

## **INFLUENCE OF NAKED NECK GENE (Na) AND DIETARY PROTEIN LEVEL ON GROWTH PERFORMANCE AND CARCASS PARTS AND COMPOSITION OF MALE SHARKASI CHICKENS**

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**Abstract :** A total number of 770 males from three genotypes, namely heterozygous naked neck (Na/na), homozygous naked neck (Na/Na) and normally feathered (na/na) were compared for growth and meat production performance at two levels of dietary protein (15 and 17% till 8 wks and 13 and 15% till 16 wks). The main results could be summarized as follows:

1- The presence of Na gene led to a significant ( $P<0.01$ ) increase in body weight. The Na/na genotype was heavier than na/na genotype by about 2.80%, 2.60%, 13.30% and 10.70% at 4, 8, 12 and 16 wks of age, respectively. The corresponding values for Na/Na were 2.70%, 1.03%, 11.80% and 7.70% at the same ages, respectively. Also a highly significant difference ( $P<0.01$ ) in body weight gain was shown due to genotype. High protein level improved significantly ( $P<0.01$ ) body weight and gain where body weight increased by 2.4%, 1.4%, 6.4% and 6.6% whereas body weight gain improved by 4.90% from 0-8 wks and 8% from 9-16 wks of age, respectively. The Na/- birds consumed less feed than na/na sibs and the reduction was about 7% and 11.80% in Na/na and Na/Na genotypes, respectively. The presence of Na gene

improved significantly feed conversion. Also, the results indicate a significance increase ( $P<0.01$ ) in feed consumption and conversion values due to low level of protein.

2- The presence of Na gene improved the dressing percentage by about 6.7% and 9.20% in Na/na and Na/Na genotypes. Breast meat increased by 16.70% and 18.20% whereas thighs meat increased by 11.40% and 16.40%. Moreover, high protein level significantly ( $P<0.01$ ) improved dressing, breast and thighs meat percentages by about 3.40%, 7.10% and 3.70%, respectively. The presence of Na gene significantly ( $P<0.01$ ) reduced fat percentage in breast and thigh meat. Low protein level significantly reduced protein percentage whereas it increased the fat and ash percentages in both breast and thigh meat.

In conclusion, the results of the present study clearly indicate that naked neck birds (Na/-) exhibited superiority in growth and meat production performance. However birds were less sensitive to low dietary protein level as compared with normal feathering genotype (na/na), which may be due to the lower requirements for feather growth.

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**Key words:** Naked neck gene, protein level, growth, meat composition.

## **Introduction**

In Upper Egypt, the naked neck gene (Na) is widespread in unselected local population and known as Sharkasi chicken. This gene which reduce feather coverage by 20-40% was associated with an advantage in growth rate and meat yield under moderate environmental conditions which was more pronounced under heat stress (Merat, 1990; Abd El-Rahman, 1990, 1998, 2000 a, b; Yahav *et al.*, 1998; Deeb and Cahaner, 1999, 2001; Yunis and Cahaner, 1999; Galal, 2003 and Fathi *et al.*, 2003).

The protein requirement for feather growth is likely to be a significant proportion of the total protein requirements of the bird during periods of rapid growth (Wylie *et al.*, 2003). Several articles reported that genotypes with less feathers exhibited higher body weights, better feed efficiency, lower fat content and higher meat yield (Hanzl and Somes, 1983, Ajang *et al.*, 1993 and Abd El-Rahman, 2000c). Similar results were obtained for broilers were fed on diets formulated to contain protein levels exceeding the minimal amounts needed for optimal growth. It can be postulated that the beneficial effect of reduced feather coverage obtained from such genotypes is not only associated with reduced plumage but also with

a relative spare of dietary protein (Nir, 1994).

The Na gene advantage was more pronounced in diets with low protein levels (Zein El-Dein *et al.*, 1984 and Merat, 1990) especially under high environmental temperatures. Ajang *et al.* (1993) suggested that the decrease in the amount of dietary protein directed into feather synthesis makes more available protein for skeletal and lean tissues. Therefore, a reduction in feather coverage may decrease the dietary protein requirements.

