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Effects of Inclusion of Different Levels of Watermelon Bug Meal In Broiler Diets on Feed Intake, Body Weight Changes and Feed Conversion Ratio

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ABSTRACT

T This study was conducted in El-Obeid, North Kordofan State, Sudan with the objective of evaluating the effects of inclusion of different levels of watermelon bug meal (WMBM) as a substitute for sorghum grains in diets on broiler chick's performance. One day old unsexed 200 broiler chicks with an average weight of 40g/bird were used in an experiment designed as completely randomized design (CRD) with five treatments and four replicates. At the beginning of the experiment the chicks were fed a pre-starter diet for one week and then offered five diets prepared using (WMBM) substitution of sorghum at 0, 15, 30, 45 and 60 percent. The diets were offered twice a day. Chicks were weighed weekly during the experimental period. The collected data were analyzed using analysis of variance. The results indicated that feed intake of broiler chicks increased significantly ($P < 0.05$) with inclusion of WMBM. The chicks consumed 67, 89, 94, 97 and 97 g/day/bird when the WMBM constituted 0, 15, 30, 45 and 60 percent in the diets, respectively. The final body weight followed the same trend where the groups weighed 1332.5, 2130, 2100.6, 1922.5 and 1772.3 g for the birds that consumed diets of 0, 15, 30, 45 and 60 percent (WMBM) respectively. Weight gains and feed conversion ratio were also significantly ($P < 0.05$) improved. It was concluded that WMBM could replace sorghum grains as source of energy in broiler diets and it was recommended that more studies be carried out to investigate effects of inclusion of the WMBM on weight of cuts and meat quality.

Keywords: poultry diets, insect meals, body weight change, feed conversion ratio

INTRODUCTION

Poultry keeping in Sudan is an ancient occupation that started as a traditional practice and it is still dominantly traditional as seen in almost all parts of the country. The concurrent growth of the animals' feed industry was due to the increasing demand of poultry products (Osman, 1988). Poultry production development faced many difficulties that constrained establishment of sustainable indigenous production systems. Highly productive commercial hybrids and feed ingredients were always imported. In traditional and small scale production systems are mainly constrained by feed availability and cost, it represented an especial challenge. For the purpose of obtaining maximum benefits from the imported high yielding commercial hybrids, super concentrates and premix of vitamins and minerals were brought from different countries at very high cost. Importation was sometimes constrained by some noncommercial restrictions such as embargoes and economic sanctions on the country. The poultry industry was seriously affected by the dioxins' contamination of feed at the beginning of the century that necessitated looking for local sources of poultry feed. Sorghum grains are used as source of energy in broiler diets despite of the fact that the crop is a staple food for humans in different parts of the country including North Kordofan state. This created a high competition between man and poultry over this common food resource (Technoserve, 1987).

The bug (*Aspongopus viduatus*) is distributed over the Middle East and Africa in general and has a wide distribution in the Sudan occurring in all regions of the country. Watermelon bug is a notorious pest to cucurbitaceous plants in general and particular to water melon. The crop is considered as one of the main cash crops where its seeds are collected and used internally or exported to Egypt with relatively high prices.

A. viduatus was reported being controlled by several methods but the hand picking method is followed mainly as a control practice in North Kordofan State by the Plant Protection Department (PPD) assisted by World Food Programme (WFP). They used to pay farmers to collect manually and burn the watermelon bugs during the dry season.

Chemical analysis of the meal of watermelon bugs reported by Shamat (2007) has indicated that the insect meal was rich in oil and minerals and though it was found to be low in crude protein, so it can consider as a good source of metabolizable energy which can substitute sorghum grain in broiler diets. Also Mariod *et al.,* (2004) reported that watermelon bug meal contained 46.3% linoleic acid and 41.3% Oleic acid.

The objective of the study was to assist in developing appropriate small scale poultry production systems that could make use of the available resources of feed concomitant with control of some insect pests on cash crops of the region and minimizing poultry production cost by reducing the amount of sorghum grains used in broiler diets formulation since the grains represent 65% of the broiler diet/ ton. Specifically this study is proposed to study, also to study the effects of replacement of sorghum grains by different levels of watermelon bug meal on broilers feed intake, body weight changes, feed conversion ratio and feeding cost.

