

Growth performance and fattening ability in castrated male and female East Balkan pigs reared organically in Strandzha mountain

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ABSTRACT

(An experiment with two groups of East Balkan pigs – castrated males (n=10) and females (n=10), was carried out to study the growth performance and fattening abilities of the animals from the weaning until slaughter. The pigs were included in the trial at 60 day age. The average live weight of the castrated males was 8.65 ± 1.08 kg and for the females, 8.5 ± 0.62 kg.

The pigs were reared using traditional technology, grazing on natural pastures in the Strandzha mountain, Bulgaria. In autumn, acorns were naturally present in their diet. According to the category, the animals additionally received ground organic feed (50% barley and 50% wheat). The trial lasted 304 days (from February to November, 2019). During this period the final live weight of the male castrated pigs reached 88.00 kg while that of the females was 84.4 kg. The difference, however, was not significant. Furthermore, no significant differences in the growth performance characteristics that could be attributed to the sex of the animals were observed. The average daily gain of both sexes tended to be lower in summer and higher in autumn. The feed conversion ratio was higher in summer. The animals showed high average daily weight gain at pasture when their live weight was over 50 kg.

Keywords: East Balkan pigs; fattening; sex; season; organic feed.

INTRODUCTION

The East Balkan Pig is an indigenous Bulgarian breed, spread in the East Balkan and the Northern slopes of the Strandzha mountain. Due to its specific rearing (almost entirely on pastures) this breed is suitable for producing of healthy meat and meat products of high quality which can be competitive on the national market as well as worldwide.

Petrov (1970) showed that the wild like, straight ear East Balkan domestic pig is the prototype of the Mediterranean peat swine and originated from the wild *Sus scrofa scrofa*. The breed developed under the natural selection and almost without human participation. It uses various food sources with low nutritional value. According to Danchev (1984), this autochthonous breed has safe reproduction and high survival of their offspring.

Hlebarov (1922) carried out an experiment with East Balkan pigs at the age of 2.5-3 years to determine the fattening capacities and the carcass composition as well as the meat quality. The pigs were included in the experiment at 75 kg and reached 115 kg for 97 days. The average daily weight gain for the trial period was 414 g. The feed per 1 kg of weight gain was 8.88 kg corn. According to Georgiev et al. (1959), the fattening of the East Balkan pigs only with concentrate was not profitable.

Stefanova et al. (2005) studied the formation and development of muscles and adipose tissue in indigenous and modern pig breeds (East Balkan and English Large White), applying two rearing technologies for East Balkan pigs, respectively indoors and on pasture. The pigs reared indoors reached 90 kg slaughter weight for 213 days at 0.365 kg weight gain, whereas the pasture reared animals reached the same weight for 273 days and 0.273 kg weight gain. The animals on pasture displayed more meat (1.5 – 8.0 %) and less fat (2.4 - 12.5 %) deposition in the carcass when compared to the indoors reared. The dressing percentage and the meat : bone and meat : fat ratios were the most favourable at 90 kg live weight. Palova et al. (2009) examined the performance of the East Balkan pigs finished on pasture and two levels of protein in the diet and observed better protein assimilation when the feed contained lower level of protein. The average daily weight gain of the animals was 0.272 kg, and the feed conversion ratio was 5.372 kg/kg. According to the authors, sex did not affect these performance traits. Slanev et al. (1993) reported average daily weight gain of 0.417 kg for male pigs, 0.371 kg –for females and 0.380 kg for a mixed group. Palova et al. (2010) found that in pigs fattened from 60 to 90 kg and reared on pasture with additional concentrate, the animals had a good weight gain –respectively 0.303 vs. 0.249 kg.

Feeding and rearing strategies are of great importance for the fattening of the pigs but also their sex can exert effect. The fattening ability is the increase of the live weight for a certain period of time depending on the feed. It is the final stage which realises the effect of rearing (Zhelev, 1995). Rusev et al. (1979), pointed that growth, which is the basis of the meat productivity of farm animals, represents a consistent quantitative and qualitative change in the animal organism under the influence of internal regulatory mechanisms and environmental factors. In an experiment to study the effect of the crossing and sex on the performance of fattening pigs, Imrich et al. (2016)

reported insignificant influence of the sex. Quiniou et al. (2010) also found no considerable differences in the weight gain between male and female pigs.

