicates) in a pen , in a completely randomized design . Four experimental isocaloric and isonitro-genous diets were supplied *ad libitum.*

2.5 Experimental Rations

Each pen was provided with a feeder and a drinker. Each experimental diet was fed to 4 replicates, in a completely randomized design. Broiler chicks were kept on a deep litter floor system. Four experimental iso-caloric and iso-nitrogenous diets were formulated to comply with the NRC (1994) requirements of broiler chicks. One group was kept as a control with 0.0% MOSP while other three experimental diets contain 0.5, 1.0, and 2.0% MOSP feed (table 1) and water was provided *ad libitum.*

2.6 Chemical Analysis of Moringa Seeds

Moringa sample was taken to the Agricultural Research Corporation-Wad Medani for analysis. Proximate chemical analysis, anti-nutritional factors and protein digestibility of Moringa seeds were performed. Removed hull content, (51.8%) crude protein, (25.75%) oil, (11%) crude fiber and (4.7%) ash were calculated. Metabolizable energy (ME) content (3.390 Kcal/kg) on dry matter basis is shown in table 1.

2.7 Parameters of Feedlot

2.7.1 Feed Intake (g)

The feed was weighed every week to determine the average feed intake per chick for the different treatment groups. Feed intake was calculated by the remained feed and divided by the number of birds in each group per day and totalized to be per week.

Feed Intake = Introduced parts of food – Residual parts of food

2.7.2 Weight Gain (g)

The birds were weighed every week to determine the average weight gain per chick for the different treatment groups. Weight gain was calculated as the difference between two successive weekly body weights as follows:

Weight Gain = Final weight – Initial weight

2.7.3 Feed Conversion Ratio (F.C.R)

The birds and feed were weighed every week to determine the average FCR per chick for the different treatment groups. Feed conversion ratio was calculated by dividing the amount of feed consumed (g) with body weight gained (g) as follows:-

$$F C R = \frac{\text{Feed intake (g) /bird / week}}{\text{Body weight gain (g) /bird/ week}}$$

2.7.4 Mortality Rate

Daily monitoring of the different treatment groups due to MOSP supplementation was made to check and record any case of death in each treatment. Calculation of MR is expressed as percentage as follows:

$$\text{Mortality Rate (MR)} = \frac{\text{Number of deaths}}{\text{Number of total chicks}} \times 100$$

2.7.5 Carcass Evaluation

At the end of the experiment period, 2 chicks from each replicate within each treatment were randomly selected from each dietary treatment. They were fasted for 12 hrs and then weighed to obtain live body weight, then slaughtered by a sharp knife for complete bleeding, immersed in boiling water for de-feathering. Feathers were plucked, head, viscera and shanks were removed. Carcasses were left for 1 hr to remove excess water. Heart, gizzard, liver, crop, trachea, oesophagus, intestinal tract, spleen, lungs, kidneys, reproductive organs and abdominal fat behind the carcass were weighed and calculated as percentages of live body weight as follows:

$$\text{Dressing percentage} = \frac{\text{Dressing carcass weight}}{\text{Live body weight}} \times 100$$

2.8 Data Management and Statistical Analysis

The data was managed and analysis of variance (ANOVA)-complete randomized design (CRD) was made due to Statistical Packages of the Social Sciences (SPSS). Duncan's Multiple Range Test (DMRT) was used to assess significant differences between means (Little and Hills, 1978). Tables were drawn using Microsoft Excel 2010.

3. Results

Results with respect to supplementation of 0.0% , 0.5%, 1.0% and 2.0% MOPS to broiler chicks' diet for the 6- week experiment period and their effects on the performance and carcass characteristics are shown in tables 2 and 3. Table (1) shows the composition of experimental diets and the proximate chemical analysis of *Moringa Oleifera* seeds percentage.

Supplementation of 0.5% MOSP to broiler chick diet significantly ($P<0.05$) increased feed consumption compared to 1.0 and 2.0 % MOSP (table 2). Addition of MOSP up to 2.0 % to the diet significantly ($P<0.05$) lowered weight gain, feed efficiency and body weight. Nevertheless, addition of different levels of MOSP showed no significant ($P>0.05$) effect on weight gain, feed efficiency and bodyweight (table 2). Inclusion of 0.5% (MOSP) in the broiler chicks' diet resulted in significant ($P<0.05$) lower weight of gizzard compared to control diet. Abdominal fat weight showed significant ($P<0.05$) differences with increased supplementation level of (MOSP). However, addition of different levels of MOSP showed no significant ($P>0.05$) effect on final live body weight, dressing percentage, liver weight and heart weight (table 3).No mortality occurred among the broilers during the experiment period.