MATERIALS AND METHODS

The Study Area

The experimental birds were housed in the poultry Farm of the Animal Resources Administration Headquarters in Elobied city. The experiment was carried out during the period extending from June to July 2007.

The experimental birds Housing and treatments

The study used a total of 200 one day old unsexed commercial broiler chicks (ROSS 308) that were produce. The experiment was carried out in an open housing system on a deep litter floor. The house was closed up in three sides with a plastic shelter and divided into 20 pens of $1m^2$ each at the floor space. The pens were separated from each other by wire mesh and pampoo and they were supplied with a source of light for lighting 23 h/ day. Each pen was provided with fountain drinker and a feeder trough.

The chickens were delivered at the experimental site in the second day afternoon (on the 2^{nd} day to the hatchery release). The birds were weighed upon arrival by a scaled balance and every 10 birds were randomly penned as replicate with a mean weight of 40g and a total of 20 replicates for the experiment. The penned chicks were reared for 7 days as an adaptation period. At that period, the birds were fed broiler pre starter feed and were introduced afterwards to the experimental diets for 5 weeks.

Prior to commencement of the treatments, the chicks were vaccinated against infectious diseases such as bronchitis, Newcastle, Bursa and with two doses for the mentioned diseases during the rearing period. The birds were also treated for five days by coccidostat and anithlementic dose that was administered as prophylactic doses.

The chicks were subjected to five different level of feeding and were fed the experimental diets till 42 day of age. Throughout the experimental period, feed intake was calculated daily by weighing the remained feed and subtracting it from the feed provided the previous day. Water was provided continuously. The live body weight was recorded weekly. Feed intake and weight gain was used to estimate the feed conversion ratio (FCR) according to the equation: - FCR= (g) feed / (g) gain. Feed cost was calculated by adding price value of each quantity in one metric ton of the diet.

The Experimental Diets

The diets used in this study were isocoloric, isonitrogenic and formulated using Watermelon bug *(Aspongogus viduatus)* meal. The bug meal was used as substitute for sorghum grains as source of energy at five different levels and grouped as B, C, D and E with 15, 30 ,45 and 60 % watermelon bug meal substitute with sorghum and last group A as control with 60% sorghum and zero watermelon bug meal (Table 2) . The insect meal was hand collected, dried and packed in jute sacs and stored prior being ground. The chemical composition of the water melon bug meal (W.M.B.M) and other ingredients incorporated in the diets shown in table (1).

Table 1.The chemical composition of the ingredient used in the experimental diets (%)

Ingredient	CP	CF	E.E	ASH	Ca	P	Na	ME(MJ/Kg)
WMBM	10.9	-	15.1	3.75	0.35	1.6	0.81	1.25
Sorghum	13.23	24.8	-	21.5	0.5	3.1	1.2	14.38
Wheat bran	16.83	129.8	-	54.4	1.7	7.3	0.8	7.91
Groundnut cake	43.5.8	97.2	-	92.5	6.2	3.7	1.5	11.46
Sesame cake	41.57	81.8	-	138.6	20.1	9.3	1.5	11.62
Oyster shell	-	-	-	990.5	375	0.6	-	-
Salt	-	-	-	102.5	64.2	10.6	840	-
Super-concentrate LNB	40	3	-	-	8–11	4.6	1.5	37.6

The percent of ingredients used in formulating diet containing different levels or watermelon bug meal in the experimental diets shown in table (2).). Feed Cost Energy, protein and minerals

contents of diets containing different levels of watermelon bug meals were shown in table (3). Different level of diet that replace with sorghum cost less than sorghum diet.

