www.roavs.com EISSN: 2223-0343
RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

The effect of feeding pearl millet (Darmsa cultivars) on broiler performance

Amal Eltayeb Mahmoud[1] and Elfadil A. Elzubeir[2]

[1]Department of Poultry Production, Faculty of Agriculture, Omdurman Islamic University, Sudan
[2]Department of Animal Nutrition, Faculty of Animal Production, University of Khartoum, Shambat, Sudan

Abstract

One hundred and sixty of Lohman-types were randomly distributed on body weight basis, into 16 pens. Four experimental diets were allocated to the one of the four treatments. At the end of the experimental period (six weeks) 12 birds from each treatment were slaughtered and the different parameters were studied. Results showed that the birds fed Darmsa cultivar exhibited an increase ($P<0.01$) in live body weight, weight gain and better feed conversion ratio. Relative thyroid gland weight was increased ($P<0.01$) in birds given Darmsa cultivar compared to those fed sorghum. Feeding Darmsa cultivar showed that the thyroid follicles were considerably enlarged and lined by flattened epithelium. The birds fed on Darmsa diet showed a significant ($P<0.01$) increase in the concentration of breast meat lipids, phospholipids, triglycerides and free fatty acids compared to those on the sorghum based diet. The findings of this study indicated that feeding pearl millet has no unwanted effect on the performance of broiler chicks.

Keywords: Millet; Lohman; lipid profile

To cite this article: Mahmoud AE and EA Elzubeir, 2013. The effect of feeding pearl millet (Darmsa cultivars) on broiler performance. Res. Opin. Anim. Vet. Sci., 3(2), 35-40.

Introduction

Pearl millet is the most widely grown of all the millets. Simhaee et al. (1971) reported that chicks fed 600 g/kg millet showed a significantly better feed conversion ratio, however, the body weight gain did not change. In addition, Sanford et al. (1973) reported that the weight gain and efficiency of feed utilization were found to be favourable for pearl millet as compared to sorghum grain when used as sources of energy and protein for broiler chicks. Similarly, Kraf et al. (1971) compared millet varieties with maize at a level of 40% for starter diets and 74% for the finisher diets, millet diets resulted in higher mean body weight gain than maize. Elzubeir et al. (1995) observed that in broiler chicks relative thyroid gland weight increased as the level of millet increased.

The objective of the present work was to find the effect of feeding pearl millet on the performance of broiler chicks.

Materials and Methods

One hundred and sixty unsexed (Lohman) day-old broiler chicks were obtained from the African Poultry Production. The birds were randomly distributed into four groups of 40 birds each. Each group was further divided into four replicates (each containing 10 broiler chicks).

Pearl millet (Darmsa cultivar) used in this study was purchased from Zalingei market (West Darfur State). Darmsa cultivar and sorghum grain were decorticated to 80-90% extraction rate. The analysis of Darmsa cultivar is shown in Table 1. Four diets were formulated to be isocaloric and isonitrogenous as shown in Table 2. The Darmsa diets were formulated to meet or exceed the National Research Council requirements (NRC, 1984). The diets were allocated randomly to the four experimental treatments.

Feeding period was continued for 6 weeks. The chemical composition of the experimental diets is shown in Table 3.

Corresponding author: Amal Eltayeb Mahmoud, Department of Poultry Production, Faculty of Agriculture, Omdurman Islamic University, Sudan

