



## Article

# The effect of parity number on the growth performance of piglets around weaning

Henrietta NAGYNÉ KISZLINGER<sup>1\*</sup>, Alexandra HORVÁTH<sup>1</sup>

<sup>1</sup> Hungarian University of Agriculture and Life Sciences (MATE), Kaposvár Campus, Kaposvár

**ABSTRACT** - In this study, authors examined the effects of parity number on piglet weight gain around weaning. The research was carried out on a Hungarian pig farm on the litters of 3 first parity (P1) and 3 second parity (P2) Landrace x Large White sows. The traits examined were individual weight, weight gain, and number of deaths. A total of 90 piglets were individually weighed 9 times. Thus, measurements were taken at 1 day of age, at 10, 20, 26, 28, 29, 30, 36, and 47 days of age. Weaning occurred on the 28th day. The difference in weight can be seen as early as 1 day of age between the piglets of the two groups (290 grams). The 1-day average weight of piglets in the P1 group was 1.20 kg, and the average weight of piglets of P2 sows was 1.49 kg ( $P < 0.05$ ). The observed difference remained until the end of the study, it was 2650 grams at 47 days of age. At this time, the mean weight of the piglets of P1 sows was 12.13 kg, while the average weight of the piglets of P2 sows was 14.78 kg ( $P < 0.05$ ). In terms of weight gains, there was a statistically significant difference between the two groups over four periods, including the post weaning period. During this period, however, weight loss occurred. The weight of the piglets of P1 sows fell to a greater extent. In their case, the average daily weight loss at that time was 185 g. The other group had a weight loss of 80 g over the same period. Several of the piglets (95.2%) of P1 sows lost weight on the day after weaning while 73.5% of the piglets of P2 sows showed weight loss on this day. Based on the results it can be said that piglets of P1 sows are more sensitive to weaning than piglets of P2 sows. At the last measurement time point, there was no statistically significant difference between the performances of the two groups. There is a moderate association ( $R^2=0.22$ ) between the weight gains measured in the pre- and post-weaning period, with the weight of individuals gaining more in the pre-weaning period falling to a greater extent after weaning. There was a higher mortality rate among the piglets of the P2 sows. The weak piglets died in the first 4 weeks of the trial except for 1 piglet.

**Keywords:** weaning, first parity sow, second parity sow, piglet weight gain

## INTRODUCTION

In Hungary and Europe the 28-day weaning is common in farm conditions. According to Hungarian legislation, "Piglets may be weaned before the age of 28 days only if the health or welfare of the sow or piglets is endangered." FVM regulation 32/1999 (III.31.). The main reason for this is to maintain and increase production to reach the weaned pig weight of 200 kg per sow per year. In the case of the 18-23 day weaning, the average weight of the weaned piglets is 6.5 kg, so 30.7 piglets per sow per year are needed to achieve the previously mentioned production target. In the case of weaning at 28-30 days of age, the

\*CORRESPONDING AUTHOR

Magyar Agrár- és Élettudományi Egyetem (MATE), Kaposvári Campus

✉ 7400 Kaposvár, Guba Sándor u. 40., ☎ 82/505-800

E-mail: [naqyne.kiszlinger.henrietta@uni-mate.hu](mailto:naqyne.kiszlinger.henrietta@uni-mate.hu)

average weaning weight is 7.5 kg to 8 kg, so 25-26.6 piglets per sow are required to reach 200 kg of weaned pig weight per year. The advantage of the previous weaning of 21 days for sows is that it significantly shortens the time required for their re-breeding, thus improving the sow's rotation and increasing the number of fatteners raised by one sow. The disadvantage, however, is that if the weaning is made without taking into account the physiological status of the piglets, the improvement listed above will not be achieved, and the piglets will have difficulty surviving the weaning (*Barceló, 2009; Horn et al., 2011*).

