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Original article

Placental traits and their relation with birth weight in Meriz and Black goats

J.E. Alkass, K.Y. Merkhan*, R.A.H. Hamo
Animal Production Department, Faculty of Agriculture and Forestry, University of Duhok, Kurdistan Region, Iraq.

*Corresponding author; Animal Production Dept., Faculty of Agriculture and Forestry, University of Duhok, Kurdistan Region, Iraq; Mobile phone: 009647504741916.

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ABSTRACT

At a commercial farm of goat, Duhok province, Kurdistan Region, Iraq, the relationship between placental traits and birth weight of kids together with some factors affecting these traits were investigated in this study. A total of 79 foetal placental delivered at normal kidding were collected from Black goat (n=33) and Meriz (n=46). The results revealed that neither breed of goat nor sex had a significant effect on all placental traits. A positive correlation between birth weight (BW) of kids and each of placental efficiency (PE) (r=0.38; P≤0.01), placental weight (PW) (r = 0.01, P≥0.05), cotyledon weight (CW) (r = 0.08, P≥0.05) was found, and a non significant negative correlations was noticed between BW and each of cotyledon number (CN) (r = -0.05, P≥0.05), and cotyledon density (CD) (r = -0.12, P≥0.05). PW is positively correlated with the CW (r = 0.73, P≤0.01) and CN (r = 0.41, P≤0.01) and negatively correlated with PE (r = 0.80, P≤0.01) and CD (r = -0.46, P≤0.01). Results showed a significant positive correlation between placental efficiency and each of birth weight of kids and cotyledon density.

1. Introduction

In ruminants, including goat, neonatal mortality has an important influence on the productivity of the farm and indicator for sustainability of the flock. Hence placental growth and development of its functional ability are important because they are the means by which the fetus received metabolic substances for growth (Ocak and Onder, 2011), therefore, the survival of a newborn is affected by sufficiency of placenta (Mellor and Stafford, 2004).

In goat and sheep, a positive correlation was found between birth weight and the weight of cotyledons (Alexander, 1964; Alkass et al., 1999; Osgerby et al., 2003; Madibela, 2004; Oramari et al., 2011). Also, it has been reported that the number of cotyledons per fetus varies between and within breed, litter size, sex and environmental conditions (Alexander, 1964).

Meriz goat is found along the northern boarder of Kurdistan region of Iraq. It is white, red or brown and some are mixture of these colors. This breed is raised primarily for its fine hair. The Black goat is distributed all over the country. Its color varies with a dominance of grey or black. This goat is of medium size and suited to grazing over vast areas and raised mainly for meat and milk production (Alkass and Juma, 2005). Since no studies have been carried out on birth weight and placental traits of Meriz goats in particular, therefore, the aim of the current investigation was to evaluate some placental factors as affected by some maternal traits as well as its relationships with the newborn birth weight of Meriz and Black goat kids.

2. Materials and methods

A total of seventy nine fetal placenta delivered at normal kidding were collected from Black goat (n=33) and Meriz (n=46) maintained at a commercial farm during kidding season 2013. Immediately after parturition, placentas were collected and weighed with the aid of digital scales. The cotyledons were separated from the placenta, counted (CN) and weighed (CW). Placental efficiency (PE) was expressed as the rate of total kid birth weight (g) to placental weight (PW) (g) (Molteni et al., 1978). Cotyledon density (CD) was defined as the number of cotyledons per gram placental weight (Ocak and Onder, 2011). The weights of kids (BW) and their dams were recorded by digital balance within 24 hours post kidding. The data were statistically analyzed by General Linear Model using SAS (2005) according to the following module:

$Yijkl = \mu + Bi + Aj + Sk + b(xl - x) + eijkl$

Where:

Yijkl= Measurements on mth observation;

μ = Overall mean;

Bi = Effect of ith Breed (i = Black goat, Meriz);

Aj = Effect of jth Parity (j = 1, 2, 3, 4 and more);

Sk= Effect of kth Sex of birth (k = Male, Female);

b (xl-x)= the regression coefficient of studied traits on dam weight at kidding.

eijkl =Experimental error assumed to be NID with (0, $\sigma 2$ e).

