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Izvorni znanstveni članak

GROWTH AND LOSSES OF YORKSHIRE SUCKLING PIGLETS WITH REGARD TO THE BIRTH WEIGHT

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Summary

Growth of piglets during the suckling period is determined by both genetic and environmental factors. In addition to breed composition, one of the most important endogenous factors is the body weight at birth. This factor also significantly affects the losses to weaning, since it is known that light piglets are more susceptible to diseases and stress factors. In this paper we wanted to present trends of growth of Yorkshire piglets during the suckling period, with respect to the birth weight, as well as mortalities in each group. To lessen the effects of mother genetics and sex of individuals, as well as the influence of external factors, in the litter in which we observed the piglet of birth weight less than 1000 grams, the same-sex offspring heavier than 1000 g was taken as a control. Piglets were weighed at birth, on 7th, 14th and 21st day. Obtained results indicate that a statistically significant difference in body weight between the two groups maintained until weaning at the same level ($P<0.01$), where the piglets in the control group consistently progressed, while the lighter piglets were of very uneven growth and final weight at weaning. Average daily gain during the entire period was significantly higher ($P<0.01$) in heavier animals by 66.7 grams per day. Correlation of birth weight with body mass at weaning was positive and strong ($r = 0.61$, $P<0.05$). Furthermore, higher losses were recorded in the experimental group of piglets (29.2% compared to 8.3% in the control group), where they were the highest during the first 7 days.

Key words: Large White, piglets, birth body mass, weight gain, losses.

Introduction

Breeds and hybrids used in intensive pig production have high productive and reproductive features, and number of piglets per litter rises with the selection of breeding animals. Hence, it is more frequent to have piglets of the birth mass below average. Cutler et al. (2006) stated that the number of piglets of small birth mass grow significantly in litters with more than 11 piglets.

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Many authors mentioned the importance of piglets birth weight for their subsequent growth and development as well as its' influence on mortality during the suckling (Ferić et al., 1990; Pešić et al., 1990; Wilson et al., 1991; Milligan et al., 2002; Quiniou et al., 2002; Johansen et al. 2004; Cutler et al., 2006). Usual birth weight of piglets of commercial breeds and hybrids amounts to 1.3 - 1.4 kg (Cutler et al., 2006). It is known that the piglets lighter than 1000 g at birth are more prone to disease, negative influences of stress factors, they have lower growth rate and cause more losses than the piglets of usual body mass (Quiniou et al., 2002; Cutler et al., 2006). Processes of extra uterine growth and development in the piglets are related to significant physiological changes. Young animals are more capable of increasing the protein synthesis than older animals and efficiently use aminoacids from the food for growth. That especially refers to the skeletal muscle synthesis (Davis et al., 2003; Lefaucheur et al., 2003). Rehfeldt and Kuhn (2006) and Dwyer et al. (1994) stated that animal species with a large number of offspring in the litter had a greater variability in their birth mass and muscle fibres number in the skeletal muscle structure of young animals. According to them, in the majority of piglets of small birth mass the differentiation of a minor number of muscle fibres occurs during the prenatal miogenesis. Such animals could not increase their mass equally fast as the piglets of usual birth mass during the postnatal growth. Thus, the aim of this study was to determine the influence of birth mass on the growth and losses of Yorkshire piglets during the suckling period.

Material and methods

This research was performed at a pig breeding farm in the Eastern part of Croatia. The study encompassed 48 piglets of the Yorkshire breed (Large White) from 17 sow litters. In order to decrease the effects of mother genetics and sex of individuals, as well as the influence of external factors, from each litter in which we observed the piglet of birth weight less than 1000 grams (experimental group, n = 24), the same-sex offspring heavier than 1000 g was taken as a control (control group, n = 24). During the observed period, piglets were kept in uniform, automatically controlled conditions in farrowing unit. Besides sucking sow's milk, piglets were offered prestarter mixture (with 22% crude protein) from the 7th day to get accustomed to solid food. They were weighed after birth, on 7th, 14th and 21st day of life. The growth per week and losses were being observed in both groups.