The aim of the study was to monitor the growth and fattening ability of castrated male and female pigs of the East Balkan breed reared under traditional technology in the area of Strandzha mountain and to determine the possible differences in these traits according to the sex of the animals during three seasons.

MATERIALS AND METHODS

The experiment was carried out at the Scientific Center of Agriculture-Sredetst, Bulgaria on castrated male and female East Balkan pigs. The pigs were divided into two groups according to their sex. Each of the groups contained 10 pigs. The dynamics of the growth from the weaning at 60 days (the males were castrated immediately after weaning) until 85-88 kg was monitored. The experiment lasted from February to November, 2019.

The animals were reared traditionally and grazed daily on pasture, consisting of natural herbage in Strandzha mountain from 9 a.m. till 4 p.m. Acorns were also naturally present in the diet of the animals in autumn. According to the category, each group received additionally ground organic feed (barley – 50% and wheat– 50%) which was prepared in the feed unit of the Scientific Centre of Agriculture. Water was provided *ad libitum*. The rainfalls, the monthly average, minimum and maximum air temperatures were recorded (Figure 1 and 2).

The botanical composition of the pastures was determined in a representative pool sample, by sampling plants from spots of 0.250 m². The content of the individual plant species was expressed as percentage and presented in Figure 3. The chemical analysis was performed after drying the plant samples from the pasture at 105°C to constant weight and included content of water and dry matter, crude protein, fat, fiber and ash (Table 1). The content of protein was determined by the Kjeldahl method, the fat –by Soxhlet method and the fiber, according to Weende method (as described by Sandev, 1964). Green mass production was determined by the method of Shanin (1977). The samples of the barley and wheat were taken from two certified organic fields. The chemical composition of the feeds was determined according to the methods described above (Table 2).

The growth performance and fattening abilities of the East Balkan pigs were determined through monitoring of the live weight at the beginning of the trial (initial live weight, kg), live weight at the end of the fattening period (final live weight, kg), live weights at controlled periods (three seasons), average daily weight gain during the trial, feed intake of the group (for the controlled periods and the whole trial), feed conversion ratio (for the control periods and

the whole trial). The feed intake was determined only for the organic feeds. For the herbage it was not possible due to factors such as natural pastures and transitions of the animals with different duration.

The differences in the examined traits between the castrated males and females during the whole trial and the different periods were statistically evaluated using t-test through StatSoft 6, STATISTICA for Windows. The differences were considered significant at $p < 0.05$. Values were presented as Mean \pm SD.

RESULTS AND DISCUSSION

1. Climate conditions

Climate conditions and especially rainfall are an important factor influencing the natural grassland productivity. During the study period in 2019, the rainfalls were 380.3 mm/m². In November the highest rainfall was 99 mm/m² and in August it was 6 mm/m² (Figure 1). The average monthly air temperature during the same period was + 16.1°C. In July the maximum reached 37.2°C and the lowest was in February -6.2°C (Figure 2).