In the week before the weaning, the average daily weight gain is 300 g / day with a 28-day weaning, and this can reduce to 200 g / day as a result of the weaning. Since there is a positive correlation between the growth rate in the first few weeks after the weaning and the subsequent growth intensity, it is important to maintain the growth rate even after the weaning. Research shows that piglets that are heavier at weaning have a higher performance than their lighter contemporaries (*AHDB, 2010*). According to some sources, weaning weight is a much more accurate indicator of post-weaning growth than birth weight or age. However, experiments on the effects of birth weight have shown that piglets born with a body weight of less than 1 kg have very little chance of making it till the weaning, and 86% of individuals born with a weight below 0.8 kg did not survive the weaning (*Gondret et al., 2005*). For optimal performance in both the rearing and fattening periods, the ideal weaning weight should be between 7.5 and 8.0 kg on average, and not more than 10% of individuals should weigh less than 6 kg (*Gondret et al., 2005; Smith et al., 2007*).

### *Feeding at the time of weaning*

Enhancing intestinal development, pre-weaning growth, and achieving the best possible weaning weight can be accomplished with supplementary feed, which is initially a milk replacer and then a prestarter. It is important that the composition and nutrient content of the milk replacer be similar to that of sow's milk. The earlier the weaning is made, the more important the quality of the feed offered to the piglets. The milk replacer has a crude protein content of at least 25-26%. The energy component is cereals, but since the starch decomposition of the piglets in the first two weeks is only small, the milk replacer feeds contain cereal seeds extracted by a hydrothermal process. The energy concentration of these feeds can be increased with feed oil or feed fat. Already in the first week, the milk replacer can be placed in the pen so that the piglets can get to know the solid feed as soon as possible.

In the pre-weaning period, piglets are already fed prestarter feed as a supplement. Partly because the sow's milk production no longer covers the litter's need for nutrients. Another reason is that this can help to ensure the proper secretion of the required enzymes, and because they can get used to this feed before the weaning, thus partly facilitating their transition after the weaning. Prestarter feed is easily digestible, contains 20-21% protein, essential amino acids, minerals, vitamins, flavors and aroma and more and more organic acids.

### *Comparison of piglets of first parity sows and multiparous sows*

Piglets of first parity (P1) sows are born with less weight (*Hendrix et al., 1978; Tantaasuparuk et al., 2001*) and also weigh less when weaned (*Burkey et al., 2008; Holyoake, 2006*) than piglets of multiparous sows. Their weight gain also lags behind that of piglets of second-parity sows. Furthermore, it can be said that the mortality rate is higher among the piglets of the P1 sows. These can be explained, on the one hand, by the fact that the body of primiparous sows is still developing and is able to produce less milk than sows that have already farrowed. Also, the transport of immune substances to the colostrum is less efficient, so the weaker immune system of piglets of the P1 sows can be traced back to this (*Vila, 2013; Gadd, 2011*).

The aim of the study was to determine the extent to which weaning influences the weight gain of piglets in the immediate post-weaning period, and to compare the growth of piglets of first parity and of second parity sows during the period of weaning.

## **MATERIAL AND METHOD**

The research was carried out at a Hungarian pig farm on the litters of 3 first parity (P1) and 3 second parity (P2) Landrace x Large White sows. The growth of piglets in the litters was monitored by continuous, individual weight measurement. Litter equalization was performed at the farm, so the number of piglets per litter for each sow was 15. During the first measurement, the 1-day weight of the piglets were measured and individually marked. Subsequent measurements occurred at 10, 20, 26, 28, 29, 30, 36, and 47 days of age, in each case between 11 a.m. and 2 p.m. The piglets were placed one by one in a plastic crate and put on a digital scale accurate to 0.05 kg.

The sows were housed in farrowing rooms, one room could accommodate 54 sows. The room had a full plastic slatted floor. The room temperature was 20 °C, and the additional heaters were put in the pen for the piglets up to 10

