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# EFFECTS OF EWES' LIVE WEIGHT AND BACKFAT THICKNESS AT MATING ON FERTILITY AND PRODUCTION PERFORMANCE IN SUFFOLK SHEEP AND THEIR CROSSES

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## Abstract

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The objective of work was to evaluate relationships among ewes' live weight and backfat thickness at mating and level of their fertility and production performance. The monitoring was carried out in meat type Suffolk sheep (n = 286) and their Merinolandschaf and Kent crossbreeds (n = 124) bred on five extensive farms in the period of one year. The fertility traits (lambing rate in % and litter size in pcs.) and production traits (total litter weight at birth and at weaning in kg) were observed. Selected factors concerning to ewe live weight (LW) and backfat thickness (BT) at mating measured via ultrasound were observed and evaluated. Ewes were assigned to three groups according to their LW (≤ 69.9 kg; 70.0 to 80.7 kg; ≥ 80.8 kg) and BT (≤ 7.69 mm; 7.70 to 10.65 mm; ≥ 10.66 mm). The statistical analysis was performed using the SAS 9.1. Ewes of the highest LW (≥ 80.8 kg) showed higher lambing rate (+2.49 to 11.0%; P > 0.05). The higher LW, the higher litter size were determined (P < 0.05 to 0.01), when ewes´ LW above 70 kg means increased litter size (+0.20 to 0.28 pcs.). The same tendencies were detected as well as in total litter weight at birth (+0.68 to 0.75 kg; P < 0.01) and at weaning (+4.13 to 4.81 kg; P < 0.01). Results of BT evaluation showed non-significant effect on both fertility parameters. On the other hand significant effect (P < 0.05) of BT was found in relation to total litter weight at birth. The highest BT caused increasing the total litter weight at birth by 0.23 kg. Despite the similar trend, differences in total litter weight at weaning were insignificant (P > 0.05).

*Key words:* ultrasound measurement, lambing rate, litter size, lamb, live weight at birth, live weight at weaning

## Introduction

The profitability of all the meat type livestock breeding is influenced by the progeny number as well as their meat performance. Therefore they are intensively bred (Stádník et al., 1999; Michels et al., 2000; Stádník et al., 2009) and selected on these traits (Šafus et al., 2006; Ducháček et al., 2011). The total sheep efficiency is expressed as the complex of reproduction and production traits. In this connection the factor of dam is counted as the key effect in the period from birth to weaning. However, also effects of breed, stud, sex of lamb, age of dam, litter size or sire influence the growth intensity parameters of lambs (Momani et al., 1995; Yilmaz et al. 2007; Esmailizadeh et al., 2011). The basic assumption of desired sheep efficiency is an adequate forage and/or concentrate protein feeds intake as well as microorganism activity and rumen functioning (Grigorova et al., 2012; Ruzic-Muslich et al., 2013), all expressed by ewe live weight (LW) and their body fat reserves (Atti et al., 2001; Yilmaz et al., 2011; Aliyari et al., 2012; Vatankhah et al., 2012). All the authors described in detail the influence of both the ewe LW and body fat reserves at mating on reproductive and productive traits of rustic fat-tailed African and Asian sheep breeds of Lori-Bakhtiari, Afshari, Kivircik and Barbarine. According to their results the lower reproduction and production traits were found in ewes with lower live weight and body fat reserves at mating. These authors assessed ewe body fat reserves subjectively by method of body condition score (BCS). In addition they claimed

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that differences of ewe BCS at mating vary from their genotype and region and thus BCS standard should be determined individually and locally. The measuring of BCS may vary among technicians. As a result of Abdel-Mageed and El-Maaty (2012) suggests, ultrasound measurement of backfat thickness in the area of the end part of the thoracis vertebra is an alternative method for body condition scoring.

No current study has detail the focus on the fertility and production traits of intensive meat breeds of sheep in relation to mentioned factors yet. Although, according to the introduction, we can definitely claim that both these traits affect the economic efficiency of sheep breeding. Therefore the aim of this study was to evaluate reproduction and production traits of intensive meat breed of sheep (Suffolk and their crossbreeds) especially in relation to ewes´ live weight and body fat reserves at mating.