Collected data were analyzed by statistical reference programme Statistica v.9 (StatSoft Inc.). The significance of differences between the experimental and the control group was determined by Student T-test. Analysis of variance was used for determining the significance of differences between individual weighings within the groups (ANOVA Repeated Measures, with Unequal n HSD test for post-hoc analysis). The relation between body mass at birth and at the end of the suckling period was determined by linear correlation and between body mass and survival till 21st day by nonparametric Spearman rank order correlation**.**

Results and discussion

Increase in body weight in two groups of piglets from birth to weaning is presented in Table 1 and Graph 1.

Table 1 - GROWTH OF YORKSHIRE SUCKLING PIGLETS WITH REGARD TO THE BIRTH WEIGHT (in grams)

Tablica 1. – RAST ODOJAKA VELIKOG JORKŠIRA TIJEKOM RAZDOBLJA SISANJA, S OBZIROM NA PORODNU MASU (u gramima)

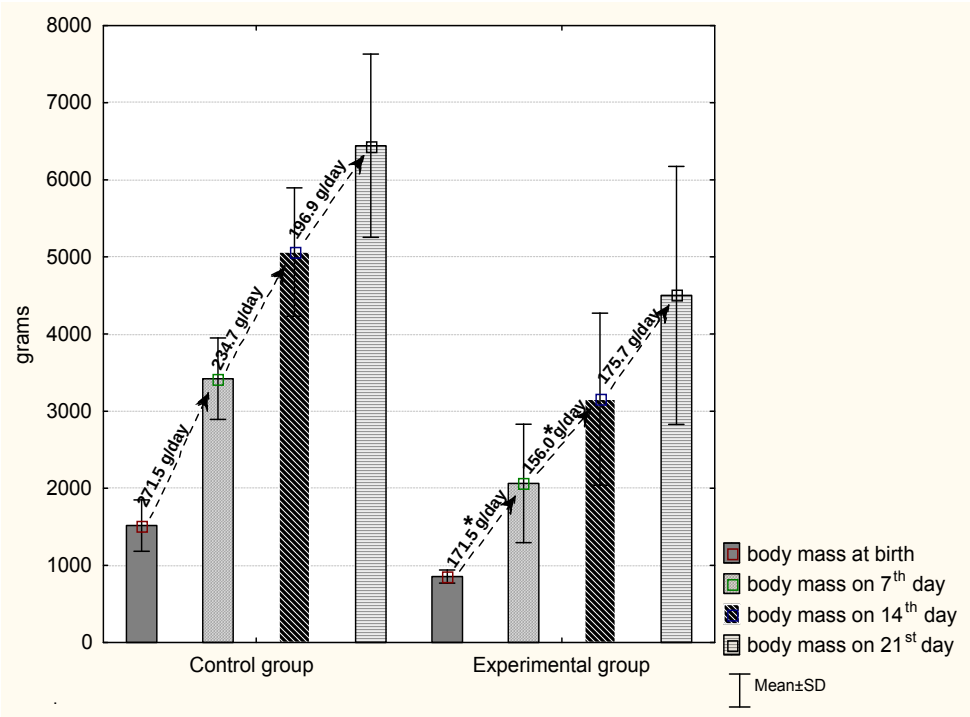
Group	Statistical indicator	Age of suckling piglets (n = number of animals of normal / low birth mass)			
		At birth (n = 24/24)	7 days (n = 22/20)	14 days (n = 22/18)	21 days (n = 22/17)
Control group	Mean ± SEM	1516.67 ± 67.97	3420.68 [a] ± 112.54	5063.64 [a] ± 177.49	6442.27 [a] ± 253.24
	CV %	21.95	15.43	16.44	18.44
Experimental group	Mean ± SEM	854.92* ± 17.51	2062.90*,[a] ± 171.57	3154.75*,[a] ± 249.36	4501.18*,[a] ± 405.72
	CV %	10.03	37.20	35.35	37.15

SEM = standard error of the mean; CV = coefficient of variability

* statistically significant difference (P<0.01) in relation to the value determined in the control group
[a] statistically significant difference (P<0.01) in relation to the previously determined value within the same group

