

**MATERNAL WEIGHT GAIN IN GILTS AND CHANGES
IN THE BODY WEIGHT AND BACKFAT THICKNESS
OF SOWS FED DIETS CONTAINING NAKED OATS
(*AVENA NUDA*)**

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Key words: feeding, gilts, naked oats, sows.

Abstract

The optimal body condition of gilts and sows significantly influences their future reproductive results. The aim of the study was to determine the effect of naked oats used in feed rations for gilts on their diets and on changes in body weight and backfat thickness during gestation and lactation. The study was carried out on Polish Landrace gilts raised on a breeding farm. Three gilts weighing about 30 kg were selected from each of 60 litters and assigned to three groups – two experimental and one control – with 60 individuals each. The ration to the experimental groups contained 40% (D_1) and 20% (D_2) naked oats of the Akt variety. In the sows, body weight and backfat thickness were measured in each reproductive cycle on the day before parturition, the first day after parturition and day 42 of lactation. During the period from the 91st day of pregnancy and during the mating period the gilts and sows were fed the same mixed feed as during lactation. The study showed that the naked oats used in the diet of the gilts and sows had a beneficial effect on their body condition and fat reserves measured as backfat thickness. The naked oats included in the diets to the gilts and sows of both experimental groups increased body weight gain in the sows during gestation, and the lowest weight loss during lactation was noted in these groups as well.

ZMIANY MASY CIAŁA I GRUBOŚCI SŁONINY U LOSZEK I LOCH ŻYWIONYCH MIESZANKAMI Z UDZIAŁEM OWSA NAGOZIARNISTEGO (*AVENA NUDA*)

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Słowa kluczowe: żywienie, loszki, owies nagoziarnisty, lochy.

Abstrakt

Stopień otluszczenia loszek i loch znacząco wpływa na ich wyniki rozrodcze. Celem badań było określenie wpływu diety zawierającej nasiona owsa nagoziarnistego, stosowanej w żywieniu loszek, na ich otluszczenie oraz na zmiany masy ciała i grubości słoniny loch podczas ciąży i laktacji.

Badanie przeprowadzono na zwierzętach rasy Landrace utrzymywanych w gospodarstwie hodowlanym. Z 60 miotów wybrano po trzy loszki o masie ciała około 30 kg i metodą analogów przydzielono je do trzech grup: dwóch doświadczalnych i jednej kontrolnej po 60 osobników w każdej. Mieszanka pełnoporcjowa podawana grupom doświadczalnym zawierała 40% (D_1) i 20% (D_2) owsa nagoziarnistego odmiany Akt. U loch zmierzono masę ciała i grubość słoniny w każdym cyklu reprodukcyjnym w dniu przed porodem, pierwszego dnia po porodzie i w 42 dniu laktacji. Loszki i lochy od 91 dnia ciąży i w okresie krycia były żywione taką samą mieszanką, jak podczas laktacji.

W badaniu wykazano, że owies nagoziarnisty stosowany w diecie loch i loszek miał korzystny wpływ na stan ich ciała i rezerwy tłuszczu mierzone grubością słoniny. Mieszanki paszowe z udziałem owsa nagoziarnistego, podawane loszkom i maciorom obu grup doświadczalnych, przyczyniły się do zwiększenia przyrostu masy ciała u loch podczas ciąży. W grupach doświadczalnych odnotowano też najniższą utratę masy ciała loch podczas laktacji.

Introduction

Nutrition is the main factor influencing reproductive performance and longevity sows (KARPIESIUŁ et al. 2018). Normal functioning of the body requires an appropriate balance to be maintained between the amount of energy supplied by the diet and the amount of energy expended. The degree of diets in gilts significantly influences their future reproductive results (BOCIAN et al. 2010, MATYSIAK et al. 2010, REKIEL et al. 2016).

Rational nutrition for pregnant and nursing sows affects their body weight in individual phases of the reproductive cycle, as well as the thickness of the backfat. The diet of pregnant sows should ensure appropriate body condition in the sow during lactation. According to YOUNG et al. (2004), backfat thickness is a reliable indicator that is simple to assess.

Proper nutrition is also necessary to prevent excessive weight loss in sows during lactation and excessive fat storage during gestation, which affects reproductive performance. According to FANDREJEWSKI et al. (1994), in order to protect sows from excessive loss of body weight and reserves of fat and protein, they should be ensured a suitable level and quality of nutrition. The appropriate level of energy, protein and amino acids in fodder given to sows is discussed by WILLIAMS and MULTAN (1989), JOHNSTON et al. (1993), COFFEY et al. (1994), PETTIGREW and YANG (1997) and GRELA et al. (2005).

