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INVESTIGATION SOME PLACENTAL TRAITS IN GOATS OF BULGARIAN WHITE DAIRY BREED AND THEIR CROSS-BREEDS

Svetoslava STOYCHEVA, Tsvetelina DIMITROVA, Tsvetomira BANCHEVA, Nikolay MARKOV

Research Institute of Mountain Stockbreeding and Agriculture, 281 Vasil Levski Str., 5600, Troyan, Bulgaria

Corresponding author email: s.e.stoycheva@abv.bg

Abstract

The aim of our study was to investigate the relationship between some placental parameters such as Placental weight (PW), Cotyledon number (CN), Placental efficiency (PE) and Cotyledon density (CD), as well as the Litter weight (LW) with the genotype of goats, type of birth and the gender of kids. The study was conducted in the goat farm of the RIMSA, Troyan, Bulgaria. The study involved 94 goats of 53 Bulgarian White Dairy breed (BWD) and its crossbreeds with Anglo-Nubian (AN)21 and Togenburg (TG)20. The results showed that PE in goats BWD was significantly higher compared to BWD x AN, BWD x T. There was a strong downward relationship between PW and PE. A significant downward relationship between PW and CD was found in all three genotypes. The PW of twins is higher than that singles ($p<0.01$). The total CN in twins is higher than in singles ($p<0.01$). A significant positive relationship was found between PW and LW in all studied genotypes and was highest in BWD x AN ($p>0.05$). A significant positive relationship was found between PW and the total CN in BWD.

Key words*: breed, goats, placental efficiency, placental weight.*

INTRODUCTION

Through the placenta, the fetus receives nutrients and oxygen from the mother and removes unnecessary substances from its metabolism. The development of the placenta is influenced by various factors (maternal nutrition, breed, parity of goat, litter size, sex, etc.). The postnatal survival of the newborn also indirectly depends on these factors.

Size at birth is critical in determining life expectancy. It affects not only neonatal viability but also adult rates of morbidity and mortality (Fowden & Forhead, 2009).

Sen & Önder (2016) describe the characteristics of the placenta as one of the most important indicators of fetal growth and development that affect the vitality of kids.

According to Mellor & Stafford (2004), the factors that determine the survival and mortality of the newborn are placental insufficiency and hypothermia. Nutrient delivery to the fetus depends on a number of critical factors, which include placental growth and development, uteroplacental circulation, nutrient availability, placental metabolism, and transport capacity (Dunlap et al., 2015).

The size of the cotyledons is known to be crucial for the prenatal and postnatal survival of kids. The number of cotyledons varies between breeds, as within the breed, and is influenced by litter size, sex and etc (Alexander, 1964).

In hair goats, Ozyurek (2019) studies the relationship between kids vitality and placental characteristics. In their study it was found that placental efficiency was affected by the vitality of kids ($p<0.05$) and observed that there was no x large cotyledon (> 51 mm diameter) in the dead kids.

Some authors (Dwyer et al., 2005; Konyalı et al., 2007; Alkass et al., 2013) mention that smaller placentas are more effective than large ones because large ones need more nutrients.

The Bulgarian white dairy goat breed is the main dairy goat breed that is bred in Bulgaria. There are studies on placental parameters in different breeds of goats, but in the breed Bulgarian White Dairy there are none. For this reason, the aim of our study was to examine some placental parameters such as placental weight, cotyledon number, placental efficiency and cotyledon density, as well as litter weight and their relationship to the goat breed

(genotype), type of birth and sex of kids in the Bulgarian white dairy breed of goats and it's crosses with the Anglo-Nubian and the Togenburg breeds.

MATERIALS AND METHODS

The study was conducted in the goat farm of the Research Institute on Mountain Stockbreeding and Agriculture in the town of Troyan, Bulgaria. The facility is located at an altitude of 380 m (42°53'39"N/24°42'57"E).

