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THE INFLUENCE OF GENOTYPE-BY-ENVIRONMENTAL INTERACTION ON PRODUCTIVE PERFORMANCE OF BROILER CHICKENS.

BY

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Abstract: *This study was conducted to evaluate the significance of genotype-by-environment interaction for sub-tropic poultry breeding. Three environmental conditions were considered summer (32.6°C, RH, 45.1%), autumn (26.0°C, RH, 50.0%) and winter (24.4°C, RH, 53.0%) seasons. Experimental stock comprised about 500 chicks per season of four genotypes: normal (na/na f/f), naked neck (Na/na f/f), frizzled (na/na F/f) and naked neck–frizzled (Na/na F/f). Summer season had a negative effect on body weight (BW) and weight gain (WG) of broiler chicks compared to normal ambient temperature (autumn and winter seasons). Na allele significantly increased BW5, BW7 and WG5-7 by about 3.9, 4.4 and 3.8% in summer and 3.4, 4.5 and 5.1% in autumn season, respectively. Also, frizzled chicks had significantly heavier BW7 than normal ones in summer and autumn seasons by 3.2 and 2.4%. The combination between Na and F alleles had a better effect on BW7 in summer and autumn season (this superiority estimated by 9.5 and 6.2%, respectively). Moreover, the Na allele-by-season interaction had a significant effect on the BW7. However, similar result was not observed for F allele-by-season interaction. The interaction of season x Na x F was not statistically significant. Feed conversion in summer season was significantly lower by 4.5% than autumn and winter ones. There was a significant season x Na x F interaction where the naked neck and frizzled birds consumed more feed in autumn and winter seasons compared to summer one, while it had a better feed conversion by about 2.56 and 1.78% in summer and autumn. The relatively lower rectal temperature was associated with either Na or F alleles and their combinations (Na/na F/f) during all seasons. However, insignificant interaction effects were observed, where the genotype effect increased with ambient temperature. The Na and F alleles interacted with season for total fat%, which reduced by the Na allele 7.89, 8.58 and 6.72% and F allele 1.89, 3.13 and 0.81% during the three seasons, respectively. Moreover, the combination between Na and F alleles significantly reduced total fat% by*

14.22, 10.35, and 9.41%, and increased breast meat% (5.78, 8.13, and 5.50%) and meat yield% (4.43, 6.71 and 4.71%) in the three seasons, respectively.

INTRODUCTION

Poultry industry in developing countries is facing many challenges diseases, unfavorable circumstances and bad management are major factors resulting in economic loss in broiler sector. A hot environment is one of the dangerous stressors in poultry production. The resultant heat stress comes from the interaction among air temperature, humidity, radiant heat and air speed, where the air temperature plays the major role. When the thermo-requirement of chickens is not satisfied, heat strees may occur, depending on the strain, feathering, nutrition and production system.

The effect of the naked neck gene, which reduces the number of feathers and restricts their distribution in chickens have been reviewed comprehensively, espically with regard to high ambient temperature (Mérat, 1986 and 1990). Cahaner et al. (1993) and Yunis and Cahaner (1999) found that fast-growing naked neck broilers are advantageous over their normally feathered sibs for body weight and meat yeild at a constant ambient temperature of 24°C and also at of 32°C. In naturally hot climates naked neck broiler exhibited greater weight at 7 wks of age than their normal counterparts (Younis, 1996 and Yalçin et al., 1997b). Moreover, an increase in meat yeild in the eviscerated carcass was observed in chickens with reduced plumage (Zein El-Dein et al., 1984; El-Attar and Mérat, 1985; Younis, 1996 and Saleh and Younis, 1997).

The F gene curls feathers and reduces their size, thus increasing the heat conductivity from the feather coverage (Somes, 1990). The effect of frizzled gene on the performance of layers was reported by Männer (1992) and Harren-Kiso et al. (1992). The combining of the two genes at the heterozgous state (Na/na F/f) resulted in a better heat tolerance compared with the fully feathered birds and with that of birds heterozgous only for one locus (Pech-Waffenschmidt, 1992).