Alam *et al.* (1995) reported that naked neck birds might be an alternative to exotic broiler stocks when reared on lower quality diets under Bangladesh conditions. On the other hand, the quantitative amino acids and protein requirements of Na/na and na/na broilers were similar (Pesti *et al.*, 1996 and Yalcin *et al.*, 1996).

Recently, interest has been directed toward the use of low crude protein (CP) diets as a means of lowering expenses, particularly when the cost of dietary protein sources is high. Previous research has indicated that dietary CP may be slightly lowered without affecting growth performance and breast muscles weight if essential amino acids are supplied to requirements (Farghaly, 1989, Deschepper and De Groote, 1995; Jacob *et al.*, 1995;

Aggoor *et al.*, 1997, Edwards *et al.*, 1997 and Emmert *et al.*, 2000).

Makled *et al.* (2001) reported that naked neck genotypes (Na/-) had the best growth rate compared to na/na genotype and 17% CP with 2700 k cal ME/kg is recommended till 6 wks of age whereas 15% CP with 2850 k cal ME/kg from 7-12 wks of age.

Therefore, the objective of this study was to evaluate the effect of different levels of dietary protein on growth performance, carcass and meat composition of male Sharkasi chicks.

## **Materials and Methods**

### **Birds and management.**

The present study was carried out at the Poultry Research Farm, Assiut University. Local brown heterozygous naked neck males and females (kept as a basic stock) were mated to produce the offspring of the three genotypes namely, homozygous naked neck (Na/Na) genotype, heterozygous naked neck (Na/na) genotype and normal feathering (na/na) genotype.

The discrimination between Na/Na and Na/na genotypes was determined at hatch according to Abd El-Rahman (1998). A total number of 770 males chicks from the three genotypes were brooded and reared in cages from hatch to 16

wks of age. The birds were reared from 9-16 wks under prevailing environmental conditions (25-30°C temperature and 55-60% relative humidity).

Two experimental diets were formulated to contain 17% and 15% CP with 2700 kcal ME/kg from 0-8 wks of age and another two CP levels 15% and 13% with 2800 k cal ME/kg from 9-16 wks of age (Table 1). Feed and water were available all the time.

### **Traits studied**

All chicks were weighed individually at four wk intervals till the termination of the experiment and body weight gain (BWG) was calculated. Feed consumption and conversion were recorded only from 9 to 16 wks of age.

At 16 wks of age, a random sample of 120 males from the genotypes were used for carcass measurements. Birds were weighed by electronic balance before slaughter and the feathers were removed manually and birds reweighed to calculate feather weight by difference then the birds were eviscerated. Heart, liver, gizzard, and carcass, were weighed and recorded. Thighs, breast and muscles weight were also recorded. Each portion was expressed as a percentage of the live body weight.

**Table(1):** Composition of diets used in the experiment.

Ingredients	Starter (0-8 wks)		Grower (9-16 wks)	
	High. CP	Low CP.	High CP.	Low CP.
Yellow corn	57.90	60.36	66.75	69.83
Soybean meal	22.00	15.01	16.75	10.32
Wheat bran	16.35	20.67	13.25	16.42
Calcium diphosphate	1.50	1.50	1.50	1.50
Limestone	1.50	1.50	1.00	1.00
Premix	0.25	0.25	0.25	0.25
Common salt	0.25	0.25	0.25	0.25
D-L Methionine	0.15	0.20	0.15	0.20
Lysine	0.10	0.26	0.10	0.23
<b>Calculated composition</b>				
ME (K cal /kg )	2700	2687	2850	2852
Crude protein (%)	17.15	15.00	15.05	13.00
Lysine (%)	0.91	0.90	0.76	0.73
Methionine (%)	0.41	0.43	0.39	0.40
Methionine + Cysteine (%)	0.67	0.65	0.62	0.60
Fat (%)	2.62	2.81	2.71	2.88
Crude fibers (%)	4.41	4.48	4.00	4.01
Calcium (%)	1.07	1.06	0.86	0.85
Available phosphorus (%)	0.44	0.43	0.42	0.41
Total phosphorus (%)	0.72	0.73	0.67	0.67

One hundred and twenty samples from thigh and breast meat of the genotypes were chemically analyzed for protein, fat and ash according to A.O.A.C. (1990) methods and data were expressed on dry matter basis.