Table 2.The percent ingredients used in formulating ration containing different levels or watermelon bug meal in the experimental diets (%)

Ingredient%	Level of WMBM %				
	A	B	C	D	E
Sorghum	60	45	30	15	-
Water melon bug	-	15	30	45	60
Wheat bran	10	3.5	3.5	3.5	3.5
Concentrate(LNB)	5	5	5	5	5
Ground nut cake	12.5	19	19	19	19
Sesame cake	10	10	10	10	10
Oyster shell	2	2	2	2	2
Salt	0.5	0.5	0.5	0.5	0.5
Total	100	100	100	100	100

Table 3. Feed Cost Energy, protein and minerals contents of diets containing different levels of watermelon bug meals

Ingredient%	Level of WMBM %				
	A	B	C	D	E
ME(MJ/KG)	13.13	13.4	13.4	13.4	13.4
CP	22.3	23.6	23.2	22.7	22.3
Ca	1.00	1.00	1.4	1.4	1.5
P	0.3	0.6	0.8	1	1.2
Cost/ton/SDG	547.5	492.4	434.9	377.4	319.9

Chemical and Statistical Analyses

Proximate analysis of watermelon bug, *Aspongopus viduatus* was carried out according to AOAC (2002). After estimation of the total ash of the sample, sodium Na, calcium Ca phosphorous, P, and Potassium were determined according to the methods described also by AOAC, (2002) using flame photometer method. Metabolisable energy estimation was done according to the equation of Lodhi *et al*, (1976).

Metabolisable energy MJ/Kg

ME MJ/kg DM = 1.549+ (CP%×0.0102) + (EE%×0.0275) + (NFE%×0.0148) + (CF%×0.0034).

Where:

ME= Metabolisable energy DM= dry matter CP=Crude Protein EE=Ether Extract NFE= Nitrogen- Free Extract CF= Crude Fiber

The data obtained on feed intake, weight change and feed conversion ratio was considered to complete randomized design and was analyzed via analysis of variance. Where treatments were different least significant difference, LSD, was used to separate means differences (Gomez and Gomez, 1984).

RESULTS

Effects of feeding broilers with diets of different Levels of Watermelon Bug meal on Feed Intake

The weekly mean feed intake (g) for the experimental birds is presented in Table (4). The first week was an adaptation period where the groups were left on pre starter diet. Afterwards the experimental birds were kept on diets containing different levels of watermelon bug meal, WMBM, or sorghum grains. Significant differences (P<0.01) in feed intake were observed during the first week and thereafter and it was significantly (P<0.05) higher for chicks fed diets with different levels of WMBM compared with those fed a diet containing sorghum grains only till the end of the experimental period.

Table 4.The effect of feeding different levels of WMBM on weekly feed intake

Level of WMBM%	Week					
	1st	2nd	3rd	4th	5th	6th
A	97.5^{a}	205^{b}	338.75^{d}	573.75^{d}	643.75^{b}	940^{c}
B	96.9^{ab}	210^{b}	411^{c}	778.13^{c}	1034.13^{a}	1277.25^{b}
C	100^{a}	215^{b}	423.76^{bc}	820^{b}	1051.25^{a}	1344^{b}
D	93.8 ^{b}	220.3^{a}	451^{a}	870^{a}	1107.88^{a}	1414.12^{a}
E	93.8^{ab}	210^{b}	438.75^{ab}	847.5	1103.63^{a}	1452.93^{a}
Total mean	96.4	212.15	412.8	774.31	988.13	1285.73
± SE	0.92	2.09	9.53	25.11	41.10	43.33

Values in the same column with different letters are significantly different at P<0.05
WMBM= Watermelon Bug Meal SE= Standard Error of the mean.

The birds on diets that contained 15 or 30 percent W.M.B.M consumed significantly (P<0.05) greater amount of feed compared to those fed the control diet, while their feed intake was significantly (P<0.05) lower compared to those fed 45 or 60 percent WMBM diets.

Effects of Feeding diets with different Levels of Watermelon Bug Meal on Broilers Body Weight change

The weekly live body weight change of the experimental birds during the experimental period is presented in Table (5). Birds fed diets containing different levels of WMBM had significantly (P<0.05) higher weight gains compared to those on the control diet. Within the WMBM diets, the feed that contained 15, 30 and 45 percent caused significantly (P<0.05) higher weight gains compared to those on a diet containing 60 % WMBM.

Within the different levels of WMBM, consumption of diets containing 15, 30 and 45 percent led to significantly (P<0.05) higher weight gains compared to consumption of a diet containing 60 % WMBM and finally the performance of chicks at 5th and 6th weeks followed the same trend of the 4th week.