The effect of the frizzle gene and its combination with the naked neck gene on broilers have been studied by Yunis and Cahaner (1999). They found that at 32°C in low- and high-growth rate stocks, the F allele increased weight gain from 4 to 7 weeks. Body weight at 7 weeks of fully feathered genotype (na/na F/f) did not increase body weight at 7 weeks when compared with the Na/na geneotype. In an intensive study of the influence of frizzle gene on carcass measurements, Galal and Fathi (2001) proved that the frizzled gene improved the percentage of dressing carcass and breast muscles in normal and naked neck chickens.

The purpose of the present study was to compare the effects of naked neck (Na) allele with those of frizzle (F) allele and look for Na/F interaction effects on the perfomance of broilers during three seasons.

MATERIALS AND METHODS

The experiment was carried out at the Poultry Research Farm, Department of Poultry Production, Faculty of Agriculture, Kafr El-Sheikh University. The parent stock of this experiment included double heterozygote males (Na/na F/f) which were mated with normally feathered females (na/na f/f), to produce four genotypes : na/na f/f, Na/na f/f, na/na F/f and Na/na F/f.

Three hatches of broiler chicks were obtained in summer, autumn and winter seasons. In each hatch, all chicks were wing-banded at hatch and raised under conventional open-sided houses until they reached 7 wks of age. These houses were provided with wheat hulls as litter. The average maximum and minimum ambient temperatures and relative humidity recorded during the experimental period are listed in Table 1.

Table 1: Average ambient temperature (Max. & Min) and relative humidity recorded during experimental periods.

Age / wk	Ambient temperature (°C)						Relative humidity (%)		
	Summer		Autumn		Winter		Summer	Autumn	Winter
	Min.	Max.	Min.	Max	Min.	Max.			
3	27.6	32.0	26.5	28.7	26.9	28.0	46.3	45.2	44.3
4	27.3	31.6	25.6	28.4	21.6	26.3	43.4	47.0	49.2
5	27.0	32.6	23.7	27.5	21.0	23.2	47.4	49.1	53.2
6	25.7	33.7	22.1	25.1	20.0	22.9	43.1	52.6	58.2
7	25.8	32.9	21.4	24.2	20.1	21.4	45.3	56.3	60.3
Av.	**26.7**	**32.6**	**23.9**	**26.8**	**21.9**	**24.4**	**45.1**	**50.0**	**53.0**

Feed and water were supplied ad libitum throughout the experiment. They were fed a starter diet containing 21.3% crude protein and 3003 Kcal ME/kg (0-3 wks), a grower diet containing 19% crude protein and 3181 Kcal ME/kg (4-5 wks) and a finisher diet containing 17.5% crude protein and 3060 Kcal ME/kg (6-7 wks).

Body weights were determined to the nearest gram at 3, 5 and 7 weeks of age. The amount of feed consumed was recorded weekly, the average of feed consumption and conversion could be calculated for each replicate (two replicates) then, calculated for each genotype. Rectal temperature was measured using digital thermometer at 2 pm o'clock one day before slaughtering (48 days of age).

At 7 wks of age after recording the final body weight, 20 males and 20 females per genotype were randomly taken and sacrificed by severing the jugular vein. Feathers were machinery removed with some hand plucking necessary to insure complete defeathering and weighed to determine fresh feather weight. Abdominal fat was removed from around gizzard, proventriculus and cloaca. Skin was removed from the entire carcass excpet wings, head, neck and shank of each bird and weighed. Breast and thigh meat were dissected and weighed (meat yeild).

The data were statistically analyzed by a three way model with season (Sea), naked neck (Na) and frizzle (F) alleles as main effects and their interactions were also considered. Data were analyzed using General Linear Model (GLM) procdure of SAS ® (SAS institute, Inc., 1996) and tabular results are least square means.

