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# EFFECT OF MATERNAL AGE ON PLACENTAL CHARACTERISTIC AND KID BIRTH WEIGHT

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***Abstract***

*Optimum placental development influence fetal growth and may hence postnatal mortality of offspring. The aim of this study was to examine the effect of dam age on placental characteristics and kid birth weight in Saanen goats. The experiment were conducted on 10 youth goat singleton bearing Saanen does (ranging from 10 to 12 mounts of age) and 10 mature singleton bearing Saanen does (ranging from 3 to 4 years of age). Birth weight, kid's sex and placental measurements were recorded within 12 h after parturition. Adolescent doe had significantly lower (P<0.05)kid birth weight and placental weight than those of mature doe. Also the total number of placental cotyledons dissected from the chorioallantois in mature does were significantly higher (P<0.05) than those of adolescent doe. There were positive correlation between kid birth weight and placental weight (0.795; P<0.01), kid birth weight and total cotyledons number (0.578; P<0.01) and placental weight and total cotyledons number (0.594; P<0.01).The results suggest that adolescent dams in the first parity may alter placental characteristics and fetal development resulting in a reduced kid birth weight from singleton gestations.*

**Key words**: *maternal age, placenta, cotyledon, fetal development, kid birth weight.*

## INTRODUCTION

The placenta is defined as a functional organ which provides nutrients, gases and waste exchange between the maternal and fetal systems (Igwebuike, 2010). Placental characteristics are important indicator of postnatal mortality of offspring in small ruminants (Ocak et al., 2014). Mellor and Stafford (2004) reported that postnatal viability of newborn is associated with placental growth and development during gestation. The caprine have polycotyledonary placenta and placentomes performs exchange between the maternal and foetal circulatory system (Ocak et al., 2014). Thus, exchange capacity of placental between the maternal and fetal systems in the caprine is depend on placental size and number of the placentomes (Ocak et al., 2014). Therefore the size, which is relationship with nutrient transfer capacity of the placenta, play a pivotal role in determining the prenatal growth trajectory of the fetus and hence birth weight and postnatal viability (Sen et al., 2013).

Placental growth and development support consequent fetal development during mid- to late gestation (Redmer et al., 2004; Sen et al., 2013). Previous studies indicated that placental development during gestation is dominantly affected by maternal factors, especially nutrition levels (Owens et al., 1994; Wu et al., 2004; Sen et al., 2013). Also, many studies have demonstrated that there are relationships between weight of the placenta and birth weight of the newborn (Osgerby et al., 2003; Sen et al., 2013). Dwyer et al. (2005) reported that maternal age affected birth weight and placental characteristics. Moreover, Wallace et al. (2001) suggest that nutrient partitioning during gestation was changed to promote growth of the maternal body at the expense of the gradually increasing nutrient requirements of the gravid uterus and mammary gland in young growing females. Thus, adolescent dams have an increased risk of a major restriction in placental mass, and leads to a significant decrease in birth weight with high mortality rates within the first year of life (Wallace et al., 2001). Therefore, we hypothesized that adolescent dams in the first parity may alter placental development due to a large part of the nutrition intake deliver to continue body mass growth, resulting in change placental characteristics and birth weight. The aim of this study was to examine the effect of dam age on placental characteristics and kid birth weight in Saanen goats.

## MATERIALS AND METHODS

The study was conducted on 10 adolescent (ranging from 10 to 12 mounts of age) and 10 mature singleton bearing Saanen does (ranging from 3 to 4 years of age) in normal breeding season. All does were pregnant by naturally mate using mixed multiple sires and housed under the same conditions.

Birth weight (BW) and the sex of kids were recorded within 12 h after parturition. Each doe was left to deliver the placenta naturally and placentas were collected from singleton gestations immediately after delivery; care was taken to ensure that any placental weight (PW) taken were of the total placenta with any fluid being removed before weighting. The total numbers (TCN) of placental cotyledons dissected from the chorioallantois were also counted and determined.

