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SOME PHYSIOLOGICAL RESPONSES TO CROSSING OSSIMI OR SAIDI EWES WITH CHIOS RAMS

M.A. EL-Barody[1], E.B. Abdalla[2] and A.A. Abd El- Hakeam[1]

1- Department of Animal Production, Faculty of Agriculture, Minia University, Minia, Egypt, 2- Department of Animal Production, Faculty of Agriculture, Ain Shams University, Cairo, Egypt

SUMMARY

This study was undertaken to evaluate some physiological traits of ewes, representing four genotypes namely, Ossimi (O), Saidi (S) and their crosses with Chios (C), ½ Chios ½ Ossimi (CO) and ½ Chios ½ Saidi (CS) under Minia province conditions. Average daily milk yield, total milk yield and lactation period length were significantly ($P < 0.01$) affected by genotype of ewes. Crossbred ewes recorded higher ($P<0.05$) values of these parameters than the pure local breed and CS ewes were superior in this respect compared with CO ewes. However, none of milk constituents (fat, total solids, solids non-fat and lactose) was affected by genotype. High lactating ewes had higher ($P < 0.05$) prolactin concentration than low lactating. Milk production was found to be correlated with plasma prolactin concentration ($r = 0.67$, $P< 0.05$). Genotype of ewes had a significant ($P < 0.01$) effect on prolactin profile.

Body weight of lambs at birth, weaning (2 months) and 4 months old significantly ($P < 0.01$) differed among the various genotypes studied. Crossbred lambs (CO) recorded the heaviest ($P < 0.05$) birth and weaning weight than the other three groups. Daily body weight gain at weaning was significantly ($P < 0.05$) affected by genotype, being higher in the crossbred lambs compared with the pure breed. Plasma thyroxine (T_4), glucose, cholesterol and total protein at birth, weaning and 4 months of age were significantly ($P<0.05$) affected by genotype, being higher in the crossbred lambs. Body weight of lambs was negatively correlated with plasma T_4 concentration ($r = -0.84$, $P < 0.01$) with advancing age from birth to 12 months. Present results indicate that crossing local non-dairy ewes with foreign Chios rams may improve the lactation performance of ewes and the growth rate of their lambs under sub-tropical environmental conditions.

Keywords: Sheep breeds, lactation performance, growth rate, T_4, prolactin

INTRODUCTION

Preweaning growth of lambs is largely dependent on the amount of milk consumed from dam (Aboul Naga *et al.*, 1981). Ewe's milk yield is an important component for lamb growth, which depends, in part, on the breed of ewe (Peart *et al.*, 1972). In Egypt, local Ossimi sheep is poor in prolificacy (1.1 lambs per ewe lambing; Marzouk, 1986) and low in milk production (65.5 kg in 79.7 days; Mousa and Shetaewi, 1994). Saidi sheep is characterized by slightly high prolificacy (1.3 lambs per ewe lambing; Marzouk, 1986) and low milk production (64.7 kg in 135 days; Hassan, 1995). Chios sheep, imported from Cyprus, is characterized by high milk production (267 kg in 220 days), considerably high prolificacy (1.8 lambs per ewe lambing), early sexual maturity (8 to 9 months) and had satisfactory growth rate of lambs (0.20 to 0.25 kg/day) (Louca, 1972).

Several investigations in Egypt have been conducted to estimate the effect of crossing local sheep breeds with foreign Chios breed on growth performance, some reproductive traits (Suliman, 1994), milk production and some milk constituents (Hassan, 1995). However, the endocrine mechanisms in terms of prolactin profile of ewes of such crosses in association with their milk yield, as well as thyroid activity and some blood metabolites of lambs in association with their growth performance have not been investigated. Undoubtedly, the relationship between thyroxine (T_4) and the growth performance of lambs as well as the relationship between prolactin profile and pattern of milk production of ewes should lead to a better understanding of the mechanisms through which growth and milk production are controlled in different genotypes of sheep.

MATERIALS AND METHODS

This study was carried out at the Experimental Research Station belonging to Animal Production Department, Faculty of Agriculture, Minia University. Forty-seven ewes, representing four genotypes were used: Ossimi (O, n=15), Saidi (S, n=12), and two F1 crosses, Chios x Ossimi (CO, n=10) and

Chios x Saidi (CS, n=10) obtained by mating Chios (C) rams with O and S ewes. Ewes were mated for the first time at one year old to rams of two years old. Breeding season reasonably lasted two months (May - June). Animals were fed a concentrate mixture (12.5 % cotton seed meal, 12.5 % cotton seed hulls, 6 % extracted rice bran, 44 % wheat bran, 19 % yellow corn, 3 % molasses, 2 % calcium carbonate and 1 % common salt) 0.5 kg/ head/day, which increased to 1 kg during late pregnancy and lactation. Beside the concentrate mixture, they were fed green berseem (*Trifolium alexandrinum*) during winter and grazed drawa (green corn plants) in summer. Average air temperature and relative humidity were 37.3 ^{0}C and 62.1% in summer, and 10.2 ^{0}C and 73.5% in winter, respectively.