days of age. The relative humidity in the room was 60-70% and the air exchange was 1 m<sup>3</sup>/ live weight/hour. Routine treatments of piglets such as iron supplementation, castration, tail docking, tooth clipping took place at the age of 3 days. Piglets received ad lib. milk replacer from an automatic system from the age of 3 days and then from the age of 16 days, there is a gradual change to a different type of milk replacer. From the age of 23 days, they received the prestarter feed, and in the nursery they continue to consume this as well. The amount of milk replacer fed is 400-500 g dry matter / 4 weeks/piglet. Nutrient composition of feed is presented in *Table 1*. Weaning of the piglets took place on the 28th day of life and they were placed separately by groups. One group consisted of the piglets of first parity (P1) sows, and the other of the piglets of second parity (P2) sows. In the nursery, they received the dry prestarter feed in an automatic feeder for 10 days, then there was a changeover to piglet starter feed at 16 days of age. They did not receive Zinc-oxide supplementation. Nipple drinkers were placed separately. There was also a complete plastic slatted floor in the rearing rooms. 30-35 piglets were placed per pen. The sex ratio was approximately 50% female and 50% male. The temperature was reduced weekly, from 30 ° C to 28 ° C, then to 26 ° C, and finally to 25 ° C. All piglets were vaccinated against Circo virus and Mycoplasma hyopneumoniae at 35 days of age.

**Table 1.**

Nutrient composition of feed

	Milk replacer	Prestarter	Starter	Lactating sow feed
Crude Protein %	22	16.5	17.7	17.5
Crude Fat %	20	6	4.6	4.7
Crude Ash %	7	4.4	4.8	6.5
Crude Fibre %	0.04	2.7	3.7	5.6

The feeding of sows was adjusted to the needs of the individuals as the lactation progressed, as shown in *Table 2*.

**Table 2.**

Feed ration of the sows

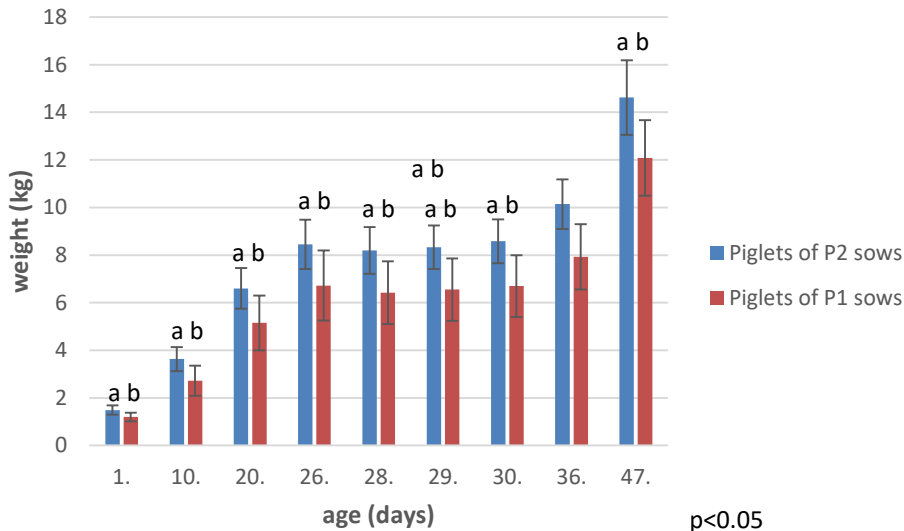
	Weekly system - days of the week						
	Monday*	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
The week of farrowing	1.5	1.5	3	3	3	3	3
The 1st week after farrowing	4.5	4.5	4.5	4.5	6	6	6
The 2nd week after farrowing	6	6	7.5	7.5	7.5	7.5	7.5
The 3rd week after farrowing	9	9	9	4.5	4.5**		

\*\*the day of farrowing; \*the day of weaning

Statistical analysis: to compare the weights of piglets of P1 and P2 sows at the different measurement points, GLM was used. Differences in weight gains between groups at the measurement points was carried out using covariance analysis, where parity of the sow was the categorical factor and initial weight of piglets at the observed period was the covariate factor. Grouping of piglets based on weight gain/loss or stagnation after weaning was also done subtracting the weight on the day after weaning from the weight on the day of weaning. Linear regression analysis was used to assess the association between weight gains of periods directly before and after weaning or the last observed period, that is between the periods of days 26-28 and that of days 28-29 and 36-47. Difference in mortality rate between the groups was analysed using Chi-square test. For all statistical procedures the SAS 9.1.4 software was used.