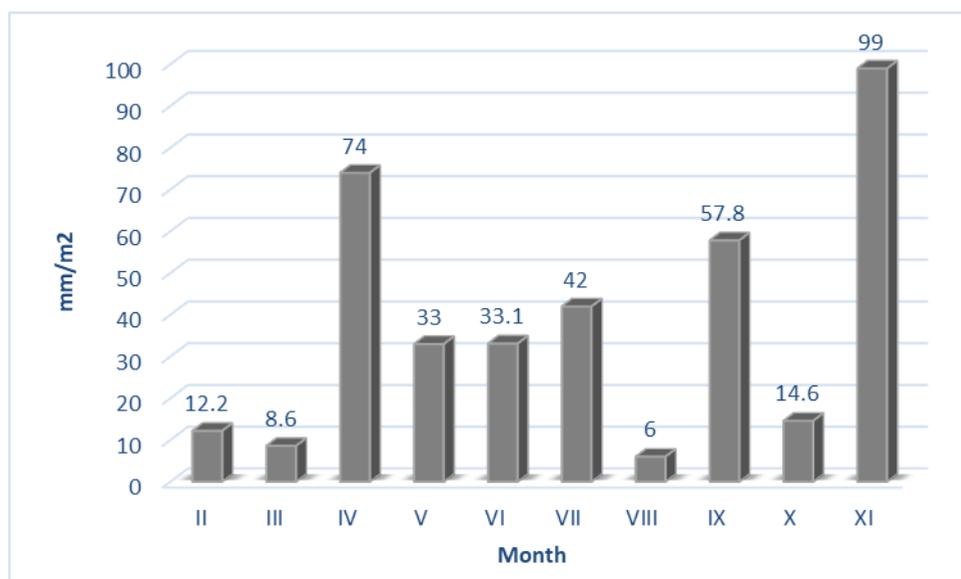


Figure 1. Average monthly rainfall during the trial period (February-November, 2019)

In February and March, the rainfall was recorded well below the average for the area and this slowed the development of the grass. Later, the insufficient rainfall during the summer had an adverse effect as well. August

was extremely critical with only 6 mm/m² of rainfall, which stopped the growth of the grass and some of the pastures and meadows dried up. The autumn period, however, proved to be favourable, as heavy rainfall caused the grassland to remain wet and restored the herbage.

The average monthly temperatures for the trial were considerably higher than the ones for the multiannual period, as in May-September, 2019 an unexpectedly high maximum temperatures for the area were measured. The monthly average, minimum and maximum air temperatures indicate that during the trial period (February – November, 2019), the coldest in the Strandzha region was February with a monthly average temperature of + 5°C (with deviations from -6.2 to +20.1). The average monthly air temperature during the same period was highest in August + 23.8°C. In May and June the temperatures were lower than in August.

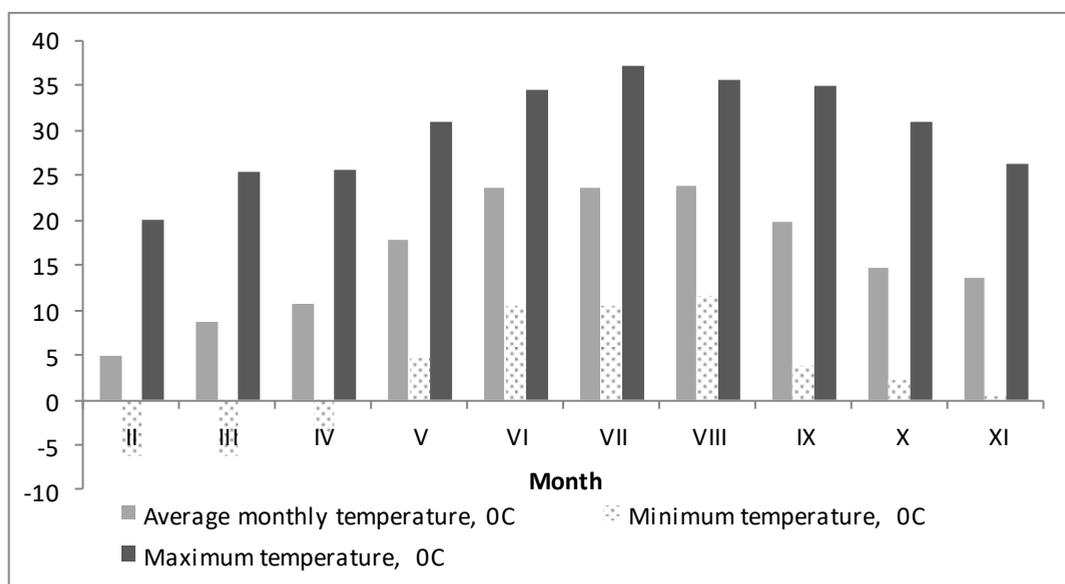


Figure 2. Average monthly, minimum and maximum temperatures during the trial period (February-November, 2019)