The effects of maternal age on placental characteristics and kid birth weight were analyzed using a completely randomized design by the General Linear Model (GLM) procedure of the SPSS package program. The sex of kids was used as a cofactor in the model to adjust the birth weight and the placental characteristics. Significant differences between means were tested using Duncan's test and results were computed as mean ± s.e.m. Statistical significance was considered at P<0.05 and P<0.01. Relationships between variable traits for discrete data were determined with Pearson correlation analysis at the 95% confidence interval.

## RESULTS AND DISCUSSIONS

Dwyer et al. (2005) reported that increasing maternal parity increased the lamb birth weight carried by ewes and younger ewes have low birth weight than older ewes. Similarly, in the present study adolescent does in the first parity produced kids with low birth weight compared to mature goats (Table 1).

Table 1. Kid birth weight and some placental characteristics of adolescent and mature Saanen doe

| | BW (g) | PW (g) | TCN |
|---|---|---|---|
| Adolescent | $3098.5 \pm 33.8^{b}$ | $412.4 \pm 26.3^{b}$ | $118.0 \pm 6.0^{b}$ |
| Mature | $3757.3 \pm 45.4^{a}$ | $661.7 \pm 30.6^{a}$ | $132.0 \pm 5.0^{a}$ |

[a, b,] Different superscript letters in the same column indicate significant difference (P<0.05).
BW = kid birth weight, PW = placental weight, TCN = total cotyledon number.

As a general fact, the does may be used as stock breed once they reach to 60-70% of their adult weight. In the present study, although the adolescent does had sufficient live weight for breeding (approximately 30 kg), their some placental traits (placental weight and cotyledon numbers) found to be insufficient and they had low birth weight in their offspring compared to mature goats. Adolescent does relatively having lower body weight, might have caused a delay in feto-placental development during gestation, allowing in lower birth weight in kids. The underlying mechanism of this result can be explained that younger dams utilized dietary nutrients in high level for growth of body when their body weight is lower (Wallace et al., 2001). Otherwise, they might have decreased the transfer of nutrients to the feto-placental growth and development. In the other word, when the does are not reached the optimal breeding body weight, their priority would be their nutritional requirements rather than their fetus. For this reason, breeders should develop strategies fulfilling both maternal nutrient requirements, especially for younger pregnant does, and the feto-placental growth and development.

The results of present study demonstrated that increasing of maternal age increased placental weights and cotyledon numbers. Placenta of adolescent doe was lighter and contained fewer amounts of cotyledons than those of older doe (Table 1). Similarly, Konyali et al. (2007) indicated that the first parity does had lower placental weight and higher cotyledon density, but total numbers of cotyledon in per placenta were greater than higher parity does in contrast to our study. Ocak et al. (2013) also showed that maternal parity influenced placental traits and ewes in the 1-3 parities had lower placental weight, total cotyledon numbers and total cotyledon weights than those of ewes in the <3 parities, without affecting the cotyledon density. Dwyer et al. (2005) also reported that placenta weight and average cotyledon weight were not changed number of cotyledon, increased with ewe age or parity. Contrast to Ocak and Onder (2011) reported that placental weight was not influenced by parity, but total cotyledon numbers and total cotyledon weights were affected. Previous studies showed that low weight of placenta and reduced numbers of cotyledons associated with growth deficiency of fetus (Jenkinson et al., 1995; Greenwood et al., 2000; Dwyer et al., 2005). Therefore, these differences in placental weight, cotyledon number and total cotyledon weight by parity explained that adolescent doe carried lighter kids than mature goats in the second or third parities. The explanation of this situation is very difficult, but future experiments may be clarified with histological studies. On the other hand, reduced numbers of the cotyledons obtained from placentas of adolescent doe may show evidence of decreased growth of fetus in comparison to those of older does.

Previous studies reported that there was no significant correlation between birth weight and placental weight in sheep (Ocak et al., 2013) and goats (Ocak et al., 2014). However, in the present study pearson coefficient showed a significant positive correlation between birth weight and placental weight (0.795; P<0.01, Figure 1). Echternkamp (1993), Dwyer et al. (2005) and Konyali et al. (2007) reported similar findings for beef cattle, sheep and goats. The positive correlation between kid birth weight and total cotyledons number (0.578; P<0.01, Figure 1)obtained in the present study are in agreement with past studies in beef cattle and sheep (Echternkamp, 1993; Dwyer et al., 2005; Konyali et al., 2007). The positive correlation observed in the present study between placental weight and total cotyledons number (0.594; P<0.01, Figure 1).