RESULTS AND DISCUSSION

Body weight (BW) and weight gain (WG):

Data listed in Table 2 speculated the effect of genotype, season and their interaction on BW and WG of broiler chicks. Regardless of genotype effect, it could be noticed that the high ambient temperature (summer season) had a negative effect on BW of broiler chicks compared to normal ambient temperature (autumn and winter). The optimum temperature for performance is likely to be 19 to 22°C for laying hens and 18 to 22°C for growing broilers (Charles, 2002). Body weight was significantly lower in summer than in autumn in all genotypes (mean reduction of 13.5%), while this effect was substantially greater in WG5-7 (24%). However, BW at 7 wk of age and WG5-7 in winter was similar to those in autumn. Similar results have been obtained in controlled temperate experiments (Cahaner and Leenstra, 1992 and Cahaner et al., 1992) and in open sided poultry houses (Yalçin et al., 1997a, b). In addition, relative humidity values in the summer were somewhat below the optimum for broiler under heat exposure (Yahav et al., 1995), suggesting that the summer effect combined high temperature and low relative humidity. Concerning the effect of Na allele on BW at 3, 5 and 7 wks of age and WG5-7, it could be speculated that the presence of Na allele significantly increased BW at 5 and 7 wks of age and WG5-7 wks by about 3.9, 5.08 and 5.62%, in summer and 3.39, 4.54 and 5.11% in autumn, respectively compared with normal genotype (na/na f/f). Fewer and negative values were noticed in winter season. In other words, the advantages of Na allele was more pronounced at both summer and autumn seasons rather than at winter. Similar results were obtained by Younis (1996); Saleh and Younis (1997); Yalçin et al., 1997b and Yunis and Cahaner (1999). Likewise, Cahaner et al. (1992) reported that the heterozygous naked neck broilers gain about 3% more weight than their normally feathered sibs under commercial condition during the spring and summer months, and this advantage is almost tripled under a constant high temperature of about 32°C. The current results revealed that, the effect of F allele was more pronounced on BW at 7 wks of age. Moreover, frizzled chicks had significantly heavier body weight than normal ones in summer and autumn seasons by about 3.2 and 2.4%, respectively. However, in winter season the frizzled and normal chicks had similar BW and WG. Yunis and Cahaner (1999) stated that the F allele increased BW 7 and WG 4-7 of fully feathered broilers under constant high ambient temperature (32°C).

With respect to double segregation alleles, it could be concluded that the combination between Na and F alleles significantly increased BW at 5 and 7 wks of age and WG5-7 by about 5.8, 9.46 and 17.97%, respectively in summer season compared to normally feathered genotype (na/na f/f). Also, the effects of the two alleles acted in additive manner in the double heterozygote chicks in autumn season (3.92, 6.19 and 8.95%) in the same trend. The objective of using the F allele in this study was to decrease the level of insulation of the feather coverage of heterozygous naked neck broilers to improve further their performance under summer season. Pech-Waffenschmidt (1992) found that the effect of the F allele on growth and egg production of egg-type layers at high ambient temperature was similar to that of Na allele, and both effects were additive in the double heterozygote birds. The naked neck gene-by-season interaction had significantly affecting BW7. However, similar result was not observed for frizzle gene-by-season interaction. Though, the interaction between naked neck-frizzle genes and season interaction was not statistically significant. The naked neck broiler exhibited larger BW at a constant high ambient temperature (32°C) and normal ambient temperature (24°C) than normally feathered broilers (Cahaner et al., 1993). However, the relative advantage of the Na allele was more significant at the high ambient temperature. Yunis and Cahaner (1999) reported that, the effect of the naked neck and F alleles and their combination were more significant at the high ambient temperature (32°C) than that at the standard ambient temperature (24°C).

Feed consumption and conversion:

Feed consumption from hatch to 7 wks of age was significantly affected by season where, the birds during summer season consumed less feed than autumn and winter ones by about 9 and 12%, respectively. However, feed conversion in summer season was significantly lower by 4.5% compared to autumn and winter ones. Highly significant differences among either seasons or cool and hot rooms for feed intake and conversion in broilers were reported by Hanzle and Somes (1983); Cahaner et al. (1993); Yalçin et al. (1997b) and Yahav et al. (1998).