### Statistical analysis

Data were analyzed by using the General Linear Models Procedure (GLM) of SAS software (SAS Institute, 1990) according to the following model:

$$Y_{ijk} = \mu + G_i + P_j + (G \times P)_{ij} + E_{ijk}$$

where  $Y_{ijk}$  is the observation,  $\mu$  is the general mean,  $G_i$  is the genotype effect,  $P_j$  is the protein level effect;

$(G \times P)_{ij}$  is the interaction between genotype and protein level and  $E_{ijk}$  is the random error. Duncan's Multiple Range Test (Duncan, 1955) was used for means comparisons.

### Results and Discussion

#### Body weight and gain

Data of body weight (BW) and body weight gain (BWG) and statistical analysis are presented in Table (2). Although the naked neck (Na/-) and normally feathered (na/na) birds came from the same parents, body weight and gain of the Na/- was greater than their normal sibs.



At 4 wks of age, body weight of Na/na and Na/Na genotypes surpassed that of na/na genotype by about 2.80% and 2.70% respectively. At 8 wks of age, the increase in body weight due to Na gene was 2.60% and 1.03% in Na/na and Na/Na genotypes, respectively. The improvement due to Na gene was more pronounced at 12 wks of age, where body weight increased by about 13.30% and 11.80% in the Na/na and Na/Na genotypes, respectively. At 16 wks of age, the corresponding values were about 10.70% and 7.65% for Na/na and Na/Na genotypes, respectively. The obtained result are in agreement with the findings of Abd El-Rahman (1998); Deeb and Cahaner (1999); Galal (2003) and Fathi *et al.* (2003).

As shown in Table(2) the presence of Na gene, also increased BWG by about 2.70% and 1.20% till 8 wks of age in Na/na and Na/Na genotypes, respectively. The improvement in BWG due to Na gene from 9-16 wks was about 17.09% and 12.90%. Cahaner *et al.* (1987) postulated that since feathers contain less water than muscles, a reduction of one gram in feather weight may increase body weight gain by 1.5 g.

Regarding to protein level, the results in Table (2) indicate that the higher BW and BWG were obtained when chick fed on high levels of CP till 16 wks of age. BW values

increased by 2.4%, 1.7%, 6.4% and 6.6% at 4, 8, 12 and 16 wks of age, respectively. Also, BWG improved by about 4.9% and 8% from 0-8 wk and 9-16 wks of age, respectively. The previous results are in agreement with those of Bregendahl *et al.* (2002) who reported that low protein diets failed to support equal growth performance to that of high protein diets. Similar results were also obtained by El-Naggar *et al.* (1997) and Abd El-Hady and Abd El-Ghany (2003).

Jacob *et al.* (1995) reported insignificant differences in final body weight, feed intake and conversion when broiler chicks fed 17% CP compared with 20.5% CP from 21-42 days of age..Final body weight and gains of broilers fed 15% CP were significantly better than those fed 12% or 18% CP, feed intake increased as CP decreased although, the differences between 15% and 18% were not significant (Aggoor *et al.*, 1997). Also, for local Dokki-4 chickens, the best growth was found when fed on 18% CP (Farghaly, 1989).

Statistical analysis (Table 2) exhibited a significant ( $P<0.01$ ) interaction between genotype and protein level at all ages studied. The results also exhibited that na/na genotype was more sensitive to the reduction in CP levels as compared with Na/- genotypes especially at the last 8 wks of growth period.. At

12 wks of age, the reduction in body weight was about 4.90%, 4.80% and 10% in Na/na, Na/Na and na/na genotypes when chicks fed low levels of CP. At 16 wks of age, the corresponding values were 5.3%, 4.6% and 10.20%, respectively. Makled *et al.* (2001) indicated that genotype and dietary protein levels had significant influence on BW, BWG and feed conversion ratio. The present study confirmed the results obtained by Zein El-Dein *et al.* (1984), Ajang *et al.* (1993), Nir (1994) and Alam *et al.* (1995) who reported that the advantages of genes in reducing feather coverage appeared when birds were fed on lower protein levels.