## Material and Methods

### *Animals and Management*

The monitoring was performed in five extensive farms bred Suffolk sheep (Farm 1; n = 124; Farm 2; n = 89; Farm 3; n = 74) and crossbreeds of Suffolk x Merinolandschaf (Farm 4; n = 85), resp. Suffolk x Kent (Farm 5; n = 39) in the period of one year. All the stations were located at the altitude of 290 to 350 m (above the sea level), with the average annual rainfall of 650 to 800 mm per year and average annual temperature of 7.5 to 11.0°C. The sheep breeding system applied on monitored farms is commonly used for commercial production of slaughter lambs in the Czech Republic. The feed ration during the grazing season was consisted of the grassland pasture only. There was no flushing effect applied before mating season. The sheep had access to mineral lick and to drinking water (*ad libitum*) during the whole year. In the winter period, the ewes' feed ration consisted of haylage (5kg per head per day) and hay (*ad libitum*). The feed ration of the observed lambs (n = 630) consisted of ewe's milk, pasture (*ad libitum*), meadow hay (*ad libitum*) and concentrates (alfalfa granules for lambs, Mikrop Čebín, a.s., Czech Republic, 400g per head per day).

### *Data Collection*

The live weight (LW) and backfat thickness (BT) of ewes at mating (day before introduction of the ram) were assessed. The mating period was carried out from the end of August to the half of November.

The ewe LW (kg) was obtained using tensometric scale VHD (My Weigh; Erkelenz, Germany) ±0.1 kg designated for the weighting of small ruminants. The evaluation of BT was performed in the area of last thoracis vertebra (mm) using the ultrasound Aloka 500 and 5 MHz linear probe (Hitachi Aloka Medical, Ltd.; Tokyo, Japan) in accordance with methodology stated by Milerski (2007) and Stádník et al. (2009).

The stud, breed, sex of lambs, age of dams, month of lambing, litter size and number of weaned lambs were also recorded from the farms records.

### *Evaluated traits*

The basic reproduction traits of fertility – lambing rate (LR) (% proportion of lambed ewes within the group) and litter size (LS) (included all born lambs – live and dead) and production parameters – total litter weight at birth and at weaning in kg were assessed. Within 12 h of birth, lambs were identified to their dam, weighed and tagged. They were weighted again with the use of tensometric scale VHD (My Weigh; Erkelenz, Germany) ±0.1 kg repeatedly at the weaning (at the age from 80 to 120 and the age was recalculated by linear interpolation on an average of 100 days).

### *Statistical evaluation*

The statistical analysis of reproduction and production traits was performed by SAS 9.3 (SAS/STAT® 9.3., 2011) using the CORR, REG and GLM procedures. The REG procedure under STEPWISE method was used to appropriate model selection.

Combined effect of stud and breed as well as of ewe LW at mating, ewe BT at mating, and linear regression of the ewe's age on the lambing rate and litter size were taken into account as the evaluated factors. The model equation for production traits was supplemented by effects of litter sex, linear regression on month of lambing, and linear regression either on litter size (in litter weight at lambing) or number of weaned lambs (in litter weight at weaning). Ewes were divided according to their LW and BT at mating into three groups in accordance with thresholds stated by $\bar{x}$ -½ $_{sd}$ <; $\bar{x}$ -½ $_{sd}$ to $\bar{x}$ + ½ $_{sd}$; > $\bar{x}$ + ½ $_{sd}$.

$Y_{ijklm} = \mu + HB_i + LW_j + BT_k + SEX_l + b_1(AGE) + b_2(MONTH) + b_3(LITTER\ SIZE\ or\ WEANED) + e_{ijklm}$

$Y_{ijklm}$ = value of dependent variable (lambing rate, litter size, litter weight at lambing, litter weight at weaning),

$HB_i$ = combined effect of herd and breed (i = Farm 1, Suffolk, n = 124; Farm 2, Suffolk, n = 89; Farm 3, Suffolk, n = 74; Farm 4, Suffolk x Merinolandschaf, n = 85; Farm 5, Suffolk x Kent, n = 39),

$LW_j$ = fixed effect of ewe'live weight group (j = ≤ 69.9 kg, n = 119; 70.0 – 80.7 kg, n= 178; > 80.8 kg, n = 113),

$BT_k$ = fixed effect of ewe'backfat thickness group (k = ≤ 7.69 mm, n = 126; 7.70 – 10.65 mm, n = 161; ≥ 10.66 mm, n = 123),

$SEX_l$ = fixed effect of litter sex (l = ram lambs only, n = 109; lambs only, n = 103; both sex of lambs, n = 137) – in evaluation of production traits only,

$b_1$(AGE) = linear regression to age of the ewe,

$b_2$(MONTH) = linear regression to month of lambing – applied in evaluation of production traits only,

$b_3$ (LITTER SIZE) = linear regression to litter size – applied in evaluation of litter weight at birth only,

$b_3$ (WEANED) = linear regression to number of weaned lambs – applied in evaluation of litter weight at weaning only,

$e_{ijklm}$ = residual error.