The effect of the Na allele on feed consumption changed with ambient temperature in seasons, from 2.86% in summer, 3.21% in autumn and 4.47% in winter. Moreover, the higher feed consumption of the naked neck birds under the three seasons could be expected due to the higher rate of heat dissipation. Feed conversion of the naked neck birds as compared to their fully feathered counterparts was 2.14% and 1.33% higher in the summer and autumn seasons and 3.66% lower in winter season, respectively. The significantly higher feed conversion of naked neck birds in the present study could be attributed to the higher growth potential of the broilers used, the rearing system, or the natural climatic high temperature. In several studies, with controlled temperature (Hanzle and Somes, 1983; Mérat, 1986 and Cahaner et al., 1993), reported that heterozygous naked neck birds exhibited no significant advantage in feed efficiency at ambient temperature of 31 to 38°C. However, Yalçin et al. (1997b) reported that feed efficiency was higher for naked neck birds by about 7-10% in the hot climates than normally feathered counterparts.

According to results in Table 2 the frizzled birds consumed more feed than normally feathered birds by about 1.87, 2.10 and 2.2% in the three seasons, respectively. However, the F allele improve feed conversion by about 1.28 and 0.44% in summer and autumn seasons, respectively. Galal (1999) reported that heterozygous frizzling females consumed more feed than normally feathered sibs by about (1.02) from 8-12 wks of age under prevailing ambient temperature of 32°C. There was a significant season by Na and F alleles interaction where the naked neck and frizzled birds consumed more feed in autumn than summer one. Also, the naked neck-frizzled birds exhibited higher feed consumption during the three seasons while it had better feed conversion by about 2.56 and 1.78% in the summer and autumn seasons and opposite effect in the winter one.

Body measurements:

Effect of Na, F and double segregation alleles on body measurements of chickens in the three seasons are summarized in Table 3. It seemed that the birds carrying either Na or F alleles exhibited significantly higher shank length and shank width than that of normally feathered ones. This longer leg associated with Na and F alleles may enhance the heat release. Moreover, the naked neck and frizzled birds had insignificantly higher keel length (all seasons) and breast width (autumn and winter seasons). The double segregation genes had a favorable effect on all traits which could partially explain the superiority of this genotype (Na/na F/f) concerning heat tolerance. These observations are in harmony with Galal (1999).

Rectal temperature:

Increasing heat conductivity of the feather coverage by reducing their number or by changing their distribution, size or shape may enhance the dissipation of internal heat, and consequently improved the birds heat tolerance (Cahaner et al., 1994). Data presented in Table 4 revealed that season had significant effect on this trait, where rectal temperature of the all genotypes increased with increasing ambient temperature, i. e., it was higher in summer season than in autumn and winter ones. The relatively lower rectal temperature was associated with either Na or F alleles, it could be noted that the Na and F alleles reduced rectal temperature by about 1.16 and 0.32% in summer, 0.95 and 0.22 in autumn and 0.37 and 0.12 in winter, respectively. Moreover, the combination of both Na and F alleles was lower rectal temperature compared to either Na or F alleles during all seasons. Insignificant interaction effects were observed, where the genotype effect increased with ambient temperature relative to the fully feathered birds. These results indicate the superiority of naked neck and frizzle alleles for heat tolerance through allowance of losing the excess amounts of heat production. A plumage reduction led to higher body surface temperature, improved heat loss and consequently, lower body temperatures under heat stress (Pech-Waffenschidt et al., 1995). Also, rectal temperature of naked neck birds was similar to normal birds in Izmir-spring and lower by 0.35°C in Izmier-summer and by 0.43°C in Adana-summer (Yalcin et al., 1997b).

Feather percent:

Relative to their normally feathered counterparts, the naked broilers exhibited lower feather percent in the three seasons, where feather percent was lower in Na/na broilers by 18.25, 16.92 and 19.13% in summer, autumn and winter, respectively. As in all previous studies (Yunis and Cahaner, 1999 and Galal, 1999), the naked neck genotype reduced feather percent by about 20%, independent of climate, sex or age. Moreover, the F allele had no effect on feather percent in all seasons while it reduced feather percent by about 4.84, 4.79 and 4.15% in all seasons, respectively. Yunis and Cahaner (1999) reported that F allele reduced feather percent at high ambient temperature (23°C) by about 5.5%. The combination between Na and F alleles had negative effect on feather percent by about 25.14, 21.54 and 21.12% in all seasons, respectively. Moreover, the effects of the two alleles were additive, the double heterozygous birds exhibited lower feather percent than the other three genotypes. Similar results was reported by Yunis and Cahaner (1999) where the reduction was 22.2%. There were no significant interactions among factors studied on the reduction in feather percent.