Graph 1 - INCREASE OF BODY MASS AND AVERAGE DAILY GAIN (in grams) IN TWO GROUPS OF PIGLETS DURING PREWEANING PERIOD

Graf 1. – PORAST TJELESNE MASE I PROSJEČNI DNEVNI PRIRAST (u gramima) U DVIJE SKUPINE ODOJAKA DO ODBIĆA



* significant difference (P<0.01) in relation to the daily gain at the same period in the control group

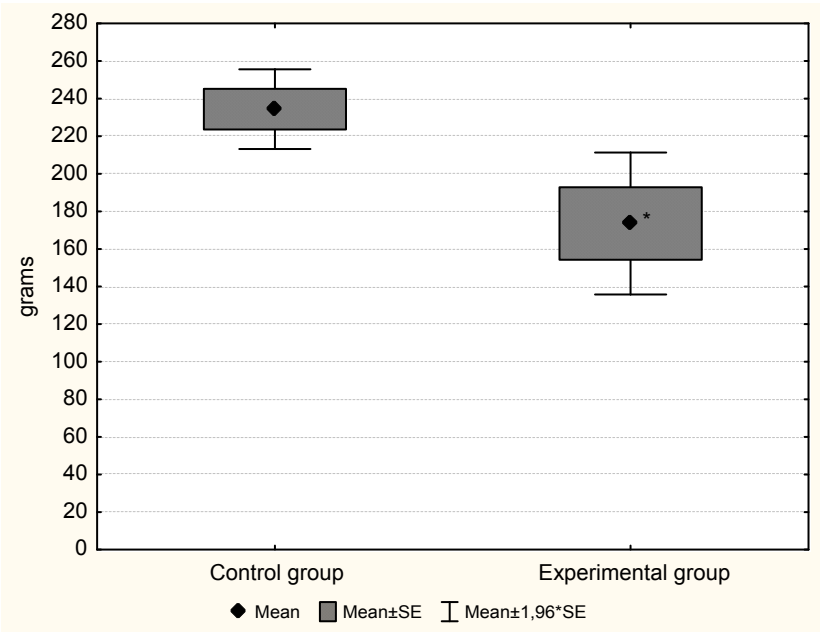
As we can see from Table 1 and Graph 1, in both groups significant increase between individual sequential measurements of body mass was observed during the study period (P<0.01). Furthermore, analysed results showed that significant difference in body mass at birth (P<0.01) between two observed groups remained at the same level during complete period. Milligan et al. (2002) summarized the findings of individual authors that piglets to weaning compete with each other in two ways. On the one hand aggressively compete for access to the teats, whereby heavier ones get better front teats, and on the other hand, indirectly compete because larger piglets suckle vigorously and more effectively by stimulating the release of milk, and thus a higher amount of nutrients. As a result, the difference in birth weight between

lightweight and heavier pigs usually remains the same or even increases until weaning. Thus, we also noticed an increase in the mass difference between the two groups of piglets from average 661.75 grams after the birth, to 1941.09 g before weaning.

Thereby, the normal birth weight piglets progressed more consistently, while the lighter piglets were very uneven in growth and final weight at weaning. So the coefficients of variability for body mass from 7th day apart were lower in the control group of piglets (from 15.4% to 18.4%) than in the experimental group (ranged from 35.3% to 37.2%) (Table 1). In accordance with this, Milligan et al. (2002) found a negative correlation between birth weight and coefficient of variation for weight at weaning (r = - 0.38).

Graph 2 – AVERAGE DAILY GAINS IN TWO GROUPS OF PIGLETS DURING SUCKLING (in grams)

Graf 2. – PROSJEČAN DNEVNI PRIRAST U DVIJE SKUPINE ODOJAKA TIJEKOM RAZDOBLJA SISANJA (u gramima)



* significant difference (P<0.01) in relation to the value determined in the control group

Looking at the daily gain of piglets (Graphs 1 and 2) we can see that during the entire period it was significantly higher ($P<0.01$) in heavier animals by an average of 66.7 grams per day (average daily gain to weaning in the control group was 234.4 g, and in the experimental 167.7 g). The difference in gain was highest during the first week (100 g/day; $P<0.01$) and decreased until weaning - from 78.7 g/day in the second week ($P<0.01$) to 21.2 g/day during the third week. Johansen et al. (2004) in their study found that low birth weight presented a risk factor associated with lower body weight until weaning. They also found that the growth of small piglets decreased by 8.4 grams per 100 grams of body mass.

