Piglet Livability as KPI & How to Influence

A.A.M. van Wesel, M. van den Bosch

Cargill Animal Nutrition. Ad_van_wesel@cargill.com

1. What is Piglet Livability?

Piglet livability is an important performance parameter and can be described as the piglet's quality of life. It is calculated as follows: Livability = 100% - ((# still born + # preweaning mortality)/total born)). Cargill's research shows that the average livability in the areas we work is 83%, however, we also see significant variation ranging from 75% till 90%.

Piglet livability is influenced by multiple factors originating from both the sow and the piglet. These factors affect piglet livability in a direct or an indirect way. In this conference paper, the focus will be on sow feeding effects around farrowing.

In 2011, on average 13% of all live born piglets died before weaning in the Netherlands (Agrovision, 2011). Pigprogress (2012) estimates a preweaning mortality over 10% worldwide, the Ministry of Agriculture, Food and Rural Affairs (2008) indicates a preweaning mortality of 12 to 15%, while Kappel Theil (2011) indicates a preweaning mortality of 14%. Based on these above mentioned estimates, preweaning piglet mortality will be between 12 and 15%.

Due to increasing sow productivity, resulting from genetic improvement, pig farmers are facing low birth weight and high preweaning mortality problems leading to gradual declining livability, as shown in Figure 1, which shows livability development over the years in the Netherlands.

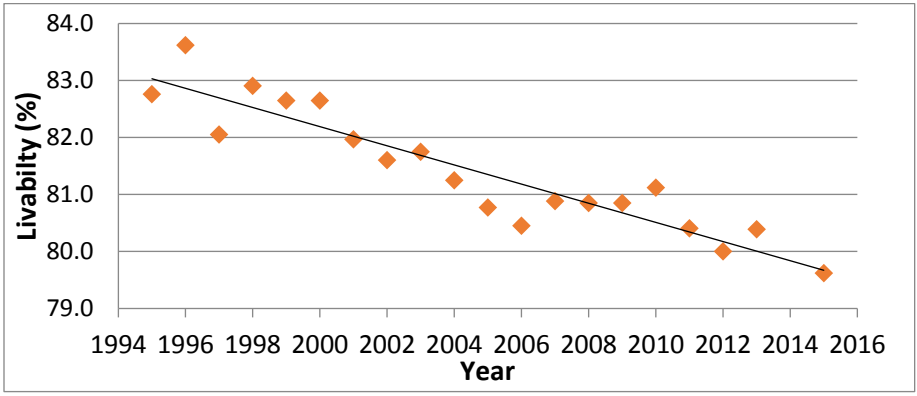

Figure 1. Livability development over last 20 years (Source; “Kengetallenspiegel” Agrovision NL)

2. Factors Influencing is Piglet Livability

Piglet Livabilty is clearly a multifactorial characteristic on a sow farm. Cargill researchers created a concept map to give insight into the factors they think are most important (Figure 2).

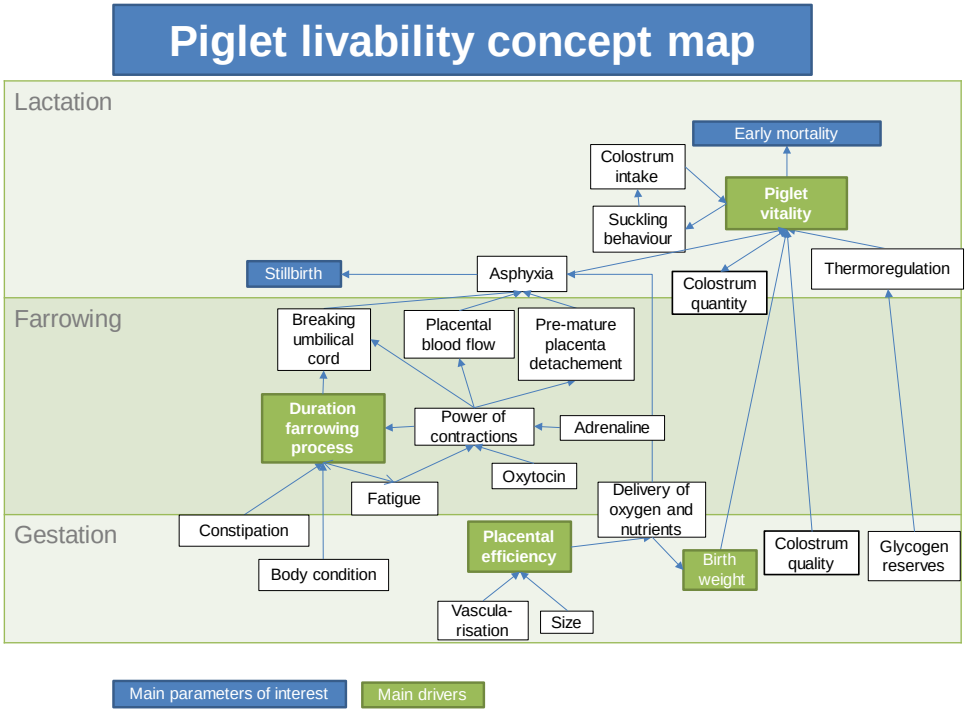

Figure 2. Concept map piglet livability (source: Van den Bosch, Cargill Research)

