THE EFFECT OF FEEDING THREE PEARL MILLET CULTIVARS ON PERFORMANCE OF LAYING HENS AND THYROID GLAND HISTOLOGY

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ABSTRACT

The effect of feeding millet cultivars on performance or egg quality characteristics ,relative thyroid gland weight and thyroid gland histology were investigated on sixty 23 weeks old Bovan hens in random design. The laying hens were raised in battery cages. Fives dietary treatments were used based on sorghum, maize or one of the millet cultivar Darmsa, Dembi and Bioda.

Results revealed a significant($P<0.01$) increase on egg production rate of the hens fed the three millet cultivars compared to feeding sorghum or maize. Shell thickness tended to increase ($P<0.01$) in the hens fed the millet diets. A significant ($P <0.01$) increase was observed in the relative thyroid gland weight and the follicular epithelial cell were flatten of the hen fed the three millet cultivars. These results showed that peal millet can be used in the diet of laying hens without any adverse effect on hen performance or egg quality and the effect on thyroid histology is cultivar dependent.

Keywords: sorghum ,maize ,Bovan hens

INTRODUCTION

Eggs remain to be a popular food in all countries of the world, as a rich source of high quality protein and important source of unsaturated fatty acids (mainly oleic) iron, phosphorus, trace minerals, vitamins A, E, K and the B vitamins. Eggs are low in calcium and contain very little or no vitamin C. their high nutrient content, low caloric value and ease of digestibility make eggs valuable in many therapeutic diets for adults (William and Owen, 1977) .pearl millet has been shown to be asuitable feedstuff for poultry diet .It can be added to the diet of laying hens without adversely effecting egg production or feed efficiency (Amini and Ruiza ,2007).Feeding cultivar Bioda or Dembi to laying hens increased ($P<0.05$) relative thyroid weight (Alzubeir and AbdElrazig 1999). AbdElrazig(1997) reported that feeding dembi cultivar to laying hens resulted in enlarged thyroid colloid follicles with flatten epithelial cells.

Therefore, the present study was carried out to investigate the effect of feeding three millet cultivars (Dembi, Bioda and Darmsa) on egg production ,egg quality and histology of the thyroid gland of laying hens.

MATERIALS AND METHODS

Sixty 23-weeks old Bovan hens were used in this study. The hens were obtained from Kuku Poultry Center. They were selected on the basis of body weight and were randomly distributed to five groups (treatments). Each group had 12 hens with four subgroups (replicates) each comprised 3 hens.

Five experimental diets were formulated, containing three cultivars of millet, sorghum, maize and other fed ingredients to be approximately isocaloric and isonitrogeous and meeting the nutrients requirements for laying hens recommend by the National Research Council (1984). The hens were fed on the sorghum based diet for 7 days. Then the dietary treatments were offered. The nutrient composition of ingredients used are shown in Table 1. The composition of ingredients used in the diets formulation are shown in Table 2. The calculated and determined analyses of the experimental diets are shown in Table 3.

The hens were weighed individually at the start and the end of the experiment. Eggs were collected daily and the percentage of hen-day production or hen-house production were estimated. Feed intake and egg weight were determined weekly.

Egg samples were taken weekly for the measurement of shape index by using shape index apparatus (No. 70504/2), albumin height and shell thickness were measured using a vernia and yolk colour was determined using a 15 grade yolk colour fan (Hoffman, 1987

At the termination of the experiment the birds were killed and the thyroid gland were excised, weighed and kept in 10% formaline solution for histological examination. The liver was also removed from each hen, weighed and stored for analyses.

Table (1): The nutrient composition of ingredients used in the experimental diets formulation.

Feedstuff	Crude protein (%)	ME* (Kcal kg)	Calcium (%)	Phosphorous	L-lysine (%)	DL-methionine (%)
Dembi cultivar	13.69	3296	0.14	0.27	0.20	0.30

Bioda cultivar	10.16	3231	0.15	0.28	0.20	0.30
Darmsa cultivar	13.89	3279	0.11	0.27	0.20	0.30
Sorghum	13.23	3437	0.05	0.31	0.24	0.17
Maize	11.05	3588	0.05	0.31	0.27	0.20
Groundnut meal	43.58	2739	0.62	0.56	1.77	0.42
Sesame meal	41.57	2777	2.01	0.93	1.37	1.48
Wheat bran	16.83	18590	0.18	0.75	0.60	0.20
Oyster shell	-	-	36.94	0.06	-	-
Vegetable oil	-	8800	-	-	-	-

* Calculated according to equation of Lodhi *et al*. (1976).

Values for L-lysine and DL-methionine, were based on table values from National Research Council (1984). All other values are analyzed.