The study involved 94 goats of 53 Bulgarian White Dairy breed (BWD) and its crossbreeds with Anglo-Nubian (AN)21 and Togenburg (TG)20. There were 53 singleton (31 male and 22 female) and 41 twin pregnancies.

All goats were housed and cared for under the same conditions. During the winter period animals were kept in a barn and fed with a ration containing of 2 kg hay, and 0.8 kg concentrated fodder per head. There was free access to water and salt. In the spring months (May-November) goats were grazing.

Goats were vaccinated against enterotoxemia, treated for parasites, and given vitamins A, D, and E (Vialiton, Biovet).

Kidding of goats took place in February and March. Before kidding goats were separated in individual pins and were under surveillance. Placentas (chorioalanantois and related fetal cotyledons) were collected immediately after natural delivery and weighed fresh in digital scales.

The kids were weighed right after birth. When twins were born the weight of each placenta was summed up.

The Cotyledon number (CN) from each delivered placenta was counted and recorded. Cotyledons were classified by size according to Konyali et al. (2007). Cotyledon number (< 10 mm diameter); Cotyledon number (between 10 and 30 mm diameter); Cotyledon number (≥ 3 mm diameter).

Placental efficiency was defined as the ratio of total kid birth weight (g) to Placental weight, (g) (Molteni et al., 1978).

Cotyledon density was defined as the number of cotyledons per gram of Placental weight (Ocak et al., 2013).

One-way ANOVA was used for statistical comparison. Relationships between the placental traits were determined with a Pearson correlation analysis.

RESULTS AND DISCUSSIONS

The placental parameters (placental weight, cotyledon number, placental efficiency and cotyledon density) and the litter weight according to the goat genotype and the type of birth are presented in Table 1.

Table 1. Placental parameters and total weight of the born kids according to genotype and type of birth

	Litter weight, g LW x S_x	Placental weight, g PW x S_x	Cotyledon number CN				Placental efficiency PE x S_x	Cotyledon density CD x S_x
			total x S_x	≤1 x S_x	1-2 x S_x	≥3 x S_x		
BWD	a*5749.62± 259.78	637.17± 29.83	84.92± 3.62	8.62± 1.11	68.10± 3.53	7.62± 0.89	9.43± 0.36 a** c*	0.14± 0.01
BWD x AN	a*4771.43± 394.37	628.57± 52.83	86.52± 5.76	11.52± 2.00	67.48± 5.89	7.52± 2.01	7.84± 0.41 a**	0.15± 0.01
BWD x T	4820.00± 371.44	627.00± 43.20	81.25± 4.67	6.16± 1.17	68.30± 4.47	7.05± 1.17	7.89± 0.44 c*	0.14± 0.02
Total singleton	b**3961.32± 97.96	b**526.42± 22.98	b**73.36± 3.11	9.67± 1.12	58.33± 3.05	5.75± 0.89	8.03± 0.30	0.15± 0.02
Singleton male	4109.68± 143.80	522.26± 30.73	73.97± 4.11	8.93± 1.50	59.80± 4.00	5.94± 1.35	8.39± 0.40	0.15± 0.01
Singleton female	3765.91± 107.98	527.27± 35.99	73.09± 4.70	10.68± 1.71	56.55± 4.74	5.86± 1.05	7.66± 0.43	0.15± 0.01
Twins	b**7106.83± 206.08	b**770.98± 30.22	b**98.90± 3.20	3.20± 1.20	80.27± 4.79	9.71± 1.06	9.67± 0.40	0.13± 0.01

Note: a-BWD/BWD x AN; b-total singleton/ twins; c-BWD/BWD x T ;*p<0.05,**p<0.01

Although the litter weight of the Bulgarian White Dairy breed goats was significantly higher than that of the Bulgarian White Dairy x Anglo-Nubian with a difference of 978 grams, the placental weight of the three genotypes we studied was almost the same. Placental effectiveness in the Bulgarian White Dairy breed is significantly the highest. According to Ocak & Önder (2011), when studying the effects of the breed it is important to identify the effects of the maternal and fetal genotype as they have an effect on gestational period and birth weight. Alkass et al. (2013) studied two breeds of goats bred in Iraq and found that the effect of the breed is not a reliable source of variation in all studied placental traits. The studies of Ocak et al. (2009) in different breeds and (genotypes) of sheep are similar. Jawasreh et al. (2009) and Oramari et al. (2011) report that the litter weight is strongly influenced by placental weight in Awasi and Karadi lambs.