Table 1: Chemical composition of the experimental diet

Constituents (%)	Darmsa cultivar		
	Whole Grain	Endosperm	Bran
Dry matter	91.50	92.00	91.92
ME (MJ/kg)[1]	13.72	14.20	12.52
Crude protein	13.89	12.41	11.45
Crude fibre	5.25	3.41	10.72
Ether extract	3.95	3.75	8.91
Ash content	1.85	1.68	8.69
Calcium	0.11	0.08	0.06
Total phosphorus	0.27	0.29	0.45
Potassium (ppm)	4120		
Iodine (ppm)	673		
Manganese (ppm)	38.20		
Iron (ppm)	148		
Cobalt (ppm)	20.60		
Copper (ppm)	7.07		
Zinc (ppm)	17.10		
Molybdenum (ppm)	1.08		
Propionic acid (µg/100ml)	0.01		
Butyric acid (µg/100ml)	0.37		
Palmatic acid (µg/100ml)	28.34		
Stearic acid (µg/100ml)	1.20		
Oleic acid (µg/100ml)	1.26		
Linolenic acid (µg/100ml)	0.93		

[1]Calculated according to the equation of Lodhi et al. (1976)

An open sided poultry house (6 x 5 meter) with concrete floor and galvanized aluminum roof was used. The house contained 16 pens (1x1m each) and three pens were prepared to accommodate the experimental birds. Each pen was supplied with a drinker and a feeder and light was provided for 24 hours per day.

Broiler chicks were weighed at the start of the experiment and then weekly for 6 weeks. Body weight gain, feed intake and feed conversion ratio (kg fee/kg weight gain) were estimated weekly throughout the experimental period. Mortality was recorded when it occurred.

At the end of the experimental period, 12 birds from each treatment (3/replicate) were selected at random, weighed and then slaughtered. During slaughter, blood samples were collected from each bird into test tubes, and then allowed to clot. Serum was separated by centrifugation at 3000 rpm for 10 min and collected into Eppendorf tubes, and stored at -20^{o}C pending analysis.

Immediately after slaughter the thyroid gland of each bird was excised, weighed and then kept in 10% formalin solution for histological examination. Also the liver was removed from each bird, weighed and kept frozen for analysis. Approximately 3 to 5 gram specimens of breast meat were also taken and kept frozen until analyzed. The fatty acid methyl esters were determined using the methods of Christic (1982). Serum total lipids were determined by the methods described by Frings et al (1972). Histolopathological examination of the thyroid gland was done according to the methods descriibed by Culling (1974).

Statistical analysis

The data were tabulated and subjected to analysis of variance using the microstat computer program. The significant between means were determined using the least significant difference (LSD) as outlined by Steel and Torrie (1960).

Results

Mean feed intake, live body weight, body weight gain, feed conversation ratio, liver weight and thyroid gland weight are shown in Table 4. The results showed that birds fed sorghum and Darmsa cultivar grains consumed (P<0.01) more feed. However, the group fed Darmsa cultivar exhibited an increase (P<0.01) in live body weight, weight gain and better feed conversion

Table 2: The composition of the experimental diets based on Darmsa cultivar (percent of the diet)

	Darmsa cultivars (%)			
	Sorghum	Darmsa cultivar	Darmsa endosperm-sorghum bran	Darmsa bran + sorghum endosperm
Sorghum	65.00	-	-	-
Darmsa millet	-	65.00	-	-
Darmsa endosperm	-	-	45.00	-
Darmsa bran	-	-	-	20.0
Sorghum endosperm	-	-	-	45.00
Sorghum bran	-	-	20.00	-
Super concentrate*	5.00	5.00	5.00	5.00
Groundnut meal	13.00	13.00	14.75	15.00
Sesame meal	14.00	13.50	14.00	13.50
Vegetable oil	-	1.50	-	0.50
Oyster shell	1.00	0.92	0.94	0.88
L-lysine	0.09	0.12	0.13	0.12
Filler (sand)	1.91	0.96	0.18	-
Total	100	100	100	100

*Chemical constituent of broiler super concentrate in %, crude protein 45%, methionine 4.2, meth-cystin 4.8, lysine 11, calcium 10, phosphorous 6, common salt 2.5 and ME 1825 Kcal/kg.