Table (2): Formulation of the experimental diets (percent of the diet)

	Millet cultivars (%)				
	Sorghum	Dembi	Bioda	Darmsa	Maize
Millet	-	63.11	64.41	63.43	-
Sorghum	61.05	-	-	-	-
Maize	-	-	-	-	58.00
Groundnut meal	4.60	4.18	8.17	3.98	10.00
Sesame meal	5.50	4.50	10.00	5.50	4.00
Wheat bran	13.70	11.00	2.00	10.50	12.85

Concentrate*	5.00	5.00	5.00	5.00	5.00
Oyster shell	9.50	9.35	9.09	9.41	9.50
Vegetable oil	0.94	1.61	0.92	1.18	-
Salt	0.25	0.25	0.25	0.28	0.25
Filler (sand)	1.71	-	0.19	0.12	0.40
Total	100	100	100	100	100

* Crude protein 40%, crude fat 8%, crude fiber 3%, salt 4%, sodium 1.6%, calcium 10% total phosphorous 5.8%, lysine 6%, methionine 2.8%, methionine + cystine 3.10% and metabolizable energy 2000 Kcal/kg.

Table (3): Calculated and determined composition of the experimental diet

	Millet cultivars %				
	Sorghum	Dembi	Bioda	Darmsa	Maize
Calculated composition %:					
Crude protein	16.59	16.59	16.59	16.59	16.59
ME (MJ/kg)*	11.71	11.70	11.71	11.71	11.75
Calcium	4.20	4.20	4.20	4.20	4.20
Available phosphorous	0.64	0.61	0.62	0.61	0.65
L-lysine	0.68	0.64	0.72	0.69	0.76
DL-methionine	0.38	0.51	0.52	0.52	0.38
Determined composition %					
Dry matter	94.90	95.41	95.36	95.67	95.72
Crude protein	16.98	17.15	18.20	17.15	18.30
Crude fiber	4.50	6.75	8.50	7.25	8.50

Ether extract	2.75	6.50	6.40	6.95	5.60
Ash content	10.39	9.50	9.34	10.92	11.92
Free fatty acid	11.0	13.50	14.38	14.15	9.75
Calcium	3.26	3.07	3.99	4.06	3.55
Total phosphorous	0.64	0.51	0.49	0.40	0.55
Propionic acid (µl/100ml)	-	-	0.18	0.01	3.01
Butyric acid (µl/100ml)	0.10	0.10	0.08	-	-
Stearic acid (µl/100ml)	0.07	0.02	0.19	2.51	3.64
Oleic acid (µl/100ml)	4.50	-	0.27	-	-
Arachidonic acid (µl/100ml)					

* Calculated from chemical composition using the equation of Lodhi *et al*. (1976)

RESULTS

The data of laying hens performance, egg quality characteristics, relative liver and thyroid weight during the experimental period are presented in Table 4.

The overall performance results revealed a significant ($P<0.01$) increase in egg production rate of the hens fed the three millet cultivars compared to feeding sorghum or maize. Hens fed the Dembi or Bioda cultivars had the highest rate of lay, but those fed the Darmsa cultivar and maize showed the lowest egg production rate.

The results also indicated that the hens fed the Bioda cultivar consumed significantly ($P<0.01$) more feed during the experiment followed by the hens fed the sorghum or the Dembi cultivar diet, but those fed the Darmsa cultivar and maize diets had the lowest feed consumption.

In addition, the hens fed the Bioda cultivar diet had the poorest ($P<0.01$) feed conversion ratio, while the hens fed the maize diet had the best feed conversion ratio.

Feeding the three millet cultivars had no significant ($P>0.05$) effect on average egg weight, shape index and mortality rate. Death which occurred among hens fed Bioda and maize diets was due to cannibalism.

Shell thickness tended to increase (P<0.01) in the hens fed the millet diets. However, hens fed the Bioda or Darmsa cultivars diets had the highest shell thickness followed by the group fed the Dembi cultivar diet compared to those fed the sorghum or maize diets.

Albumin height of all the experimental groups ranged between 6.44 and 7.15 mm. the hens fed the Bioda and Darmsa cultivars diets had a significant (P<0.01) increase in albumin height, while the hens fed the Dembi or maize diets had the lowest albumin height.

The egg yolk colour of hens fed the maize diet was significantly (P<0.01) increased, followed by the hens fed the millet cultivars diet (Dembi and Bioda), but those fed the Darmsa and sorghum diets had the lowest yolk colour scores.

A highly significant (P<0.01) loss in bodyweight was observed in the hens fed the Darmsa, Dembi cultivars and the sorghum diet.

Feeding Dembi, Darmsa millet cultivars and sorghum diets had a significant (P<0.01) increase in liver weight. The hens fed the maize diet showed the lowest liver weight.

A significant (P<0.01) increaser was observed in the relative thyroid gland weight of the hens fed the three millet cultivars (Dembi, Bioda and Darmsa respectively). However, the hens fed the maize diet had the lowest thyroid gland relative weight.