We found that logically the litter weight increases ($p<0.01$) with an increase in the number of offspring from one to two by 3145 g. The placental weight of the twins was significantly higher than that of the single ones ($p<0.01$). The total number of cotyledons in twins was significantly higher than in singles ($p<0.01$). This could be explained by the statement of Dwyer et al. (2005), that the uterus of sheep with a smaller number of caruncles would not be able to carry more than one fetus. Ocak et al. (2015) define the cotyledons of twins as larger and heavier than those of singles, which would explain the higher effectiveness of their placenta. Our study showed that the placental effectiveness of twins is higher than that of singles. These results are in agreement with Ocak et al. (2015), according to whom different-sex twins have better placental efficiency than same-sex twins in Damascus goats. Ozyurek & Türkyilmaz (2020) found that in Morkaraman sheep the type of birth has a significant effect on the birth weight, placental weight, and the cotyledon number. Male singles were heavier than female singles, which is in line with our previous studies (Hristova et al., 2013; Stoycheva, 2014) in the same genotypes as found by Ozyurek (2019) in hair goats and Ocak et al. (2009) in sheep. Despite the observed difference in weight according to the gender, the weight of their placentas was almost the same.

Contrary to the findings of Ocak et al. (2015), we observed lower placental effectiveness in the placentas of male singles than females ($p>0.05$). No significant difference was found in the total number of cotyledons between the genotypes studied by us, as well as between males and females. The density of cotyledons for all groups studied by us was almost the same. Table 2 presents the correlations between placental parameters according to the genotype of the goats.

Table 2. Pearson correlation coefficient of placental parameters by breed (genotype)

	LW	CN	PE	CD
BWD				
PW	0.653**	0.576**	-0.446**	-0.554**
LW		0.610**	0.331*	-0.217
CN			-0.059	0.292*
PE				0.387**
CD				
BWD x AN				
PW	0.730	0.413	-0.358	-0.568**
LW		0.120	0.336	-0.581**
CN			-0.477*	0.393
PE				-0.047
CD				
BWD x T				
PW	0.643**	0.404	-0.361	-0.600**
LW		0.444*	0.449*	-0.288
CN			0.004	0.444*
PE				0.306
CD				

*p<0.05, **p<0.01

Significant positive relationship between placental weight and liter weight ($p<0.01$) was found in Bulgarian White Dairy goats ($r = 0.653$), Bulgarian White Dairy x Togenburg ($r = 0.643$) and the highest in Bulgarian White Dairy x Anglo- Nubian ($r = 0.730$, $p>0.05$), which is in line with that found by Konyali et al. (2007) in Turkish Saanen goats.

The weight of the fetus was related to the weight of the placenta, the two together formed the whole of the tissues of the mother and the fetus and thus the placenta was the factor determining the growth of the fetus (Konyalı et al., 2007; Ocak & Onder, 2011).

A significant positive relationship was found in Bulgarian White Dairy breed goats between placental weight and total number of cotyledons ($r = 0.586$, $p<0.01$).

We found a significant negative relationship between placental weight and cotyledon density ($r = -0.554$; -0.568; -0.600, $p<0.01$) in all three breeds (Bulgarian White Dairy, Bulgarian White Dairy x Anglo - Nubian, Bulgarian White Dairy x Togenburg), which is in agreement with Ocak et al. (2009) in sheep. Significant negative dependence was also found between liter weight and cotiledon density in Bulgarian White Dairy breed x Anglo-Nubian ($p<0.01$).