Although, Yalcin *et al.* (1996) reported that protein requirements of Na/na and na/na genotypes were similar and the Na/na birds did not require less protein as a result of their reducing feather covering. The naked neck birds (Na/-) were expected to exhibit higher BW and BWG than their normally feathered sibs because of their better thermoregulation (Deeb and Cahaner, 1999) and possibly also of amino acids saved from feather production, hence becoming available for meat tissues (Cahaner *et al.*, 1987).

### **Feed consumption and conversion**

The results of feed consumption, and conversion are presented in Table (3). The results indicate that

both genotype, protein level and interaction between them were highly significant ( $P < 0.01$ ) during the experimental period.

The naked neck birds (Na/-) consumed less feed than their na/na sibs. The reduction in feed consumption due to Na gene from 9-12 wks of age in Na/na and Na/Na genotypes was about 4.90% and 3.30%, respectively. From 13-16 wks of age the corresponding values were about 9% and 15%, respectively. Within the growth period from 9-16 wks of age, the reduction in feed consumption of Na/na and Na/Na was about 7% and 11.80%, respectively. The present results are in disagreement with those of Makled *et al.* (2001) who reported that the naked neck genotypes consumed more feed than fully feathered ones.

It is worthy to mention that, Cahaner *et al.* (2003) reported that feathers contain about 80% protein (90% protein of dry matter) and the normal bird consumed more of dietary protein to produce feathers. Therefore by eliminating the feathers, either less feed is needed to produce a broiler with the same carcass weight, or more meat is produced from the same amount of feed. Also, Yalcin *et al.* (1997) claimed that feed consumption was affected by ambient temperatures but not by genotype when they





compared the broiler Na/na and na/na genotypes.

The Na/- birds had a better feed conversion ratio values than normal sibs (na/na). The ratio during the period from 9-16 wks of age were about 4.90, 4.90 and 6.40 for the Na/na, Na/Na and na/na genotypes, respectively. Although, Makled *et al.* (2001) reported that naked neck birds (Na/-) consumed more feed than normals (na/na) sibs, the Na/- birds in the present study exhibited better feed conversion values than na/na birds. The advantage due to Na gene could be attributed to the increase in body weight gain (Table 2) together with the reduction in feed consumption due to Na gene (Table3).

The results presented in (Table 3) indicate significant increase in feed consumption and feed conversion values as CP decreased at all studied periods which agree with results reported by Jacob *et al.* (1995) and Abd El-Azeem *et al.* (2001).

### **Carcass measurements**

As shown in Table (4), the na/na genotype exhibited larger slaughtering weight than Na/- genotypes. The presence of Na gene reduced feather significantly ( $P<0.01$ ) by about 24.8% and 44% in Na/na and Na/Na genotypes, respectively. The current results agreed with those reported by Abd

El-Rahman (1998), Fathi and Galal (2001) and Galal (2003).

According to the results of BWG (Table 2) and also the reduction in feather percentage, it could be noticed that Na gene significantly increased ( $P<0.01$ ) the carcass and giblets percentage. Similar trend was also obtained for dressing percentage, where the Na gene improved the dressing percentage by 6.70% and 9.20% in Na/na and Na/Na genotypes, respectively. As it is shown in Table (4), this significant increase ( $P<0.01$ ) in dressing % is due mainly to Na gene in breast and thighs percentages. The Na gene improved not only the slaughter yield but also the meat yield of breast and thighs. Breast meat of Na/na and Na/Na was more than of na/na by about 16.70% and 18.20%, respectively. The thighs meat of the naked neck genotypes increased by about 11.40% and 16.40% in Na/na and Na/Na genotypes, respectively. The data obtained are in agreement with the findings of Abd El-Rahman (1998) and Deeb and Cahaner (2001). Deeb and Cahaner (2001) reported that heterozygous (Na/na) and homozygous (Na/Na) broilers maintained at 32°C produced about 17% and 32% more breast meat than their normally feathered sibs (na/na).