Table 3: Calculated and determined composition of Darmsa cultivar experimental diets

Ingredients composition (percent of diet as fed)	Darmsa cultivar (%)			
	Sorghum	Darmsa cultivar	Darmsa endosperm-Sorghum bran	Darmsa bran + sorghum endosperm
Calculated composition (%)				
ME MJ/kg	12.84	12.91	12.81	12.83
Crude protein (%)	22.44	22.55	22.28	22.20
Calcium (%)	1.26	1.26	1.26	1.23
Available phosphorous (%)	0.71	0.68	0.71	0.75
L-lysine (%)	1.11	1.08	1.07	1.08
DL-methionine (%)	0.58	0.65	0.59	0.54
Dry matter (%)	93.42	93.41	93.52	93.40
Determined composition				
Crude protein	25.70	22.87	23.10	22.75
Crude fiber	4.50	5.00	6.75	6.50
Ash content	8.00	8.45	9.00	9.03
Calcium (%)	1.11	1.04	1.13	1.15
Phosphorous (%)	0.12	0.75	0.80	0.80
Free fatty acid (mg)	12.08	13.23	13.18	14.51
Propionic acid (µl/100ml)	-	-	0.01	-
Butyric acid (µl/100ml)	0.02	0.19	1.20	0.18
Oleic acid (µl/100ml)	0.53	4.70	1.67	0.75
Linoleic acid (µl/100ml)	-	1.42	-	-
Arachidonic acid (µl/100ml)	-	-	-	14.01

Table 4: The performance* of broiler chicks fed different dietary levels of Darmsa cultivar

	Darmsa cultivars diets (%)				
	Sorghum	Darmsa cultivar	Darmsa endosperm-sorghum bran	Darmsa bran + Sorghum endosperm	±SE
Feed consumption (g/bird/6 week)	3354.17^{d}	3365.10^{a}	2080.55^{b}	1842.08^{c}	18.66
Final live body weight (g/bird/6 week)	2072.30^{b}	2164.33^{a}	1126.87^{c}	1025.33^{d}	5.88
Body weight gain (g/bird/6 week)	1969.99^{b}	2062.15^{a}	1022.12^{c}	923.34^{d}	10.34
Feed conversion ratio (kg feed/kg weight gain)	1.72^{c}	1.64^{d}	5.51^{a}	2.59^{b}	0.02
Mortality (%)	5.00	5.00	7.50	7.50^{NS}	0.27
Relative liver weight (mg/100g BW)	17.40^{c}	17.64^{c}	23.69^{b}	25.41^{a}	0.19
Relative thyroid gland (mg/100gBW)	0.080^{c}	0.113^{a}	0.095^{b}	0.093^{b}	0.003

SE: Standard error of the mean; $^{a-d}$Values in the same row with different superscript are significantly different ($P \leq 0.01$); *Values are means of four replicate of 10 birds each; NS: Not significant

Table 5: Effect of dietary levels of Darmsa cultivar on serum lipids of broiler chicks (values are means of four replicate of 10 birds each)

	Darmsa cultivars diets (%)				
	Sorghum	Darmsa cultivar	Darmsa endosperm-sorghum bran	Darmsa bran + sorghum endosperm	±SE
Total lipids (mg/100ml)	497.18^{d}	527.52^{c}	752.52^{a}	605.33^{b}	0.27
Cholesterol (mg/100ml)	71.35^{c}	44.40^{d}	74.45^{b}	76.19^{a}	0.23
Phospholipids (mg/100ml)	205.36^{d}	305.75^{a}	220.61^{c}	240.95^{b}	2.45
Triglycerides (mg/100ml)	76.00^{c}	59.50^{d}	96.25^{b}	107.75^{a}	0.62
Free fatty acid (mg/100ml)	12.24^{c}	16.72^{b}	16.30^{b}	24.45^{a}	0.16

SE: Standard error of treatment mean; $^{a-d}$Values in the same row with different superscript are significantly different ($P \leq 0.01$)