Table (4): Performance and egg quality characteristics* of hens fed the three cultivars of pearl millet

	Millet cultivars (%)					
	Sorghum	Dembi	Bioda	Darmsa	Maize	±SE
Hen-day egg production (%)	65.95^{b}	74.93^{a}	74.56^{a}	62.67^{c}	64.76^{bc}	0.76
Hen-housed egg production (%)	65.95^{c}	74.93^{a}	71.82^{b}	62.67^{d}	63.11^{d}	0.82
Daily free intake (gm)	79.88^{b}	79.46^{c}	85.79^{a}	73.08^{d}	71.17^{d}	0.81
Kg feed per kg egg	1.65^{b}	1.69^{b}	1.91^{a}	1.57^{b}	1.48^{c}	0.06

Mortality (%)	-	-	8.33	-	8.33^{NS}	0.16
Mean egg weight (g)	47.38	46.86	48.15	46.25	47.66^{NS}	0.43
Shape index (%)	75.85	75.34	75.66	74.68	74.95^{NS}	0.56
Shell thickness (mm)	0.27^{c}	0.39^{b}	0.40^{a}	0.40^{a}	0.26^{d}	0.00
Albumin height (mm)	6.70^{b}	6.48^{c}	7.15^{a}	6.81^{ab}	6.44^{c}	0.13
Yolk colour (Roche fan)	1.00^{d}	1.20^{b}	1.14^{bc}	1.05^{cd}	2.05^{a}	0.05
Change in body weight (gm)	-53.67^{ab}	-101.92^{a}	-8.66^{b}	-113.17^{a}	-22.42^{b}	23.50
Relative liver weight (mg/g100gBW)	25.29^{a}	26.82^{a}	21.85^{b}	27.00^{a}	23.23^{b}	0.70
Relative thyroid gland (mg/100gBW)	6.07^{c}	8.70^{a}	8.40^{a}	2.27^{b}	3.30^{d}	0.20

* Values are means of four replicated groups of 3 birds each

SE: Standard error of treatment mean

a-d: Means in the same row with different letters were significantly

NS: Not significant

HISTOLOGICAL EVALUATION OF THYROID TISSUES

The histological changes of the thyroid tissue of laying hens fed on the millet cultivars, Darmsa, Bioda and Dembi, were extremely variable as compared to feeding the maize based diet (control). These changes are summarized as follows:

1. Sorghum diet:

The thyroid gland was normal structure without any significant alterations on the follicular structure.

2. Dembi cultivar diet:

The thyroid gland showed moderately distended follicles with flatten epithelial and colloidal substance.

3. Darmsa cultivar diet:

The thyroid follicles were relatively enlarged and the follicular epithelial cells were flatten. The follicles were fairly distended with colloidal material. Focal areas of epithelial hyperplasia were occasionally seen.

4. Bioda cultivar diet:

The histological alterations of the thyroid gland were similar to those previously observed with Dembi cultivar. However, the lining epithelium was less affected and maintained a normal cuboidal shape.

5. Maize diet:

No remarkable changes were observed on the morphological structure of the thyroid gland. The follicles were apparently normal in size and contained easinophilic homogenous colloidal material.

DISCUSSION

The results of this study indicated that pearl millet grain is a suitable cereal for layer's diets and can be efficiently, utilized as a source of dietary energy and protein.

Similarity in hen day egg production was observed in birds given the Damsa cultivar and maize diets in this study. This result is in agreement with the findings of Abdelrazig (1997) who recorded improvement in egg production with inclusion of millet in the diet. The increase in hen day egg production associated with feeding Dembi and Bioda cultivars diets was a compound by a similar increase in feed consumption. These results, however, disagree with those of Leandro *et al* (1999) and Café *et al*. (1999) who reported that pearl millet did not affect the production performance of laying hens.

The mean temperature of the house during the experimental period was 36.14^{o}C and this may explain the low level of feed intake and the loss in body weight of the experimental birds. These findings confirm the results of Hurwitz *et al*. (1980) and Charles *et al*. (1981) who reported that high ambient temperature reduced feed intake.

Feeding millet cultivars did not have adverse effect on egg weight, which is in agreement with the results of Karunajeewa and Tham (1984).

The increased yolk colour of the eggs of the birds fed millet and maize diets may be due to the fact that both millet and maize grains contain higher amount of than xanthophylls pigments than sorghum grains. This finding agrees with the result of Abdelrazig and Elzubeir (1998); Narahari and Rajini (1999).

The increase in shell thickness observed in the hens fed the millet cultivars diets may be related to the fact that pearl millet contain high minerals. This finding agrees with the results of Abdelrazig (1997)

The considerable variation in follicular size with varied amount of cholloid material and the increase in relative weight of thyroid gland tissues associated with feeding millet cultivars are similar to the observation of Elzubeir and Abdelrazig (1999) and Birzer *et al*. (1987). The latter reported that methanol extract of pearl millet, when added to sorghum grain and given to rats, caused histological changes in the thyroid gland and thyroid hormone level.

From the results of this study further research is needed to explain the influence of millet on the thyroid gland.

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