The statistical significant differences were evaluated on the levels P < 0.05 and 0. 01.

## Results

The correlation coefficients among selected parameters of ewes and fertility and production traits are presented in Table 1. Ewe live weight (LW) at mating was correlated with selected traits (r = 0.230 to 0.508; P < 0.01). Ewe backfat thickness (BT) at mating correlated with total litter weight at birth (r = 0.219; P < 0.01) and at weaning (r = 0.152; P < 0.05). The results are in accordance with the biological principles confirming that lambs live weight at weaning is influenced by others factors. The supposition that heavier litters at birth are also heavier at weaning was confirmed by r = 0.548, P <0.01.

The aim of this study was to evaluate effect of ewes' LW and BT at mating on lambing rate (LR) and litter size (LS) values. The results are presented in Table 2. An evident increase in LR was observed with an increase of ewe LW at mating. Differences between the 1st group of the lightest sheep (LW ≤ 69.9 kg) and 2nd (middle weight ewes of LW 70.0 to 80.7 kg) or 3rd group (the heaviest sheep of LW ≥ 80.8 kg) were 8.51% or 11.00% (P > 0.05) respectively. An identical trend was also observed in parameter of LS depending on the LW at mating (P < 0.05 to 0.01). The lowest values were thus observed in the 1st group when the differences compared to 2nd or 3rd group were 0.20 pcs. (P < 0.05) or 0.28 pcs. (P < 0.01) respectively.

There were marked no statistically significant differences (P > 0.05) in LR depending on ewe BT. The highest value (87.65%) was found in the 1st group (BT ≤ 7.69 mm) +0.75% compared to ewes in the 2nd (BT 7.70 – 10.65 mm) or +0.18% to ewes in the 3rd group (BT ≥ 10.66 mm). Similarly the same tendency in LS related to BT (maximum difference 0.02 pcs.; P > 0.05) was observed. A definite interpretation of results of both parameters is complicated with respect to low variability and high SE in a context of their LSM. Thus it can be concluded that evaluated production traits were not influenced by sheep BT level (P > 0.05).

The next aim was to evaluate effect of ewes LW and BT at mating on their lamb's weight as production trait. The results are presented in Table 3.

The increase of litter weight at birth with increase of ewes LW was as well as in reproduction traits determination. Thus the 3rd group had higher total litter weight at birth (+0.75 kg; P < 0.01) compared to the 1st and (+0.07 kg; P < 0.05) to the 2nd group. The lower total litter weight at birth (-0.68 kg; P < 0.01) was also detected in the 1st compared to 2nd group. The same trend was also reflected by the total litter weight at weaning (at the age of 100 days). The higher total litter weight was observed in the 3rd group +4.81 kg (P < 0.01) or +3.13 kg (P < 0.01) compared with the 1st or 2nd group respectively.

There was a trend clearly increased the litter weights with respect to BT evaluation at mating. The highest value of total litter weight at birth (8.68 kg) was determined in the 3rd group when the differences amounted +0.23 kg (P < 0.05) or +0.13 kg (P > 0.05) compared to the 1st or the 2nd group respectively. An increased trend was subsequently observed in total litter weight at weaning as well. The highest values were also found in the 3rd group with +1.33 kg or +0.68 differences to the 1st or

**Table 1**
**Correlation coefficients (r) among selected variables and its significance (P)**

| | | Ewes‘ backfat thickness at mating | Age of ewes | Litter weight at birth | Litter weight at weaning |
|---|---|---|---|---|---|
| Ewes‘ live weight at mating | R | 0.508 | 0.377 | 0.393 | 0.230 |
| | P | <.0001 | <.0001 | <.0001 | 0.0002 |
| Ewes‘ backfat thickness at mating | R | | -0.041 | 0.219 | 0.152 |
| | P | | 0.409 | <.0001 | 0.015 |
| Age of ewes | R | | | 0.210 | 0.035 |
| | P | | | <.0001 | 0.572 |
| Litter weight at birth | R | | | | 0.548 |
| | P | | | | <.0001 |

2nd group (P > 0.05). Simultaneously the higher average value of total litter weight at weaning +0.65 kg (P > 0.05) was found in the 2nd group compared to 1st one. However, these results can be interpreted due to lower SE values in a context to their LSM despite the absence of statistical significance (P < 0.05 to 0.01). Thus it can be stated that the litter weights increased with increasing BT of ewes at mating.