## RESULTS AND DISCUSSION

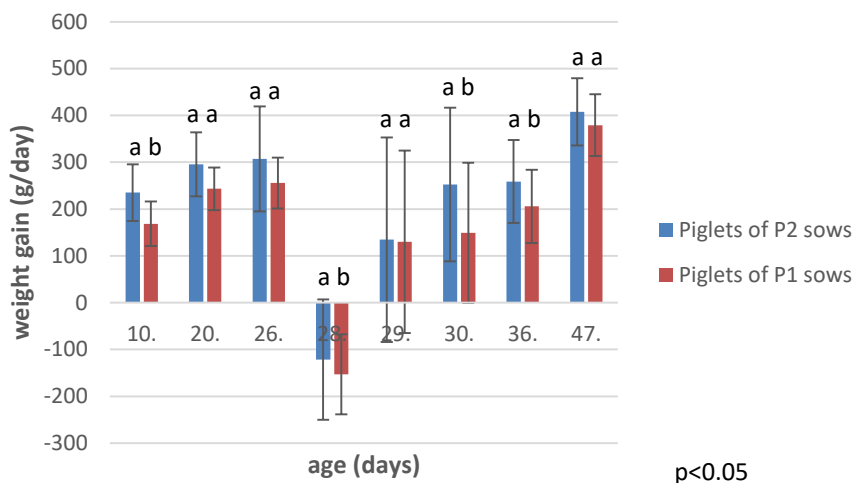
The weights of the piglets of the two groups were averaged at each measurement time point (*Figure 1*). Based on the calculated average weights, it can be said that the weights of the piglets of the P2 sows were significantly higher than the weights of the piglets of the P1 sows at each time point. This difference at day 1. was 290 grams. The 1-day average weight of piglets in the P1 sows was 1.20 kg, and the average weight of piglets in the P2 sows was 1.49 kg ( $P < 0.05$ ). Thus, our results are in accordance with the findings of *Hendrix et al.* (1978); *Tantasuparuk et al.* (2001) on birth weight. As the age progresses, however, the gap shows a gradual increase. At 10 days of age, 950 grams, at 20 days of age, 1600 grams is the difference between the weights of piglets of P1 and P2 sows based on group averages. Then, there is a statistically significant difference between the weights measured at 26, 28, and 29 days of life. The difference between the weights of the piglets in the two groups at 26 days is 2010 grams and at 28, 29 days 2020 grams, which is not negligible from a practical point of view. The findings of *Burkey et al.* (2008) and *Holyoake et al.* (2006) regarding weaning weight also agree with our results. From the age of 30 days, there is again an increase in the weight difference. The difference is 2120 grams at 30 days of age, 2430 grams at 36 days of age, and 2650 grams at 47 days of age. Thus, the largest difference can be measured at day 47 of life between the mean weights of the two groups. At this time, the mean weight of the piglets of the P1 sows was 12.13 kg, while the mean weight of the piglets of P2 sows was 14.78 kg ( $P < 0.05$ ). Throughout the observed period, piglets of P2 sows weighed 21-33% more with lower value being at day 47 (21%), the highest at day 10 (33%).



**Figure 1:** The average weight of piglets of P1 and P2 sows

Results on daily weight gain are showed in *Figure 2*. There was a difference in daily weight gain from day 1 to day 10 between piglets in the two groups. The average daily weight gain of the piglets of P2 sows was 218 g/day, while the average daily weight gain of that of the P1 sows was 182 g/day. During this period, a significant difference can be detected between the two groups. In the next two life stages, however, the weight gain of the two groups leveled off, with the measured values close to each other. In the case of piglets of P2 sows, the daily weight gain in the two life stages is 268 g/day and 276 g/day, respectively. For P1 sows, 265 g and 280 g/day ( $P < 0.05$ ). At 28 days of age, the day after weaning, there was again a difference between the piglets in the two groups. During this period, however, weight loss occurred. The weight of the piglets of P1 sows dropped to a greater extent. In their case, the average daily weight loss at that time was 185 g/day. The other group had a weight loss of 80 g over the same period. By the next measurement time, which was at 29 days of age, weight gain was observed again. Although there was no statistically significant difference between the two groups, it is important from the point of view of practice that the expected trend is characteristic, the weight gain of piglets of P2 sows is higher. At the 30th and 36th day of life, piglets of P1 sows continued to grow with a lower average daily weight gain ( $P < 0.05$ ). At the last measurement time point, piglets at 47 days of age, there was no

