NAKED NECK GENE AND THE INHERITANCE OF SEX DIFFERENCES FOR GROWTH PERFORMANCE AND SOME SELECTED CARCASS MEASUREMENTS

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ABSTRACT

Sexual dimorphism for:body weight(at 4,6 and 8 weeks of age),weight gain(at 4-6 and 6-8 weeks of age)and some selected carcass measurements(at 63 days of age)were compared for naked neck and normal genotypes.

It seems that the Na gene may be responsible for increasing sex differences in body weight at early period of growth(from 4 to 8 weeks of age). This effect issued from it's effect on plumage reduction.This trend is reversed at 9 weeks of age where sex differences in body weight were less for the naked neck birds than for normally feathered birds.This is a quit favourable for broiler production because increasing uniformity at market age is demanded.

Genotype and sire family had highly significant effect on sex differences for weight gain at 4-6 and 6-8 weeks of age.($P \leqslant 0.01$)

The analysis of Variance of the sex differences for some selected Carcass measurements revealed some important points:

(a) The naked neck gene"Na"may be associated with better meat yield specially in the thoracic region for both sexes.

(b) The naked neck females had less intermascular

fat weight than neked neck males.This trend is reversed for normally feathered birds.

(c) In general,meat/bone ratio of females exceeded that of males for both naked neck and normal genotypes.

INTRODUCTION

The phenomenon of sexual dimorphism issued from the fact that broiler production requires uniformity in body weight at market age.

Buvanendran(1969)on unselected population of W. L. estimated the genetic correlation between male and female weights by 0.586,indicating considerable genotype X sex interaction.

Shaklee et.al. (1952) on turkey; Ayoub and Mérat (1972) on L_{22} (a population derived from Leghorn) and M_{55} (a population derived from RIR); Ayoub and Magraby (1975) on Dokki-4 and WPR (adapted under the climatic conditions of Egypt), proved the superiority of selection based on dam families over that based on sire families .

Ayoub and Magraby (1976); Abdel-Warith et. al. (1979) found that sire X sex interactions were not significant while dam families within sire X sex interactions were significant.

Marks (1985) using two randombred and two commerical broiler stocks investigated sex differences in body weight,feed intake,water intake and feed efficiency. He observed that the divergence in all these studied characters started immediately after hatching and increased in a more or less linear fashion with age till 14 days of age.

The naked neck gene,"Na", is a genetic mutant reduces plumage by about 40% for NaNa females and 30% for Nana females (Bordas et.al.,1978); the corresponding figures are lower for males.

EL-Attar and Mérat (1985) found that naked neck chicks (Nana) of both sexes had a lower proportion of plumage expresed as percentage of live weight and had a better meat yield of the eviscerated carcass than their normally feathered siblinges.

Zein-El-Dein et.al. (1981-a) compared the growth performance of naked-neck and normally feathered birds during two seasons (October and April) in Egypt. They found that the naked-neck birds (Nana) showed a body weight about 11% superior in males and 9% in females at 8,10 and 12 weeks of age during spring only.

Zein-El-Dein et.al.(1981-b) found that Nana birds had a significantly larger proportion of boneless meat and a greater ratio of meat to bone than nana birds at 8 weeks of age .

Zein-El-Dein et.al.(1984) compared the carcass composition of two groups of the naked neck (Nana) and normal (nana) genotypes slaughtered at 75 days of age (males) and at 82 days of age (females). The two groups fed a diet with 2900 K Cal ME/Kg and protein levels of 16 and 20% respectivety. They found that,in all cases,the Nana genotype showed a lower loss after defeathering, a higher meat yield of the eviscerated carcass and a lower percentage of fatty tissue (significant only for intermascular fat).

The aim of this paper was to investigate the effect of the naked-neck gene on the sex differences for body weight and some selected carcass measurements at early period of growth.

MATERIALS AND METHODS

A.Experimental birds and Conditions

Eight cocks of cornish bred in"L' Institut de sélection animale,Isa,France"were used in this study. These cocks were of genotype DwDw nana (normal body size and normal plumage),Each cock was mated to five dams of the genotype dw-Nana (dwarfs and naked-neck). These dams were taken from the experimental line of "Laboratoire de Génétique Factorielle,Jouy-En-Josas, France".

