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The effect of the backfat thickness loss on reproduction in lactating sows

Vliv změny výšky hřbetního sádla u laktujících prasnic na reprodukci

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Abstract

The work discusses the influence of the backfat thickness change, during sow´s lactation, on their subsequent litter characteristics. The reproduction potential of 478 sows of two genotypes was assessed. The genotypes were 50 Large White (LW_D) sows and 428 crossbreeds Large White x Landrace (LW_D x L) sows. The backfat thickness decline was examined in accordance to P_2, backfat thickness in sows during lactation namely 1 day before planned parturition as well as weaning. From the obtained results it can be stated that the backfat thickness decline level during lactation has a small influence on the number of total born piglets. In contrast, the number of piglets born alive increased when backfat thickness rate increased. With a moderate backfat thickness decline, the average birthweight piglets gradually increased. However, the opposite trend was shown for the average weight at weaning. The backfat thickness decline level during sow´s lactation influences their farrowing interval. Animals with a lower increase of the backfat thickness subsequently showed a shorter farrowing interval (148.99, respectively 151.86 days), as well as a shorter weaning – estrus interval.

Keywords: backfat thickness, pigs, reproduction, sows

Abstrakt

Práce se zabývá vlivem poklesu výšky hřbetního sádla prasnic během laktace na vybrané znaky reprodukční užitkovosti následujících vrhů. Hodnocen byl reprodukční potenciál 478 prasnic dvou genotypů. Genotypy byly 50 prasnic BU a 428 kříženek BU x L. Tělesná kondice byla posouzena v souladu s výškou hřbetního sádla P_2 u prasnic během laktace v přesně stanovený 1 den před porodem a odstavem.

Ze získaných výsledků je zřejmé, že míra poklesu hřbetního sádla během laktace má malý vliv na celkový počet narozených selat. Naproti tomu se při zvýšení vrstvy hřbetního sádla zvýšil počet živě narozených selat. S mírným poklesem výšky hřbetního sádla se postupně zvyšovala průměrná porodní hmotnost. Nicméně opačný trend byl zjištěn pro průměrnou hmotnost při odstavu. Mezidobí bylo ovlivněno mírou poklesu hřbetního sádla během laktace. Kratší délka následujícího mezidobí (148.99, respektive 151.86 dní) byla zjištěna u prasnic s mírným zvýšením výšky hřbetního sádla, stejně jako kratší interval mezi odstavem – říjí.

Klíčová slova: hřbetní tuk, prasata, prasnice, reprodukce

Detailní abstrakt

Energie, jako jedna ze složek krmné dávky, pokud je přijímána v nadbytečném množství, je uložena v tukové tkáni. Výška tukové tkáně hraje významnou roli u plemenných zvířat, zvláště u samic během březosti a laktace, kdy je na organizmus samice kladen vysoký energetický nápor. Během tohoto období pak samice využívají této energetické rezervy – tuku. Je nezbytné, aby prasnice, stejně jako i ostatní samice, byly během reprodukčního cyklu v odpovídajícím kondičním stupni. Za tímto účelem je měřena výška hřbetního tuku a je sledováno její kolísání během březosti a laktace.

V práci je sledován vliv poklesu výšky hřbetního sádla prasnic během laktace na vybrané znaky reprodukční užitkovosti následujících vrhů. Sledováno bylo 478 prasnic dvou genotypů. Četnost byla 50 prasnic BU a 428 kříženek BU x L. Tělesná kondice byla posouzena podle výšky hřbetního sádla P_2. Měření probíhalo dvakrát, první měření se konalo 1 den před plánovaným porodem – FATF, druhé měření proběhlo 1 den před odstavem – FATW. Na základě změny výšky hřbetního tuku během laktece (FATF – FATW) byly prasnice rozděleny do třech skupin. Změna výšky hřbetního tuku u skupiny G1 byla v intervalu – 15 až – 3.5 mm; G2 od – 3 do + 1 mm a G3 + 1 až + 1.5 mm.

Analýza reprodukčního potenciálu následných vrhů u prasnic byla provedena pro každou skupinu, kde byly sledovány tyto reprodukční charakteristiky: celkový počet narozených selat, počet selat narozených živě, počet odstavených selat, průměrná porodní hmotnost selat (kg), průměrná hmotnost selat při odstavu (kg), průměrná hmotnost vrhu při porodu (kg), průměrná hmotnost vrhu při odstavu (kg) a mezidobí (dnů).

Statistické analýzy byly provedeny za použití GLM procedury programu SAS (SAS Institute Inc., 2001).

