Macedonian Journal of Animal Science, Vol. **2**, No. 3, pp. 273–276 (2012)
114 In print ISSN 1857 – 6907
Received: July 25, 2009 On line ISSN 1857 – 7709
Accepted: December 15, 2009 UDC: 636.4.084.1
Original scientific paper

INFLUENCE OF BIRTH MASS ON LOSSES AND WEIGHT GAIN OF LARGE YORKSHIRE PIGLETS DURING PREWEANING PERIOD

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Taking into account the health and economic aspect, the most significant losses in the pig farming are those during preweaning period. In this research we observed the influence of birth mass on losses and weight gain of large Yorkshire piglets. In order to decrease the influence of external factors as much as possible, manner of holding and feeding, sows genetic influence, milk yield and productivity and sex of offspring, from each litter where a piglet was studied (one or more) with the weight below 1000 g (experimental group, $n = 24$), as a control offspring of the same sex with body mass above 1000 g was taken (control group, $n = 24$). A statistically significant difference determined in the body mass ($P < 0.01$) between the experimental and control group, remained at the same level until the weaning. The correlation between the birth mass and body mass on 21st day was significant, positive and strong ($r = 0.60$). The obtained regression equation for the body mass calculation on the 21st day (Y) based on the mass at birth (X) reads as follows: $Y = 2609.5156 + 2.426*X$. During this period losses in the experimental group were significantly higher (29.17%) in comparison with the losses in the control group (8.33%).

Key words: suckling piglets; birth mass; growth; losses

ВЛИЈАНИЕ НА ПОРОДИЛНАТА МАСА ВРЗ НАМАЛУВАЊЕТО И ЗГОЛЕМУВАЊЕТО НА ТЕЖИНАТА НА ПРАСИЊАТА ОД РАСАТА ГОЛЕМ ЈОРКШИР ВО ПЕРИОДОТ ПРЕД ОДБИВАЊЕ

Имајќи го предвид здравствениот и економскиот аспект, најзначајните загуби за време на одгледувањето на прасињата се случуваат во периодот пред одбивање. Во овој опит го следевме влијанието на породилната маса врз губењето или зголемувањето на тежината кај прасиња од расата голем јоркшир. За колку што е можно повеќе,да се намали влијанието на надворешните фактори како што се начинот на држењето и хранењето, генетското влијание од маториците, приносот на млеко и продуктивноста, полот на потомството, од секое легло беа проучувани прасињата (едно или повеќе) со тежина под 1000 g (експериментална група $n = 24$), како и контролен подмладок од истиот пол со телесната тежина над 1000 g. (контролна група, $n = 24$). Статистички значајна разлика детерминирана во телесната маса ($P < 0,01$) помеѓу опитната и контролната група остана на истото ниво сè до одбивање. Корелацијата помеѓу телесната маса при раѓање и телесната маса на 21-иот ден беше сигнификантна, позитивна и јака. Добиената пресметана регресија на телесната маса, искалкулирана на 21-иот ден (Y), базирана на масата при раѓање (X), е следнава: $Y = 2609,5156 + 2426*X$. За време на овој период загубите во опитната група беа сигнификантно повисоки (29,17%) во споредба со загубите во контролната група (8,33%).

Клучни зборови: дојни прасиња; породилна маса; пораст; загуби

INTRODUCTION

Some studies showed that the birth mass of suckling piglets has a significant influence on their further growth and development (Cutler et al., 2006; Johansen et al., 2004; Quiniou et al., 2002; Milligan et al., 2002; Uremović M. and Z. Uremović, 1997; Wilson et al., 1991; Pešić et al.,

1990; Ferić et al., 1990). The normal mass at birth is in the range from 1.3–1.4 kg (Cutler et al., 2006). It is known that the suckling piglets with the body mass at birth below 1000 g are more prone to disease, negative influences of stress factors, they have lower growth rate and cause bigger losses than the piglets with the normal body mass (Cutler et al., 2006; Quiniou et al., 2002; Uremović M. and Z. Uremović, 1997). Furthermore, Cutler et al. (2006) state that the number of piglets with small birth mass grow significantly in litters with more than 11 piglets. Breeds and hybrids used in intensive pig production have high productive and reproductive features, caused that the majority of litters frequently go above that number. Hence, it is more frequent to have piglets with the birth mass below average.

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 amino acids 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) state that animal species with a bigger number of offspring in the litter have a greater variability in the birth mass and muscle fibres number in the skeletal muscle structure of young animals. According to them, in the majority of piglets with small birth mass if comes to the differentiation of a minor number of muscle fibres during the prenatal miogenesis. Such animals cannot increase their mass equally fast as the piglets with normal birth mass during the postnatal growth. The aim of this study was to determine the influence of birth mass to 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 Slavonia. The study encompassed 48 piglets of the Large Yorkshire breed from 17 sow litters that pigged during April and May, and in which at least one piglet was born with birth mass less than 1000 grams. In order to decrease the influence of external factors as much as possible, the manner of holding and feeding, sows genetic influence, milk yield and productivity and sex of offspring, out of each litter where a piglet was studied (one or more) with the weight below 1000 g (experimental group, n = 24), as a control offspring of the same sex with the body mass above 1000 g (control group, n = 24) was taken. During the observing period, piglets were kept in same conditions. They were weighed five times during the preweaning period: after their birth, on 1st, 7th, 14th and 21st day of life. The growth per week and losses were being observed in both groups.

Processing of collected data was implemented with the application of the statistical reference programme Statistica 8.1 (StatSoft Inc., 2008). The significance of differences between the experimental and control group was determined by the Student's t-test. Analysis of variance was used for determining the significance of differences between individual weightings within the groups (ANOVA Repeated Measures, with Unequal n HSD test for post-hoc analysis). The relation between the body mass at birth and at the end of suckling period was determined with linear correlation**.** Estimation of the dependent variable value (body mass on 21st day of life), based on the known values of independent variable (body mass at birth) was studied with single regression analysis.

