

LIFE DAILY GAIN OF INDIGENOUS PIG BREEDS IN SERBIA

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Invited paper

Abstract: Indigenous breeds of pigs, in addition to representing genetic heritage, have great scientific, cultural and economic significance for every country. The Serbian indigenous breeds of pigs Mangalitsa, Moravka and Resavka are endangered breeds with little research interest, which resulted in insufficient data on their production results. The aim of this study was to determine the differences in the life daily gain (LDG) of male heads of Swallow Belly Mangalitsa breed of different body weights (20 kg - I group, 45 kg - II group and 100 kg - III group), as well as between males of Swallow Belly Mangalitsa, Moravka and Resavka in seven consecutive measurements, once a month, during the experiment. Within the Swallow Belly Mangalitsa breed, the third group (280 g/day) had a statistically significantly higher LDG compared to the first (110 g/day) and the second (200 g/day). In all measurements, Moravka had the highest LDG, and Mangalitsa the lowest, but the differences were not significant. It was to be expected that the Mangalitsa would have the lowest LDG because it is a fatty breed, unlike Moravka and Resavka, which are breeds of combined production abilities (meat and fat). By researching the production performance of indigenous pig breeds, it is possible to predict and improve production possibilities by selection measures while preserving the desired genetic structure.

Key words: life daily gain, indigenous breeds, Mangalitsa, Moravka, Resavka

Introduction

Pig farming in the Republic of Serbia has long been of great importance and represents a very important branch of agricultural production (*Radović et al.*,

2019a). Pig farming is a significant branch of animal husbandry that is mainly based on the breeding of highly productive breeds of pigs. This has led to a decrease in the size of the population of indigenous breeds of pigs that today belong to endangered species. Currently, three autochthonous pig breeds (Mangalitsa, Moravka and Resavka) are bred in the Republic of Serbia, while within the Mangalitsa breed, the Swallow Belly strain is the most represented, compared to the red and white strains. In the last few years, there has been a growing interest in the farming of autochthonous breeds of pigs, both for the preservation of genes and for the production of cured meat products produced in the traditional way (Petrović *et al.*, 2010). Autochthonous breeds of pigs in Serbia can be divided into fatty breeds, such as Mangalitsa and breeds of combined production abilities (Moravka and Resavka), Petrović *et al.* (2007). Life daily gain is one of the key traits in pig breeding because it contributes to its efficiency (Nielsen *et al.*, 2018). Otkrivanje i uklanjanje ograničavajućih faktora u svinjarskoj proizvodnji predstavlja važan segment za efikasno iskorišćavanje resursa, promovisanje održivog pristupa uzgoja svinja i poboljšanja dobiti farmera (Carter *et al.*, 2013). The profitability and economy of pig production is largely conditioned by the growth traits. The profitability and economy of pig production is largely conditioned by the growth traits. Growth is an important property of all living organisms (Lawrence and Fowler, 1997), and represents an increase in cell number and body size over a period of time (Schulze *et al.*, 2001). Potential growth is also defined as the highest level at which an animal can grow in non-restrictive conditions (Emmans and Kyriazakis, 1999; 2000). It is conditioned by genetic parameters and the current state of the individual animal. Non-restrictive conditions are following: 1. the diet must be *ad libitum*, 2. the nutrient content must at least provide the required energy level, 3. food consumption must not be limited due to inaccessibility of food or the presence of toxins, and 4. environmental factors (temperature and diseases) must not restrict food consumption. The growth rate is therefore influenced by various genetic and non-genetic factors. The increase can be expressed in absolute or average daily gain over a period of time. The average daily gain is a value that shows how much the body weight of the animal has increased daily, i.e. the ratio between the increase in body weight in a certain period and the duration of the period (Marin *et al.*, 2013). It has long been known that the difference between individuals in the conversion of ingested food into body weight is an important determinant of profit in pork production (MacNeil and Kemp, 2014) and is also an indicator of how well an individual uses ingested food into the body. The increase depends on two factors: food intake and food efficiency (Patience *et al.*, 2001).