Výsledky dokládají, že míra poklesu hřbetního sádla během laktace má malý vliv na celkový počet narozených selat. Naproti tomu se při zvýšení vrstvy hřbetního sádla zvýšil počet živě narozených selat. S mírným poklesem výšky hřbetního sádla se postupně zvyšovala průměrná porodní hmotnost. Nicméně opačný trend byl zjištěn pro průměrnou hmotnost při odstavu. Mezidobí bylo ovlivněno mírou poklesu hřbetního sádla během laktace. Kratší délka následujícího mezidobí (148.99, respektive 151.86 dní) byla zjištěna u prasnic s mírným zvýšením výšky hřbetního sádla, stejně jako kratší interval mezi odstavem – říjí.

Introduction

Backfat thickness is the principal production character in pigs. It expresses the amount of energy intake in relation to energy output and consequently the requirement of body – fat – cover renewal (Boyd et al., 2002).

The adequate sow´s nutrition during their reproduction cycle is selected in accordance to their body score condition (BSC) which, in many respects, represents the body fat proportion. This can be measured as backfat thickness or subjectively evaluated on the basis of an exterior assessment of the animal (Beckova et al., 2005).

A low backfat thickness at the time of sow fertilization (less than 10 – 20 mm) means a low body fat store of required fat – soluble vitamins, as well as a lower disease resistence and worse reproduction results, especially in the winter months and during short-term temperature changes (Odehnal et al., 1989).

Older sows, when compared to gilts, are larger and heavier. Logically they require a greater maintenance ration. With higher reproduction potential during the previous reproduction cycle, this difference is even greater. The spectrum of potential reproduction, as well as body fat deposits, is very wide. The backfat thickness of 22 – 24 mm at the last rib before gilt parturition, respectively 17 – 19 mm for sows, corresponds to the recommended BSC which leads to satisfactory pig reproduction potential (Boyd et al., 2002).

The result of a precise feeding strategy during sow pregnancy is medium growth intensity and maintenance of approximately the same level of backfat thickness for subsequent parturition. From this point of view, a backfat thickness of 18 – 22 mm is recommended. For optimum BSC ante partum, it is necessary to measure backfat thickness at weaning. Then it is possible to establish an adequate feeding strategy for pregnant sows (O´Doherty, 2002).

It has been documented that sows with a 17 – 21 mm backfat thickness are more efficient than those with a backfat thickness beyond this interval (Block, 2003). However, sows with a fat cover of 22 – 24 mm ante partum did not demonstrate a higher efficiency. The lives of sows with a fat cover of 12 mm or less are in direct jeopardy (Boyd et al., 2002).

Lactation is the most crucial period of the reproductive life of sows. During this period BSC declines, respectively the backfat thickness by cca 4 – 5 mm. At the same time, there is a significant variability in the parities between both various farms and also sections of one farm in parities of various sows (Kiehne, 2002). The body score decline is connected with milk production. Body fat and protein deposits are essential for milk production. For a sow in partum, therefore it is important to be in good condition corresponding to a 3.5 BSC at weaning, respectively cca 20 – 23 mm of backfat thickness (Mackinnon, 2003).

A significant body reserve reduction causes the lowers parameters of subsequent reproduction characters, including lactation (Whittemore, 1996). A body weight loss of 8 – 11 kg is considered as normal (Kodes et al., 2001). The greater weight loss then is a function of litter frequency (Rydhmer et al., 1992), the piglets´ growth intensity and mortality (Valros et al., 2003), subsequent fertility after weaning (Mullan, Williams, 1989), the number of non – productive days (Mercer, Francis, 1988), as well as the degree of backfat thickness loss during lactation (Thorup, 2004).

A backfat thickness loss of 1 mm ante partum means a backfat thickness decrease by 0.2 mm in lactation (Guedes, Nogueir, 2000).

This work focuses on the examination of the influence of the extent of changes in backfat thickness during lactation on selected reproduction traits of subsequent litters in pigs. The change in backfat thickness during a sow's lactation influences reproduction traits of subsequent litters in pigs.

Materials and Methods

Animals and herd

The monitoring was carried out in a commercial large scale production pig farm with closed herd turnover. Part of the herd was used for reproductive purposes and consisted of breeding animals, producing F1 cross – breds for the further purposes of breeding. The remaining part of the herd consisted of production animals (dihybrid sows), for purposes of final hybrids production. The total sum of animals used in this study was 1750 sows and gilts. The herd consisted of 210 purebred sows of the LW_D genotype and 1540 dihybrid sows of the LW_D x L genotype. In order to obtain data for this study, there was a total number of 478 animals (358 sows and 120 gilts) randomly selected and further monitored. These subjects were used in order to monitor the reproduction parameters following several successive parturitions. 40 parturitions of sows of different parities were monitored weekly.