statistically significant difference between the performances of the two groups. According to the data obtained at the age of 47 days, the average daily growth of piglets of P1 sows is slightly 5 g/day higher than the growth of piglets of P2 sows. *Pineiro et al.* (2019) studied the piglets' growth from birth to finishing phase and found that growth superiority of piglets from P2 sows was maintained for the overall period. The development of digestive tract in low birth weight piglets is delayed as reported by *Michiels et al.* (2012), that is also reflected in our data (*Figure 2*).

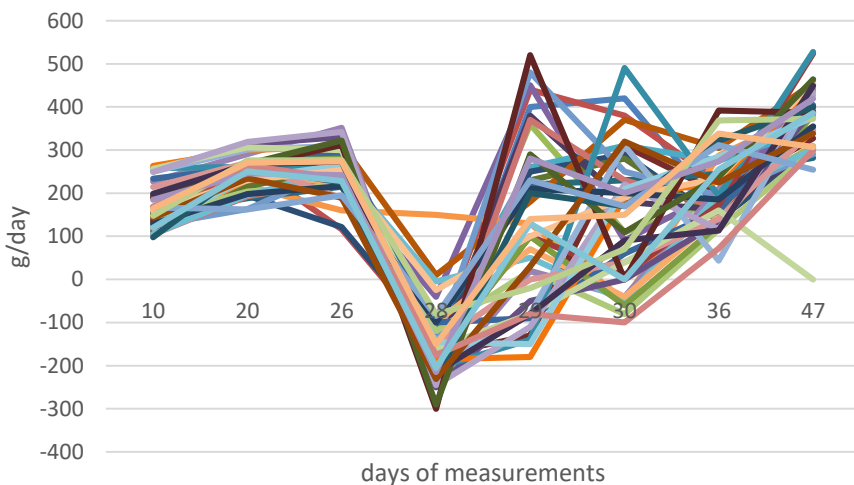


**Figure 2:** The average daily gain of piglets of P1 and P2 sows

Also the intra-group ratios of weight gain, weight loss, and stagnation in the periods between each measurement time point were evaluated. By the day before the weaning, all individuals in both groups showed growth. Then, during the critical period, the day after weaning, several of the piglets of P1 sows lost weight. In their group, a decrease was observed in 95.2% of the individuals. 73.5% of the piglets of P2 sows showed weight loss on this day. Two days after weaning, we experienced a decline in fewer individuals, and more piglets began to gain weight, but there was still a higher proportion of weight loss among piglets of P1 sows. 3 days after weaning, on day 30 of life, the difference between the two groups of piglets is greater. At this time, 97% of the piglets of P2 sows show an increase. Of the piglets of P1 sows, more than 16% experienced a weight decrease, and the weight of 7% of the individuals did not change

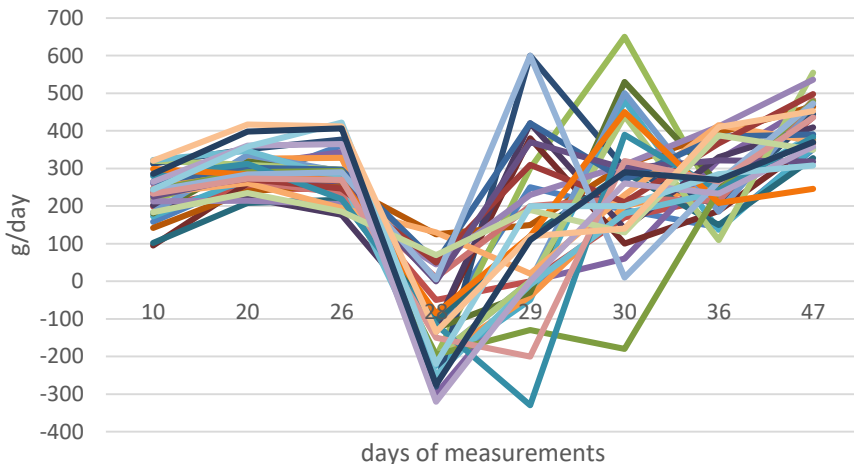
compared to the previous day. For the measurement at 36 days of age, the piglets of the first farrowing sows caught up. Again, all individuals in their group showed growth. This was also seen during the last measurement we performed at 47 days of age in piglets. *Figure 3.* and *4.* show the daily gain of all piglets in P1 and P2 groups. Regardless of group and initial weight weaning had a negative impact on growth, but the rate of growth stabilized at the group level at the last measurement time point.