This result is support the findings of Ocak and Onder (2011) and Ocak et al. (2014). It was observed that increased placental weight causes an increase in total cotyledon number and kids' birth weights.

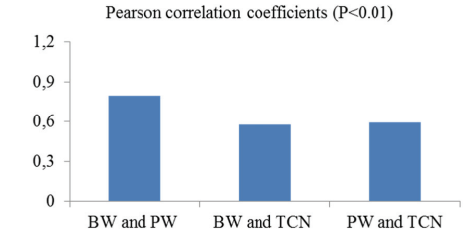


Figure 1. Pearson correlation coefficients of placental characteristics and birth weight

BW = kid birth weight, PW = placental weight, TCN = total cotyledon number.

## CONCLUSIONS

In conclusion, the results of the present study imply that maternal age influence placental development and exchange capacity of placenta to fetus, which reflect variations in birth weight of kids. Especially, adolescent dams exhibit different placental morphology cause placental insufficiency.


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## REFERENCES


Dwyer C.M., Calvert S.K., Farish M., Donbavand J., Pickup H.E., 2005. Breed, litter and parity effects on placental weight and placentome number, and consequences for the neonatal behavior of the lamb. Theriogenology, 63, 1092–1110.

Echternkamp S.E., 1993. Relationship between placental development and calf birth weight in beef cattle.Anim.Reprod. Sci., 32, 1–13.

Greenwood P.L., Slepetis R.M., Bell A.W., 2000. Influences on fetal and placental weights during mid to late gestation in prolific ewes well nourished throughout pregnancy. Reprod. Fertil. Dev., 12:149–156.

Igwebuike U.M., 2010. Impact of maternal nutrition on ovine foetoplacental development: A review of the role of insulin-like growth factors. Anim. Reprod. Sci., 121, 189–196.

Jenkinson C.M.C., Peterson S.W., Mackenzie D.D.S., McDonald M.F., McCutcheon S.N., 1995. Seasonal effects on birth weight in sheep are associated with changes in placental development. New Zeal. J. Agric. Res., 38, 337–345.

Konyali A., Tölü C., Daş G., Savaş T., 2007. Factors affecting placental traits and relationships of placental traits with neonatal behaviour in goat.Anim.Reprod. Sci., 97, 394–401.

Mellor D.J., Stafford K.J., 2004. Animal welfare implications of neonatal mortality and morbidity in farm animals. Vet. J., 168, 118–133.
Ocak S., Ogun S., Gunduz Z., Onder H., 2014. Relationship between placental traits and birth related factors in Damascus goats. Livestock Sci., 161, 218–223.
Ocak S., Ogun S., Onder H., 2013. Relationship between placental traits and maternal intrinsic factors in sheep.Anim.Reprod. Sci., 139, 31–37.
Ocak S., Onder H., 2011. Placental traits and maternal intrinsic factors affected by parity and breed in goats. Anim. Reprod. Sci., 128, 45–51.
Osgerby J.C., Gadd T.S., Wathes D.C., 2003. The effects of maternal nutrition and body condition on placental and foetal growth in the ewe. Placenta, 24, 236–247.
Owens J.A., Kind K.L., Carbone F., Robinson J.C., Owens P.C., 1994. Circulating insulin-like growth factor-I and II and substrate in fetal sheep following restriction of placental growth. J. Endocrinol., 140, 5–13.
Redmer D.A., Wallace D., Reynolds L.P., 2004. Effect of nutrient intake during gestation on fetal and placental growth and vascular development. Domest.Anim. Endocrinol. 27, 199–217.
Sen U., Sirin E., Kuran M., 2013. The effect of maternal nutritional status during mid-gestation on placental characteristics in ewes.Anim.Reprod. Sci., 137, 31–36.
Wallace J., Bourke D., Da Silva P., Aitken R., 2001. Nutrient partitioning during adolescent pregnancy. Reprod., 122, 347–357.
Wu G., Bazer F.W., Cudd T.A., Meininger C.J., Spencer T.E., 2004. Maternal nutrition and fetal development. J. Nutr., 134, 2169–2172.

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