Table 6: Effect of feeding Darmsa cultivar diets on liver lipids of broiler chicks (values are means of four replicate of 10 birds each)

	Darmsa cultivars diets (%)				
	Sorghum	Darmsa cultivar	Darmsa endosperm-sorghum bran	Darmsa bran - sorghum endosperm	±SE
Total lipids (mg/g)	366.73^{d}	954.17^{a}	682.00^{b}	540.31^{c}	3.84
Cholesterol (mg/g)	124.31^{b}	103.87^{d}	118.47^{c}	151.04^{a}	0.33
Phospholipids (mg/g)	47.52^{c}	74.13^{b}	75.62^{b}	104.98^{a}	1.30
Triglycerides (mg/g)	26.29^{c}	20.91^{d}	31.81^{b}	39.72^{a}	0.05
Free fatty acid (mg/g)	165.39^{d}	191.70^{b}	181.98^{c}	206.58^{a}	0.20

SE: Standard error of treatment mean; $^{a-d}$Values in the same row with different superscript are significantly different ($P \leq 0.01$)

Table 7: Effect of feeding Darmsa cultivar diets on breast meat lipids of broiler chicks (values are means of four replicate of 10 birds each)

	Darmsa cultivars diets (%)				
	Sorghum	Darmsa cultivar	Darmsa endosperm-sorghum bran	Darmsa bran - sorghum endosperm	±SE
Total lipids (mg/g)	128.96[d]	367.18[a]	241.17[c]	268.15[b]	2.16
Cholesterol (mg/g)	43.64[b]	35.64[d]	41.54[c]	46.17[a]	0.22
Phospholipids (mg/g)	16.47[d]	22.32[b]	20.75[b]	18.63[c]	0.53
Triglycerides (mg/g)	10.69[c]	12.68[b]	18.87[a]	8.69[d]	0.03
Free fatty acid (mg/g)	8.65[c]	11.51[a]	10.52[b]	8.87[c]	0.10

SE: Standard error of treatment mean; [a-d]Values in the same row with different superscript are significantly different ($P \leq 0.01$)

Table 8: Effect of dietary level of Darmsa cultivar on serum, liver and breast mean fatty acids composition of broiler chicks

	Darmsa cultivars diets				
	Sorghum	Darmsa cultivar	Darmsa endosperm - sorghum bran	Darmsa bran + sorghum endosperm	±SE
Serum:					
Propionic acid	1.59[b]	0.06[c]	0.07[c]	3.87[a]	0.02
Butyric acid	-	-	-	-	-
Myristic acid	-	-	-	-	-
Plamatic acid	-	-	-	-	-
Stearic acid	-	-	-	0.04	0.01
Oleic acid	-	0.62	-	-	0.02
Linoleic acid	-	2.12[b]	-	2.42[a]	0.03
Lineolenic acid	-	-	0.28[a]	0.01[b]	0.002
Arachidonic acid	16.32	-	-	10.23[b]	0.003
Liver:					
Propionic acid	4.79[a]	0.41[c]	0.03[d]	0.97[b]	0.04
Butyric acid	-	-	-	-	-
Myristic acid	-	-	8.37	-	0.02
Plamatic acid	-	-	0.12	-	0.004
Stearic acid	-	-	-	-	-
Oleic acid	1.05[d]	3.66[a]	1.33[c]	2.98[b]	0.01
Linoleic acid	-	0.03[b]	-	0.47[a]	0.004
Linolenic acid	-	-	0.01	-	0.001
Arachidonic acid	11.46[a]	0.99[b]	-	-	0.01
Breast					
Propionic acid	-	-	-	-	-
Butyric acid	-	3.46	-	-	0.004
Myristic acid	-	5.09	-	-	0.004
Plamatic acid	-	0.01[b]	-	1.20[a]	0.004
Stearic acid	-	-	-	-	-
Oleic acid	-	0.19[c]	1.24[a]	0.55[b]	0.004
Linoleic acid	1.38[a]	0.51[b]	0.11[c]	0.09[c]	0.01
Lineolenic acid	-	-	0.25	-	0.01
Arachidonic acid	1.38[b]	4.29[a]	4.29[a]	-	0.01

ratio. But those fed Darmsa bran plus sorghum endosperm showed poorer ($P<0.01$) live body weight, weight gain, and lower feed conversion ratio compared to those fed sorghum based diet. Mortality rate was lower in all the treatments.