Milk yield was determined throughout 24-hour period at biweekly interval till 22 weeks of lactation using the technique of partial milking (Hassan, 1995). Milk samples were taken from a mixture of morning and evening milk yields. Milk fat, protein, lactose and total solids percentages were determined according to Ling (1963). Heparinized blood samples were taken from ewes of each experimental group at the same time of milk recording, before drinking and feeding. Blood plasma samples were harvested and prolactin concentration was determined using a double-antibody radioimmunoassay (Fell *et al.*, 1972). The intra-and inter- assays precision as determined by coefficients of variation were 11 and 13%, respectively.

To exclude the sex effect, only male lambs (8 O, 7 S, 8 CO, 7 CS) were used in this study. Lambs born were kept with their dams till weaning (2 months). Birth weight was recorded within 24 hours from birth and weaning weight at 2 months of age. Lambs were gradually fed starter consisted of 24 % wheat bran, 24 % rice bran, 23 % ground corn, 15 % molasses, 7 % cotton seed meal, 4 % soybean meal, 2.5 % limestone, 0.5 % common salt and blocks of minerals and vitamins mixture, in addition to drawa in summer and berseem in winter up to 4 months of age. Thereafter, lambs were fed the same concentrate pelleted diet of ewes. Lambs were weighed monthly after weaning till yearling. Heparinized blood samples were collected from all lambs of each breed at birth, weaning, 4 ,8 and 12 months of age. Blood plasma samples were harvested and analyzed for throxine (T_4), using radioimmunoassay technique (Rumsey *et al.*, 1990). The intra-and inter-assay coefficients of variation were 4.2 and 6.6%, respectively. Plasma glucose, total protein and cholesterol were determined using commercial kits (Bio-Merieux Laboratory Regents and Products, France). Data were statistically analyzed according to SAS (1990) using the general linear model (GLM) procedure. Significant differences among means of the breeds were detected using Duncan's multiple range test (Duncan, 1955).

RESULTS

1. Milk performance and prolactin level of ewes:

Highly significant differences ($P<0.01$) in the average daily milk yield, total milk yield, lactation period and plasma prolactin levels were found among the various genotypes (Table 1). Crossbred (CS) had the highest average daily milk yield (581±31.0 g), highest total milk yield (86.6 ± 7.0 kg) and longest lactation period (149±7.4 days). On the other hand, Ossimi had the lowest values for these parameters compared with the other three groups. Twinning percentage was very low being almost similar in all breed groups, therefore the effect of twinning on milk yield was neglected. The differences in milk composition (fat, total solids, solids non-fat and lactose) due to breed were not significant. Results in Table (1) also revealed that prolactin levels were paralleled with the milk yield performance. Significant positive correlation between both was detected ($r= 0.67$, $P<0.05$). The difference in prolactin level due to breed was significant ($P < 0.01$). The hormone level was higher in the crossbred ewes compared with the pure breed.

Table 1. Overall means (±SE) of a 22-week duration for lactation performance and plasma prolactin level in Ossimi, Saidi and their crosses with Chios sheep

Parameter	Genotype of ewe				Significance
	O	S	C X O	C X S	
Daily milk yield (g)	453±23.2^{a}	475±25.4^{a}	568±32.1^{b}	581±31.0^{b}	(P<0.01)
Total milk yield (kg)	53.9±6.1^{a}	63.2±6.3^{a}	85.4±6.7^{b}	86.6±7.0^{b}	(P<0.01)
Lactation period (day)	119±5.2^{a}	133±5.8^{a}	147±6.4^{b}	149±7.4^{b}	(P<0.01)
Fat (%)	5.6±0.21	5.7±0.23	5.9±0.19	5.8±0.20	ns
Total solids (%)	18.6±0.16	18.9±0.19	18.9±0.22	18.8±0.24	ns
Solids non-fat (%)	13.0±0.15	13.2±0.19	13.0±0.23	13.0±0.25	ns
Lactose (%)	4.8±0.12	4.9±0.14	4.9±0.16	4.9±0.19	ns
Prolactin (ng/ml)	4.6±0.12^{a}	4.7±0.10^{a}	5.3±0.17^{b}	5.8±0.18^{b}	(P<0.01)

O = Ossimi, S = Saidi, C X O = Chios X Ossimi, C X S = Chios X Saidi, ns = non-significant.

a, b Means in the same row with different superscripts are significantly (P<0.05) different.