From the obtained data we determined the coefficient of linear correlation between birth mass and the mass on 21st day, which amounted to $r = 0.61$ (level of significance $P<0.05$). Coefficient of correlation between piglets birth mass and body mass at weaning that Milligan et al. (2002) calculated in their research was $r = 0.58$ ($P<0.05$). Furthermore, Ferić et al. (1990) calculated that coefficient of correlation between piglets body mass on 4th and 21st day of life was positive, significant ($P<0.01$) and amounted to $r = 0.97$ for Yorkshire and their crossbreeds, while Jelić et al. (1974) found a significant correlation between birth weight and body mass of 28 days old Swedish Landrace piglets ($r = 0.2655$, $P <0.01$). Similar was found in research of Balenović et al. (2007) who stated that correlation between body mass after birth and on 21st day of life in Landrace x Yorkshire crossbreed piglets was strong, positive and significant ($r = 0.67$). Siers et al. (1976) stated that piglets of lower birth mass also had lower growth rate and body mass at 120 days of life.

In the control group of piglets of normal birth mass, 8.3% of losses were recorded during the suckling period, while losses in the experimental group amounted to 29.2%. Finch et al. (2004) stated that low birth mass was the main factor influencing neonatal morbidity and mortality of domestic animals, which was also in line with the statements of other researchers (Johansen et al., 1994; Milligan et al., 2002; Quinion et al., 2002; Cutler et al., 2006). In agreement with findings of these authors, most animals in our research died during the first week of their life (2 in the control group, and 4 in the experimental group). Milligan et al. (2002) in their study determined a positive correlation between birth weight and survival percentage of piglets to weaning ($r = 0.43$), while we also found positive non-significant correlation between birth weight and survival ($r = 0.23$).

Conclusion

Body mass at birth presents one of the most significant endogenous factors which influences the vitality of newborn piglets and has high prognostic value at death risk estimation and further growth. These results confirm the statements that the piglets of small birth mass have higher losses, significantly lower growth rate as well as wider variability of body mass during suckling period.

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PRIRAST I GUBICI ODOJAKA VELIKOG JORKŠIRA TIJEKOM RAZDOBLJA SISANJA S OBZIROM NA PORODNU MASU

Sažetak

Prirast odojaka tijekom razdoblja sisanja određen je kako genetskim, tako i okolišnim čimbenicima. Pored pasminskog sastava, jedan od važnijih endogenih čimbenika je tjelesna masa pri porodu. Taj čimbenik također u značajnoj mjeri utječe i na gubitke do odbića, s obzirom da je poznata činjenica da su lakši odojci podložniji bolestima i stresu. U ovom smo radu željeli prikazati utjecaj porodne mase na prirast odojaka velikog jorkšira tijekom razdoblja sisanja te ukupna uginuća po skupinama. Kako bismo što više umanjili genetski utjecaj krmača te spola jedinki, kao i utjecaje vanjskih čimbenika, iz svakog legla u kojem smo promatrali odojka porodne mase manje od 1000 grama, kao kontrola promatran je istospolni potomak teži od 1000 g. Odojci su vagani po porodu, te 7., 14. i 21. dana. Dobiveni rezultati pokazuju da se statistički značajna razlika u tjelesnoj masi između dvije skupine zadržala do odbića na istoj razini ($p<0,01$), pri čemu su odojci kontrolne skupine ujednačeno napredovali, dok su lakši odojci bili vrlo neujednačenog prirasta i završne težine kod odbića. Nadalje, odojci kontrolne skupine tijekom promatranog razdoblja imali su značajno veći ($p<0,01$) prosječni dnevni prirast u odnosu na pokusnu skupinu za 66,7 grama/dan. Povezanost porodne mase s tjelesnom masom kod odbića bila je pozitivna i jaka (0,61; $p<0,05$). U pokusnoj skupini odojaka zabilježeni su veći gubici (29.2% u odnosu na 8.3% u kontrolnoj skupini), posebice tijekom prvih 7 dana.

Ključne riječi: veliki jorkšir, odojci, porodna težina, povećanje mase, uginuća.

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