Nevertheless, losses in body weight during lactation are inevitable. During lactation the sow exploits her accumulated energy reserves in the form of subcutaneous fat and internal fat. When these reserves are exhausted, the organism of the sow draws energy from other tissues, leading to a significant decrease in body weight. The magnitude of the loss of body weight components depends on the quantity and type of fodder given in each period of the reproductive cycle (particularly lactation), on the size of the litter that the sow is nursing, and on the length of the nursing period (WIELBO 1995, REKIEL 2002).

Restoration of fat tissue and maintenance of optimal body weight in successive cycles are very difficult, and in consequence the reproductive potential of sows is not fully exploited (KOCZANOWSKI 1986). During the rearing of each litter, fat content in the body of the sow gradually decreases (YANG et al. 1989). High-energy feeding during the lactation period reduces weight loss and the decrease in backfat thickness, so that sows fed in this manner exploit the energy reserves of their own bodies to a lesser degree (COFFEY et al. 1994, DOURMAD et al. 1994, MIGDAŁ 1996).

Naked oat grain is an excellent fodder for pigs because it has the highest protein and fat content of all cereals, as well as beneficial fibre composition (PELTONEN-SAINIO 1997, PETKOV et al. 2001, SEMENIUK 2001, PISULEWSKA et al. 2011). Naked oats have higher energy value and protein content than other cereals regarded as the most beneficial for feeding monogastric animals (PETKOV et al. 2001). An important component of oats with and without hulls is fat, the content of which ranges from 6% to 8% of dry matter (PIECH et al. 2003, PISULEWSKA et al. 2011). The fat of naked oats is dominated by unsaturated fatty acids (UFA), which account for 80% of the fat (PISULEWSKA et al. 1999). The lipids in oats have been found to contain compounds with strong antioxidant properties, such as tocopherols, ferulic acid, caffeic acid, polyphenolic compounds, their esters and amides, alkylphenols, flavonoids and avenanthramides (PETERSON 2001).

The positive effect of oats on the animal organism is also linked to their high mineral content (CYRAN 1997).

The aim of the study was to determine the effect of naked oats used in feed rations for gilts on their diets and on changes in body weight and backfat thickness during gestation and lactation.

Material and Methods

The study was carried out on Polish Landrace gilts raised on a breeding farm. Three gilts weighing about 30 kg were selected from each of 60 litters and assigned to three groups – two experimental and one control – with 60 individuals each. The animals were fed complete mixed rations in amounts consistent with the requirements given in *Swine Feeding Standards [Normy żywienia świń]* (1993). The mix fed to the experimental groups (3) contained *C* (control) 0%, *D*₁ 40% and *D*₂ 20% naked oats of the Akt variety. The composition and nutritional value of the diets is presented in Table 1.

Table 1

Composition of diets for gilts and for pregnant and lactating sows

Feed [%]	Gilts and sows up to 90 th day of gestation			Lactation		
	<i>C</i>	<i>D</i> ₁	<i>D</i> ₂	<i>C</i>	<i>D</i> ₁	<i>D</i> ₂
Naked oats meal	–	40.00	20.00	–	40.00	20.00
Wheat meal	40.00	–	20.00	40.00	–	20.00
Barley meal	48.40	48.50	48.45	40.00	40.10	40.05
Soybean meal	9.00	9.00	9.00	17.00	17.00	17.00
2-Ca phosphate	0.90	0.90	0.90	1.00	1.00	1.00
Fodder chalk	1.30	1.30	1.30	1.30	1.30	1.30
<i>L</i> -lysine 50% premixture	0.10	–	0.05	0.30	0.20	0.25
NaCl	0.30	0.30	0.30	0.40	0.40	0.40
Content [g/kg of diet]						
ME MJ	12.75	13.03	12.89	12.72	13.01	12.87
Crude Protein [g]	136.32	138.03	137.18	159.00	160.71	159.85
Crude Fat [g]	20.32	39.98	30.17	20.39	40.10	30.24
Lysine [g]	5.96	5.98	5.97	8.56	8.58	8.57
Methionine + cystine [g]	4.84	5.06	4.95	5.40	5.62	5.51
Ca [g]	7.78	7.69	7.73	8.53	8.43	8.48
P [g]	5.55	5.73	5.64	6.09	6.27	6.18
Na [g]	1.35	1.37	1.36	1.77	1.79	1.78

Following the onset of the second and third oestrus, the gilts were weighed and backfat thickness was measured with a Renco PREG-ALERT apparatus in four places: I – above the scapula, 3 cm from the back line, II – behind the last rib 3 cm from the back line, III – behind the last rib 8 cm from the back line and IV – on the lumbar region, 8 cm from the back line. Gel was used to better contact the tube with the skin.

In the sows, body weight and backfat thickness were measured in each reproductive cycle on the day before parturition, the first day after parturition and day 42 of lactation.

During the period from the 91st day of pregnancy and during the mating period the gilts and sows were fed the same diets as during lactation.

The results obtained were analysed statistically using one-way analysis of variance (group effect). Differences between means from each group were determined by Tukey's test.

