SEMEN QUALITY, BODY WEIGHT AND FOOD INTAKE OF NAKED NECK AND NORMALLY FEATHERED COCKS AS INFLUENCED BY DIETARY PROTEIN

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ABSTRACT

A total number of 92 cockerels aged 30 weeks (46 Nana and 46 nana) were randomly distributed into two groups. Each group within each genotype had fed a diet containing 14 or 16% crude protein (23 each). The experimental period was run from 30 till 40 weeks of age. Results obtained could be summarized as follows:

- The daily feed intake was significantly differed according to genotype and dietary protein level. The interaction (G*T) being also highly significant.
- The body weight of cocks did not significantly affected by genotype throughout the study.
- The low protein diet significantly increased body weight of cocks at 40 weeks of age compared to high protein diet.
- The Nana cocks gene had significantly higher semen volume than that of normally feathered one. The cocks fed high protein diet have significantly higher semen volume than that of cocks fed low protein diet at 32 weeks of age. However, the effect of dietary protein level on semen volume at 36 and 40 weeks of age did not significant.
- The naked neck gene and dietary protein diet did not significantly affected on total plasma protein at 32 weeks of age.
- In conclusion, the low protein diet may improved the semen characteristics of heterozygous naked neck cocks under low ambient temperature.

Keywords: Poultry, Semen quality, body weight, dietary protein

INTRODUCTION

Fertility of the male parent stock is a major concern of the poultry producers. They hope to maximize it through early sexual maturity and improving semen quality of both types of breeder males (egg and meat-types).

It is clear from most studies that the improving semen quality could be achieved by paying attention to the nutritional status of these flocks, particularly the dietary protein concentration.

Naked neck gene has been reported to be associated with increasing embryonic mortality up to ten percent in pure strains (Crawford, 1978 and Horst *et al*., 1986) or subfertility and low semen quality (Horst *et al.*, 1986 and Fathi *et al.*, 1993) which could be traced to a highly significant increase in the percentage of dead and abnormal spermatozoa (Fathi *et al.*, 1993).

The beneficial effect of vitamin E (Vit. E) and selenium (Se) supplementation in improving the semen quality of naked neck cocks has been reported by El-Wardany and Zein El-Dein (1995). They stated a significant reduction in the percentage of dead and abnormal spermatozoa

after addition of Vit. E and Se to the drinking water of 46 weeks old - naked neck cocks.

Commercially, there was some interact in decreasing the protein level of male-diet in the belief that low protein diets were associated with better semen production and fertility because Hocking (1990)reported that a high dietary protein diet fed to the broiler breeder males during the breeding period resulted in a decline in fertility from 45 to 60 weeks of age compared with that of males fed on a low protein diet.

Leghorn males chicks (egg-type) fed 4.5 and 6.75 % protein diets and followed by 17% protein diet during the growing period on an *ad libitum* basis matured later sexually than males fed the 9 to 16% protein diets with no differences occurred in spermatozoa concentration, fertility or hatchability (Wilson *et al.,* 1965 and Jones *et al.,* 1967).

Adult Leghorn fed 6.4, 10.7 and 16.9% protein diets did not show any differences in semen volume, fertility or hatchability (Arscott and Parker 1963).

No differences were noted by Wilson *et al.* (1972) in sexual maturity or semen characteristics of broiler breeder males (meat-type) fed 9.3% protein diet for 14 weeks and followed by 17% protein diet at 18, 20 or 22 weeks of age.

Since there is no work to our knowledge on the effect of dietary protein level in improving the semen quality (fertilizing capacity) of naked neck, this study was carried out to investigate the effects of low protein diet feeding on the body weight, feed intake and some semen quality traits of naked neck (Nana) and normally feathered (nana) cocks at different ages.

MATERIALS AND METHODS

Genetic stock and management

A total number of 92 cocks of two genotypes (46 Nana and 46 nana) were taken from F1 of the crossing between heterozygous naked neck and normally feathered Golden-Montazah hens. Each genotype were individually weighed, randomly allocated to two groups of 23 males each, housed in batteries with single cages at 30 weeks of age and fed diets with 14 or 16% crude protein up to 40 weeks of age. All birds were fed 16% crude protein-diet before beginning of the present study. Birds were subjected to 14 L : 10 D lighting regime with free access to feed and water. Temperature of birds house was fluctuated between 14 and 20°C during the experimental period depending on the outside ambient temperature. The composition and calculated analysis National Research Council (NRC, 1994) of the experimental diets are shown in Table (1). Birds were allowed two weeks for adaptation to the experimental diets specially 14% CP - fed group in each genotype.

