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Assessment of viability of new born piglets using an adjusted APGAR score

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Abstract

Since decades pig breeding goals have mainly focused on prolificacy. However, large litters can have implications on piglets' and sows' welfare. Due to increased litter size viability of piglets may decrease, leading to a higher number of stillborn piglets and increased suckling piglet mortality. Piglet viability can be assessed using an adjusted APGAR score. This score measures in the new born piglet indicators crucial for the ability to survive. So the aim of this paper is to investigate the main effects on piglet viability by using an adjusted APGAR score. For this purpose, 25 sows and 404 born piglets were assessed using an adjusted APGAR scoring system. Every live born piglet was evaluated directly after birth regarding the parameters skin colour, umbilical cord condition, latencies to respiration, first movement, first attempt to stand up and first teat contact. Each parameter was scored from 0 (bad) to 2 (good) according to predefined categories and summed up to an overall APGAR score. The influence of provision of oxytocin or manual intervention during farrowing, care of the new born by the farmer and obstetrics on viability was investigated. It was found, that new born care and the condition of the umbilical cord had the highest influence on piglet viability. Oxytocin and obstetrics had no influence on the viability of piglets and therefore on the APGAR score.

Keywords: APGAR score, piglets, umbilical cord, viability

Introduction

Since decades, pig breeding goals have mainly focused on large litter size. However, with an increase in litter size piglet welfare decreases and piglet mortality may increase (Rutherford et al., 2013). Due to larger litter size, farrowing duration and birth intervals increase which can affect piglets' and sows' welfare at birth. Furthermore, large litter sizes reduce individual birth weight and heterogeneity of litters (Vanderhaeghe et al., 2013). This can cause starvation of piglets due to increased competition for teats and milk, especially with large litter size. Furthermore, more piglets are crushed by the sow (Rutherford et al., 2013). Additionally, rate of

stillborn piglets is increased in large litters, ranging from 5 to 10%. Important factors which affect stillbirth during farrowing are birth order and birth intervals. The main reason for mortality during farrowing is lack of oxygen (hypoxia) because of umbilical cord injuries. One factor, which is an indicator for hypoxia is meconium staining of piglets. About 80% of intra-partum deaths occur in the last third of farrowing. This implies, that a shorter farrowing duration may decrease mortality (Mota-Rojas et al., 2002). Oxytocin is the most frequently used drug to induce farrowing by stimulating uterine contractions. However, oxytocin also leads to a reduced blood flow and gas exchange in the uterus which has negative effects on the intrauterine piglets. Furthermore, the number of ruptured umbilical cords is higher in oxytocin treated sows, leading to the conclusion, that oxytocin induces more foetal stress and prenatal death (Mota-Rojas et al., 2005). Recently, Austrian pig breeding organisations decided to establish a piglet viability index for routine genetic evaluation. Piglet viability is assessed by trained breeders using an extra defined scoring scheme for the assessment of the whole litter within 24 hours postpartum. However, the scoring system has to be validated before it is routinely used. The first step of the validation of the vitality assessment score is the assessment of the piglet viability at birth using an adjusted APGAR score for each individual piglet. Since the piglet vitality index should be implemented in routine genetic evaluation, it is essential to test potential effects influencing piglet viability. The aim of the paper was therefore the investigation of main effects on piglet viability as described by an adjusted APGAR score.

Materials and methods

Data were collected from October 2017 to March 2018 on six pig farms in Austria, where sows were kept in farrowing crates. Each farm was visited once at the main farrowing days, and all sows which farrowed at these days were observed directly. Farrowing management was carried out as usual. Altogether, 29 sows with a total of 464 piglets were observed. Four sows of one farm were discarded due to extreme farrowing difficulties. Finally, 25 sows (15 Large White and 10 F1 sows (Large White x Landrace)) were included in the analysis.

Born piglets were classified in live born, stillborn and mummified. For the assessment of piglets' viability an adjusted APGAR score was used. The original APGAR score is used to evaluate the viability of infants within 1 min after birth. It consists of the parameters respiration, heart rate, muscle tonus, first attempts to move and skin colour. In this study, the APGAR score was modified and complemented with additional parameters. Every parameter was scored with 0 (bad), 1 (ok) or 2 (good) points. The parameters and definitions were: skin colour (normal/pink, pale, abnormal/blue), respiration (within 15 sec, after 15 sec, irregular after 15 sec), latency to first movement (within 15 sec much movement, within 15 sec less movement, no movement within 15 sec), latency to first attempt to stand up (within 1 min, 1-5 min, after 5 min), latency to first teat contact (within 10 min, 10-30 min, after 30 min), meconium stained skin (no meconium, less, much) and condition of umbilical cord (connected, ruptured ≥15 cm, ruptured <15 cm). Additional recorded parameters are new born care (means to remove mucus from the snout, rub piglets if they do not start respiration after 15 sec, get piglets out of amniotic sac) (yes, no)

and obstetrics (yes, no). All latencies were measured by stop watches. As soon as piglets attempted to stand up they were individually marked using differently coloured sprays to identify them when they first contacted the teats of the sow. The overall score was obtained by adding up the points per single parameter, the best score of the original APGAR with the 5 original parameters being 10 and the worst score 0. All still born piglets were scored with 0. A threshold of 6 was used for classifying a piglet clinically viable (Randall, 1971; Mota-Rojas et al., 2012).