2. Growth performance and blood metabolites of lambs:

Breed differences in body weight were recorded (Table 2) at birth and weaning (P<0.01) and at 4 months of age (P<0.05). There was also a significant breed effect on daily body weight gain at weaning only and it became insignificant thereafter. Blood plasma concentrations of glucose, cholesterol and total protein and body weight tended to increase, while concentration of T_4 and daily gain tended to decrease with advancing age (Tables 2&3). The significant negative correlation between body weight of lambs and plasma T_4 concentration was detected (r = -0.84, P<0.01). Breed differences (P<0.01) were shown for T_4, glucose, cholesterol and total protein levels. Crossbred lambs (CO), the heaviest ones, had the highest levels of these parameters, while Saidi lambs (S), the lightest ones, recorded the lowest values.

Table 2. Least squares means (±SE) for body weight and daily body weight gain of lambs as affected by genotype

Traits	Birth	Weaning	4 months	8 months	12 months
		Body weight (kg)			
Genotype:	(P<0.01)	(P<0.01)	(P<0.05)	ns	ns
Ossimi	3.5±0.2^a	13.9±0.4^a	16.4±0.7^a	24.1±1.8	29.4±2.0
Saidi	3.3±0.1^b	12.3±0.5^b	14.8±0.6^b	24.2±1.7	29.5±2.0
Chios X Ossimi	3.9±0.1^c	16.5±0.5^c	17.3±0.6^c	25.4±1.6	32.0±1.6
Chios X Saidi	3.7±0.1^d	14.8±0.5^d	17.4±0.6^c	25.6±1.6	32.4±1.6
		Daily gain (kg)			
Genotype:		(P<0.05)	ns	ns	ns
Ossimi		0.17±0.02^a	0.11±0.01	0.09±0.01	0.07±0.01
Saidi		0.15±0.01^b	0.10±0.01	0.09±0.01	0.07±0.01
Chios X Ossimi		0.21±0.01^c	0.11±0.01	0.09±0.01	0.08±0.01
Chios X Saidi		0.19±0.01^d	0.11±0.01	0.09±0.01	0.08±0.01

Weaning age = 2 months, ns = non-significant.
Daily gain was calculated from birth to the designated ages.
^{a,b,c,d} Means in the same column within each parameter with different superscripts are significantly (P<0.05) different.

Table 3. Least squares means (±SE) for plasma thyroxine (T_4), glucose, cholesterol and total protein levels of lambs as affected by genotype

Traits	Birth	Weaning	4 months	8 months	12 months
			T_4 (ng/ml)		
Genotype:	(P<0.01)	(P<0.01)	(P<0.05)	ns	ns
Ossimi	150±0.04^a	130±0.01^a	85±0.15^a	50±0.64	48±0.36
Saidi	130±0.03^b	110±0.02^b	70±0.14^b	49±0.62	49±0.34
Chios X Ossimi	190±0.01^c	160±0.04^c	110±0.13^c	59±0.59	52±0.32
Chios X Saidi	170±0.02^d	140±0.03^d	90±0.11^d	54±0.54	51±0.35
			Glucose (mg/dl)		
Genotype:	(P<0.01)	(P<0.01)	(P<0.05)	ns	ns
Ossimi	31.6±1.11^a	61.1±1.19^a	68.3±1.15^a	77.8±1.13	83.8±1.16
Saidi	29.9 ±1.13^b	77.4±1.22^b	79.5±1.18^b	81.8±1.12	82.9±1.17
Chios X Ossimi	38.4±1.18^c	79.2±1.28^c	82.0±1.19^c	85.4±1.11	87.0±1.19
Chios X Saidi	34.1±1.20^d	74.9±1.31^d	81.4±1.20^c	82.8±1.40	84.9±1.22
			Cholesterol (mg/dl)		
Genotype:	(P<0.01)	(P<0.01)	(P<0.05)	ns	ns
Ossimi	50.4±1.37^a	53.1±1.08^a	58.7±1.26^a	62.5±1.54	63.2±1.42
Saidi	48.1±1.28^b	50.1±0.94^b	53.2±1.18^b	60.1±1.34	63.1±1.35
Chios X Ossimi	59.2±1.14^c	61.1±0.93^c	65.8±1.07^c	63.2±1.30	63.8±1.22
Chios X Saidi	54.1±1.19^d	57.1±0.92^d	59.1±1.05^d	62.9±1.39	63.6±1.20
			Total protein (g/dl)		
Genotype:	(P<0.01)	(P<0.01)	(P<0.05)	ns	ns
Ossimi	7.1±0.29^a	7.6±0.28^a	7.6±0.27^a	8.0±0.28	8.2±0.26
Saidi	6.5±0.25^b	6.5±0.26^b	6.9±0.25^b	8.0±0.26	8.1±0.23
Chios X Ossimi	8.2±0.24^c	9.0±0.20^c	9.0±0.23^c	8.1±0.24	8.2±0.22
Chios X Saidi	8.0±0.30^c	8.5±0.25^d	8.7±0.29^d	8.1±0.30	8.1±0.27