This type of mating offered normal sized chicks, but half of them were naked-neck (Nana) and the others were normally feathered (nana) in both sexes.

Two pedigree hatches were produced;the first one on 18 th of November (1983) and the second on 6 th of January (1984). The total number of chicks in the two hatches were 231 and 205 respectively.

Both hatches were raised on the deep litter brooding house of "L'Ecole National d'Aviculture , Rambouillet,France". The brooders were electerically heated from hatch up to the end of the 4 th week of age.

Feed and water were available ad Libitum.A broiler starter ration was fed during the first four weeks of age contained 2930 K Cal ME/Kg and 21.9% protein. Thereafter a finisher diet containd 2930 K Cal NE/Kg and 20.3% protein was used.

B. Measurements

Body weight was recorded individually at 4,6 and 8 weeks of age for both hatches and at slaughter (9 weeks) only for the first hatch.

Weight gain was calculated for two consecutive biweekly periods: 4-6 and 6-8 weeks of age.

Each female measurement was proportionated to the average of the same measurement belongs to her half-sib brothers within the same genotype. This calculated measurement was refered as sexual dimorphism.

Sexual dimorphism was estimated also for some selected carcass measurements only for the first hatch.

C. Statistical Analysis

Only sire families whose representative in the two hatches were taken into consideration for statistical analysis which was carried out using the unequal number model described by Snedecor and Cochran (1979).

RESULTS AND DISCUSSION

A. The effect on growth performance traits

This experiment was conducted to examine the effect of"Na" gene on the inheritance of sex differences for some economic traits. Unfortunately,there were no available references concerned with the effect of genotype or any mendelian gene on the sex differences for body weight.

Mean values of sex differences for body weight at 4,6 and 8 weeks of age were higher for normally feathered birds (nana) than that of naked-neck birds (Nana) for both hatches. This trend is reversed at 9 weeks of age as shown in tables(1&3). These results showed that the naked-neck gene"Na"may be responsible for increasing sex differences in body weight at early period of growth(4,6 and 8 weeks of age). This effect may be attributed to the effect of the naked-neck gene

on plumage reduction . Bordas et.al. (1978)estimated this reduction in plumage by about 40% for NaNa females and 30% for Nana females;while the corresponding figures are lower for males. At 9 weeks of age,it could be observed that mean value of sex differences for body weight was higher for naked-neck birds (Nana)than that of normally feathered birds (nana). This means that,the naked-neck birds were more homogenous in body weight at market age than normally feathered birds. This point could be considered of importance in practical broiler industry because increasing uniformity in body weight is a quite favourable in improving marketing conditions.

Generally,the average value of sex differences for body weight within each genotype which was given in table (1) showed that these differences increased with advancing age (from 4 to 8 weeks of age).

The analysis of variance (presented in table 2) showed that,the effect of genotype on sex differences for body weight was highly significant at 4 weeks of age ($P \leqslant 0.01$),while the same effect was only significant at 8 weeks of age ($P \leqslant 0.10$).

Table (2) indicated that the effect of sire family on sex differences for body weight was highly significant at 4 and 6 weeks of age ($P \leqslant 0.01$) and just significant at 8 weeks of age ($P \leqslant 0.05$). Many investigators proved the superiority of selection for sexual dimorphism based on dam families over that based on sire families (Shaklee et.al., 1952;Ayoub and Mérat,1972; Ayoub and Magraby,1975 and 1976;Abdel-Warith et.al., 1979).

Genotype X sire family interaction affected significantly the same studied character at 4 weeks of age. While,the same effect was highly significant at 6 weeks of age ($P \leqslant 0.01$).

The effect of hatch on the sex differences for weight gain was highly significant at 4-6 weeks of age ($P \leq 0.01$) and just significant at 6-8 weeks of age ($P \leq 0.05$), as shown in table(2).

Genotype X sire family interaction affected significantly sex differences for weight gain only at 4-6 weeks of age but not at 6-8 weeks of age($P \leq 0.05$).

B. The effect on some selected carcass measurements

These selected carcass measurements were done only for the first hatch and include: percentage of abdominal fat, percentage of eviscerated carcass, percentage of breast meat, percentage of Leg+thigh meat, percentage of meat in the half left side of eviscerated carcass , intermascular fat weight, meat/bone ratio in the half left side of the eviscerated carcass and finally weight of exterior pectoral muscle.