Backfat thickness measuring

At fixed periods, the backfat thickness was measured. The backfat thickness was estimated twice; firstly, 1 day before the planned farrowing for the first time – FATF, secondly, 1 day before weaning – FATW. On the basis of changes in backfat thickness level during the lactation periode (FATF – FATW) were sows divided into 3 groups. The backfat decrease for group G1 was in the interval – 15 till – 3.5 mm; G2 from – 3 to + 1 mm and G3 + 1 till + 1.5 mm.

The backfat thickness decline was estimated on the basis of P_2 backfat thickness in sows (Table 1). For this purpose the universal ultrasound SONOMARK SM 100 M equipment was used. The backfat thickness at the P_2 point is defined in accordance with Methodical Instructions for tests of individual performance realization in pigs in the following way. The initial measuring point is determined in the middle of the spinal line. Point A0 is located at the groin perpendicularly above the elbow joint. Point C0 is in the loin region perpendicularly above the knee – cap. B0 point represents the midpoint between these. The measuring point lies ¾ +30 mm caudally between points A0 and 70 mm from the middle of the spinal line.

Table 1. The sows distribution in accordance the backfat thickness level changes during the lactation

Tabulka 1. Zastoupení prasnic ve skupinách podle změny výšky hřbetního sádla během laktace

Group	Item	N	Mean	Min.	Max.
1	Change in backfat thickness (mm)	202	- 6.9	- 15	- 3.5
	Backfat thickness (mm)	202	28.6	11.5	35
2	Change in backfat thickness (mm)	234	- 1.3	- 3	1
	Backfat thickness (mm)	234	23.1	7	38
3	Change in backfat thickness (mm)	42	1.3	1	1.5
	Backfat thickness (mm)	42	20.4	9	35

Monitored variables

An analysis of the reproduction potential of the sow´s subsequent litters was performed in each group, where the following reproduction characteristics total number of born piglets, number of piglets born alive, number of piglets weaned, average piglet birthweights (kg), average piglet weight at weaning (kg), average litter weight at parturition (kg), average litter weight at weaning (kg) and farrowing interval (days) were monitored

Statistics and model

For monitoring of the reproduction characteristics, the MIKROREP (Konfirm, Ltd.) program for herd – sow – management as well as the company´s dataset was used. The statistical analyses were performed using the GLM procedure of the SAS (SAS Institute Inc., 2001).

The model included the fixed effect of the group backfat thickness change (G), parity (P) and backfat thickness a day before farrowing (ß) as covariates were used. Differences between means were tested by Tukey's method. Because no effect or interactions of genotypes (LW_D; LW_D x L) was detected, these data were removed from the model. The following model was used:

$$Y_{ijkl} = \mu + G_i + P_j + \beta_k + e_{ijkl}, \quad \text{where}$$

Y_{ijkl} = trait value of animal n,
μ = estimated mean value of a trait for the animals included in the model
G_i = effect of the group backfat thickness change ($_i$=1: <-15;-3,5>, 2:<-3;+1>, 3:<+1;+1,5>),
P_j = parity effect ($_j$ = 1,2,3,4,5,6,7,8,9,10,11,12,13),
$ß_k$ = effect of the backfat thickness a day before farrowing as a covariate ($_k$ = fat thickness in mm),
e_{ijkl} = residual errors.

Results and Discussion

Table 2. shows the basic statistics for all the variables studied. There are the values of the impact effects on reproduction characters used in the statistical model. It is evident that a significant impact on the total number of piglets born, their average birth weight and litter average birthweight at parturition has the effect of parity (P). The backfat thickness (ß) affects the average birth weight and farrowing interval.

Table 2. The monitored reproduction variables – basic statistics

Tabulka 2. Sledované proměnné reprodukce – základní statistika

Variable	G	P	β
Total number of piglets born (pc.)	0.88	0.03	0.16
Number of piglets born live (pc.)	0.61	0.16	0.91
Number of piglets weaned (pc.)	0.85	0.44	0.79
Average piglet birthweight (kg)	0.21	0.06	0.02
Average piglet weight at weaning (kg)	0.70	0.41	0.78
Average litter weight at parturition (kg)	0.46	0.04	0.36
Average litter weight at weaning (kg)	0.20	0.89	0.98
Farrowing interval	0.74	0.90	0.05

G – group; P – parity; β – bacfat thickness

On the base of the results obtained in Table 3, it is possible to state that the level of backfat thickness decline in sows during lactation has a small, significant effect on the total number of piglets born, since all the groups showed very well – balanced results in the range of 10.76 – 10.84 total piglets born.