Also, Duncan multiple test was used to detect differences among least square means within each factors (Duncan, 1955). Correlation Coefficients among all studied traits were calculated.

3. Results and discussion

The present investigation was aimed at characterizing relationship between placental traits in two goat breeds. In the present study, results revealed that the effect of breed was not a significant source of variation in all studied placental traits. Similar finding was noticed by Ocak et al. (2009) on different breeds and/or genotypes of sheep. Also, Ocak and Onder (2011) indicated that no significant differences exist among Saanen, German Fawn and Damascus in PW, PE and CW. However, Black goat kids surpassed significantly ($P \leq 0.05$) Meriz kids in birth weight (3.00 vs. 2.66 kg). Such result is in accordance with those reported earlier by Ocak and Onder (2011) on different genotypes of goat.

Placental traits were not affected significantly by fetal sex, and this result was in agreement with previous studies in sheep (Rhind et al., 1980; Al-Rawi et al., 2002; Ocak et al., 2009; Oramari et al., 2011), beef cattle (Echterncamp, 1993). However, the CW, CN and PW was higher ($P \geq 0.05$) in case of males as compared to females were the corresponding birth weight of kids (2.90, vs. 2.71 kg) (Table 1). The explanation of the sex differences as suggested by Alexander (1964) could be due to differences in the vascularity of the placenta or in the placental transfer mechanism.

Table 1
Least square means±SE for the factors affecting birth weight, placental weight and efficiency of Black and Meriz goats.

Trait	No.	Birth Wt (kg)	Placental Wt (gm)	Placental efficiency
Overall mean	79	2.80 ±0.04	259.53 ±8.30	12.13 ± 0.52
Breed		*	NS	NS
Black goat	33	3.004 ±0.05[a]	260.16 ±11.56[a]	12.94 ±0.85[a]
Meriz	46	2.66 ±0.06[b]	259.13 ± 11.55[a]	11.56 ± 0.66[a]
Parity		NS	NS	NS
1	16	2.75 ±0.11[a]	236.0 ±18.86[a]	12.29 ± 1.24[a]
2	25	2.91 ±0.10[a]	266.66 ±12.18[a]	12.15 ± 0.94[a]
3	13	2.65 ±0.06[a]	263.07 ±25.97[a]	12.31 ± 1.46[a]
4 and more	25	2.81 ± 0.06[a]	265.20 ±14.77[a]	11.93 ± 0.90[a]
Sex of birth		*	NS	NS
Male	37	2.90 ± 0.06[a]	273.71 ± 12.86[a]	11.68 ± 0.72[a]
Female	42	2.71 ±0.06[b]	247.43 ±10.56[a]	12.53 ± 0.76[a]
Regression on				
Dam weight at kidding		0.022 ± 0.01*	2.31 ±0.8[NS]	-0.01 ±0.10[NS]

Means with different letters within each column within each factor are significantly different (P<0.05).

Table 2
Least-square means ± standard errors of cotyledon weight, number and density as affected by the examined factors.

Trait	No.	Cotyledon Wt (gm)	Cotyledon No.	Cotyledon density
Overall mean	79	92.92 ±3.72	103.18 ±3.0	0.40 ± 0.01
Breed		NS	NS	NS
Black goat	33	93.29 ± 5.99[a]	103.50 ±4.61[a]	0.39 ±0.02[a]
Meriz	46	92.67 ±4.81[a]	102.97 ±3.98[a]	0.40 ±0.01[a]
Parity		NS	*	*
1	16	81.36 ± 8.58[a]	104.75 ±6.58[ab]	0.45 ± 0.04[a]
2	25	93.09 ±5.73[a]	114.50 ± 4.39[a]	0.45 ±0.02[a]
3	13	104.08 ±10.02[a]	95.50 ±6.54[b]	0.35 ± 0.02[b]
4 and more	25	94.42 ± 6.87[a]	94.30 ±5.90[b]	0.34 ± 0.01[b]
Sex of birth		NS	NS	NS
Male	37	97.45 ±5.25[a]	107.42 ±4.55[a]	0.38 ± 0.01[a]
Female	42	88.94 ±5.25[a]	99.47 ±3.93[a]	0.41 ± 0.76[a]
Regression on				
Dam weight at kidding		0.86 ±0.81[NS]	-1.45 ±0.64*	-0.01 ± 0.003**

Means with different letters within each column within each factor are significantly different (P<0.05).