The analysis of variance for the sexual dimorphism of all these studied carcass measurements indicated some interesting results concerned with:

(a) Percentage of breast meat:

Mean value of sex differences for percentage of breast meat was less for naked neck birds than that for normally feathered birds. These differences between genotypes were significant at 0.250 level. This means that the "Na" gene may be associated with better meat yield specially in the thoracic region for both sexes, while the absence of the Na gene in normally feathered birds led to increasing the sex differences for this mentioned trait. These results were in line with those obtained by El-Attar and Mérat (1985) and Zein-El-Dein et.al. (1981 - b and 1984).

(b) Percentage of leg+thigh meat:

Mean value of sex differences for percentage of leg + thigh meat for naked-neck birds exceeded that of normally feathered birds. These differences between naked-neck and normal genotypes were significant at 0.10 level. The data of Bordas et.al.(1978) did not show differences between males of different genotypes at the "Na" locus for percent of bone and muscle in the thigh region.

(c) Weight of intermascular fat:

Mean value of sex differences for this trait was less for naked-neck birds than that of normally feathered birds. These differences between genotypes were significant at 0.10 level. Within each genotype it could be noticed that the ratio between weight of intermascular fat for females to that of mean value of males was less than unity for naked-neck birds, while this ratio was more than untiy for normally feathered birds. This means that the naked-neck females had less intermascular fat weight than naked-neck males while this trend was reversed for normally feathered birds. In general,there was a trend that the naked - neck birds had a less intermascular fat weight than normally feathered birds in both sexes(El-Attar and Mérat,1985 and Zein-El-Dein et.al.,1984) .

(d) Meat/Bone ratio :

Mean value of sex differences for this trait for naked-neck birds exceeded that of normally feathered birds. These differences between genotypes were significant at 0.250 level. In general,there was a trend that meat/bone ratio of females exceeded that of males for both naked-neck and normal genotypes. These results agreed with those reported by Zein-El-Dein (1981-b) .

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TABLE (1). Means and standard deviations for Sexual Dimorphism of body weight and weight gain

Trait	Hatch (I)		Hatch (II)		Total			
	Nana (n=33)	nana (n=50)	Nana (n=58)	nana (n=40)	Hatch(I+II)		Genotype (Nana + nana)	
	$\bar{x} \pm sd$		$\bar{x} \pm sd$		Nana	nana	Hatch(I)	Hatch(II)
Body weight:								
4 weeks	83.62 ± 7.656	92.86 ± 11.694	90.23 ± 10.825	93.05 ± 11.860	86.93	92.96	88.22	91.64
6 "	83.71 ± 7.771	84.49 ± 7.933	88.47 ± 10.641	89.67 ± 11.410	86.09	87.08	84.10	89.07
8 "	81.05 ± 7.086	4.21 ± 8.535	82.65 ± 11.646	85.16 ± 9.699	81.85	84.69	82.63	83.91
Weight gain:								
4-6 weeks	84.89 ± 12.995	77.00 ± 12.379	90.76 ± 14.551	85.32 ± 13.502	87.82	81.46	80.94	88.34
6-8 "	73.59 ± 11.526	83.26 ± 16.592	72.99 ± 15.290	77.89 ± 11.675	73.29	80.58	78.43	75.44

TABLE (2). Three factors analysis of Variance for Sexual Dimorphism of body weight and weight gain.

Trait	Source of Variation - F Value						
	Hatch (E)	Genotype (G)	Sire-Family (SF)	(E)x(G) Interaction	(G)x(SF) Interaction	(E) x (SF) Interaction	(E)x(G)x(SF) Interaction
	(df =1)	(df=1	(df=5)	(df=1)	(df=5)	(df=5)	(df=5)
Body weight :							
4 weeks	2.098	11.494**	4.956**	6.845**	2.966*	0.684	1.731
6 weeks	10.841**	0.001	3.505**	0.578	5.948**	0.000	1.365
8 weeks	0.277	3.514	2.939*	0.597	2.097	2.386*	0.446
Weight gain :							
4-6 weeks	22.108**	17.495**	5.949**	0.000	2.729*	0.000	2.336*
6-8 weeks	4.766*	14.409**	3.679**	0.000	0.000	2.836*	1.376

Residual df = 157

*,** Significant at 0.05 and 0.01 level respectively.