The aim of this study was to determine variation in the average life daily gain of Swallow Belly Mangalitsa males, within the breed under the effect of body

weight of animals, and between and between three indigenous breeds in seven consecutive measurements, until slaughter.

Materials and Methods

The trial was conducted on the experimental pig farm of the Institute of Animal Husbandry, Belgrade-Zemun, where the conditions on the farm enabled a semi-intensive system of farming. The animals used in the experiment come from the herd of several breeders, and after weaning they were brought to the said farm. Only male heads that fully phenotypically corresponded to their breed were used in the experiment. The adaptation of the animals to the new breeding conditions lasted until they reached about 20-25 kg of body weight, when the experimental period began. Males gradually were accustomed to complete feed mixtures used on the farm in accordance with the age category. During the entire examination, all animals were kept in the same conditions of accommodation, nutrition and care. The animals were kept in groups, in a semi-intensive system, with each box having a range (each box had an open and a covered part). The total area of the boxes with the range was 150 m². The trial lasted 28 weeks.

The first part of the experiment included male heads of the Swallow Belly Mangalitsa breed. The animals were divided into three groups: I group - 11 animals aged 24 weeks, average body weight of 20 kg; II group - 9 heads, aged 33 weeks and weighing 45 kg; III group of animals - 13 animals, about one year old and weighing an average of 100 kg. The second part of the experiment included male heads of all three indigenous breeds of pigs - 9 boars of Mangalitsa, 8 Moravka males and 7 heads of Resavka breed. Statistical data processing was performed using the software package *SAS Institute Inc (2002-2010)*. Basic descriptive statistical parameters are presented: average value and standard deviation. The assessment of the effect of body weight and breed was performed using the GLM procedure (General Linear Model) in the mentioned software package. Determination of the statistical significance of the differences between the obtained mean values (Mean) was carried out using the t-test, at the level of significance of $P < 0.05$.

The following models were used to assess the influence of body weight (1) and breed (2):

$$y_{ij} = \mu + T_i + \varepsilon_{ij} \quad (1);$$

$$y_{ij} = \mu + R_i + b(x_{ij} - \bar{x}) + \varepsilon_{ij} \quad (2),$$

where: y_{ij} - investigated trait, μ - general population average, T_i – the effect of body weight groups ($i=1,2,3$), R_i – the effect of breed ($i=1,2,3$), $b(x_{ij} - \bar{x})$ – linear regression effect of body weight and ε_{ij} – random error.

Results and Discussion

The average values and standard deviation of daily life gain in different phases of postnatal life of Swallow Belly Mangalitsa pigs, as well as differences between groups of animals are shown in Table 1.