## Discussion

Based on previous studies it is obvious, that effects of stud, breed and age of dam are significant (P < 0.05 to 0.01) for fertility and production traits as confirmed by wide range of studies (Yilmaz et al., 2011; Abdel-Mageed and Abo El-Maaty, 2012; Aliyari et al., 2012). Therefore evaluation of relationships performed in present study was corrected for effect of these factors. As expected generally results of above mentioned authors were confirmed also in our study. Within production traits, effects of litter sex, month of lambing and either litter size (in litter weight at birth) or number of weaned lambs (in litter weight at weaning) were added into model applied. Also effect of these factors was significant (P < 0.01) and confirmed results of Kenyon et al. (2004) or Štolc et al. (2011).

Number of reports have been previously published regarding the relationship among ewe's live weight (LW), their backfat thickness (BT) or especially body condition scoring (BCS) at mating, and their fertility and production performances in fat-tailed sheep especially. The significant correlations were detected among fertility and production traits observed in our study confirming findings of Sahin et al. (2001) who determined correlation between LW at weaning (90 days of age) a LW at the age of 6 month (0.68; P < 0.01) in Merino lambs.

The factor of ewes LW at mating was described in detail by Atti et al. (2001) in fat-tailed Tunisian Barbarine sheep. The lowest values of lambing rate (LR) and litter size (LS) were detected in ewes with LW 30 kg. Progressive increase of both parameters was observed up to the weight of 50 to 55 kg. After achieving this LW a moderate decrease (-0.1%

**Table 2**
**LSM (±SE) of ewe reproduction traits according to ewe live weight and backfat thickness at mating**

| Ewes' body weight at mating | Lambing rate, % | Litter size in pcs. |
|---|---|---|
| | LSM ± SE | LSM ± SE |
| ≥ 69.9 kg (n = 119) | 80.84 ± 4.045 | 1.57 ± 0.072$^{a,A}$ |
| 70.0 to 80.7 kg (n = 178) | 89.35 ± 3.686 | 1.77 ± 0.064$^{b}$ |
| ≤ 80.8 kg (n = 113) | 91.84 ± 3.877 | 1.85 ± 0.066$^{B}$ |
| Ewes' backfat thickness at mating | Lambing rate, % | Litter size in pcs. |
| | LSM ± SE | LSM ± SE |
| ≥ 7.69 mm (n = 126) | 87.65 ± 3.998 | 1.72 ± 0.071 |
| 7.70 to 10.65 mm (n = 161) | 86.90 ± 3.596 | 1.72 ± 0.063 |
| ≤ 10.66 mm (n = 123) | 87.47 ± 3.932 | 1.74 ± 0.067 |

Different superscript letters mean a significant difference within a column – a,b = P < 0.05; A,B = P < 0.01.

**Table 3**
**LSM (±SE) of ewe production traits for ewe live weight and backfat thickness at mating**

| Ewes' live weight at mating | Litter weight at birth, kg | Litter weight at weaning, kg |
|---|---|---|
| | LSM ± SE | LSM ± SE |
| ≥ 69.9 kg (n = 119) | 8.09 ± 0.083$^{A}$ | 57.61 ± 1.295$^{A}$ |
| 70.0 to 80.7 kg (n = 178) | 8.77 ± 0.075$^{B}$ | 58.29 ± 1.148$^{A}$ |
| ≤ 80.8 kg (n = 113) | 8.84 ± 0.075$^{B}$ | 62.42 ± 1.213$^{B}$ |
| Ewes' backfat thickness at mating | Litter weight at birth, kg | Litter weight at weaning, kg |
| | LSM ± SE | LSM ± SE |
| ≥ 7.69 mm (n = 126) | 8.45 ± 0.081$^{a}$ | 58.78 ± 1.209 |
| 7.70 to 10.65 mm (n = 161) | 8.58 ± 0.072 | 59.43 ± 1.127 |
| ≤ 10.66 mm (n = 126) | 8.68 ± 0.078$^{b}$ | 60.11 ± 1.287 |

Different superscript letters mean a significant difference within a column – a,b = P < 0.05; A,B = P < 0.01.

in LR and 0.15 pcs. in LS) occurred. In our study there was a stable increase of both fertility parameters with increasing ewe LW at mating. Thus the results largely confirmed applicability of mentioned findings also for meat sheep breeds and their crossbreeds. The meat type sheep has been bred to their LW for many decades. Therefore it seems that naturally heavier sheep are characterized by better physiological functions. This is manifested by better organism conditioning for the gestation period and thus higher fertility traits (Abegaz et al., 2002; Gaskins et al. 2005).