2. Nutrition of the pigs

The assessment of the nutritional sources of the habitat is an essential element in grazing of pigs and involves the determination of the botanical and chemical composition of the pastures. This information is important, as it is a part in the development of the nutrition plan for pig fattening. The botanical

composition of natural pastures in Strandzha region grazed by the Eastern Balkan pig is presented in Figure 3. It showed high content of cereal components: wiregrass (*Cynodon dactylon*), bluestem (*Dichanthium ischaemum*), bulbous bluegrass (*Poa bulbosa*), perennial ryegrass (*Lolium perenne*), cock's foot (*Dactylis glomerata*), lower participation of legumes: clover (*Trifolium*), alfalfa (*Medicago sativa*), bird's foot trefoil (*Lotus corniculatus*), bush vetch (*Vicia sepium*) and other various species: plantains (*Plantago*), denseflower mullein (*Verbascum densiflorum* Bertol.), dandelion (*Taraxacum officinale*). Nedeva et al. (2009) defined such pastures as having low nutritional value and the yields of green and dry mass as low-productive due to the low content of legumes. In our previous studies, it was found that the yield of green mass varied from 890 kg/da to 1320 kg/da and the ratio of cereals: legumes: weeds varied from 41.1%-57.2% : 12.5%-25% : 17.8%-46.4% (Palova et al. 2017).

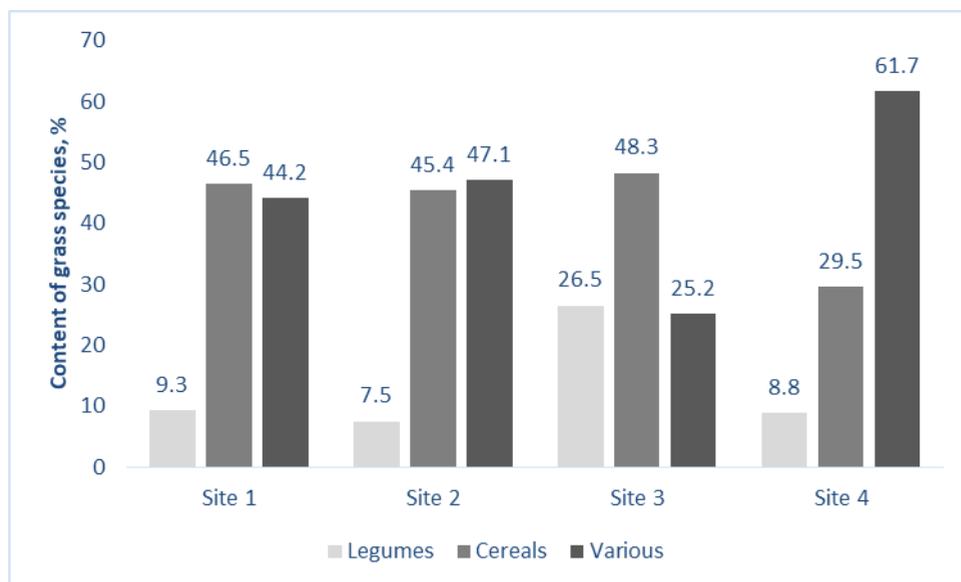


Figure 3. Content of grass species in the pasture of the East Balkan pigs

The content of crude protein in the herbage of the four pasture sites in Strandzha (Table 1) varied from 10.61% to 12.27%, whereas the crude fat was within the range of 1.05% to 1.93%. The highest values of crude fibers were determined in herbage from Pasture 2 - 31.49%, compared to the other three pastures.

Table 1. Chemical composition of herbage in four pastures in Strandzha mountain

Item	Pasture 1	Pasture 2	Pasture 3	Pasture 4
Water, %	20.14	13.26	15.89	16.97
Dry matter, %	79.86	86.74	84.11	83.03
As fed basis, %				
Crude protein	11.65	11.22	12.27	10.61
Crude fat	1.93	1.05	1.78	1.43
Crude fiber	30.50	31.49	31.28	30.37
Ash	7.92	7.99	6.7	7.75
Nitrogen free extracts	41.17	41.66	41.42	43.24

The results of the chemical analyses of the organically produced feed and acorns are presented in Table 2 and were similar to those found in previous studies (Marchev et al., 2017). Protein content ranged from 8.82% to 10.78% for barley and from 10.31% to 11.22% for wheat. The fat and fiber content were low for organic feeds. The ash and nitrogen free extracts were similar for both crops. The protein content of acorns was 5.08%, putting it after barley and wheat, and the high fiber values - 14.32%, defined it as harder to digest than the feeds.