Carcass quality:

Highly significant differences among seasons for total fat, breast meat and meat yield were detected. These results may be due to the variation for body weight at 7 wks of age among seasons. Moreover, higher value for total fat, breast meat and meat yield were observed in winter season compared to other seasons. The proportion of breast meat+bone+skin at 7 wks of age in broiler differed among seasons in Turkey (Yalçin et al., 1997b).

Total fat relative to live body weight at 7 wks of age was reduced by the Na allele by 7.89, 8.58 and 6.72% in the three seasons, respectively compared to the normal birds. In contrary, the proportion of breast meat and meat yield in the naked neck genotype was higher than in the normal birds by 3.45, 5.68 and 5.17% (breast meat) and 2.64, 3.67 and 3.59 (meat yield) in the three seasons, respectively. A similar advantage has been reported previously by Cahaner et al. (1993) for breast meat and skin and Yalçin et al. (1997b) for breast meat+bone+skin..

The F allele did not significantly affect the total fat and breast meat percentages. However, the F allele reduced total fat percent by 1.89, 3.13 and 0.81% in the three seasons, respectively and increased breast meat percent by 1.55, 2.88 and 1.92% in the same trend. The proportion of meat yield was higher in the na/na F/f genotype while insignificant differences were found. The F allele had no effect on breast percent of low-growth rate and high-growth rate birds reared either at standard or high ambient temperature (Yunis and Cahaner, 1999). In the present study the results showed that the combination between Na and F alleles significantly reduced total fat percent by 14.22, 10.35 and 9.41 in the three seasons, respectively and increased breast meat (4.92, 8.13 and 5.5%) and meat yield (6.61, 12.54 and 4.87%) in the three seasons, respectively. The proportion of dressing carcass and breast muscles increased by frizzle gene in normal and naked neck chickens (Galal and Fathi, 2001).

In conclusion, the higher production performance and feed conversion efficiency make today's chickens more susceptible to heat stress than ever before. The increasing proportion of poultry production in tropical and sub-tropical regions makes it necessary to consider the selection strategy of today's commercial breeding program in the long run and the importance of the potential use of Na and F alleles in accentuated.

Table 2: L.S.M. ± S.E. for body weight (BW) at 3, 5 and 7 wks of age and weight gain from 5 To 7 wks of age (WG5-7), feed consumption (FC) and feed conversion (FCR) as affected by genotype, season and their interaction.

Trait	Genotype				Effect of gene		
	na/na f/f	Na/na f/f	na/na F/f	Na/na F/f	Na	F	Na+ F
Summer season							
Birds	N = 150	N = 120	N = 115	N = 112	---	---	---
BW3	563.0±7.92	553.5±8.86	576.9±15.63	575.7±17.12	-1.69	+2.47	+2.26
BW5	1012.3±14.3	1051.8±16.7	1032.6±28.4	1071.0±30.3	+3.90	+2.00	+5.80
BW7	1556.7±19.4	1635.8±25.8	1606.5±37.4	1704.0±41.3	+5.08	+3.20	+9.46
WG5-7	543.1±20.51	573.6±26.4	564.8±39.48	640.7±43.51	+5.62	+3.99	+17.9
FC	3689.7±38.4	3795.2±38.4	3759.0±38.4	3919.0±38.4	+2.86	+1.87	+6.21
FCR	2.37±0.08	2.32±0.08	2.34±0.08	2.30±0.08	-2.14	-1.28	-2.56
Autumn Season							
Birds	N = 150	N = 132	N = 125	N = 121	---	---	---
BW3	656.8±8.86	657.6±10.98	645.0±10.89	655.3±10.11	+0.12	-1.80	-0.23
BW5	1078.2±15.7	1114.7±19.3	1117.3±19.3	1120.5±17.9	+3.39	+3.63	+3.92
BW7	1808.1±21.4	1890.0±25.7	1850.7±26.1	1920.2±23.5	+4.54	+2.36	+6.19
WG5-7	734.0±22.58	771.5±27.13	727.8±27.52	799.7±24.83	+5.11	-0.85	+8.95
FC	4069.9±42.3	4200.8±42.3	4155.4±42.3	4243.8±42.3	+3.21	+2.10	+6.67
FCR	2.25±0.09	2.22±0.09	2.24±0.09	2.21±0.09	-1.33	-0.44	-1.78
Winter season							
Birds	N=145	N=137	N=120	N=122	---	---	---
BW3	660.9±6.69	660.8±7.45	672.4±9.98	658.3±10.62	-0.02	+1.74	-0.39
BW5	1110.1±11.8	1111.9±13.2	1125.3±17.7	1138.1±18.8	+0.16	+1.37	+2.52
BW7	1884.4±17.5	1896.1±21.1	1906.6±25.4	1928.6±29.2	+0.62	+1.18	+2.35
WG5-7	775.2±18.43	774.9±22.15	774.3±26.76	779.8±30.77	-0.04	-0.12	+0.59
FC	4109.7±45.3	4293.5±45.3	4200.6±45.3	4384.3±45.3	+4.47	+2.21	+6.68
FCR	2.18±0.14	2.26±0.14	2.20±0.14	2.27±0.14	+3.66	+0.92	+4.13