The intake of supplemental feed for piglets differs between litters and within litters. *Bruininx et al. (2002)* distinguished between eater and non-eater piglets before weaning, and followed their feed intake after weaning. They found that eaters needed less time between weaning and first feed intake than non-eaters. As a result, eater piglets showed higher daily gain in the first 8 days after weaning. General lower feed intake after weaning was reported by *Balogh and Novotniné Dankó (2013)* as well, leading to reduced growth intensity or even weight loss of piglets after weaning.



**Figure 3:** Individual weight gain of piglets of P1 sows

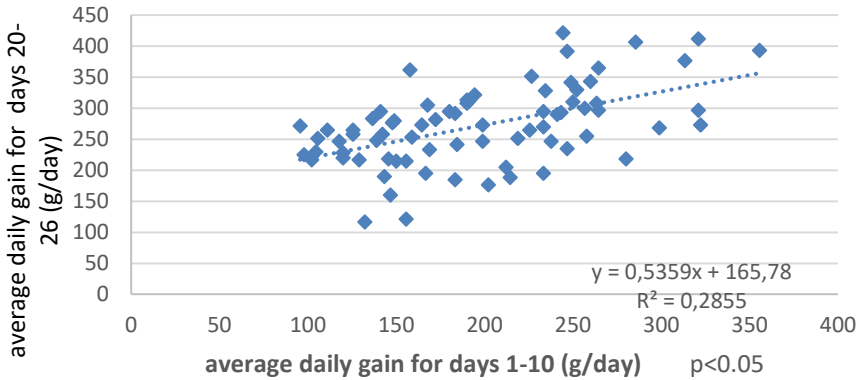




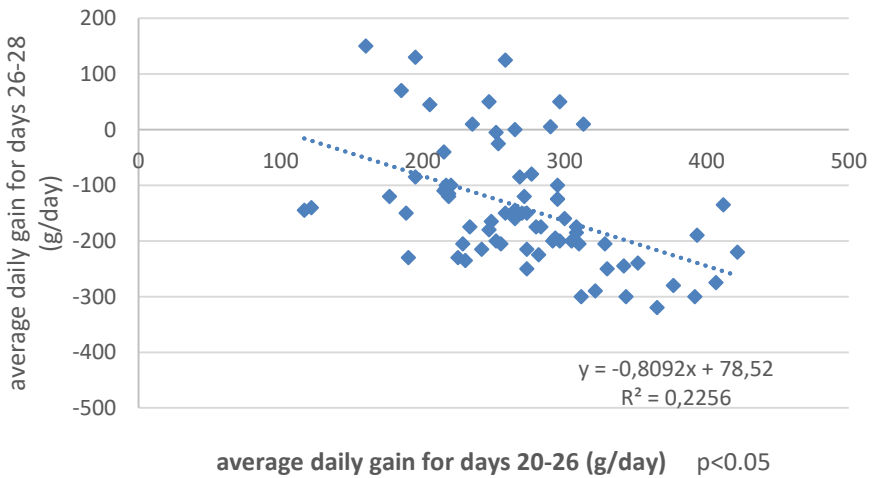
**Figure 4:** Individual weight gain of piglets of P2 sows