Table 2. Chemical composition of the organic feed and acorn

Item	Acorn	Barley I	Wheat I	Barley II	Wheat II
Water, %	40.09	11	11.67	10.41	11.71
Dry matter, %	59.91	89	88.33	89.59	88.29
As fed basis, %					
Crude protein	5.08	10.78	10.31	8.82	11.22
Crude fat	2.59	1.42	1.34	1.00	1.52
Crude fiber	14.32	5.99	4.43	5.89	3.66
Ash	1.73	3.05	4.38	2.53	1.58
Nitrogen free extracts	64.64	67.76	67.87	71.35	70.31

3. Growth performance and fattening abilities of the East Balkan pigs

The dynamics of growth in the castrated male and female pigs from the beginning to the end of the experiment (304 d) are compared on Table 3.

Table 3. Growth performance parameters in the castrated males and females of East Balkan breed

Item	Males (castrated) (n = 10)	Females (n = 10)
	Mean±SD	Mean±SD
Initial live weight, kg	8.65 ± 1.08	8.50 ± 0.62
Final live weight, kg	88.00 ± 4.38	84.40 ± 4.80
Average daily gain, kg	0.26 ± 0.01	0.25 ± 0.02
Feed intake, kg/d	1.420	1.420
Feed conversion ratio (kg/kg)	5.324	5.668
Fattening period, d	304	304

For the whole trial period, the male pigs reached 88.00 kg and the females 84.4 kg as the differences between the sexes were not significant. It was found that the sex of the animals did not influence the average daily gain as well. Similarly, no effect of sex on the fattening of crossbred pigs was observed in the studies of Imrich et al. (2016) and Quiniou et al. (2010). The animals from both groups in these studies had similar growth rate and there was no significant difference in the average daily gain. Our results are in line with the research of Slanev et al. (1992) and confirm previous studies (Palova, 2009). Stoykov (2003) also found that sex had no effect on the growth rate and feed conversion of pigs. However, nutrient intake increased with increasing age and live weight. The feed conversion ratio for castrated males was 5.324 kg while for the females it was slightly higher (5.668 kg).

For the whole fattening period, the average daily intake increased from 0.864 to 2.110 kg, respectively, with the amount of feed received from the two groups being equal - 1.420 kg/head/ day. The average daily gain for the males was 0.260 kg and for the one recorded for the females was 0.250 kg.

The changes in the live weight, the average daily gain and feed conversion ratio during three seasons in the castrated and female pigs is presented in Table 4.

No significant difference was observed in the initial and final live weight between the male castrated and female pigs during the three seasons. The feed intake and the feed conversion ratio did not differ significantly as well. The lowest average daily gain in both groups was observed in summer (June-August) – 0.20 ± 0.04 kg and 0.18 ± 0.03 kg, respectively for the males and females. The highest average daily gain was recorded in autumn (September - November), respectively 0.38 ± 0.03 kg and 0.37 ± 0.05 kg for the castrates and females. The animals showed high average daily weight gain at pasture (above 0.40 kg) after 50 kg of live weight, which might be due to the compensatory mechanism of the organism to reach optimum live weight for the respective age.