TABLE(3). Means, Standard deviations and analysis of Variance for Sexual Dimorphism of some selected carcass measurements.

Trait	Nana (n = 12) $\bar{x} \pm sd$	nana (n = 12) $\bar{x} \pm sd$	Source of Variation - F Value: Genotype(G) (df=1)	Sire-Family (SF) (df=5)	(G) x (SF) Interaction (df = 5)
Body weight prior slaughter (9 wks)	83.345 ± 9.059	80.238 ± 8.905	2.744	1.570	0.829
Abdominal fat %	105.140 ±27.140	108.380 ± 29.277	0.883	1.903	2.202
Eviscerated carcass %	98.065 ± 3.120	98.041 ± 3.898	0.019	1.095	2.398
Breast meat %	101.870 ± 5.397	106.204 ± 6.516	2.613 *	1.889	1.620
Leg + thigh meat %	102.068 ± 5.926	99.072 ± 5.285	3.009	1.776	0.809
Meat in the ½ Left side of eviscerated carcass	102.300 ± 4.802	102.743 ± 5.250	0.047	1.329	1.313
Intermuscular fat weight	93.838 ±27.380	112.185 ± 41.751	3.434 *	1.147	1.351
Meat/bone ratio in the ½ left side of eviscerated carcass	108.595 ±10.516	105.003 ± 9.164	1.425	0.580	1.455
Weight of exterior pectoral muscle	103.983 ±11.397	108.316 ± 10.035	0.699	2.587	1.945

Residual df equals 69 for body weight prior slaughter and equals 72 for the carcass measurements.

* significant at 0.10 level .

العامل الوراثى المسئول عن عرى الرقبة ووراثه الفرق بين الجنسين لصفات النمو ومقاييس الزبيحـــة

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قورن الفرق بين الجنسين للدجاج العارى الرقبة (Nana) والدجاج الطبيعى التريبش (nana) لصفات وزن الجسم عند اعمـــار ٤ ، ٦ ، ٨ اسبوع، والزيادة الوزنية فى خلال فترتين من ٤ ـ ٦، ٦ ـ ٨ اسابيـــع وكذلك لبعض مقاييس الذبيحة عند عمر ٦٣ يـــوم .

اظهرت النتائج ان العامل الوراثى المسبب لعرى الرقبة "Na" ربما يرتبـــط بزيادة الفرق فى الوزن بين الجنسين فى مراحل النمو المبكرة من ٤ ـ ٨ اسابيـــع ويرجع ذلك الى ان تأثير هذا العامل الوراثى على اختزال الريش يتم بدرجة متفاوتـــه فى كلا الجنسين، ولقد انعكس هذا الاتجاه عند عمر ٩ اسابيع حيث ادى هـــــذا العامل الى زيادة درجة التجانس بين الجنسين مقارنة بالافراد الطبيعية التريبـــش وهذا الاتجاه يتمشى مع انتاج بدارى الزبيح اذ انها تتطلب درجة عالية مـــــن التجانس عند عمر التسويق .

ولقد اظهرت النتائج ان تأثير كلا من التركيب الوراثى وعائلة الاب كان عالـــى المعنوية على الفرق بين الجنسين للزيادة الوزنية فى خلال الفترتين من ٤ ـ ٦، ٦ ـ ٨ اسابيع من العمر .

اظهرت نتائج تحليل التباين بالنسبه للفرق بين الجنسين للمقاييس المأخوذه على الذبيحة بعض النقاط الهامـــة :

أ ـ ارتباط العامل الوراثى الخاص بعرى الرقبة "Na" بانتاج لحم اعلـــى خاصة فى المنطقة الصدرية لكلا الجنسين .

ب ـ وزن الدهن الموجود بين العضلات فى الاناث العارية الرقبة اقل مـــــن ذلك الموجود فى الذكور من نفس التركيب الوراثى وكان هذا الاتجاه منعكسا بالنسبه للطيور الطبيعية التريبش .

جـ ـ نسبه اللحم الى العظم اعلى فى الاناث عن الذكور لكلا التركيبين الوراثيين موضع الدراســـة .