Birth weight is regarded as a parameter which influence the future growth rate of piglets, thus piglets with higher weight are considered to reach slaughter weight earlier. However outstanding pre-weaning weight gain might not necessarily mean better performance right after weaning compared to piglets that showed moderate gain in the farrowing unit. This phenomenon is presented in the next figures (*Figure 5., 6., 7.*). The initial weight gain is a relatively good predictor of later performance of the suckling piglets until weaning (*Figure 5.*)

Association between weight gains of days 20-26 and days 26-28 are shown in *Figure 6*. In this connection, we found that although the association is weak, it is still statistically significant. It can be stated that the post weaning weight gain tended to be lower for piglets that performed better before weaning. One reason could be that a piglet at the top of the litter ranking in the farrowing facility is adequately supplied with milk, thus it will not get used to solid feed early enough. As a result, the weight gain of piglets that grow satisfactorily before weaning will decrease more (*Wiseman et al., 1998*). So in their case, due to reduced feed intake, the decline in weight gain was greater. *Pluske et al. (2007)* observed that piglets which were good eaters in suckling period grew faster after weaning than small or non-eaters. *Mans and Magowan (2018)* confirmed that creep feed consumption in the farrowing unit increases feed intake early after weaning, however they found no effect on the growth after weaning.



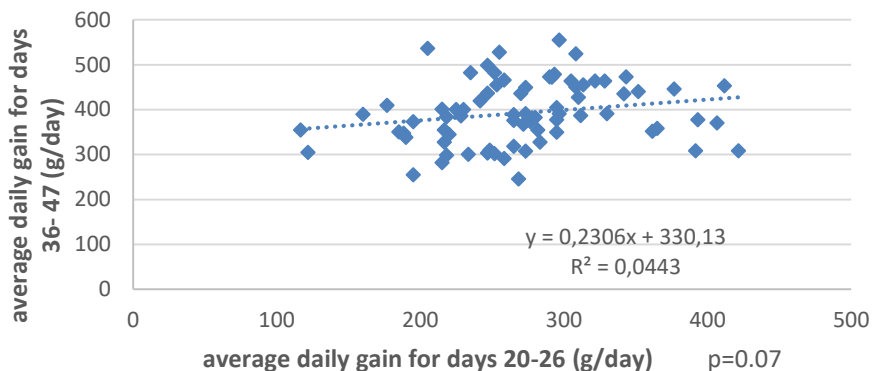
**Figure 5:** Association between average daily gain for days 1-10 and 20-26



**Figure 6:** Association between average daily gain for days 20-26 and 26-28

Figure 7. shows the relationship between pre-weaning gain and the gain at the last period. The result is not significant but the trend has reversed, indicating that piglets growing faster in the farrowing unit are coming over difficulties around weaning. It also shows the importance of this phenomenon,

since 20 days after weaning were not sufficient to clearly restore the initial trend.



**Figure 7:** Association between average daily gain for days 20-26 and 36-47

Our results on mortality are presented in *Table 3*. The results obtained do not agree with that of *Holyoake et al.* (2006), as in our study we observed a higher rate of mortality in the piglets of P2 sows ( $p=0,04$ ), 17,7 % of the P2 piglets died after the first weighing, with an average weight of 1.38 kg. The cause of this high rate of mortality was not determined, but it can be traced back to one sow, of whose piglets 46 % died after the first measurement. Furthermore, it can be said that mortality did not increase after weaning in none of the groups.

**Table 3.**

Mortality counts and ratios of piglets during the study

Age, days	10.	20.	26.	28.	29.	30.	36.	47.	Total	%
Piglets of P2 sows	8	1	1	1	0	0	0	0	11	24.4
Piglets of P1 sows	2	0	1	0	0	0	0	1	4	8.8

## CONCLUSIONS AND RECOMMENDATIONS

The weights of the piglets in the two groups showed statistically significant differences at each measurement time point with free access to the milk replacer and prestarter feed. The weight of piglets of P2 sows was greater in all stages of life we studied.

Weight gain in the piglets of P1 sows was also weaker on days 10 and 30 than in the case of the other group. Furthermore, piglets of P1 sows lost more weight on the day after weaning. In order to reduce the disadvantage of piglets of P1 sows, it would be necessary to separate these piglets from piglets of multiparous sows. Thus, their needs would be better met in terms of both feed and husbandry technology. Furthermore, this would make the stock more homogeneous and there would not be such differences between groups.