The same methodology of BT assessment was also used by Abdel-Mageed and Abo El-Maati (2012). They found LR increase from +9.0 to +26.0% ($P < 0.01$) in ewes with 1.5 to 2 mm of BT compared to < 1.5 mm ewes. There was a low LR decrease (-2.0%; $P > 0.05$) in ewes with BT > 2 mm. Nevertheless both these groups (1.5 to 2 mm as well as > 2 mm) were evaluated as optimal regarding to sheep fertility. Absolutely identical results of mentioned authors were also obtained in LS parameter. Abdel-Mageed and Abo El-Maaty (2012) consider ultrasound BT measurement as more suitable method compared to subjective BCS evaluation. Similarly Ptáček et al. (unpublished data) found high correlation (0.899; $P < 0.01$) between BT and their BCS, therefore both parameters can be substitutable. Effect of BCS at mating on fertility traits in 3 rustic Turkey breeds of Kivircik, Sakiz and Goceada was described by Sezenler et al. (2011). The lowest values of LR (-17.9 to -22.2%; $P < 0.01$) were achieved by sheep mated in the lowest BCS (2 points) compared to ewes in BCS > 3 as well as nonsignificantly the highest values of LS in sheep with BCS of 2 (+0.081 to +0.219) paradoxically. An optimal BCS at mating for ewe LR in Kivircik sheep is according to Yilmaz et al. (2011) in the range of 2.5 to 3 (+14.2 to +39.2; $P < 0.01$) compared to ewes in BCS < 2 or (+2.0 to 19.5; $P < 0.01$) compared to ewes in BCS > 3.0 respectively. Differences in fat-tailed sheep fertility are according to all the mentioned authors caused by higher ovulation rate and therefore the higher potential lambing rate in ewes with higher body reserves. These findings were also confirmed in meat type sheep monitored in our study where ewes with higher body fat reserves (BT) showed a higher fertility and thus higher LS consequently. The applicability of these findings in fat-tailed Lori-Bakhtiari breed was confirmed by Vatankhah et al. (2012) who noted either the highest conception rate (+1.0 to +67.0%; $P < 0.01$) or LS (+0.01 to +0.82; $P < 0.01$) in sheep with the highest BCS (3.5 and 4) compared to ewes in lower BCS (1, 2, 2.5, 3). The reason for the reduced conception rate in ewes of low body reserves might be the reduced gonadotrophin releasing hormone production in undernourished ewes, which inturn affects the pre-ovulatory luteinizing hormone surge, fertilization and early embryonic development (Sejian et al., 2010). As a result the lower number of fertilized and lambed ewes occurs followed by the lower LS subsequently (Louda and Stádník, 2000). In addition the lower body reserves are correlated with decline of embryo (Webb et al., 2004) and fetus (Osgerby et al., 2003) survival. Vatankhah et al. (2012) also pointed out that the optimal BCS at mating vary depending on the genotype and environment (mainly climate or nutrition conditions). The trend of improved reproduction traits connected with an increased body reserves can be generally confirmed also in intensive meat type sheep in our study as well as in the local rustic breeds published by many authors. However, the excessive body fat reserves may negatively affect the fertility of milk or multiple purpose sheep (Nedelkov et al., 2012), due to its utilization for increasing of the milk yield. Physiological background of these processes should correspond to those determined in dairy cows (Stádník et al., 2002). On the other hand it seems that the BCS limit negatively affecting fertility is up-moved in meat type sheep by the long-term selection and breeding processes of these breeds. Thus the impact of higher body fat reserves on reproduction traits of meat type sheep is rather positive.