Out of the total number of 404 born piglets, 12 were mummified, 24 were stillborn and 368 were born alive. Due to delayed recording and missing information or mummified piglets, 123 piglets were excluded from statistical evaluation. Sow parity, the farrowing time and the birth interval between piglets were noted. In addition to the parameters obtained from the piglets, it was documented, whether a sow received oxytocin or not and when it was injected.

Statistical analyses were performed using SAS 9.4 program (SAS Institute Inc., 2013). Data were analysed using the mixed procedure (PROC MIXED). Several effects (e.g. birth order, birth length) and interactions were tested for significance. If they were not significant and Akaike Information Criterion (AIC) did not decrease, they were not fitted in the mixed model. The model included the fixed effect of parity (1 to 8), breed of the sire (Large White, Pietrain), the breed of the sow (Large White, F1 (Large White x Land Race)), use of oxytocin, length of the umbilical cord (connected, ≥15 cm, <15 cm), new born care (yes, no), birth assistance (yes, no) and the random effect of sow nested within farm. Furthermore, the number of total born piglets (live, stillborn and mummified) was fitted as a covariable. Tukey's test was used to establish pair-wise differences between oxytocin treatments, umbilical cord length, newborn care as well as between obstetrics. Results are presented as least square means (LSmeans) and standard error (S.E.).

Results and discussion

The mean APGAR score for all recorded piglets was 6.2±1.75. The mean birth interval was 11±16.3 min with a minimum of 1 sec and a maximum of 2.24 hours. The time to respiration for live born piglets was 6±6 sec and the mean APGAR score for this parameter amounted to 1.8±0.55, representing the parameter with the highest APGAR score. In contrast, the mean latency to the first movement was 37±1.15 sec with a mean APGAR score of 0.58±0.78 which is the parameter with the lowest value. The two other latencies (first attempt to stand up: 2.1±3.5 min; first teat contact: 28.3±20.1 min) had a mean APGAR score of 1.2±0.51 and 0.8±0.77. With an average APGAR score of about 6 (out of 10 possible points), the half of the observed piglets seemed to be clinically viable, because on average they reached more than the half of the possible points.

Parity, breed of the dam, breed of the sire and a total number of born piglets did not affect the APGAR score in this dataset (p-values from 0.126 to 0.658). Also, there was no effect of litter size on piglet viability, probably due to a small variability in the number of overall born piglets (11 to 20 piglets born piglet including mummified piglets). However, obstetrics (P=0.647) and oxytocin treatment (P=0.261) had no significant effect on viability, while the condition of the umbilical cord (P=0.055)

showed a trend of influencing the viability and new born care (P<0.0001) affected viability as measured by the adjusted APGAR score. Results for LSmeans, S.E. and p-values of main effects on the APGAR-Score are shown in table 1. LSmeans for piglets from sows treated with oxytocin were slightly lower than when no oxytocin was used, but the p-value of 0.261 showed no statistical effect of treatment with oxytocin on the APGAR score. Similar results were also found in other studies and it remains open, whether the amount of oxytocin may decide on the effect on viability (Vanderhaeghe et al., 2013). A larger effect on piglet viability was found for the condition of the umbilical cord between ruptured short (<15 cm) and still connected. Here the LSmeans differed by about 1.1 points, with a short ruptured umbilical cord having negative impacts on the viability of the piglets. Rupture of the umbilical cord may lead to less supply of oxygen, energy and may additionally mean blood loss (Mota-Rojas et al., 2012), thus resulting in weakened piglets when born. Whether new born care was done or not it also had an influence on viability. As the LSmeans and the p-value showed the APGAR rises if no obstetrics are necessary. This appears to be plausible, as when no new born care would have been carried out, the piglets might have died. Birth assistance did not have a pronounced effect on viability. This may be explained by early assistance by the farmers so that piglet viability was not yet decreased.

Table 1. LSmeans, S.E. and p-value of the fixed effects oxytocin treatment, condition of the umbilical cord, new born care and birth assistance of the APGAR score

	Oxytocin		Condition of the umbilical cord			New-born care		Birth assistance	
	Yes	No	<15 cm	>15 cm	Connected	Yes	No	Yes	No
LSmeans	5.55^{a}	4.87^{a}	4.51^{a}	5.43^{ab}	5.67^{b}	4.08^{a}	6.33^{b}	5.1^{a}	5.3^{a}
p-value	0.183		0.063	0.018	0.302	<0.0001		0.609	
S.E.	0.49	0.4	0.57	0.38	0.34	0.47	0.35	0.48	0.34

Different superscripts ($^{a, b}$) within categories indicate significant differences (P<0.05) according to the Tukey test.

Conclusions

This study showed that piglet viability can be highly influenced by the condition of the umbilical cord. If the umbilical cord ruptured in utero resulting in a length of less than 15 cm the viability of the piglet decreased. Furthermore, if new born care is necessary piglet viability decreases. This may be linked to fact that new born care is provided to piglets that may otherwise have not survived. No influence was found for oxytocin use and for obstetrics. Moreover, neither the breed of the dam or sire, nor parity and total number of born piglets affected the adjusted APGAR score. Findings of this research suggest that auxiliary traits (birth care, birth assistance, use of

oxytocin) have to be recorded for correction in the model when viability is assessed by farmers. The length of the umbilical cord would be useful as well, but under practical circumstances, an assessment by the farmers appears to be less feasible.

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