Data in Table 4 revealed that birds fed Darmsa bran plus sorghum endosperm showed a significant ($P<0.01$) increase in relative liver weight compared to the other groups followed by birds fed Darmsa endosperm plus sorghum bran.

A significant ($P<0.01$) increase was seen in relative thyroid gland weight in birds fed Darmsa cultivar compared to those fed sorghum.

Table 5 shows the average concentration of serum lipids. Feeding Darmsa cultivar significantly increased ($P<0.01$) phospholipids and decreased ($P<0.01$) triglycerides level compared to feeding the sorghum based diet. The birds fed Darmsa bran plus sorghum endosperm showed a significant ($P<0.01$) increase in concentration of triglycerides, free fatty acids and decreased ($P<0.01$) cholesterol level.

Liver lipids of broiler fed Darmsa cultivar are presented in Table 6. Results showed a significant ($P<0.01$) increase in the concentration of liver cholesterol, phospholipids, triglycerides, and free fatty acids in birds fed Darmsa endosperm plus sorghum

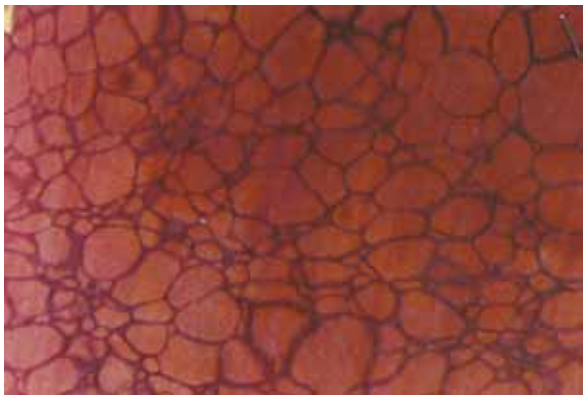

Fig. 1: Photomicrograph of thyroid gland of broiler chicks fed on sorghum diet: Normal Structure of the gland.

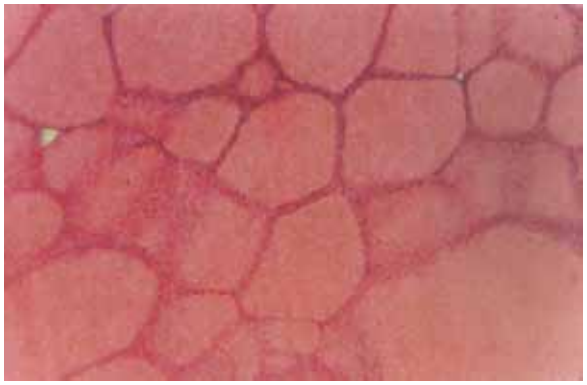

Fig. 2: Photomicrograph of thyroid gland of broiler chicks fed on Darmsa cultivar diet Enlarged follicles, distended with colloidal material. Focal hyperplasia of the glandular epithelial

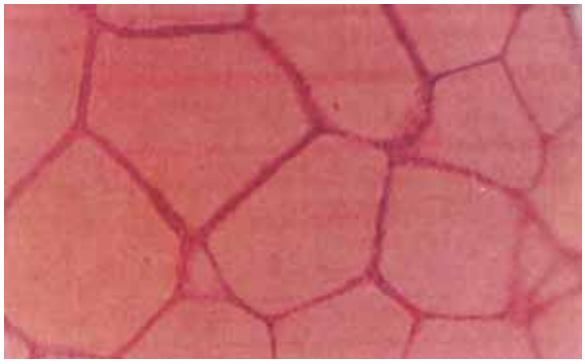

Fig. 3: Photomicrograph of thyroid gland of broiler chicks fed on Darmsa endosperm plus sorghum bran diet: Extremely enlarged follicles

bran diet, but those fed Darmsa cultivar diet grain showed a decrease (P<0.01) in liver cholesterol, triglycerides level and total lipids.

