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INVESTIGATING THE RELATIONSHIP BETWEEN THE PARITY AND SOME PLACENTAL TRAITS IN GOATS

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Abstract

The relationship between the parity, the litter weight (LW) and some placental traits with goats was investigated in this study. 94 goat were investigated in total, 28 of which from first parity, 27 from second parity, 15 from third parity, 12 from forth parity and 12 from fifth parity. One-way ANOVA was used for statistical comparison, and Pearson correlation was used to determine the relationships between the variables. The goats' placenta from the first parity weighs the least and the forth parity's placenta is significantly ($P<0.05$) the heaviest. Significant differences in placental efficiency between the investigated animals were not discovered. Positive correlation was discovered between the weight of the placenta and the birth weight of the kid in the first, second and fifth parity. The results of this study show negative correlation between the weight of the placenta and the density of the cotyledons in goats of the first, second, third and fifth parity. Further studies are required to investigate the relationship between parity and placental traits in goats.

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

INTRODUCTION

An important indicator of vitality in small ruminants is the placental traits. When the embryo grows in size, the processes of diffusion through which it nourishes become insufficient to sustain its life (Sen and Önder, 2016; Ocak et al., 2014), and then the placenta starts play a major role.

According to Bell and Ehrhardt, (2002), in late pregnancy, placental size is closely related to transport capacity and can be changed by maternal nutrition.

Goats have polycotyledonary placenta and placentomes which carry out exchanges between the maternal and foetal circulatory system (Sen and Önder, 2016; Ocak et al., 2014).

The low placental and cotyledon traits of kids who died during the early postnatal period showed that placental and cotyledon traits have an effect on kids' vitality (Ozyurek, 2019).

Sen et al. (2013) and Sen and Önder (2016) establish that the number of placentomes and the placental size of goats determines the exchange capacity of substances between the mother and the fetus. According to them, the size, which is related to the nutrient transfer capacity of the placenta, plays an important role in determining the prenatal growth of the fetus, and then the birth weight and postnatal viability.

The mother's womb directly influences the fetuses' growth and restricting the nutrition of the mother during the pregnancy leads to a lowering in the fetuses' weight and the weight of the placenta but, it also leads to the increase of placental efficiency (Konyalı et al., 2007; Osgerby et al., 2002).

The birth weight is of significant importance for the vitality of the newborn. It influences not only the neonatal vitality, but the morbidity and the fatality in adult animals too (Fowden and Forhead, 2009).

It is important to mention that according to Konyalı et al., (2007), the lower placental efficiency and density of the cotyledons leads to a longer period of time until the kid stands up after birth. They conclude that the increase of placental efficiency leads to an earlier standing up of the kid and less time until the first sucking. Furthermore, this is also one of the factors for the establishing of a proper connection between the goat mother and its kid and it also leads to the increase of probability of the kid surviving.

There are a number of determining factors for the development of the placenta – the goat mother's nutrition, the litter size, sex, breed, age and parity of the goat etc.

In their research, Dwyer et al. (2005) conclude that the placental weight and the placental efficiency are influenced by the age of the mother and the parity of the sheep. With the increasing number of births, the placentas become heavier which is likely due to the reproductive maturity of the animals. The weight of the placenta increases with the age of the goat mother, but the placental efficiency and the density of the cotyledons is not influenced by the age of the mother.

The placentas of the goats with three or more pregnancies weigh more and have a higher number of cotyledons in comparison with these from the first or second pregnancy (Ocak et al., 2013). According to Özyürek (2019), the cotyledon number is formed on the 30th day of the pregnancy and there was no change in cotyledon number in the later periods although there was a change in size.

Ozyurek (2019) investigates the relationship between kids vitality and placental characteristics in hair goats. He concludes that the 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. This means that the size of the cotyledons is of great importance for the prenatal and postnatal survival of the kid.

The purpose of our research was to investigate the relationship between the parity of goats, litter weight and some placental traits like placental weigh, cotyledon number, placental efficiency and cotyledon density.

