

# The fattening results of pigs fed with a diet with the participation of silage from steamed potatoes

## Wyniki tuczu świń żywionych paszą z udziałem kiszonki z parowanych ziemniaków

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### Abstract

The study included 60 finishers of the F<sub>1</sub> crossbreds (Polish Large White x Polish Landrace), a half of gilts and barrows. Animals were divided into two groups of 30 individuals each. The control group (K) amounted to pigs fed with a complete mixtures, while the experimental group (D) - was fed a mixture with the participation of silage from steamed potatoes (26% DM). The mixtures were prepared on the basis of their own cereal pellets and a concentrate. Fattening animals started at body weight of about 30 kg and continued to the average body weight of about 115 kg. The body weight of animals and the quantity of the consumed feed mixtures were recorded during the fattening period. Meatiness of carcasses was evaluated according to the current classification of the EUROP apparatus IM-03. The analysis has been subjected to the following features: total weight gain, fattening period, average daily weight gain, slaughter age and consumption of feed during the fattening and slaughter features: warm carcass weight, slaughter efficiency, fat thickness, the depth of loin muscle and meat content in the carcass. The assessment also includes: the sales value of porker in accordance with the evaluation of their carcasses according to the EUROP and the cost of feeding porker during the whole period of fattening. It has been shown that the pigs in group K had a higher growth rate and earlier reached the slaughter weight than pigs from group D ( $P < 0.01$ ), whereas group D demonstrated a lower feed consumption. Group K was characterized by thinner backfat, higher loin muscle and higher meatiness than the carcasses of pigs from the group D ( $P < 0.01$ ). Carcasses of finishers from the group K were qualified to the most valuable classes S, E, U whereas group D to class E, U, R and O. Lower costs of porker production were shows in group D, whereas in the group K a higher value from the sale was attained. Nutrition with the participation of silage from steamed potatoes was less favorable because of the lower slaughter value of the carcass, than while feeding with the complete mixtures.

**Keywords:** fattening and slaughter assessment, fattening profitability, feeding, pigs, silage from steamed potatoes

## Streszczenie

Badaniami objęto 60 tuczników mieszańców F<sub>1</sub> (wielka biała polska x polska biała zwistoucha), w połowie loszki i wieprzki. Zwierzęta podzielono na dwie grupy po 30 sztuk w każdej. Grupę kontrolną (K) stanowiły tuczniaki żywione mieszanką pełnoporcjową, natomiast grupę doświadczalną (D) – żywiono mieszanką z dodatkiem kiszonki z parowanych ziemniaków (26% DM). Mieszanki sporządzano na bazie własnych sruł zbożowych i koncentratu. Tucz zwierząt rozpoczęto od masy ciała około 30 kg i prowadzono do średniej masy ciała około 115 kg. W trakcie odchowu kontrolowano masę ciała zwierząt, a także ilość zadanej i zużytej w trakcie tuczu paszy. Mięśność tusz poddano ocenie według obowiązującej klasyfikacji EUROP aparatem IM-03. Analizie poddano cechy tuczne: całkowity przyrost masy ciała w okresie tuczu, długość tuczu, przyrosty dobowe, wiek uboju, zużycie paszy w trakcie tuczu oraz cechy rzeźne: masę tuszy ciepłej, wydajność rzeźną, mięśność tusz, grubość słoniny oraz wysokość mięśnia polędwicy. W ocenie uwzględniono także: wartość sprzedaży tuczniaka zgodnie z oceną ich tusz według klasyfikacji EUROP oraz koszt żywienia tuczniaka przez cały okres tuczu. Wykazano, że świnie z grupy K cechowały się wyższym tempem wzrostu i wcześniej osiągnęły ubojową masę ciała niż świnie z grupy D (P<0,01), natomiast w grupie D wykazano niższe zużycie paszy. Tusze świń z grupy K cechowały się cieńszą słoniną, większą wysokością mięśnia polędwicy i większą mięśnością niż tusze świń z grupy D (P<0,01). Tusze tuczników z grupy K zakwalifikowano do najcenniejszych klas S, E, U, natomiast z grupy D do klasy E, U, R i O. Wykazano niższe koszty wyprodukowania tuczniaka w grupie D, natomiast w grupie K uzyskano wyższą wartość ze sprzedaży. Żywienie z udziałem kiszonej parowanych ziemniaków było mniej korzystne niż żywienie mieszanką pełnoporcjową ze względu na niższą wartość rzeźną tuszy.

**Słowa kluczowe:** kiszonka z parowanych ziemniaków, ocena tuczna i rzeźna, opłacalność tuczu, świnie, żywienie

## Introduction

Low profitability of pig production results in decreasing the state of the pig population in Poland (Central Statistical Office of Poland, 2016), mainly due to unfavorable price ratio of pork to grain prices (Pepliński, 2013). Benefits of pig production guarantee only large farms, while in Poland there are many small farms producing not many of fattening pigs per year. Therefore, one way to reduce the costs is to improve yields (Balogh et al., 2016).