Table 1: The composition and calculated chemical analysis of the experimental diets.

Ingredient	T1	T2
Yellow corn	65.00	63.00
Soybean meal (44%)	15.00	21.00
Wheat bran	16.50	12.62
Bone meal	1.50	1.50
Calcium carbonate	1.20	1.20
Vitamins and Mineral mixture*	0.30	0.30
Salt	0.30	0.30
D.L. Methionine	0.05	0.05
Lysine	0.15	0.03
Total	100.00	100.00
Calculated analysis		
Crude protein	14.11	16.10
Kcal ME/kg	2727.00	2742.00
Calcium	0.97	0.99
Available phosphorus	0.31	0.32
Lysine	0.85	0.85
Methionine	0.30	0.32
Cystine	0.26	0.28
Sulphric amino acids	0.56	0.60

*** Each 2.5 Kg of Vit-mineral mix contain Vit.A 12 m.I.U., Vit.D 4 m.I.U., Vit E 15 g ,Vit K_3 2 g ,Vit B_1 1g , B_2 8 g ,Vit B_6 2 g ,Vit B_{12} 10 mg ,Pantothenic acid 10.07 g, Nicotinic acid 30 g ,Folic acid 1 g ,Biotin 150 mg ,Choline choloride 40 mg , Cupper 5 g ,Iodine 0.5 g ,Iron 15 g ,Manganese 70 g ,Zinc 60 g and Selenium 0.15 g.**

Measurements and observations

There was no data available on the experimental birds before beginning this study. Therefore, we started to collect data on body weight, food intake, total plasma protein and semen quality at 32 weeks of age (as an initial data), then we reported all parameters except total plasma protein at 36 and 40 weeks of age to detect and change could be occurred in these parameters.

Body weight was recorded at 30, 32, 36 and 40 weeks of age. Food intake was determined on weekly basis, (data not shown) then the average daily feed intake per bird was calculated in grams at 32, 36 and 40 weeks of age.

Semen samples were artificially collected free of transparent fluid by abdominal massage technique (Burrows and Quinn, 1937). Ejaculated volume (ml) was measured using 2 ml pipette. Sperm motility was estimated just after semen collection by microscopically examination. Advanced motility was expressed as a percentage of actual progressive motion. Packed sperm volume (PSV), which was considered as a guide to sperm cell concentration was determined by centrifugation of capillary tubes at 5000 rpm for 15 min. Abnormal sperms was, coiled tail and dead sperms were counted in a number of 200 sperms and then calculated as a percentage.

Statistical analysis

Data were subjected to a two - way analysis of variance with Na genotype and dietary protein level effects using the General Linear Models (GLM) procedure of SAS User's Guide, 1994 and their interaction.

The data were analysed according the following model;

$$Y_{ijk} = \mu + G_i + T_j + (G*T)_{ij} + e_{ijk}$$

Where; μ = overall mean

G_i = naked neck gene effect,

T_j = treatment effect,

$(G*T)_{ij}$ = interaction between genotype and treatment and

e_{ijk} = experimental error,

RESULTS AND DISCUSSION

Data illustrated in Table (2) showed that the daily feed intake (DFI) measured from 30 till 40 weeks of age was significantly different due to genotype ($P<0.01$) and dietary protein level ($P<0.002$). The interaction (G*T) was also highly significant ($P<0.01$). The DFI for Nana cocks was significantly higher than that of nana ones by (6.9%). This result could be attributed to the less feather coverage associated with Na-gene by about 30% in heterozygous state (Mérat, 1990; Fathi, 1992 and Galal, 1999) under lower ambient temperature (21.5°C). Similarly, the DFI for cocks fed low protein diet were significantly higher than those of cocks fed high protein diet by about (9.0%).

The interaction (G*T) was significant, where the Nana and nana cocks fed low protein diet consumed more feed than those of the high level of protein.