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 Bulgarian White Dairy breed (BWD) and its crossbreeds with Anglo-Nubian (AN) and Togenburg (TG).

The parity of goats were classified as 1st, 2nd, 3rd, 4th and 5th . 94 goat were investigated in total, 28 of which from the first parity, 27 from the second parity, 15 from the third parity, 12 from the forth parity and 12 from the fifth parity.

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 (Figure 1).

Figure 1. Goat separated in individual pins and newborns kids

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 (between10 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 of kids and goats were determined with Pearson correlation analysis.

RESULTS AND DISCUSSIONS

The placental traits (PW, CN, PE and CD) and the litter weight based on the parity are shown in Table 1.

Placental weight increased with the goat's parity. The placenta of the goats that gave birth for the first time (First parity) were the lightest, while the goats that gave birth for the fourth time (Fourth parity) had significantly ($P<0.05$) the heaviest placenta.

The placenta of the second parity was 140 g heavier than the placenta of the first parity, while the difference between the first parity and the fourth parity was 188 g.

Table 1. Placental traits and the total weight of the kids based on the parity

Goat's age	Litter weight, g LW $x\pm S_x$	Placental weight, g PW $x\pm S_x$	Cotyledon number CN				Placental efficiency PE $x\pm S_x$	Cotyledon density CD $x\pm S_x$
			total $x\pm S_x$	≤1 $x\pm S_x$	1-2 $x\pm S_x$	≥3 $x\pm S_x$		
I – Parity	*4601.79± 276.56	541.07± 31.30	89.82± 4.44	12.89± 1.57	72.19± 4.57	4.00± 0.87	8.74± 0.40	0.17± 0.01
II – Parity	5685.19± 397.87	641.11± 40.81	85.04± 4.63	8.26± 1.27	71.22± 4.56	5.44± 1.16	9.12± 0.49	0.14± 0.01
III – Parity	5440.00± 483.91	682.67± 56.82	72.47± 4.34	4.79± 1.17	57.53± 4.20	10.27± 2.22	8.55± 0.94	0.12± 0.01
IV - Parity	*6500.00± 564.48	729.17± 55.90	94.42± 8.62	6.17± 2.11	75.92± 8.24	12.33± 1.86	9.04± 0.53	0.14± 0.01
V - Parity	4815.00± 435.89	665.00± 85.04	74.20± 8.69	7.40± 3.23	55.10± 8.55	11.80± 1.81	7.69± 0.57	0.12± 0.01

*($p<0.05$)

With goats from the fifth parity there was a lowering of the weight in comparison with the forth parity.

The fetuses' weight is linked to the weight of the placenta. It is a functional unit which forms the fetus and the mother's tissue or in other words the placenta is a determining factor which limits the growth of the fetus (Konyalı et al., 2007; Ocak and Onder, 2011).

Using the placenta, the fetus receives nutrients and oxygen from the mother and exudes the unnecessary substances from the exchange. Glucose is major metabolic substrate for the exchange of the placenta and the fetus (Bell and Ehrhardt, 2002).

According to Konyalı et al. (2007), it is likely that smaller placentas are more efficient than the bigger ones which need more nutrients.

With the increase of a goat's births we could see an increase in litter weight. The lightest kids came from goats that were giving birth for the first time, while the heaviest come from goats giving birth for the fourth time.

In past experiments (Hristova et al., 2012; Stoycheva, 2014) we have found that with the increase of a goat's age (Parity), the kid's birth weight increases.

Martinez et al. (2009) remarks that goats from the breed Murciano – Granadina give birth to lighter kids in their first births than births from the second or higher parity.

Elabid (2008) finds that kids from the second parity are heavier in comparison with the first parity, but the difference is insignificant.

According to Elabid (2008) and Islam et al. (2009), a major factor in the increase of birth weight in kids is the change in live weight of the mother during the pregnancy.

The increase of the live weight of the kid found by us in the birth of older mothers is likely due to the decrease of expenses of nutrients for growth with aging of the goats and their redirection to the pregnant uterus. The birth weight of the kids corresponded with the nutrition of the goats, their breed and the homeoretical capacity of the mothers too.