Number of authors have been previously reported the relationship of LW, BT or BCS at mating on lambs live weight (total litter weight) at birth and at weaning (individual lambs as well as the whole litter). There was an increase of total litter weight at birth as well as weaning weight of lambs in dependence on increased ewe LW at mating according to Aliyari et al. (2012). Ewes in the highest LW (74 to 80 kg) overreached ewes in LW of 52 to 71 kg by 0.010 to +0.766 kg ($P > 0.05$) in total litter weight at birth and +0.13 to +2.73 kg ($P < 0.05$) in lambs weight at weaning respectively. These results previously observed in local rustic breeds are in accordance with the results achieved by intensive meat type sheep in our study. Study of Aliyeri et al. (2012) did not look for the explanation of these findings. It is possible to suppose that differences in ewe LW in the same climate, the same level of nutrition and management of breeding can be explained by the genetic disposition of the sheep individuality. That is exactly reflected in genetic predisposition and cause that some ewes were able to receive more feed and convert it to muscle and fat tissue. Their higher LW at mating was reflected in higher number of oocytes ovulated that was the basic predisposition of higher LS subsequently. Similarly, higher LW also reflecting ewe body fat reserves during pregnancy was a predisposition for increased fetal growth and thus higher litter weight at birth. Heavier lambs at birth are generally more viable (Sawalha et al. 2007). In addition, ewes with higher body fat reserves have more energy for milk production, which can be related to higher total litter weight at weaning (Snowder and Glimp, 1991). There are also differences in ewes' milk volume and content compound (Ivanova et al., 2013; *Barać et al., 2013) that could affect meat performance of their lambs according to our assumption*. Relations between ewe LW at mating and litter weight at weaning were also confirmed by the correlations presented in Table 1.

In the study of Abdel-Mangeed and Abo El-Maaty (2012) the lambs birth weight and live weight at weaning was observed based on BT of ewes in Egyptian local sheep breeds Rahmani, Barki and Ossimi. The highest birth weight (+0.2 to +0.9 kg; P < 0.05) as well as live weight (+1.8 to +3.9 kg; P < 0.05) of weaned lambs were found in sheep with BT > 2.0 mm comparing to ewes with BT <1.5 mm and from 1.5 to 2.0 mm. The similar results were obtained by Aliyari et al. (2012) in Iranian fat-tailed sheep breed Afshari in evaluation of body fat reserves using BCS. They found the highest value of total litter weight at birth in sheep of BCS 3 (+0.66 to +1.86 kg; P < 0.05) compared with BCS of 2, 2.5 and 3.5. The lowest litter weight at birth (-1.16 to -1.86 kg; P <0.05) but paradoxically also the highest live weight of lambs at weaning (+1.46 to +2.37 kg; P <0.05) were marked in sheep with the highest BCS on the level 3.5 at mating compared to others (BCS 2 to 3). The influence of ewe BCS at mating on total litter weight at birth and at weaning was confirmed also by Vatankhah et al. (2012). The lower values of litter weight at birth (-0.11 to -0.58 kg; P < 0.01) and at weaning (-0.91 to -6.5 kg; P < 0.01) in ewes with lower BCS 1 to 2.5 were observed. They explained these results by the improper nutrition of ewes in the lower BCS, during the final stages of gestation. In meat type sheep (purebreds and crossbreds) we confirmed this statement observed by BT assessment of fat reserves. Lower energy for fetal growth in final stage of pregnancy as well as lower energy source for milk production presented by improper nutrition of weaned lambs were suggested as explanation (Abdel-Mageed and Abo El-Maaty, 2012). By contrast according to study of Vatankhah et al. (2012) a decrease of litter weight at birth (-0.49 kg; P < 0.01) and at weaning (-2.13 kg; P < 0.01) respectively in sheep over BSC 3.5 at mating was observed. Effect of different ewe genotype, diet composition and environment mentioned in the reproductive traits evaluation were also manifested in production traits of meat type sheep compared to fat-tailed breeds.

## Conclusion

Results of the study confirmed the importance of factors of ewe live weight (LW) and body fat reserves expressed by backfat thickness (BT) at mating on their reproduction and production performance. Sheep with the highest LW (≥ 80.8 kg) at mating showed higher lambing rate (P > 0.05) and litter size (P < 0.05 to 0.01) as well as total litter weight at birth (P < 0.01) and at weaning (P < 0.01). Results of BT effect evaluation showed nonsignificant effect on reproduction parameters represented by lambing rate and litter size. On the other hand effect of BT on production traits as especially total litter weight at birth (P < 0.05) and at weaning (P > 0.05) was proved.

The total sheep efficiency is thus influenced by their nutrition status expressed by LW and BT. The biological processes of meat type sheep at mating as well as during pregnancy and on the beginning of lactation focusing diet utilization, growth abilities and milk yield are largely described and discussed in presented study. Consequent interactions between sheep fertility and their production abilities are also expressed in detail. The results are thus directly applicable in the commercial sheep flocks.

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