Table 3. The influence of the backfat thickness changes on the reproduction of the subsequent litters in lactation sows

Tabulka 3. Vliv změny výšky hřbetního sádla u laktujících prasnic na následnou reprodukci

Item	Groups according to the backfat thickness changes level			F value	p value
	G1 ls means	G2 ls means	G3 ls means		
Total number of piglets born	10.76	10.78	10.84	1.66	0.056
Number of piglets born live	9.73	9.97	10.17	1.17	0.056
Number of piglets weaned	9.29	9.42	9.14	0.86	0.607
Average piglet birthweight (kg)	1.26	1.24	1.31	1.92	0.020
Average piglet weight at weaning (kg)	7.08	6.81	6.94	0.97	0.488
Average litter weight at parturition (kg)	12.18	12.33	13.11	1.57	0.077
Average litter weight at weaning (kg)	65.45	64.58	62.93	0.69	0.792
Farrowing interval (days)	151.86	149.78	148.99	0.64	0.842

In contrast to this, for the number of piglets born alive, an increase of reproduction potential in sows with a lower decline in backfat thickness was confirmed, these sows were characterised with backfat increase. The maximum number of piglets born live was determined in G3 at the level of 10.17. The maximum number of piglets weaned was reached in G2, which included animals with an average decrase in the level of backfat thickness during lactation.

In comparison, group 3, with an increase in backfat thickness, showed the lowest number of piglets weaned (9.14 piglets) but the highest number of piglets born live.

It can be concluded from the above – mentioned results that sows with minimum losses of body index during lactation have problems with milk production, which eventually leads to high piglet losses in comparison with other groups.

On the other hand, sows with a high level of backfat thickness decline in group 1, showed the lowest number of piglets born live, but at the same time had no problem in maintaining them. These sows showed the lowest piglet losses at a level of 4.5 % during lactation.

It is evident from the above – mentioned results that within the framework of the reproductive traits monitored, no trends were documented. The average piglet birth weights were relatively well – balanced, with minimal differences between the monitored groups, but statistically significant (Table 3). The highest results were shown in G3 (1.31 kg), and the lowest in G2 (1.24 kg).

Concerning the average piglet weight at weaning, G2 also showed the lowest result (6.81 kg), while the heaviest piglets (7.08 kg) were found in G1. These findings indicate that there is no relationship between the level of backfat thickness decline and average piglet weight.

From the evaluation of the average litter weight, it follows that with increasing backfat thickness, the subsequent average litter weight at parturition gradually increased (a direct relationship to the parallel trend concerning the number of piglets born live). A contrary tendency was shown concerning the average litter weight at weaning.

A decreased backfat thickness was connected with higher average litter weight at weaning. Here again there is clearly a visible connection with the number of littermates in the number of piglets weaned.

In agreement with the results, it can be stated that the farrowing interval has an influence on change in backfat thickness during lactation. Those animals with an increase of backfat thickness subsequently demonstrated a shorter farrowing interval. G1 showed a farrowing interval of 151.86 days, as opposed to G3, only 148.99 days. This interaction with regard to body weight decline in lactation was confirmed by Tantasparuk et al., (2001). Animals with the greatest body weight losses had a significantly longer weaning – estrus interval, whereas Guedes and Nogueira (2000) did not demonstrate this inter – dependence.

Conclusion

The level of backfat thickness decline during lactation in sows had a small, but significant effect on the total number of piglets born. The number of piglets born live was increased with a slight increase in backfat thickness. The number of piglets weaned, in which were included animals with an average level of backfat thickness decline, was the highest in G2 during lactation (in practice, with no decline).

No interaction between backfat thickness decline and average piglet weight at weaning was demonstrated.

The moderate decline in backfat thickness indicated that average litter weight at parturition gradually decreases, which is related to a similar trend concerning the number of piglets born alive. However, an opposite trend was shown when, with a moderate backfat thickness decline, the average litter weight at weaning decreased also.

In agreement with our results, the farrowing interval is influenced by the level of backfat thickness decline during a sow´s lactation. Animals without backfat thickness decline subsequently demonstrated a shorter farrowing interval as well as weaning-estrus interval.

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