The results of our study showed that cotyledon number and cotyledon density decreased with parity which is in agreement with the findings of Sen and Önder (2016) in Saanen goats and Özyürek and Türkyilmaz (2020) in Morkaraman sheep.

An exception makes the placentas of the fourth parity in which the number of cotyledons was the highest.

The placental efficiency determines how many grams of the fetus fall per 1 g of placenta (Wilson and Ford, 2001) which means that the placental efficiency determines the capacity of the mother (Wilson and Ford, 2001), or in other words the total weight of the placenta which the mother can carry up to the birth (Bennett and Leymaster, 1989; Wilson et al., 1999).

Previous studies reported that placental efficiency increased with parity in beef, sheep and cattle (Dwyer et al., 2005; Echternkamp, 1993).

In this study we did not find an essential connection between the weight of the placenta and its effectiveness which is in agreement with Konyali et al. (2007). According to them it does not change with the parity of goats and sheep respectively. Placental efficacy is assumed to be genetically based, but on the other hand, it is also significantly influenced by environmental factors during pregnancy. The age and the reproductive maturity of the goat mothers may cause a significant impact on the placental efficiency, but it is interesting what the limit at which parity begins to have a negative effect is (Ocak et al., 2013).

Pearson's Correlation Ratio was used to characterize the relationships between the studied placental parameters.

Table 2 presents the correlations between the individual indicators according to the parity of the goats.

Table 2. Pearson correlation coefficient of placental parameters according to goat parity

	LW	CN	PE	CD
I – Parity				
PW	0.69	0.54	-0.37	-0.60
LW		0.24	0.37	-0.60
CN			-0.45	-0.28
PE				-0.05
CD				
II – Parity				
PW	0.66	0.65	-0.31	-0.53
LW		0.59	0.48	-0.23
CN			-0.07	0.25
PE				0.28
CD				
III – Parity				
PW	0.49	0.34	-0.53	-0.86
LW		0.74	0.43	-0.08
CN			0.17	0.17
PE				-0.73
CD				
IV - Parity				
PW	-0.75	0.69	-0.27	-0.08
LW		0.44	0.42	-0.37
CN			-0.30	0.57
PE				-0.42
CD				
V – Parity				
PW	0.66	0.56	-0.68	-0.83
LW		0.75	0.06	0.10
CN			0.00	0.52
PE				0,66
CD				

A moderate to significant positive correlation was found between the placental weight in the goats from the first parity, the second parity and the fifth parity and this is logical because with the increase of the placental weight the litter weight increases too. Our findings are in agreement with Sen and Önder's (2016) findings, who also find a positive correlation in

Saanen goats of different parities. Ocak et al. (2014) find the opposite to be true in Damascus goats though.
In goats from the fourth parity the relation was negative
We saw a positive correlation between the placental weight and the number of cotyledons in the first parity, the second parity, the fourth parity and the fifth parity.
Negative correlation between the placental weight and the placental efficiency was discovered in the third parity and the fifth parity.
A negative correlation was discovered between the placental weight and the cotyledon density of the first parity, the second parity, the third parity and the fifth parity. The findings reported by Sen and Onder, (2016), Özyürek and Türkyilmaz, (2020) in Morkaraman sheep supported our results.
A negative correlation was discovered between the litter weight and the density of the cotyledons in goats and first parity kids.
There was a positive correlation between litter weight and the total number of cotyledons in goats that had given birth more than one time.

CONCLUSIONS

The results of this study showed that the parity of the mother has a significant impact on the weight of the placenta and the litter weight in the goats we examined.
Young mothers gave birth to kids with lower live weight when the placental weight was lower.
A negative correlation was discovered between the placental weight and the density of the cotyledons in the first parity, the second parity, the third parity and the fifth parity.
The acknowledgement of these facts could determine a different approach in the raising and feeding of young pregnant goats which could compensate in some level their reproductive immaturity.
Further studies are required to investigate the relationship between parity and placental traits in goats.

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