4. Discussion

M.oleifera proved to be a valuable plant that is useful in mitigation of food insecurity and poverty reduction. among the poor rural population. Hence, incorporation of various parts of this plant in poultry feed formulation

is imperative for cost reduction and enhancing the performance and quality chicken carcasses. However, in our study showed a reduction in weight gain, feed efficiency and body weight as a result of the addition of higher level of MOSP (2.0%) to broilers diet during starter period. This may be due to the presence of phytate which is an anti-nutritional factor. Extracted kernel and extracted seed meal of *M.oleifera* were reported to have higher levels of phytate (Makkar & Becker 1997). Phytate was reported to reduce bioavailability of minerals in non-ruminant animals (Reddy *et al*. 1982) and decline digestibility of starch and protein (Thompson 1993).But this negative effect seemed to be overcome during the whole periods due to the presence of antibacterial materials in MOSP (Eilert *et al*. 1981). Moreover, *M. oleifera* seeds were used to reduce total bacterial count of turbid Nile water in Sudan by 1-4 log units (90-99.9%) within the first 1-2hs of treatment (Madsen *et al*. 1987). Furthermore, it was observed that *M. oleifera* and *M. stenopetala* methanol and n-hexane seed extracts produced inhibitory effect on *Salmonella typhi*, *Vibrio cholerae* and *Escherichia coli*, which normally cause water borne diseases (Walter *et al*. 2011). *M. oleifera* seeds proved to be good source of fat, protein, antioxidants and minerals (Mg and Zn), hence malnutrition due to micronutrients deficiency in children could be overcome (Compaoré *et al*. 2011). However, an increment in abdominal fat weight with increased supplementation level of MOSP to broiler chicks' diet (table 3) might be due to the higher level of fat content in Moringa seeds as observed by Compaoré *et al*. (2011). The absence of death cases among the broilers might be due to anti-microbial and availability of vitamins, proteins and minerals in Moringa plant, besides the good house management during the experiment. This is in line with the findings of Abbas & Ahmed (2012) who revealed no case of death among the broilers.

5. Conclusion

Moringa plants play a pivotal role in all aspects of life as medicinal plants and food of nutritive value. However, the higher levels of MOSP in the diet of broiler chicks were concluded to have adversely affected the performance and carcass characteristics suggesting a limited use of MOSP in the diet of broilers. Further studies are needed to use other parts of Moringa plant for performance efficiency and effectiveness in broiler chickens. Key stakeholders are urged to strategize such a miracle plant in healthy individuals, food and nutrition security through optimum poultry production.

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Table 1: The Composition of Experimental Diets and the Chemical Composition of *Moringa Oleifera* Seeds percentage

Ingredient	0.0% (MOSP)		0.5% (MOSP)		1.0% (MOSP)		2.0% (MOSP)	
	Starter	Finisher	Starter	Finisher	Starter	Finisher	Starter	Finisher
Sorghum (feterita)	58.00	61.00	57.50	61.00	57.50	61.00	57.00	61.50
Ground nut Cake	16.40	08.10	16.50	08.10	16.60	08.30	17.10	08.60
Sesame Cake	14.00	11.00	14.00	11.00	14.00	11.00	14.00	11.50
Wheat bran	02.50	09.50	02.40	09.00	01.80	08.30	00.80	06.00
Super Concentrate	05.00	05.00	05.00	05.00	05.00	05.00	05.00	05.00
Lysine	00.10	00.10	00.10	00.10	00.10	00.10	00.10	00.10
Oyster shell	00.30	00.70	00.30	00.70	00.30	00.70	00.30	00.70
Dicalcium phosphate	01.20	00.60	01.20	00.60	01.20	00.60	01.20	00.61
Oil	O2.00	03.00	02.00	03.00	02.00	03.00	02.00	03.00
Na Cl	00.25	00.25	00.25	00.25	00.25	00.25	00.25	00.25
Vitamin(Premix)	00.25	00.25	00.25	00.25	00.25	00.25	00.25	00.25
Moringa Seeds	00.00	00.00	00.50	00.50	01.00	01.00	02.00	02.00
Total	100	100	100	100	100	100	100	100

The Chemical Composition of Moringa (*Moringa oleifera* L.) Seeds percentage

Moisture	0 2.850
Oil	25.750
Sodium	09.700
Phosphorus	00.535
Potassium	00.200
Protein	51.800
Total carbohydrate	15.500
N_3O	00.045
M.E (Kcal/kg)	03.390

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Table 2: Effects of supplementation of *Moringa oleifera* seeds powder (MOSP) to broilers diet on the performance during the experiment period

	0.0 % MOSP	0.5% MOSP	1.0% MOSP	2.0% MOSP	SE
Feed consumption (g/bird/week)	511.10[b]	553.30[a]	503.60[b]	495.60[b]	12.77
Weight gain (g/bird/week)	306.00	313.00	285.20	288.50	11.47
Feed conversion ratio (g feed/ g weight)	1.68	1.77	1.77	1.72	0.048
Live body weight (g)	1388.00	1414.60	1333.50	1320.00	47.27
Mortality (%)	0.00	0.00	0.00	0.00	0.00

[a-b] Values in the same raw with different superscripts are significantly different (P<0.05).

Table 3: Effects of supplementation of *Moringa oleifera* seeds powder (MOSP) to broilers diet on the carcass characteristics during the experiment period

	0.0% MOSP	0.5% MOSP	1.0 % MOSP	2.0 % MOSP	SE
Live body weight (g)	1388.00	1414.00	1333.00	1320.00	47.27
Dressing percentage (%)	69.75	66.75	68.75	66.25	1.80
Liver weight (g)	38.13	27.50	33.33	39.38	4.62
Gizzard weight (g)	40.00[a]	25.63[b]	40.00[a]	43.75[a]	2.22
Heart weight (g)	12.25	10.00	17.50	20.00	5.27
Abdominal fat weight (g)	10.65[c]	17.50[b]	20.83a[b]	25.83[a]	1.83

[a-c] Values in the same raw with different superscripts are significantly different (P<0.05)

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