The relationship between reduced plumage and increased meat



yield was clearly demonstrated in this study confirmed the findings of Ajang *et al.* (1993) who found that after three selection cycles, the slow feathering line had lower feather and skin weight, higher body weight and breast meat than the fast feathering. This study support the hypothesis that meat production of chickens can be improved by reducing plumage either via the Na gene or by selection for quantitative loci controlling the rate of feather development (Cahaner, 2003).

Several mechanisms appeared to be responsible for higher meat production in reduced-plumage chickens: 1). Less feather production leaves more proteins for the synthesis of other tissues (Merat, 1990 and Abd El-Rahman 1998) 2). More rapid dissipation of heat results in less appetite depression and consequently better growth especially at high ambient temperatures (Eberhart and Washburn, 1993b; Yalcin *et al.*, 1997b; Yahav *et al.*, 1998 and Deeb and Cahaner, 1999). 3). Lower carcass fat content resulting from higher proportion of lipids being used for thermoregulation (Eberhart and Washburn, 1993a; Yalcin *et al.* 1997; Younis *et al.*, 1998 and Yunis and Cahaner, 1999). 4). Increased blood flow in the breast area, which becomes a cooling site (Yunis and Cahaner, 1999). 5). An increment of total protein and cholesterol levels in blood plasma. (Fathi and

Galal 2001). 6). Also, the advantages of Na gene could also attributed to the linkage between this gene and other favorable genes which are responsible for the physiological and metabolic status of the bird (Abd El-Rahman, 1998).

On the other hand, high protein levels led to improvement of dressing %, breast meat and thighs meat by about 3.40%, 7.10%, 3.70%, respectively. These results are in partial agreement with those obtained by El-Naggar *et al.* (1997) who reported that 15% CP improved significantly percentage of broiler carcass, breast thigh and total meats than 18% or 13% CP.

The results in Table (4) exhibited a significant interaction between genotype and protein level. It could be stated that the na/na genotype was more sensitive to the reduction in protein levels than the naked neck (Na/-) sibs not only on the BW and BWG but also on most of slaughtering traits.

#### **Meat composition:**

The results of meat composition are presented in Table (5). No significant differences were noticed due to genotype in moisture, protein and ash percentages of breast meat. However, there were a highly significant ( $P < 0.01$ ) differences in fat percentage where it was 5.14%, 5.70% and 6.70% in Na/na, Na/Na and na/na genotypes, respectively.



Early, Hanzl and Somes (1983), indicated that meat of Na/- birds contained more moisture. Similar protein and more ash than meat of na/na birds.

Dietary protein level showed a highly significant ( $P<0.01$ ) effect on protein, fat and ash percentages. Low level of CP decreased breast meat protein by 7.4% whereas, it increased fat and ash percentages by about 48% and 34%, respectively. Ferguson *et al.* (1998), Aletor *et al.* (2000) and Bregendahl *et al.* (2002) proved that growth performance and carcass composition became inferior to those of broiler chicks fed standard high CP diets when the dietary CP content lowered by more than three to four percentage.

The present findings indicate that there were significant differences in fat and ash percentages of thigh meat due to the genotype. The presence of Na gene reduced fat not only in breast meat but also in thigh meat, where the fat percentage was 9.80%, 8.04% and 12.02%, in Na/na, Na/Na and na/na genotypes, respectively. Also, a significant effect due to genotype ( $P<0.05$ ) was proved for ash percentage, where it was 11.80%, 13.60% and 11.90% in the three mentioned genotypes.