RESULTS AND DISCUSSION

In the control group of piglets with normal birth mass, 8.33% of losses were recorded during the suckling period, while losses in the experimental group amounted to 29.17%. Finch et al. (2004) state that low birth mass is the main factor which influences neonatal morbidity and mortality of domestic animals, which is in line with the statements of other researchers (Cutler et al., 2006; Johansen et al., 1994; Quinion et al., 2002; Milligan et al., 2002; Uremović, M. and Z. Uremović, 1997).

Table 1 shows an increase of piglets body mass through five weightings during preweaning period.

The Table 1 shows that the statistically significant difference in the birth mass ($P<0.01$) between two observed groups remained at the same level during the complete period. Also, a statistically significant difference ($P<0.01$) was observed between individual sequential measurements of the body mass, and observing the complete suckling period between the birth mass and mass on the 21st day of life ($P<0.01$) in both groups. The range of

body mass values in the control group of piglets was smaller than in the experimental group (apart from day 1). The coefficient of variability for the birth mass of the control group was constant, while in the experimental group it increased almost four times until weaning.

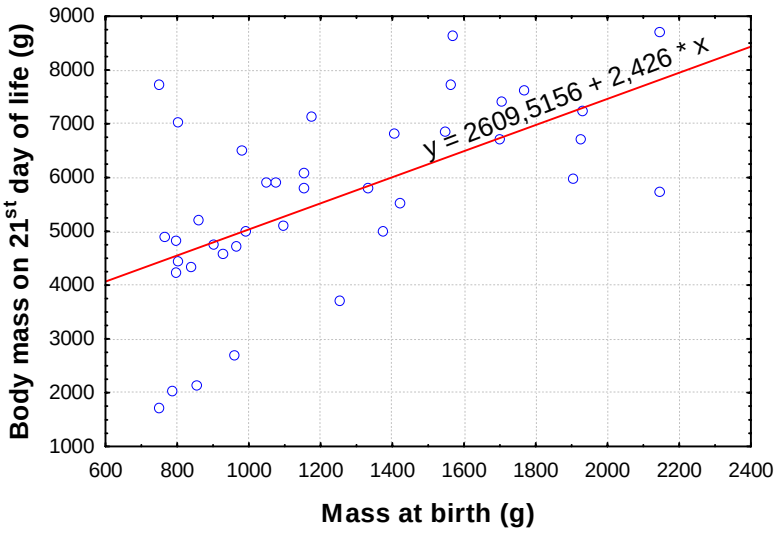
Table 1

Increase of a body mass (g) in two groups of piglets during preweaning period

Group	Statistical indicator	Age of suckling piglets (*n* = number of animals with low / normal birth mass)				
		At birth (*n* = 24/24)	1 day (*n* = 24/24)	7 days (*n* = 20/22)	14 days (*n* = 18/22)	21 days (*n* = 17/22)
Experimental group (piglets with body mass at birth <1000 g)	Mean ± SEM	854.92* ± 17.51	913.08* ± 19.03	2062.90*,[a] ± 171.57	3154.75*,[a] ± 249.36	4501.18*,[a,b] ± 405.72
	Min	705	705	953	1200	1700
	Max	995	1085	3820	5800	7700
	CV %	10.03	10.21	37.20	35.35	37.15
Control group (piglets with body mass at birth ≥1000 g)	Mean ± SEM	1516.67 ± 67.97	1833.33 ± 59.61	3420.68 [a] ± 112.54	5063.64 [a] ± 177.49	6442.27 [a,b] ± 253.24
	Min	1050	1325	2320	3700	3700
	Max	2150	2380	4460	6680	8680
	CV %	21.95	15.93	15.43	16.44	18.44

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
[b] statistically significant difference (P<0.01) in relation to the determined value in the one-day-old piglets within the same group

From the obtained data about the growth of the body mass during the observed period, we determined the coefficient of linear correlation between the birth mass and the mass on 21st day, which amounted to $r = 0.61$ (level of significance $P < 0.05$). Based on the determined statistically significant correlation, we performed the regression analysis and gained the regression equation: $Y = 2609.5156 + 2.426 * X$ (X = birth mass in g, Y = body mass at the age of 21 days, in g).



Graph 1: Regression equation for calculation of the body mass at the 21st day of life (Y) based on the birth mass (X)

The 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. Furthermore, Ferić et al. (1994) calculated that the coefficient of correlation between piglets body mass on 4th and 21st day of life was positive, significant ($P < 0.01$) and amounted to $r = 0.97$. A similar result was found in the research of Balenović et al. (2007) who stated that the correlation between the body mass after birth and the one on 21st day of life in Landrace × Yorkshire crossbreed piglets was strong, positive and significant ($r = 0.67$). Siers et al. (1976) stated that piglets with lower birth mass have also lower growth rate and body mass at 120 days of life. Jelić et al. (1974) presented the regression equation for calculation of the body mass at the age of 28 days of life (y) based on the birth mass (x), which states: $y = 4.46 + 1.222*x$. The average body mass of 21 day old piglets calculated on the base on the regression equation in McKay's (1994) research was 5.21 ± 0.94 kg.

CONCLUSION

The 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 with the small birth mass have higher losses, significantly lower growth rate as well as wider variability of the body mass during the suckling period.

Acknowledgment: The study was implemented within the projects of the Ministry of Science, Education and Sports, number 053-0532265-2238, 053-0532265-2242 and 053-0531854-1849.

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