Table 5. Mean weekly live body weight of the experimental chicks fed on diets containing different level of water melon bug meal during (0-6 week's period)

Level of WMBM%	Week				
	1st	2nd	3rd	4th	5th
A	328d	258.7c	170c	98.8b	110
B	560.7ab	476a	296a	108.8a	108.75
C	568.5a	429.7a	291.3a	109.3b	105
D	536.8b	478a	303.8a	104.9b	105
E	473.8c	416.25b	252.5b	93.75b	103.75
Total mean	493.5	411.75	262.7	103.10	106.5
± SE	24.1	19.48	12.22	3.21	1.03

Values in the same column with different letters are significantly different at P<0.05
WMBM= Watermelon Bug Meal SE= Standard Error of the mean

Feed conversion ratios of the experimental birds fed diets containing different level of WMBM

Feed conversion ratio of broiler chickens on WMB diets is presented in Table (6). Significant differences (P<0.05) could be observed in feed conversion ratio of chick groups from the first week. The experimental group on sorghum grains had significantly (P<0.05) lower feed conversion ratio values compared with the other four groups that were on diet with varying levels of WMBM. Lower feed conversion ratios were recorded for the group that was offered diets containing 45 and 60 % WMBM than the groups which consumed diet with 15 and 30 % WMBM diets in the second week. No significant differences were detected among birds that consumed diet with sorghum grains and which were on diets containing, 30 or 45 % WMBM.

Table 6. Feed conversion ratios of the experimental birds fed diets containing different level of WMBM during 0-6week's period (kg feed/ kg live weight gain)

Level of WMBM%	Week				
	1st	2nd	3rd	4th	5th
A	0.888 a	1.41a	2.16c	2.34c	1.96a
B	0.872 a	1.96b	1.42a	1.63a	1.75a
C	0.952 b	2.06b	1.45a	1.59a	1.77a
D	0.901 a	2.54c	1.50ab	1.82ab	2.08ab
E	0.916ab	2.24b	1.74b	2.03b	2.42b
Total mean	0.906	2.02	1.066	1.88	1.99
± SE	0.01	0.93	0.072	0.073	0.073

Values in the same column with different letters are significantly different at P<0.05
WMBM= Watermelon Bug Meal SE= Standard Error of the mean

DISCUSSION

Effects of feeding broilers with diets of different Levels of Watermelon Bug meal on Feed Intake

In this experiment, the inclusion of watermelon bug meal W.M.B.M at different levels to the broiler diets has increased the total feed intake when compared with consumption of the conventional diet that was formulated using sorghum grains. Such an improved appetite and greater feed intake might be due to the difference of form of energy source where the energy source of the sorghum diet was starch while energy source of the different levels of WMBM diets

was oil that was rich in essential fatty acids especially oleic and Lenoleic acids (Smith, 1995). Reporting of Eljack,(2004) said that feeding millet, rich in starch, did not have significant positive effect on mean total feed intake when replaced by wheat due to similarity of the source of energy.

The level of watermelon bug meal in the diet has also shown to be of significantly positive effects on total feed intake of the experimental broiler chicks after one week of the experimental diets being introduced i.e. during the 3rd weeks till the end of experiment periods positively correlated. The greater the percentage of WMBM in the diet, the higher was the amount of feed consumed till 45% W.M.B.M. That could be attributed to the increased amount of essential fatty acids consumed. The results obtained here are in line with (Smith, 1995) who reported that diets with fat as energy source were consumed in larger quantities than starch diets.

Eljack (2004) explained improved birds appetite on fat diets according to the body temperature of birds is not constant, and this has been suggested that heat produced after feed is consumed raises the temperature of the blood and hypothalamus, so that the appetite is suppressed in starch diet whereas heat is produced so immediately when birds are fed fat diets. This thermostatic theory would also explain why birds eat less at high ambient temperature and feed with a low heat increment such as fat can cause obesity because it is largely consumed. An alternative is the glucostatic theory. This proposes that there are glucose receptors in the hypothalamus which are sensitive to the rate at which glucose is being utilized by them. Low utilization rates leading to the above theories can possibly explain short term regulation of feed intake. Long term regulation is probably concerned with the prevention of excess fat deposition. According to this theory the hypothalamus is sensitive to concentration of circulating metabolites mobilized from endogenous fat stores. Since the amount of fat mobilized is proportional to the size of fat deposit a lipostatic mechanism keeping fat content controlling body weight. These results are in disagreement with the results reported by Gabriel and Idris, (1997) who reported that locust meal sprayed with insecticide tended to depress feed intake.