Source of variation

	P(*F*)						
Trait	**Sea**	**Na**	**F**	**Sea x Na**	**Sea x F**	**Na x F**	**Sea x Na x F**
BW3	<0.001	Ns	Ns	Ns	Ns	Ns	Ns
BW5	<0.001	0.01	Ns	Ns	Ns	Ns	Ns
BW7	<0.001	<0.001	0.02	0.05	Ns	Ns	Ns
WG5-7	<0.001	<0.02	Ns	Ns	Ns	Ns	Ns
FC	<0.001	<0.001	0.02	0.03	0.06	Ns	Ns
FCR	<0.001	Ns	Ns	0.05	0.09	Ns	Ns

Ns = Non significant

Table 3: L.S.M. ± S.E. for body measurements as affected by genotype, season and their interaction.

Trait	Genotype				Effect of gene		
	na/na f/f	Na/na f/f	na/na F/f	Na/na F/f	Na	F	Na+ F
Summer season							
KL	9.08±0.20	9.33±0.20	9.44±0.20	9.49±0.20	+2.75	+3.96	+4.51
SL	9.35±0.37	9.88±0.37	9.95±0.37	10.0±0.37	+5.66	+6.52	+6.95
SW	4.75±0.15	4.76±0.15	4.69±0.15	4.71±0.15	+0.21	-1.26	-0.84
BA	96.12±2.58	96.87±2.58	96.12±2.58	96.75±2.58	+0.78	0.0	+0.66
BW	25.09±0.43	25.25±0.43	25.85±0.43	25.47±0.43	+1.0	+3.4	+1.88
Autumn Season							
KL	9.00±0.20	9.19±0.20	9.30±0.20	9.84±0.20	+2.11	+3.33	+9.33
SL	8.55±0.37	8.70±0.37	8.93±0.37	9.16±0.37	+1.75	+4.44	+7.13
SW	5.00±0.15	4.96±0.15	4.97±0.15	5.14±0.15	+0.8	-0.6	+2.8
BA	98.00±2.58	99.65±2.58	99.63±2.58	101.3±2.58	+1.68	+1.66	+3.37
BW	28.68±0.43	29.36±0.43	29.56±0.43	29.83±43	+2.37	+3.07	+4.01
Winter season							
KL	9.20±0.20	9.40±0.20	9.35±0.20	9.53±0.20	+2.17	+1.63	+3.59
SL	8.39±0.37	9.13±0.37	8.90±0.37	8.969±0.37	+8.82	+6.08	+6.76
SW	4.54±0.15	4.88±0.15	4.87±0.15	4.98±0.15	+7.49	+7.27	+9.69
BA	97.88±2.58	98.38±2.58	98.31±2.58	99.38±2.58	+0.51	+0.44	+1.53
BW	27.8±0.43	28.76±0.43	28.83±0.43	28.96±0.43	+3.45	+3.70	+4.17