In the present work, results indicated that parity had a significant (P≤0.05) effect on CN and CD only (Table 2). Second parity does have greater number of cotyledons than did the third and higher parity does. Also, increasing maternal parity is associated with decreasing CD. Moreover, PE did not change with parity of doe in the current study. Such results are consistent with the finding of Konyali et al. (2007). On the other hand, elevated placenta efficiency in beef cattle and sheep was found with an increase in parity (Echternkamp, 1993; Dwyer et al., 2005). Such discrepancy in result is difficult to explain, but it can be clarified with histological studies at this point.

The regression of birth weight of kids was positive on dam weight at kidding (0.022±0.01, P≤0.05) and each of CN and CD were negatively correlated on dam weight at kidding (-1.45±0.64, P≤0.05) and (-0.01±0.003, P≤0.01), respectively. Also, investigators claimed that the weight of dam at kidding was significantly correlated with birth weight of their kids (Jawasreh, 2003).

Correlation coefficients of placental traits are given in Table (3). A positive correlation between BW and PE (r=0.38; P≤0.01) was found. Also, a non significant positive correlation was observed between BW and each of PW, and CW, and a non significant negative correlation was noticed between BW and each of CN and CD. The relationship between BW and PE is in agreement with previous studies in different breeds and/or genotypes of sheep (Ocak et at., 2009). It has been previously demonstrated that in appropriate maternal nutrition at key stages of pregnancy is one of the measureable factors leading to decreased live weight (Wallace et al., 1999). It was indicated that the nutrition of dam and the size of placenta are well known to determine the fetal growth rate (Mellor, 1980). Knight et al. (1988), konyali et al. (2007), Jawasreh et al., (2009), Alkass et al. (1999) and Oramari et al. (2011) showed that birth weight was strongly associated with placental traits such as placental weight.

Table 3
Correlation coefficients among birth weight and placental traits.

Traits	BW	PW	CW	CN	PE
PW	0.01^{NS}				
CW	0.08^{NS}	0.73**			
CN	-0.05^{NS}	0.41**	0.37**		
PE	0.38**	-0.80**	-0.52**	-0.45**	
CD	-0.12^{NS}	-0.46**	-0.39**	0.49**	0.29**

*Significant at (*P*≤0.05), **Significant at (*P*≤0.01), NS; non significant.

Placental weight is positively correlated with CW (r=0.73, P≤0.01), CN (r=0.41, P≤0.01) and negatively correlated with PE (r = -0.80, P≤0.01), and CD (r = - 0.46, P≤0.01), which is in agreement with konyali et al. (2007), Ocak et al. (2009), and Ocak and Onder (2011). The results of the current work revealed that large placentas are less efficient than small placentas, and large placentas probably require more nutrients (Dwyer et al., 2005). Cotyledon weight was positively correlated with CN (r = 0.37, P≤0.01) and negatively correlated with PE (r = -0.52, P≤0.01) and CD (r = -0.39, P≤0.01). Also, CN was negatively correlated with PE (r = -0.45, P≤0.01) and positively correlated with CD (r = 0.49, P≤0.01). These results were in accordance with those reported earlier by Ocak and Onder (2011). Cotyledon density was positively correlated with PE (r = 0.29, P≤0.01) which is in agreement with the findings of Konyali et al. (2007). Similarly, Ocak et al. (2009) showed a positive correlation between placental efficiency and cotyledon density among all genotypes and breeds used in their study.

4. Conclusion

In conclusion, results of the current work showed a significant positive correlation between placental efficiency and each of birth weight of kids and cotyledon density. Further works are needed to investigate the relationship between neonatal behavior of kids with placental efficiency.

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