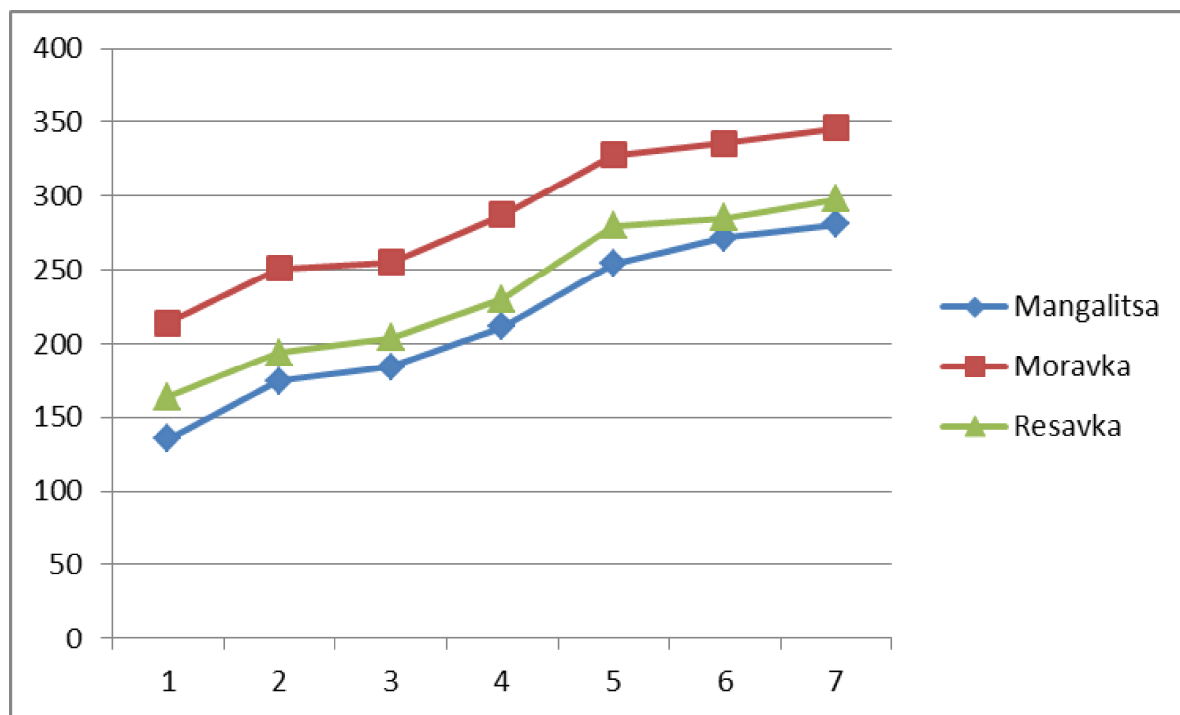
The differences in growth rate from birth to reaching the slaughter weight of 100 kg, were established during different production phases of indigenous pig breeds. These differences depended on the anatomical-histological-physiological principles of postnatal development of pigs. Mangalitsa piglets were born with a body weight of about 1 kg and during the first 5-6 months (24 weeks) piglets showed the lowest average life gain (110 g) with a larger relative deviation from the average (CV = 18%). In group II there is a statistically significant increase in LDG compared to group I, but also in group III compared to group I. Also, a statistically highly significant difference ($P < 0.001$) in LDG was found between the second and third groups. During phases II and III, the uniformity of animals is greater, with a relative deviation of 5% or less. The reason for that is a more stable defence system of animals older than 24 weeks, so that they show better resistance to various environmental agents, with good potential for food use.

Table 1. Average life daily gain (g) at different phases of postnatal life

Phases	N	\bar{x}	SD	SE	t - test		
					I-II	I-III	II-III
I	11	110	20	10			
II	9	200	10	0	P<0.001	P<0.001	P<0.001
III	13	280	10	0			

Phases: I - \bar{x} = 20 kg (age 24 weeks), II - \bar{x} = 45 kg (age 33 weeks), III - \bar{x} = 100 kg (age 52 weeks); \bar{x} - average value, N – number of animals, SD – standard deviation, SE – standard error, P – statistical significance.

Graph 1 shows the daily life gain (g/day) of three indigenous breeds of pigs in 7 phases of measurement at different body weights (kg).



Graph 1. Trend of life daily gain in 7 consecutive measurements

The highest absolute gain between the two measurements was shown by the heads of the Moravka breed for all measurements, except for the third and second measurements, where the heads of the Resavka breed achieved the highest absolute gain, because they also had the highest average daily gain between the two measurements (323 g/day).

In the first measurement, Moravka pigs were the youngest (144 days), and Resavka pigs were the oldest (174 days). At the end of the experimental period, the heads of the Mangalitsa breed were the oldest (351 days), and the heads of the Moravka breed were the youngest (314 days). By comparing breeds, it was determined that there are differences for the LDG trait, but these differences were not statistically significant. Observing all examined traits in the experiment (animal age, absolute gain as well as average daily gain between two consecutive measurements and average life daily gain), there was only a statistically significant difference ($P < 0.01$) at the end of the experiment between Mangalitsa and Moravka. The average life gain of Moravka was 347 g/day, Resavka 298 g/day and Mangalitsa 281 g/day. The obtained results were also expected, considering that Moravka and Resavka are breeds of combined production abilities, while Mangalitsa is a fatty breed. Also, with the increase in the age of the animals, there was a decrease in the life daily gain.