The efficiency of fattening pigs, the slaughter value and meat quality was significantly influenced by nutrition (Rekiel et al., 2005). In the structure of production costs of fattening pigs, the feed costs dominate and account for approx. 70% of all the costs (Szymańska, 2000a; Okularczyk, 2004; Środoń et al., 2011; Pepliński, 2013).

In the farms of large-scale pig production used the feed on the basis of the complete feed (Novotni-Danko et al., 2015), while small family farms pigs are fed traditionally, mostly based on the feed produced on their own farm (Łucjan and Zuba, 1989; Szymańska, 2000a; Okularczyk, 2004). In traditional feeding of pigs used the feed such as potatoes, beets, green forage, silage, hay, whey, skim milk and cereal meals

(Szymańska, 2000b; Klepacki and Szymańska, 2006; Nowacki, 2006; Kasproicz-Potocka and Frankiewicz, 2013).

Just a few years ago, potatoes were the basic feed for pigs, but over the years, along with the intensification of pig production, the importance of this plant as a feed decreased. In small farms, especially centers offering the weaker soils, potatoes are still an important component of feed for pigs. In addition, due to the ban on the feeding pigs with the feed of animal origin, the interest in potatoes as feed has increased in recent years (Grela, 2016).

Potatoes are a valuable feed with a high biological protein value and good digestibility up to 72% (Van Lunen et al., 1989). In the feeding of pigs they used them steamed or pickled. The treatment of potato evaporation removes significant amounts of solanine, which improves the digestibility (Gulewicz et al., 2011). They have a high palatability and are readily eaten by pigs. However, due to the high proportion of starch it is an energy feed (3.4 to 3.5 MJ) with fattening properties, thus must be delivered with moderation. Potatoes for pigs used out of necessity, e.g. when they are frozen, damaged as a result of overproduction or those which have not qualified for sale (Grela and Lipiec, 1992; Płonka and Brzóska, 1997; Szymańska, 2000b; Klepacki and Szymańska, 2006; Kasproicz-Potocka and Frankiewicz, 2013).

The requirements of the meat industry on a high meat content of pig carcasses, and also the introduced in Poland in 1993 objective classifying carcasses in the EUROP system, which are awarded pigs with higher meatiness, forced the production of more muscular pigs (Hunyadi-Bagi et al., 2016). Farmers are adapting to the requirements of the meat industry so they limited the use of potatoes in pig nutrition (Klepacki and Szymańska, 2006). Nevertheless, the desire to reduce production costs of finishers tends to re-evaluate the suitability of potatoes for pigs.

The aim of the study was to compare the effects of fattening pigs fed with a complete mixtures and with the addition of the silage from steamed potatoes in conditions of rearing farmyard.

## Material and methods

The study was conducted in 2015 in one of the farms in the province of the Kuyavian-Pomeranian Voivodship. The study involved 60 pigs from the F<sub>1</sub> crossbreds (Polish Large White x Polish Landrace), involving one half of gilts and the other of hogs. The animals were housed in groups of 15 animals in a pen (1 m<sup>2</sup> per animal), on a shallow bedding in accordance with the requirements of welfare, with continuous access to water.

Animals were divided into two groups of 30 individuals each. The control group (K) of pigs was fed ad libitum with the complete feed mixture, and the experimental (D) - fed ad libitum with the composition feed (concentrate, and the grain Supremus TU 15/10) with addition of the silage from steamed potatoes (26% DM), according to the norms for pigs feeding (Grela and Skomial, 2014). The mixtures were prepared on the basis of their own cereal pellets and concentrate. The nutritional value of 1 kg of complete mix was: in group K 12.97 MJ\*kg<sup>-1</sup> metabolizable energy and crude protein 162 g, Lysine 10.9 g (I fattening period), 13.14 MJ\*kg<sup>-1</sup> metabolizable energy and 151 g of crude protein, Lysine 9.0 g (II fattening period); Group D 11.42 MJ\*kg<sup>-1</sup> metabolizable energy and crude protein 176 g, Lysine 12.6 g (I fattening period), 11.52 MJ\*kg<sup>-1</sup> metabolizable energy and crude protein 154 g, Lysine 9.3 g (II fattening period).

The fattening of animals started from the body weight of about 30 kg and continued to the average body weight of about 115 kg. Throughout the period of fattening controlled the feed consumption and the individual growth of animals. After the end of fattening, the animals were transported to the slaughterhouse, and have been slaughtered in accordance with the applicable standards and regulations (Dz.U.04.205.2102). The carcasses of fattened pigs were evaluated according to the current classification - EUROP. The meatiness of carcasses evaluated with the use of the apparatus IM-03 which is approved for use in small abattoirs.