Source of variation

P(*F*)

Trait	Sea	Na	F	Sea x Na	Sea x F	Na x F	Sea x Na x F
KL	<0.05	Ns	Ns	Ns	Ns	0.06	0.02
SL	<0.001	0.05	0.05	Ns	Ns	Ns	0.03
SW	Ns	<0.03	0.04	Ns	Ns	0.01	0.001
BA	<0.001	Ns	Ns	Ns	0.05	Ns	Ns
BW	<0.001	Ns	Ns	Ns	Ns	Ns	0.01

KL = Keel length, SL = Shank length, SW = Shank width,
BA = Breast angle and BW = Breast width.
Ns = Non significant

Table 4: L.S.M. ± S.E. for rectal temperature (R.T.), Feather %, total fat %, breast meat %, meat yield % as affected by genotype, season and their interaction.

Trait	Genotype				Effect of gene		
	na/na f/f	Na/na f/f	na/naF/f	Na/naF/f	Na	F	Na+ F
Summer season							
Birds	N=20	N=20	N=20	N=20	……	……	……
R. T	41.51±0.2	41.03±0.2	41.38±0.2	41.00±0.2	-1.16	-0.32	-1.23
Feather, %	5.37±0.66	4.39±0.66	5.11±0.66	4.02±0.66	-18.25	-4.84	-25.14
Total fat*, %	6.89±0.43	6.35±0.43	6.76±0.43	5.91±0.43	-7.89	-1.89	-14.22
Breast meat %	11.58±0.5	11.98±0.5	11.76±0.5	12.25±0.5	+3.45	+1.6	+5.78
Meat Yield,%	28.83±1.1	29.59±1.1	29.11±1.1	30.13±1.1	+2.64	+0.9	+4.43
Autumn season							
Birds	N=20	N=20	N=20	N=20	……	……	……
R. T	40.99±0.1	40.60±0.1	40.90±0.1	40.51±0.1	-0.95	-0.22	-1.17
Feather, %	5.85±0.66	4.86±0.66	5.57±0.66	4.59±0.66	-16.92	-4.79	-21.54
Total fat*, %	7.34±0.43	6.71±0.43	7.11±0.43	6.58±0.43	-8.58	-3.13	-10.35
Breast meat %	11.44±0.5	12.09±0.5	11.77±0.5	12.37±0.5	-5.68	+2.9	+8.13
Meat Yield,%	29.19±1.1	30.26±1.1	29.62±1.1	31.15±1.1	+3.67	+1.5	+6.71
Winter season							
Birds	N=20	N=20	N=20	N=20	……	……	……
R. T	40.65±0.1	40.50±0.1	40.60±0.1	40.38±0.1	-0.37	-0.12	-0.66
Feather, %	5.54±0.66	4.48±0.66	5.31±0.66	4.37±0.66	-19.13	-4.15	-21.12
Total fat*, %	7.44±0.43	6.94±0.43	7.38±0.43	6.74±0.43	-6.72	-0.81	-9.41
Breast meat %	12.00±0.5	12.62±0.5	12.23±0.5	12.66±0.5	+5.17	+1.9	+5.50
Meat Yield,%	30.39±1.1	31.48±1.1	30.92±1.1	31.82±1.1	+3.59	+1.7	+4.71

Source of variation

P(*F*)

Trait	Sea	Na	F	Sea x Na	Sea x F	Na x F	Sea x Na x F
R. T	<0.001	<0.001	Ns	Ns	NS	NS	NS
Feather, %	Ns	0.003	Ns	Ns	Ns	Ns	NS
Total fat*, %	<0.001	<0.001	0.01	0.03	<0.04	Ns	NS
Breast meat %	<0.001	<0.04	0.04	Ns	Ns	Ns	NS
Meat Yield,%	<0.001	<0.003	Ns	Ns	Ns	Ns	NS