Results of Table 7 showed a significant (P<0.01) increase in the concentration of breast meat lipids,

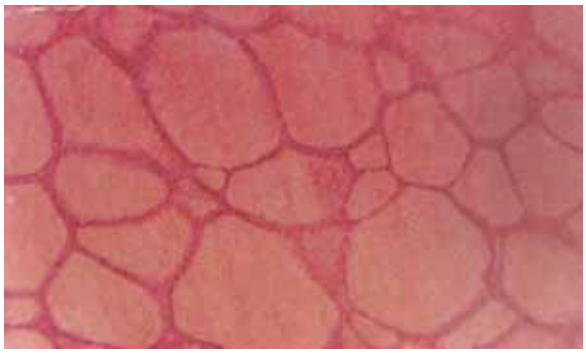

Fig. 4: Photomicrograph of thyroid gland of broiler chicks fed on Darmsa bran plus sorghum endosperm: Many follicles are enlarged and distended with colloidal material

phospholipids, triglycerides and free fatty acids level of the experimental bird fed on Darmsa diet compared to those fed on the sorghum based diet. However, feeding Darmsa bran plus sorghum endosperm showed a significant (P<0.01) increase in the level of cholesterol and a decrease (P<0.01) in triglycerides and free fatty acids levels.

The results showed (Table 8) a significant (P<0.01) increase in oleic acid and linoleic acid of the serum and liver in birds fed the Darmsa cultivar and Darmsa endosperm plus sorghum bran diets and a decrease (P<0.01) in propionic acid and archidonic acid values of serum and breast meat compared to those fed the control diet. The results also revealed that the birds fed on the Darmsa cultivar diet showed a reduction (P<0.01) in breast meat linoleic acid and an increase (P<0.01) in butyric acid, myristic, palmitic, oleic and arachidonic cid of the breast meat values compared to those fed on the sorghum diet.

Histological evaluation of thyroid tissues:

Feeding millet cultivars to broiler chicks showed more pronounced effect on the thyroid gland. The follicles were variably enlarged.
Details of histological changes include:

Sorghum diet: The thyroid gland follicles were normal in size and filled with colloidal material.

Darmsa cultivar diet: The thyroid follicles were considerably enlarged and distended with colloidal material. The lining epithelium appeared flat with focal areas of hyperplasia.

Darmsa endosperm plus sorghum bran diet: The thyroid follicles were enlarged and considerably distended with colloidal material.

Darmsa bran plus sorghum endosperm diet: The thyroid follicles were variably enlarged and distended

with colloidal substance. Focal hyperplasia of the glandular epithelium was occasionally seen.

Discussion

In the present study, the improvement in live weight gain and feed conversion ratio associated with feeding Darmsa cultivar may be due to the increase in feed consumption which indicates the high nutritive value of Darmsa cultivar. These results are in line with the observation reported in previous studies (Simhaee et al., 1971; Mohamedian, 1986; Eljack, 1993). In addition, Sanford et al. (1973) found that the rate of live weight gain and efficiency of feed utilization of broiler were increased by millet feeding compared to sorghum. However, the increase in weight gain in the birds fed Darmsa cultivar diet in this experiment disagrees with the findings of Klopfenstein et al. (1983) and Elzubeir et al. (1995), who reported a decrease in growth rate in birds receiving pearl millet in the diet. This discrepancy may be due to the millet cultivars or the type of diets used in their study.