The fattening traits were analysed: the total weight gain during the fattening period, the length of fattening, daily gains, feed consumption during the fattening and slaughter traits: hot carcass weight, dressing percentage, carcass leanness, backfat thickness and height of the loin muscle. The assessment also included: sale value of a porker in accordance with the evaluation of their carcasses according to EUROP and the cost of feeding of pigs during the whole fattening period.

The obtained results were statistically analyzed. An arithmetic mean and standard deviation was calculated. The significance of differences between groups K and D were verified with the t-student. Statistical analysis was performed using the Statistica 8.0 (2008).

## Results

Nutritional value of compound feed is shown in Table 1.

Table 1. The nutritional value of feed mixtures  
Tabela 1. Wartość pokarmowa mieszanek paszowych

Composition of feed mixture	Group feeding			
	K		D	
	Complete feed mixture		Mixture with share of potato	
	Fattening period		Fattening period	
	30 to 70 kg	70 to 110 kg	30 to 70 kg	70 to 110 kg
Ground barley, %	40	40	5	5
Ground wheat, %	25.1	35.3	57	65
Ground triticale, %	17	12	0	0
Steamed potato silage (26 DM), %	0	0	14	14
Protein concentrate <sup>a</sup>	17.5	12.5	24	16
Supremus Tu 15/10, %				
Acidulant feed Selacid dry, %	0.4	0.2	0	0
Metabolizable energy, MJ*kg <sup>-1</sup>	12.97	13.14	11.42	11.52
Crude protein, g	162	151	176	154

<sup>a</sup> Composition: metabolizable energy, 13.69 MJ; crude protein, 430 g; crude fiber, 42.8 g; crude ash, 185.8 g; crude fat, 22.2 g; Ca, 42.9 g; P, 8 g; Na, 12 g; Lysine, 55 g; Methionine, 6.55 g; Tryptophan, 5.2 g; Threonine, 17.26 g

The level of metabolic energy and crude protein in the compound, without the participation and with the participation of silage from steamed potatoes, both in the first and second fattening period were similar.

The results of fattening pigs are summarized in Table 2. The body weight of pigs at the beginning of fattening was equal, but at the end have proven to be heavier from the group K than in the group D. The pigs from the group K fed with the complete feed, remained shorter in the fattening period for six days, and reached the slaughter weight about seven days earlier, and also had a higher growth rate compared with the fatteners obtaining with the addition of the silage of steamed potatoes (26% DM)

Bocian et al.: The Fattening Results Of Pigs Fed With A Diet With The Participation Of Silage... (group D) ( $P < 0.01$ ). In the group D recorded lower feed intake throughout the fattening period for 1 kg of growth than in Group K.

Table 2. The results of fattening  
Tabela 2. Wyniki użytkowości tucznej

Trait	Feeding group <sup>a</sup>	
	K	D
Number, n	30	30
Body weight, kg		
- at the beginning of fattening	30.3 ±2.98	30.43 ±4.55
- at the end of fattening	116.23 ±7.92	113.37 ±15.12
Total weight gain, kg	85.93 ±5.24	82.93 ±11.02
Fattening period, days	107 <sup>A</sup> ±2.03	113 <sup>B</sup> ±1.02
Average daily weight gain, g	804 <sup>A</sup> ±56	734 <sup>B</sup> ±97
Age of slaughter, days	176 <sup>A</sup> ±2.03	183 <sup>B</sup> ±1.02
Feed consumption per animal throughout the fattening period, kg	246.9	229.44
Feed consumption per 1 kg of weight gain, kg*kg <sup>-1</sup>	2.87	2.77

<sup>a</sup> Significance of differences: A, B –  $P < 0.01$ .

Table 3 shows the results of characteristics of carcasses. Hot carcass weight in both groups was similar. The thinnest backfat thickness evaluated with the apparatus IM-03, the largest height of the loin muscle, as well as the highest meatiness characterized carcasses of pigs fed with complete feed (Group K), in comparison with the carcasses of pigs from group D ( $P < 0.01$ ). Carcasses of pigs from Group K were classified among the most important classes: S, E and U (100%), while the carcasses from the group D-nourished with a blend with the addition of the silage from steamed potatoes (26% DM) to the class E, U (60%) and R and O (40%).

The sale value of fatteners and the cost of the feed are shown in Table 4. The carcasses of pigs classified with the slaughter, received a higher value from the sale of a pig of about 85 PLN in group K compared to group D. In contrast, lower costs of pig feeding throughout the fattening period of about 42 PLN has been shown in group D obtaining with a feed mix with the addition of the silage from steamed potatoes. Therefore, the revenue from the production of finishing pigs fed with the participation of potatoes was lower by about 42 PLN per 1 porker.