Table 4. Growth performance parameters in castrated males and females of East Balkan breed according to the season

Items	Males (castrated) (n = 10)	Females (n = 10)
	Mean±SD	Mean±SD
Spring (March, April, May)		
Initial live weight, kg	13.95 ± 2.87	13.65 ± 1.42
Final live weight, kg	35.45 ± 5.90	33.05 ± 1.76
Feed intake, kg /d	0.967	0.967
Average daily gain, kg	0.23 ± 0.05	0.21 ± 0.02
Feed conversion ratio, kg/kg	4.140	4.588
Duration of the period, d	92	92
Summer (June, July, August)		
Initial live weight, kg	35.45 ± 5.90	33.05 ± 1.76
Final live weight, kg	53.55 ± 2.85	50.00 ± 1.39
Feed intake, kg /d	1.359	1.359
Average daily gain, kg	0.20 ± 0.04	0.18 ± 0.03
Feed conversion ratio, kg/kg	6.906	7.375
Duration of the period, d	92	92
Autumn (September, October, November)		
Initial live weight, kg	53.55 ± 2.85	50.00 ± 1.39
Final live weight, kg	88.00 ± 4.38	84.40 ± 4.80
Feed intake, kg /d	2.110	2.110
Average daily gain, kg	0.38 ± 0.03	0.37 ± 0.05
Feed conversion ratio, kg/kg	5.348	5.431
Duration of the period, d	92	92

Our results are in line with those obtained by Georgiev et al. (1959) for fattening pigs of the East Balkan breed (0.341kg and 0.325 kg weight gain in the last fattening period). We have reported similar values of this trait in a previous study with organically reared East Balkan pigs (Palova, 2006).

The higher average daily gain during the autumn period is probably also a consequence of the combination of favourable agro-meteorological conditions, the abundant pasture and acorns available. The growth of the most plant species depends mainly on the rainfall - they require higher humidity and lower temperatures for their development. This is further confirmed by the fact that during the summer when there is almost no grazing and the available herbage is poor in nutrients and more difficult to digest by animals, as the vegetation has undergone grazing maturity, the weight gain of the pigs is lower than in the autumn and spring season. Marchev and Nedeva (2003) also concluded that the unfavourable weather conditions affected adversely the average daily gain. The high live weight at the end of the period also

corresponds to the greater average daily gain during the fattening, which is expected for the breed. Differences in the average daily gain in the castrated male and female pigs during the different seasons were negligible and no significant influence of the sex on the average live weight was recorded. Decrease in the average live weight of female pigs compared to males has been observed, but this can only be taken as a trend. Similar conclusions were made by Vasupen et al. (2008), who found no significant difference in weight gain between female and male local Thai pigs. The high values of average daily gain found at the end of the fattening period in pigs of both sexes were close to those obtained by Slanev et al. (1993) and Stefanova and Stefanova (2005). We believe that the age of the animals during this period allows for optimal absorption of feed and leads to better weight development. With the increase in the weight of the pigs, the feed conversion ratio increases, varying between seasons. The high average daily gain and live weight at the end of the period are not linearly related to feed utilization, as the feed conversion during the different seasons and for the whole experimental period was similar in both groups. The data in Table 4 shows that the animals in the two groups had equal feed intake during the different seasons - 0.967 kg in spring, 1.359 kg in summer and 2.110 kg in autumn. With the increase in the weight of the pigs, the feed conversion ratio also increased, significantly decreasing at the end of the fattening period (5.348 kg and 5.431 kg, respectively for the castrated and female animals). The feed conversion ratio was highest during the summer, reaching 6.91 kg/kg in males and 7.38 kg/kg in females. This would be explained by the impact of adverse climatic conditions. The negative correlation between temperature and rainfall during the summer months causes insufficient grazing with poor quality of vegetation, increasing the relative share of indigestible or indigestible ingredients (lignin and cellulose). This, respectively, leads to an increased feed intake, but its worse utilization. These results are similar to our previous studies (Palova et al., 2009). From a practical point of view, it is of interest that in the autumn the feed intake decreases in both groups, which is probably due to the abundant acorn and root grazing during the season. When analyzing the costs per 1 kg of weight gain, we conclude that the genetic of the breed plays major part to achieve economic efficiency in a particular particular fattening system.

CONCLUSION

During the trial (304 d), no significant differences between castrated male and female pigs were observed in regard to the growth performance. During this period the final live weight of the male castrated pigs reached 88.00 kg while that of the females was 84.4 kg. The average daily gain tended to be lower in summer and higher in autumn for both sexes. The feed conversion

ratio was higher in summer in male castrate and female pigs. The animals showed high average daily weight gain at pasture when their live weight exceeds 50 kg.

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