Contrary to our research related to monitoring the average life gain in different phases of postnatal life, *Radović et al. (2019b)* report a better increase of LDG in Swallow Belly Mangalitsa. The authors report an LDG of 136 g/day in the early phase of growth, corresponding to the suckling period, 434 g/day for the whole phase of fattening (430 in the early phase of fattening, 519 g in the mid phase and 405 g/day in the final phase of fattening), with animals gaining on average 307 per day in the period from birth to slaughter. In the early phase of growth, the daily gain was 310 g/day. A partial similarity exists with the research of *Savić et al. (2019)* who divides the growth levels for the breed as the growth phase (from weaning to 30 kg body weight) and the phases of early, mid and final fattening with body weights of between 30 and 60 kg, 60 and 100 kg and above 100 kg body weight, respectively. The authors show that the daily gain in the growth phase is extremely low (192 g/day), which corresponds to the second phase of postnatal development from our experiment, and increases to 477, 521 and 478 g/day in the early, mid and final phase of fattening, respectively, while the average daily gain for the phase of total fattening is 508 g/day, and only 285 g/day for the period from birth to slaughter. LDG in our study was much lower than in the research of *Pietrol et al. (2006)* who report LDG of 467 g/day in the Italian indigenous Casertana breed grown in the open system of a body weight of 35 to 60 kg, 491 g/day in animals of body weight of 60 to 100 kg and 361 g/day for heads with a body weight above 100 kg, until the moment of slaughter. All these differences in growth are a consequence of different breeds, different systems of farming and conditions, but also experimental design. Also, in our study LDG is lower than in research by *Brunius (2011)* who established LDG 854 g/day. Differences in LDG between studies can be explained in differences in breeds, housing systems, and conditions, as well as in experimental design. In all measurements during the experiment, the heads of the Moravka breed had higher LDG in relation to the heads of the Mangalitsa breed, similarly to *Radović et al. (2017a; 2017b)*. However, as noted, the differences were not statistically significant, similarly to *Petrović et al. (2011)*.

Conclusion

The results of the research show that there are highly significant ($P < 0.001$) differences in LDG between different weight groups of boars of the Swallow Belly Mangalitsa, which is primarily conditioned by the anatomical-histological-physiological principles of postnatal development of pigs. The heads of the Moravka breed had the highest absolute gain between the two measurements, except between the third and second measurements, where the heads of the

Resavka breed had the highest absolute gain. The highest values for LDG in the measurement phases were observed in the heads of the Moravka breed.

This research should be expanded and improved in order to increase LDG and other production traits of indigenous breeds, all in the function of encouraging their breeding and preservation. It is necessary to carry out selection measures in order to prevent their extinction, such as the forever lost breeds of pigs of Šiška and Šumadinka.

Životni dnevni prirast autohtonih rasa svinja u Srbiji

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Rezime

Autohtone rase svinja, osim što predstavljaju genetičko nasleđe, imaju veliki naučni, kulturni i ekonomski značaj za svaku državu. Srpske autohtone rase svinja mangulica, moravka i resavka su rizično ugrožene rase sa malim istraživačkim interesom, što je rezultiralo nedovojnim podacima o njihovim proizvodnim rezultatima. Cilj ovog rada bio je da se utvrde razlike u životnom dnevnom prirastu (ŽDP) muških grla rase lasaste mangulice različitih telesnih masa (20 kg – I grupa, 45 kg – II grupa i 100 kg – III grupa), kao i između muških grla lasaste mangulice, moravke i resavke u sedam uzastopnih merenja, jednom mesečno, tokom trajanja ogleda. Unutar rase lasasta mangulica, statistički značajno veći ŽDP imala je treća grupa (280 g/day) u poređenju sa prvom (110 g/day) i drugom (200 g/day). U svim merenjima moravka je imala najveći ŽDP, a mangulica najmanji, ali razlike nisu bile značajne. Bilo je za očekivati da će mangulica imati najmanji ŽDP jer je masna rasa, za razliku od moravke i resavke koje su rase kombinovanih proizvodnih sposobnosti (meso i mast). Istraživanjem proizvodnih osobina autohtonih rasa svinja moguće je predvideti i unaprediti proizvodne mogućnosti selekcijskim merama uz očuvanje poželjne genetičke strukture.

Ključne reči: životni dnevni prirast, autohtone rase, mangulica, moravka, resavka

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