Moreover, the present findings indicate a highly significant ( $P<0.01$ ) effect due to dietary protein level on protein, fat and ash of thigh meat. Low protein level

decreased thigh protein by 6.6% but increased fat and ash percentages by about 23% and 11%, respectively. El-Naggar *et al.* (1997) found positive effect of CP level on protein content of breast and thigh meat. They also reported that percentage ash of breast and thigh meat of chicks fed 18% CP was significantly ( $P<0.05$ ) higher than those fed 15% and 12% CP although there were no significant differences between 15% and 12% crude protein level. Sherif (1989) did not find any significant effect on protein or ash percentages of breast or thigh meat due to the differences in CP levels.

Finally, the results exhibited that moisture and protein percentages of breast meat were higher than those of thigh meat, whereas thigh had more fat and ash than breast. These results are in agreement with those obtained by El-Naggar *et al.* (1997).

In summary, the results of the present study clearly indicate that the naked neck birds (Na/-) exhibited superiority in growth and meat production performance and they were less sensitive to the reduction in protein level than the normally feathering ones.

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## تأثير العامل الوراثي للرقبة العاربية ومستوى البروتين في الغذاء على أداء النمو وأجزاء الذبيحة ومكوناتها في ذكور الدجاج الشركسي

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أستخدم في التجربة 770 ذكراً من ثلاثة تراكيب وراثية هي العاربي الرقبة الخليط والعاربي الأصيل والطبيعي للتربيش لمقارنة صفات النمو وإنتاج اللحم مع مستويين من بروتين العليقة ويمكن تلخيص النتائج كما يلي :

1- أدى وجود جين الرقبة العاربية إلى زيادة معنوية (مستوى 1%) في وزن الجسم . زاد وزن التركيب الوراثي الخليط عن الطبيعي بحوالي 2% ، 2.6% ، 12.30% ، 17.70% عند عمر 4 ، 8 ، 12 ، 16 أسبوع بينما زاد العاربي الأصيل بحوالي 2.7% ، 1.03% ، 11.80% ، 7.7% عند نفس الأعمار وأظهرت التراكيب الوراثية العاربية فريقياً معنوية لمعدل الزيادة في الوزن. كما أن ارتفاع نسبة البروتين في العليقة أدى إلى تحسن وزن الجسم بحوالي 2.4% ، 1.4% ، 6.4% ، 6.6% في الأعمار السابقة مع تحسن في العائد من النمو بحوالي 4.9% ، 8% ، في الفترة من الفقس حتى 8 أسبوع والفترة من 9-16 أسبوع من العمر . كما انخفض استهلاك العليقة للطيور العاربية الرقبة الأصيل والخليط بحوالي 7% ، 11.80% في الفترة 8-16 أسبوع بالمقارنة بالطيور الطبيعية التربيش وتحسنت معنوياً (مستوى 1%) الكفاءة التحويلية لهذه الطيور . وأدى انخفاض البروتين في العليقة إلى زيادة معنوية في استهلاك العليقة وقيم الكفاءة التحويلية .

2- أدى وجود جين الرقبة العاربية إلى تحسن نسبة التصافي ونسبة لحم الصدر والأفخاذ بحوالي 6.7% ، 16.70% ، 11.40% في العاربي الخليط بينما كانت هذه النسب 9.2% ، 18.20% ، 16.40% للعاربي الأصيل . وأدى ارتفاع نسبة البروتين إلى تحسن معنوي في نسبة التصافي ونسبة لحم الصدر والأفخاذ بحوالي 3.4% ، 7.10% ، 3.70% على التوالي . وأدى وجود جين الرقبة العاربية إلى انخفاض معنوي في نسبة دهن لحم الصدر والفخذ بينما لم يتأثر معنوياً نسب كل من البروتين والرماد . وأدى انخفاض نسبة بروتين العليقة إلى انخفاض معنوي في نسبة البروتين مع زيادة في نسبة دهن ورماد كلاً من لحم الصدر والفخذ .

وتشير نتائج هذه التجربة وبوضوح إلى أن الطيور العاربية الرقبة أظهرت تفوقاً في معدلات النمو وصفات إنتاج اللحم كما أنها أقل متأثراً بانخفاض نسبة بروتين العليقة بالمقارنة بالطيور الطبيعية التربيش.