* Total fat = Abdominal fat plus skin
Ns= Non significant

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الملخص العربى

تأثير التداخل بين التركيب الوراثي والبيئة على الأداء الإنتاجي لدجاج التسمين

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أجريت هذه الدراسة للتقييم المعنوي لتداخل التركيب الوراثي والبيئة بالنسبة لمربى الدواجن في المناطق شبه الحارة. ثلاث ظروف بيئية كانت مراعاة هي فصول الصيف (٣٢°م، رطوبة نسبية ٤٥,١%)، الخريف (٢٦°م، رطوبة نسبية ٥٠%) والشتاء (٢٤,٤°م ، رطوبة نسبية ٠,٥٣%). قطيع التجربة كان مكون من ٥٠٠ كتكوت تسمين لكل موسم تقريبا ويحتوى على أربع تراكيب وراثية هي : كتاكيت طبيعية، عارية الرقبة، طبيعية الرقبة مجعدة الريش، عارية الرقبة-مجعدة الريش).

أظهرت النتائج أن فصل الصيف ذات تأثير سلبى على وزن الجسم والزيادة في الوزن لكتاكيت التسمين مقارنة بدرجات الحرارة العادية (فصلي الخريف والشتاء). جين عرى الرقبة أظهر زيادة معنوية فى وزن الجسم عند ٥، ٧ أسابيع وكذلك الزيادة في الوزن من ٥-٧ أسابيع من العمر بحوالي ٣,٩، ٥,٠٨، ٥,٦٢% في فصل الصيف، ٣,٣٩، ٤,٥٤، ٥,١١% في فصل الخريف على التوالي .

أيضا الكتاكيت المجعدة الريش كانت أثقل معنويا في وزن الجسم عند ٧ أسابيع عن الكتاكيت الطبيعية في فصلى الصيف والخريف بحوالي ٣,٢، ٢,٤% على التوالي.

تأثير اتحاد عاملي عرى الرقبة والريش المجعد كان أفضل على وزن الجسم عند عمر ٧ أسابيع فى فصلى الصيف والخريف (٩,٥ ، ٦,٢% على التوالى). علاوة على ذلك ، تداخل جين عرى الرقبة مع فصل السنة كان له تأثير معنوى على وزن الجسم عند ٧ أسابيع. ولكن النتائج غير مشابهة لذلك بالنسبة لتداخل جين الريش المجعد مع فصل السنة. التداخل بين فصل السنة وعامل عرى الرقبة وعامل الريش المجعد كان إحصائيا غير معنوى. الكفاءة الغذائية فى فصل الصيف كانت معنويا اقل بحوالى ٤,٥% مقارنة بفصلى الخريف والشتاء. كان هناك تداخل معنوى بين فصل السنة وجين عرى الرقبة والريش المجعد حيث كانت الطيور العارية الرقبة والمجعدة الريش تستهلك علف اكثر فى فصلى الخريف والشتاء مقارنة بفصل الصيف بينما كانت هذه الطيور احسن فى الكفاءة الغذائية بحوالى ٢,٥٦ ، ١,٧٨% فى فصل الصيف والخريف.

الانخفاض النسبى لدرجة حرارة المستقيم كان مصاحبا لجين عرى الرقبة والريش المجعد وكذلك اتحادهما معا خلال فصول السنة. ولكن تأثيرات التداخل غير معنوية كانت مشاهدة حيث تأثير التراكيب الوراثية مع درجات الحرارة. جين عرى الرقبة تفاعل مع جين الريش المجعد مع الموسم بالنسبة لنسبة الدهن حيث وجد ان عامل عرى الرقبة قلل نسبة الدهن بحوالى ٧,٨٩، ٨,٥٨، ٦,٧٢% بينما عامل الريش المجعد قلل نسبة الدهن بحوالى ١,٨٩، ٣,١٣، ٠,٨١% خلال الثلاث فصول على التوالى كذلك الاتحاد بين العاملين كان معنويا حيث قلل نسبة الدهن بحوالى ١٤,٢٢، ١٠,٣٥، ٩,٤١% وزاد لحم الصدر بحوالى ٥,٧٨، ٨,١٣، ٥,٥٠% وكذلك محصول اللحم بحوالى ٤,٤٣، ٦,٧١، ٤,٧١% خلال فصول السنة الثلاثة على التوالى.