Results and Discussion

Body condition and fat reserves in gilts at first mating affect the length of their reproductive life. The mean thickness of the fat tissue was highest in the group D_1 gilts; depending on oestrus number (second or third) it ranged from 15.6 to 17.7 mm. The backfat thickness (mean of the 4 measurements) is related to the fat content in the diets: 0, 40, 20 of CF/kg of diets C , D_1 and D_2 corresponds to linear decrease in the backfat thickness of gilts (Table 2).

Table 2

Backfat thickness in gilts during the second and third oestrus

Oestrus	Group	n	Backfat thickness [mm]				
			meas- urement 1	meas- urement 2	meas- urement 3	meas- urement 4	mean of 4 meas- urements
II	C	60	19.3	14.1	10.8	09.8	13.5 ^B ± 2.80
	D_1	60	21.9	16.4	12.8	11.2	15.6 ^A ± 3.20
	D_2	60	20.6	14.7	11.6	10.2	14.3 ± 2.90
III	C	30	20.6	15.4	12.3	11.3	14.9 ^B ± 3.30
	D_1	30	23.6	19.1	14.6	13.3	17.7 ^A ± 4.10
	D_2	30	23.1	16.8	13.2	11.7	16.2 ±3.80

n – number of gilts evaluated

^{A,B} – significant differences within groups of gilts in the second or third oestrus at $p \leq 0.01$

These values differed significantly ($P < 0.01$) from the backfat thickness noted in the control group. It can be stated that the diets containing naked oats fed to the gilts in this study beneficially influenced the increase in backfat thickness. According to many authors (WHITTEMORE et al. 1995, SINCLAIR et al. 1998), backfat thickness exceeding 16 mm determines good reproductive results. The average backfat thickness of currently grown Polish Landrace gilts is approximately 10 mm. The obtained genetic progress of this feature did not adversely affect their reproductive performance (BLICHARSKI and SNOPIKIEWICZ, 2017). High-energy 'flush feeding' a few days before the onset of oestrus in gilts has a beneficial effect on the intensity of ovulation. This effect is much less perceptible in sows (HOFFMANN 1994, VAN DEN BRAND et al. 2001).

Changes in body weight and backfat thickness in sows mated during the second oestrus are presented in Table 3. The data show that the increase in body weight during pregnancy was lower in primiparous sows than in multiparous sows. Body weight and backfat thickness during gestation increased more in the experimental groups than in the control. Body weight loss after parturition ranged from 17.90 to 20.14 kg. Sows in the experimental groups lost less body weight during lactation, although no statistically significant differences were found. Fat reserves measured as backfat thickness at the time of mating were greater in gilts and sows whose diets included naked oats. A similar tendency persisted in the case of the increase in backfat thickness during gestation.

Table 3
Changes in body weight and backfat thickness in sows during gestation and during lactation

Reproductive cycle	Experimental group	Gross body weight gain during gestation [kg]	Body weight loss after parturition	Body weight loss during lactation [kg]	Backfat thickness at mating [mm]	Increase in backfat thickness during pregnancy [mm]	Decrease in backfat thickness during lactation [mm]
I	C	57.90±5.55	17.90	17.00	13.6	4.7	4.6
	D ₁	59.36±4.93	18.33	16.36	16.0	4.9	4.3
	D ₂	58.78±5.10	18.01	16.85	14.4	4.8	4.5
II	C	63.30±6.23	18.97	25.11	13.7	5.5	5.6
	D ₁	64.94±5.47	19.81	23.72	16.6	5.7	5.6
	D ₂	64.09±5.90	19.43	24.39	14.7	5.6	5.8
III	C	63.96±6.64	19.42	25.72	13.6	5.5	5.6
	D ₁	66.72±5.63	20.14	25.90	16.7	6.0	5.9
	D ₂	65.23±6.20	19.88	26.86	14.5	5.8	5.7

A measure of rational nutrition in gilts and sows is the change in body weight and backfat thickness in each stage of the reproductive cycle. During the productive life of the sow, periods of increased body weight during gestation, weight loss after parturition and weight loss during lactation occur in succession (WIELBO 1995, REKIEL 2002). The use of naked oats had a beneficial effect on body weight and fat gain, and also slightly reduced weight loss during lactation. During lactation a 10 kg loss of body weight in sows is a normal process of mobilization of energy and protein reserves needed for intensive milk production. Losses exceeding 10% of body weight may prolong the weaning-to-mating period, which occurs most often in primiparous sows (KAMYCZEK 2006).

Conclusions

The study showed that the naked oats used in the diet of the gilts and sows had a beneficial effect on their body condition and fat reserves measured as backfat thickness.

The naked oats included in the diets to the gilts and sows of both experimental groups increased body weight gain in the sows during gestation, and the lowest weight loss during lactation was noted in these groups as well.

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