Table 3 presents the correlations of the placental parameters according to the gender and the type of birth.

Table 3. Pearson's correlation coefficient of placental parameters according to the gender and the type of birth

	LW	CN	PE	CD
Singles				
PW	0.479**	0.311*	-0.746**	-0.528**
LW		-0.140	0.165	-0.586**
CN			-0.441	0.560**
PE				0.193
CD				
Singles male				
PW	0.428*	0.373	-0.728**	-0.493**
LW		-0.207	0.257	-0.687**
CN			-0.554	0.532**
PE				-0.008
CD				
Singles female				
PW	0.700**	0.247	-0.836**	-0.598**
LW		-0.096	-0.292	-0.607**
CN			-0.381	0.554**
PE				0.482*
CD				
Twins				
PW	0.363*	0.312	-0.721**	-0.687**
LW		0.246	0.285	-0.124
CN			-0.244	0.265
PE				0.583**
CD				

*p<0.05; **p<0.01

Ocak et al. (2009) found that placental weight, placental efficiency, and cotyledon number were influenced by the type of birth of the lambs and not by their gender. We found a significant negative relationship between placental weight and cotyledon density in singles ($r = -0.528$, $p<0.01$), in females ($r = -0.598$, $p<0.01$), and in twins ($r = -0.687$, $p<0.01$).

Significant negative dependence between liter weight and cotyledon density was observed in all singles ($r = -0.586$, $p<0.01$), in males ($r = -0.687$, $p <0.01$) and in females ($r = -0.607$, $p<0.01$). Our study also showed that there was a significant positive relationship between cotyledon number and cotyledon density ($r = 0.560$, $p<0.01$) in singles, in single males ($r = 0.532$, $p<0.01$) and in single females ($r = 0.554$, $p<0.01$).

In male singles, we found a significant negative relationship between both cotyledon number

and placental efficiency ($r = -0.554$, $p<0.01$). In female singles, we found a strong positive relationship between placental weight and liter weight ($r = 0.700$, $p<0.01$). In twins, we found a significant positive relationship between placental weight and cotyledon density ($r = 0.583$, $p<0.01$).

A strong negative relationship between placental weight and placental effectiveness was found in singles ($r = -0.746$, $p<0.01$), in male singles ($r = -0.728$, $p<0.01$), in female singles ($r = -0.836$, $p<0.01$).) and in twins ($r = -0.721$, $p<0.01$), ie with the increasing weight of the placenta its effectiveness decreased. According to Wilson & Ford (2001), the placental efficiency determines how many grams of the fetus fall per 1 g of placenta, which means that the placental efficiency determines the capacity of the mother.

Our findings support the claims of many authors (Mesa et al., 2003; Dwyer et al., 2005; Ocak et al., 2009) that smaller placentas are more effective. According to the authors, this is due to lower nutrient expenditure.

CONCLUSIONS

The results of this study showed that the placental effectiveness in Bulgarian White Dairy breed goats is significantly higher compared to crosses Bulgarian White Dairy x Anglo-Nubian and Bulgarian White Dairy x Togenburg.

As the weight of the placenta increases, its effectiveness decreases. A strong negative relationship was found between placental weight and placental effectiveness ($p<0.01$) in single and twin as well as male and female kids.

A significant negative relationship was found between placental weight and cotyledon density ($p<0.01$) in all three genotypes (Bulgarian White Dairy breed, Bulgarian White Dairy x Anglo-Nubian, Bulgarian White Dairy x Togenburg).

The weight of the placenta of twins is higher than that of singles ($p<0.01$). The total number of cotyledons in twins is higher than in singles ($p<0.01$).

A significant positive relationship was found between placental weight and liter weight in all studied genotypes ($p<0.01$).

A significant positive relationship was found in Bulgarian White Dairy goats between placental weight and the total cotyledon number ($p<0.01$).

Further studies are required to investigate the relationship between the genotype and the placental parameters in Bulgarian White Dairy breed goats and its crossbreeds.

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