ns = non-significant.
$^{a, b, c, d}$ Means in the same column within each parameter with different superscripts are significantly (P<0.05) different.

DISCUSSION

The superiority of crossbred ewes (Chios x Ossimi & Chios x Saidi) in average daily milk yield, total milk yield and lactation period over that of either Ossimi or Saidi ewes are in agreement with those reported for Ossimi, Awassi and their crosses with Chios sheep (Mousa, 1991) and for Flemish milksheep, Suffolk and Texel ewes and their crosses (Peeters *et al.*, 1992). They found that such crossbred ewes had the highest milk yield than the pure ones. Present data confirmed that crossing imported dairy breed (Chios) with local non-dairy breed might help in increasing milk yield under Egyptian environmental conditions. However, the magnitude of such increase is largely dependent on the genetic potential of each local breed.

The insignificant effect of crossbreeding on milk composition is in agreement with the previous results reported by Sakul and Boylan (1992). They reported similar insignificant differences among breeds in percentage of milk fat. Peeters *et al.* (1992), working on Flemish, Suffolk and Texel ewes and their crosses, found that percentage of fat was not significantly influenced by breed of ewe during the first 45 days of lactation. Also, Hassan (1995) working on Ossimi, Saidi and their crosses with Chios, reported similar results. The insignificant effect of breed on milk total solids in the present study is in agreement with the results reported by Aboul Naga *et al.* (1981), Peeters *et al.* (1992) and Hassan (1995). However, the mechanism by which genotype affecting milk composition is not fully understood.

Prolactin concentration in farm animals is variable, such variability depends to large extent on age, sex, season, physiological status, breed, photoperiod, climatic conditions...etc (Abdalla *et al.*, 1989; Von Brackel-Bodenhausen *et al.*, 1994). The highly significant breed effect on prolactin levels observed in the present study is in a harmony with previous results reported by Fawzy and El-Harairy (1996). In addition, they found that crosses had intermediate prolactin values between the two parents, suggesting possible genetic effect on prolactin concentration. Prolactin is an important hormone for the initiation and maintenance of lactation in the ewe (Hooley *et al.*, 1978).

In respect to the effect of genotype on body weight at birth, weaning and 4 months of age, Salam *et al.* (1990) and El-Barody *et al.* (1996) working on goats reported significant differences in body weight of kids at 3, 6 and 9 months of age among breeds. El-Barody *et al.* (1996) added that crossing local goats with exotic breeds improved their body weight. This may explain the superiority of body weight of crossbred lambs (CO and CS) compared with the O and S lambs in the present study. The insignificant effect of genotype on daily gain of lambs at the most age stages, indicate the ability of local breed of lambs to compensate for smaller body weight with advancing age. Kanaujia *et al.* (1985) reported that breed of lambs did not significantly affect either preweaning or postweaning daily gain of lambs. In the present study, growth rate of lambs decreased, and body weight increased which was negatively correlated with the thyroid secretion of T_4 (r= -0.84). Similar trend was found by Falconer and Robertson (1961) in sheep and Falconer and Draper (1968) in cattle. Those authors mentioned that the young growing individual of all species has a higher thyroid hormone output per unit body weight than the adult. The changes in blood constituents of glucose, total protein, cholesterol and T_4 as affected by genotype in the present study are in agreement with the previous results reported by Mert *et al.* (1998) in various sheep breeds. Moreover, Carstens *et al.* (1997) found that plasma glucose, T_3, T_4, cortisone and NEFA were higher at birth in Brahman than Angus calves. In conclusion, milk yield of ewes, growth performance of lambs and blood concentrations of prolactin and T_4 were generally higher in the crossbreds than in the pure local breeds.

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