Effects of Feeding diets with different Levels of Watermelon Bug Meal on Broilers Body Weight change

These results are consistent with those findings reported by Sulistujanto, *et al, (*1999) who showed that feeding broiler chicks with fat rich diets could increase their final weight. However, Gabriel and Idris, (1997) reported that chicks fed locust meal did not increase in weight than those fed conventional diet of sorghum grains when locust meal was used as a protein source and not energy source as it was in the present study. Live body weight gain was greater in chicks upon consumption of the experimental diets. However the results of this study were in agreement with the results of a demonstration by Sulistujanto, *et al.,* (1999) who reported that among the energy yielding foodstuff, fat sources seem to be better utilized, with no age dependency on growth, weight gain or feed conversion ratio and he concluded that energy utilization of carbohydrates and protein sources during 10 days post-hatch tended to increase with age.

Feed conversion ratios of the experimental birds fed diets containing different level of WMBM

Feed conversion ratio of the broiler chicks was affected by inclusion of W.M.B.M in the experimental diets and the level of the bug meal in the diet. Feed conversion ratios of the groups fed diets that were formulated of W.M.B.M at all levels were significantly ($P<0.01$) better than the group consumed the conventional diet of sorghum grains. The results are in with Sulistujanto *et al.,* (1999) who reported that caused greater weight and lower (better) feed conversion diets

when chicks were fed diets of fat. The results of this were in line with Odunsi *et al.,* (2007) that carried out a study on broilers were

Supplementation with vegetable oil (VO) in his study only gave marginal improvement on performance indices when compared with corresponding wood charcoal (WC) based diets without (VO). The conversion ratio was best (3.37) when the broilers were fed diet without vegetable oil or charcoal whereas the FCR were high when the birds were fed diet with vegetable oil.

REFERENCE

AOAC. 2002. Association of Official Analytical Chemists. The official Methods of analysis, 16th edition. Washington DC.

Eljack B. H. El. 2004. The Effect of Feeding Millet on Growth, Laying and Hatching Performance of Fayoumi Breed. Thesis Ph.D. University of Khartoum.

Gabriel, S. and A. A. Idris. 1997. Utilization of Locust Meal in Poultry Diets .*JONARES*. 1(1):19-23

Gomez, K. A. and Gomez, A. A. 1984. Statistical procedures for agricultural research John Willey and sons. New York U.S.A.

Lodhi, G. N., Singh, D., and I. chponani .1976. Variation in nutrients content of feeding stuffs rich in protein and reassessment of the chemical methods for metabolizable energy estimation for poultry. *J. Agric. Sci*. 69:634-639.

Mariod, A. A., B. Matthäus, and K. Eichner. 2004. Fatty acid, tocopherol and sterol composition as well as oxidative stability of three unusual Sudanese oils. *J. Food Lipids .11*:179-189.

Odunsi, A. A. ; A. A. Rotimi ; E. A. Amao. 2007. Effect of different vegetable protein sources on growth and laying performance of Japanese quails (*Coturnix coturnix japonica*) in a derived savannah zone of Nigeria. *World Appl. Sci. J.* 3 (5): 567-571.

Osman, A. H. 1988. The role of indigenous and exotic genetic resources for poultry development in the Sudan. Proceedings of Symposium. Ministry of Animal Wealth. Khartoum, Sudan.

Shamat, A. .2007.physical and chemical properties of oil extracted from watermelon bugs Veterinary Research Laboratories, Suba. Sudan (unpublished).

Smith, A. J. 1995. The tropical Agriculturalist "Poultry". C.T A.Macmillan. London, UK.

Sulistujanto, B A. Y, and K. Sato. 1999. Energy utilization of Carbohydrates , fat and Protein sources in newly hatched broiler chicks. *British Poultry Science*. 653 – 659.

Technoserve .1987.Credit Component Base line Survey. Technoserve Inc. Agricultural Bank of Sudan, US Agency for International Development, Elobeid, Sudan.