Data presented in Table (3) showed that although, there is a slightly increase in body weight of nana cocks as compared to Nana ones except at 40 weeks of age, the body weight (BW) of cocks at all studied ages did not significantly affected by genotype. As regards the effect of dietary protein content, it could be noticed that the low protein diet resulted in significantly heavier cocks at 40 weeks of age by about 6.7% in comparison to those of the high protein diet. Ichikawa *et al.* (1988) came to the same conclusion when reported that the chickens received 14% CP exhibited faster growth than chickens reared on 18.5% CP. Conversely, Wilson *et al.* (1987a) reported that the effect of dietary protein levels (12, 14, 16 and 18%) on body weight of broiler breeder males from 17 to 59 weeks of age was not significant. The heavier BW at 36 and 40 weeks of age associated with cocks fed low protein diet in the present study could be attributed to the higher DFI of cocks than those fed the high protein diet. The last observation may be explained by the relatively low protein content (15%) resulted in a significant higher growth hormone (GH) values compared to broiler fed a 20% crude protein diet (Buyse *et al.,* 1992). In addition, low dietary protein was also associated with higher circulating plasma T3 levels. No significant (G*T) interaction was calculated.

من الأصل3+2

The effects of genotype, dietary protein level and their interaction on semen quality at 32, 36 and 40 weeks of age are summarized in Tables (4 and 5). Semen volume of Nana cocks was significantly higher than that of nana ones by 23.6, 29.7 and 24.6% at 32, 36 and 40 weeks of age, respectively. These results were confirmed with Omeje and Marire, (1990); Darwish *et al.* (1993); El-Hammady *et al.* (1995); Fathi *et al.* (1998) and Galal, (1999). They reported that the Na-gene was associated with significantly higher semen volume than normally feathered under both natural and warm temperatures. With respect to dietary protein content, it could be noticed that the cocks fed high protein diet have significantly higher semen volume than cocks fed low protein diet at 32 weeks of age. However, the effect of dietary protein levels on semen volume at 36 and 40 weeks of age did not significant.

El-Hammady *et al.* (1995) using local strains of chickens, found that the dietary protein level did not significantly affect semen volume of cocks. This means that increasing the dietary protein level from 14 to 16% had no effect on semen volume. Also, Wilson *et al.* (1987a, b); Bootwalla *et al.* (1988) and Hocking (1989), reported that the semen volume of broiler breeder males was not affected by dietary protein levels (12, 14, 16 and 18%) from 17 till 59 weeks of age. They added that males can be fed 12 or 14% dietary protein without adverse effects on semen volume. At all studied ages, no significant (G*T) interactions were observed when the semen volume was varied according to protein level within each genotype without any constant trend.

The had no obvious effects on advanced motility at all studied ages. Although the high protein level had a positive effect on advanced motility at 32 weeks of age, the opposite situation was found at 36 and 40 weeks of age. At the latter two ages, the advanced motility (%) was significantly higher for cocks fed the low protein diet than those fed the high one by about 12.4 and 4.9%, respectively. This result was confirmed with El-Hammady *et al.* (1995) who observed that the advanced motility of cocks fed 13% protein exceeded that of males fed 15%. The improvement of advanced motility associated with low protein diet may due to improvement in sperm abnormalities, especially dead and coiled tail sperms at 36 and 40 weeks of age. The (G*T) interaction was not significant in respect of advanced motility.

The Na gene had a negative effect on PSV measured at 32 weeks of age for Nana cocks as compared to normally feathered (nana) ones. This result could be attributed to that the Na-gene associated with higher semen volume than normally feathered cocks. However, the Na-gene had a positive effects on PSV at 36 and 40 weeks of age as compared to normally feathered cocks. These results are agreement with those of Hammade *et al.* (1987), who found that naked neck males had higher semen concentration than normal cocks. The cocks fed low protein diet had significantly lower PSV than those fed high protein diet at 32 weeks old however, the opposite situation existed at 36 and 40 weeks of age, without significant differences between them. Wilson *et al.* (1987a) and Hocking (1989) concluded that males can be fed 12 or 14% protein in the diet without any adverse effects on spermatozoa concentration. It was observed that at 32 and 36 weeks of age, the (G*T) interactions were not significant in respect of PSV, however, it was significant

at 40 weeks of age, whereas the Nana cocks fed low protein diet had significantly higher PSV than Nana ones fed high protein diet. In contrast to Nana cocks, the nana cocks fed low protein diet had significantly lower PSV than nana cocks fed high protein diet. This result could be attributed to lower feathering percentage in naked neck males by about 20-30% than the normal ones (Mérat, 1986, Horst *et al.,* 1986 and Galal, 1999), which may decrease the protein requirements (Bordas *et al.,* 1978 and Monnet *et al.,* 1979).