For best herd feed efficiency and overall efficient pig production it is also recommended to find the optimal sow herd structure where the proportion of first parity sows does not exceed 20%.

## REFERENCES

- Balogh P., Novotniné D. G. (2013). Versenyképes kocartatás és malacnevelés. Bp.: Szaktudás Kiadó Zrt.
- Barceló J. (2009). What is the best age for weaning piglets? Downloaded: [Link](#) (Downloaded: 01.15.2018)
- Bruininx, E. M. A. M., Binnendijk, G. P., van der Peet-Schwering, C. M. C., Schrama, J. W., den Hartog, L. A., Everts, H., Beynen, A. C. (2002). Effect of creep feed consumption on individual feed intake characteristics and performance of group-housed weanling pigs. *J. Anim. Sci.*, 80(6), 1413–1418. DOI: [10.2527/2002.8061413x](#)
- Burkey, T. E., Miller, P. S., Johnson, R. K., Reese, D. E., Moreno, R. (2008). Does dam parity affect progeny health status?, *Nebraska Swine Reports*. 36. University of Nebraska, Nebraska-Lincoln.
- Gondret, F., Lefaucheur, L., Louveau, I., Lebrete, B., Pichodo, X., Le Cozler. (2005). Influence of piglet birth weight on postnatal growth performance, tissue lipogenic capacity and muscle histological traits at market weight In: *Livestock Production Science* 93 (2005) 137-146
- Gadd J. (2011). *Modern Pig Production Technology*. Nottingham University Press
- Hendrix, W. F., K. W. Kelley, C. T. Gaskins, and D. J. Hinrichs. (1978). Porcine neonatal survival and serum gamma globulins. *Journal of Animal Science* 47, 1281- 1286.
- Holyoake, P. K. (2006). Dam parity affects the performance of nursery pigs. In: *International Pig Veterinary Society Conference*, Denmark. p 149.
- Horn P., Pászthy Gy., Bene Sz. (2011). Sertésenyésztés- A malacok takarmányozása Downloaded: [Link](#) (Downloaded: 12.05.2017)
- Michiels, J., De Vos, M., Missotten, J., Ovyin, A., De Smet, S., Van Ginneken C. (2012). Maturation of digestive function is retarded and plasma antioxidant capacity lowered in fully weaned low birth weight piglets. *British Journal of Nutrition*, 109(1), 65-75.
- Piñeiro, C., Manso, A., Manzanilla, E.G., Morales J. (2019). Influence of sows' parity on performance and humoral immune response of the offspring. *Porc Health Manag* 5, 1
- Pluske J. R., Kim J.-C., Hansen C. F., Mullan B. P., Payne H. G., Hampson D. J., Callesen J., Wilson R. H. (2007). Piglet growth before and after weaning in relation to a qualitative estimate of solid (creep) feed intake during lactation: A pilot study. *Archives of Animal Nutrition* 61(6), 469-480.
- Smith, A.L., Stalder, K.J., Serenius, T.V., et al. (2007). Effect of piglet birth weight on weights at weaning and 42 days post weaning. *J Swine Health Prod.* 2007;15(4), 213–218.
- Tantasuparuk, W., Lundeheim, N., Dalin, A.-M., Kunavongkrit, A., Einarsson, S. (2001). Weaning-to-service interval in primiparous sows and its relationship with longevity and piglet production. *Livestock production science* 69, 155-162.
- Vila, R. M. (2013). Welfare and management strategies to reduce pre weaning mortality in piglets.

Wiseman, J., Varley, M.A., Chadwick J.P. (1998). Progress in Pig Science. Nottingham University Press; Nottingham, UK

[www.bpex.org.uk](http://www.bpex.org.uk) (2010). Agriculture and Horticulture Development Board (AHDB) (Downloaded: 03.25.2018.)



© Copyright 2021 by the authors. This is an open access article under the terms and conditions of the Creative Commons attribution ([CC-BY-NC-ND](https://creativecommons.org/licenses/by-nc-nd/4.0/)) license 4.0.