The increase in relative weight of the thyroid gland with much enlarged thyroid follicles associated with feeding Darmsa cultivar may be due to the anti-nutritional factors present in millet. These results are in agreement with the findings of Osman (1981), Gaitan et al. (1989) and Elzubeir et al. (1995).

The effect of dietary Darmsa cultivar on serum, breast meat and liver lipids content are in agreement with results reported by Leushin et al. (1983) and Mohammed (1999).The reduction in serum cholesterol associated with feeding Darmsa cultivar may be due to some unknown factors present in Darmsa cultivar.

The findings of this study indicated that pearl millet (Darma cultivar) has satisfactory effects on the production performance of broiler chicks.

References

Eljack, E.B.H. 1993. Nutritive value of two cultivars of millet for broiler chicks. M.Sc.Thesis,University of Khatoum, Sudan.

Christic, W.W. 1982. Lipid analysis. 2nd ed. Peergaman Press Ltd. Heat .Ington Hill Hall, Oxford, Ox3, OBD, England. PP: 52-53.

Culling, C.F.A. 1974. Handbook of Histpathological and Histochemical Techniques. 3rd Ed. Butterworths Ltd. London.

Elzubeir, E.A., Ali, A.M. and Abdelrazig, S.M. 1999. Effect of feeding pearl millet on thyroid gland histology and blood serum triodothyronine T_3 and thyroxin T_4. *Sudan Journal. Veterinary Science and Animal Husbandry*, 38 (1, 2): 44-49.

Frings, C.S., Ted, W., Fendley, Ralph, R.T.D. and Cecelia, A.Q. 1972. Improved–Phosphovanillin reaction. *Clinical Chemistry*, 18: 7:673-674.

Gaitan, E., LInday, R.H., Reichert, R.D., Lngbar, S.H., Cooksey, R.C., Legan, L., Meydrech, E.F., Hill, J. and Eubola, K. 1989. Anti thyroid and goitrogenic effect on millet: Role of C-glycosyl-flavone. *Journal of Clinical Endocrinology and Metabolism*, 68 (4): 707-714.

Klopfenstein, C.F., Hoseney, R.C. and Leipold, H.W. 1983. Goitrogenic effect of pearl millet diets. *Nutrition Report International*, 27: 1039-1047.

Kraf, T.S., Scheverria, I. and Bisaro, V. 1971. Grain of two varieties of summer forage toxtail millet setoria italica in relation for broilers. In Nutitionr Abstracts And Reviews 1976, P: 504.

Leushin, S.G., Fedorinova, M.K. and Levakhin, V.I. 1983. Millet oil for cattle feeding obmen-lipid-ov-l-Lipidnoe-pitanie-sel skokhoz- yaistrennykh-zhivotny Kh. Gg-102.

Mohamedain, G.M., Babiker, S.A. and Mohammed, T.A. 1986. Effect of feeding millet, maize and sorghum on performance of meat. *Tropical Agriculture*, (Trindad) 63: 173-176.

Mohammed, A.K. 1999. Effect of pearl millet on lipid profile and fatty acid composition in chicken. M.Sc. Thesis, University of Khartoum, Sudan.

Osman, A.K. 1981. Bulrush millet (*Pennisetum lyphoides*) a contributing factor to the endemicity of goiter in western Sudan. *Ecology and Food Nutrition*, 11: 121-128.

Sanford, P.E., Canacho, F., Faake, Deyoe, C.W. and Casudy, A.J. 1973. Performance of meat strain chicks fed peal millet as source of energy and protein. *Poultry Science*, 52: 208 (Abstract).

Simhaee, E., Ghorban, K. and Makarechian, E. 1971. Comparison of nutrient value of corn, wheat and millet in broiler diets. *Iranian Journal of Agricultural Research*, 1: 51-55.

Steel, R.G.D. and Torrie, J.H. 1960. Principles and procedures of statistics McGraw Hill book Co. Inc. New York.