Table 3. The carcass characteristics

Tabela 3. Wyniki cech rzeźnych

Trait	Feeding group <sup>a</sup>	
	K	D
Hot carcass weight, kg	91.52 ±7.72	88.5 ±14.6
Carcass yield, %	78.66 ±1.34	77.76 ±2.95
Backfat thickness, mm	15.73 <sup>A</sup> ±4.52	25.96 <sup>B</sup> ±7.91
Loin muscle depth, mm	60.91 <sup>A</sup> ±6.23	49.68 <sup>B</sup> ±7.47
Carcass meat content, %	57.6 <sup>A</sup> ±2.99	49.89 <sup>B</sup> ±4.77
EUROP carcass classification system		
class S, n/%	10 / 33.33	-
class E, n/%	16 / 53.34	3 / 10
class U, n/%	4 / 13.33	15 / 50
class R, n/%	-	6 / 20
class O, n/%	-	6 / 20

<sup>a</sup> Significance of differences: A, B – P<0.01.

Table 4. The value of sales and cost of feeding pig

Tabela 4. Wartość sprzedaży i koszt żywienia tucznika

Trait	Feeding group		Difference, PLN
	K	D	
Value of sale of 1 pig, PLN	537.22	452.24	84.98
Cost of feeding 1 pig throughout the fattening period, PLN	226.79	184.11	42.68
Profit, PLN	310.43	268.13	42.3

## Discussion

In the present study concerning fattening of pigs in the experimental group (D) used in the feed dose the addition of a mixture of the silage from steamed potatoes.

In turn, Van Lunen et al. (1989) in fattening pigs used a diet consisting of steamed potato peels with different proportions: from 0 to 30% DM.

The authors showed that the peels of steamed potatoes may be added to the feed up to 30% DM in the diet of pigs without impairing the performance of fattening. It also showed that the steamed peels of potatoes can be replaced in 30% by corn or barley in the Starter, Grower and Finisher feed. Turyk et al. (2014) also used in fattening of pigs unconventional diet with the addition of steamed potatoes (21.5% DM), concentrate and forage. The authors concluded that the feeding pigs with the added potatoes can influence the improved technological quality of meat, but it can degrade the meat parameters of the carcass. Rahnema and Borton (2000) in fattening of piglets and pigs obtained excellent results of feeding them with potato chips in the amount of 15-20% of the diet, obtaining average daily gains of above 800 g\*day<sup>-1</sup>. However, in many Asian countries a significant component of the feed for pigs is the silage from sweet potatoes (Peters, 2004).

Lower than in the present work daily gains of pigs fed with the silage from steamed potatoes were shown by Płonka and Brzóška (1997). These authors compared the production results of fattening pigs fed with the silage from steamed potatoes and the silage from raw potatoes, obtaining higher daily gains (677 g vs. 609 g) in the group of pigs fed with the silage from steamed potatoes. Similar results of daily body gains from the presented were presented by Grela and Lipiec (1992), who in the comparative studies of efficiency of fattening pigs fed with the participation of the silage from raw and steamed potatoes, obtained higher daily gains for the whole fattening period in the group of fattening pigs fed with the silage from steamed potatoes (730 g vs. 585 g). While Kisiel and Domeradski (1993) in the study obtained slightly worse growth effects in the group of pigs fed with the addition of steamed potatoes compared to the mixtures of feed. It demonstrated that the volume of the daily gains affects the duration of fattening, and thus its effectiveness, as well as the amount of meat of the carcass (Orzechowska et al., 2010; Bocian et al., 2012; 2015).

The obtained results of the slaughter value of carcasses evaluated are consistent with the studies of Kapelański et al. (1997), which showed that carcasses from older pigs at the slaughter time are classified in classes R, O, and the carcasses of younger pigs in classes E and U. In addition, the carcasses in classes E and U were characterized by thinner backfat and bigger musculature. Lower values of backfat thickness than those obtained in this study were demonstrated in studies by Rahnema and Borton (2000) feeding pigs with the diet without additive, and with 15% and 20% addition of potato chips.

The conducted simplified analysis of the production costs of fattening pigs fed with the feed with the participation of potatoes, showed that the lower feeding costs and better utilization of feed will not counterbalance the lower sale value of livestock due to a reduction in the amount of meat in carcasses.

## Conclusion

On the bases of the conducted studies in the traditional farming conditions, showed lower production costs of pigs, fed with a mixture containing the silage from steamed potatoes, while higher value from selling the animals fed with the complete mixture.

Feeding with the addition of potatoes appeared to be less profitable way of feeding of pigs due to the resulting lower slaughter value.



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