The sperm abnormalities of Nana cocks were significantly higher than those of nana ones at 32 and 36 weeks of age by about 9.7 and 12.5%, respectively. Conversely, at 40 weeks old, the Nana cocks had significantly lower abnormal sperms than nana ones by about 8.6%. The cocks fed low protein diet had higher abnormal sperms than cocks fed high protein diet at 32 and 40 weeks of age. However, the opposite was true at 36 weeks of age when the cocks fed the high protein diet had higher sperm abnormalities percent than those fed the low protein diet by about 20.7%. At all studied ages, the (G*T) interaction was not significant in respect of abnormal sperms.

Dead sperms of Nana cocks were significantly higher than those of nana ones at 32 and 36 weeks of age, while the apposite was true at 40 weeks old. The cocks fed low protein diet had significantly higher value of dead sperms than those fed high protein diet at 32 weeks of age. However the level of protein had no significant effects at 36 and 40 weeks old, where the two groups had nearly similar values. The significant (G*T) interaction observed may be due to the Nana cocks fed low protein diet had higher dead sperm % than other genotypes. The (G*T) interaction in respect of dead sperms at 32 and 36 weeks of age were significant.

The Nana cocks had significantly higher coiled tail sperms than those of nana ones at 32 and 36 weeks of age. However, the genotype does not significantly affect coiled tail sperms at 40 weeks old. Concerning the dietary protein content, it could be noticed that the coiled tail sperms at 32 weeks old for cocks fed low protein diet were significantly higher than cocks fed high protein diet. Conversely, the cocks fed low protein diet were significantly lower coiled tail sperms than cocks fed high protein diet at 40 weeks. The (G*T) interaction had significantly effects on coiled tail sperms at 32 and 36 weeks of age. However, at 40 weeks old, the interaction (G*T) did not significant.

The total plasma protein values were not affected by the genotype or the protein level in the diet (Fig. 1).

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Fig1

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تاثير البروتين الماكول على جودة السائل المنوى، وزن الجسم، الغذاء الماكول فى ديوك عارية الرقبة وطبيعية التريش

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اجريت هذه التجربة على عدد 92 ديك عمر 30 اسبوع (46 ديك عاري الرقبة الخليط + 46 ديك طبيعى التريش). قسمت هذه الديوك عشوائيا الى مجموعتين. غذيت كل مجموعة داخل كل تركيب وراثى على عليقة تحتوى على 14، 16% بروتين خام (23 ديك/تركيب وراثى/معاملة). واستمرت الفترة التجريبية من 30 الى 40 اسبوع من العمر. وكانت اهم النتائج المتحصل عليها كالتالى:

- تأثرت كمية العليقة الماكولة يوميا معنويا بالتركيب الوراثى ومستوى بروتين العليقة. وايضا سجل التداخل بين التركيب الوراثى والمعاملة تاثير معنويا على الاستهلاك اليومى من العليقة.
- لوحظ عدم وجود فروق معنوية بين اوزان الجسم راجعة للتركيب الوراثى خلال الفترة التجريبية.
- لوحظ وجود زيادة معنوية فى وزن جسم الديوك المغذاة على مستوى منخفض من البروتين عند عمر 40 اسبوع مقارنة باخواتها المغذاة على مستوى مرتفع من البروتين.
- صاحب العامل الوراثى عارى الرقبة الخليط بارتفاع معنوى فى حجم القذفة المنوية مقارنة بنظيرة طبيعى التريش.
- سجلت الديوك المغذاة على مستوى مرتفع من البروتين حجم قذفة منوية اكبر معنويا من الديوك التى تغذت على مستوى منخفض من البروتين عند 32 اسبوع من العمر.بينما لم يكن هناك تاثير معنوى لمستوى البروتين على حجم السائل المنوى عند عمر 36، 40 اسبوع.
- شوهد عدم وجود اختلافات معنوية فى بروتينات البلازما الكلية عند عمر 32 اسبوع راجعة الى التركيب الوراثى او مستوى بروتين العليقة.
- انخفاض محتوى العليقة من البروتين ربما يحسن خصائص السائل المنوى فى الديوك عارية الرقبة الخليطة تحت ظروف الجو البارد.