Zooming in on still-birth we see that the duration of the farrowing process is of importance. Not only the total length of time, but also the inter-piglet interval. Research shows that still-born piglets are on average born after longer birth intervals (see Figure 3). We can observe sows who take a break during the farrowing process and after this pause we see more still borns.

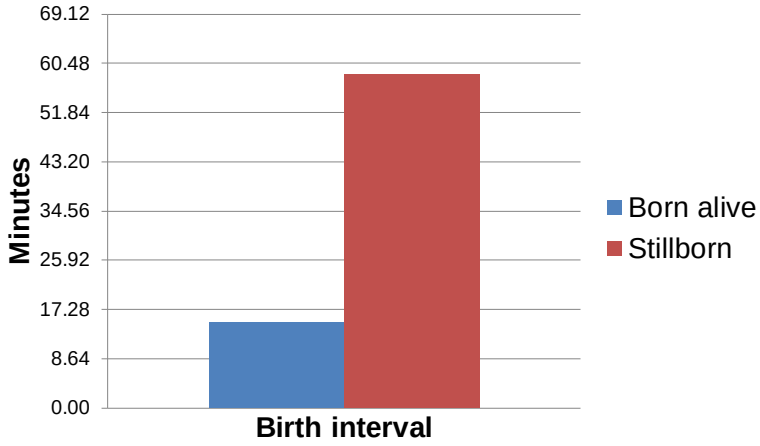

Figure 3. Birth interval in minutes of still born vs. live born piglets (Van den Bosch, Cargill unpublished)

Another important factor for still-borns is oxygen supply to the piglets just before and during the birth process. Oxygen supply takes place via the umbilical cord through the placenta, and oxygen is supplied via the sow's blood. This means the total pathway, from sufficient sow's blood oxygen, placenta quality/size and umbilical cord quality has to be optimal. If oxygen supply is not sufficient we see asphyxia and oxidative stress leading to still born and/or weak born piglets. Mortality after birth is interrelated with this. Weak piglets have low vitality scores and thus do not approach the udder fast enough, leading to hyperthermia and low colostrum antibody intake. Next to vitality, the birth weight of piglets is a well-documented factor having strong influence on piglet mortality throughout the suckling period, as is shown in Figure 4. According to Lay et al. (2002), the resulting hypoxia can lead to still-births and reduced postnatal viability. Consequently, piglets with a reduced postnatal viability are not able to stimulate

milk production. Therefore, piglets' vitality also has a big influence on milk production.

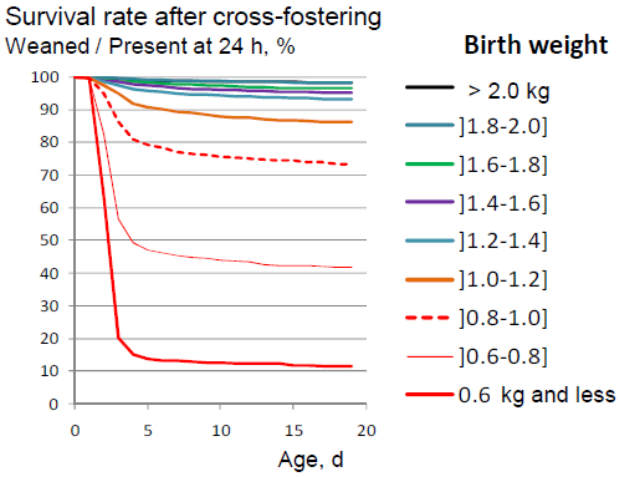

Figure 4. Survival rate in relation to birth weight (Source: Quiniou 2002)

3. Nutritional Strategies for Improving Piglet Livability

Recent research shows that we have several options to improve the challenging circumstances the sow and her piglets face around birth. In this paper we will highlight a couple of nutritional technologies we have recently discovered in our research. There are in fact 3 main nutritional intervention moments that can influence piglet livability. 1) Period from estrus to embryonic implantation, 2) Period around farrowing, 3) Neonatal piglet from a few days post farrowing to weaning. The focus in this paper is on period 2: around farrowing.

Antioxidant Concepts

Since there is a proven oxidative stress at the end of gestation-beginning of lactation (Figure 5), it is evident that antioxidant concepts can be used to help mitigate negative effects of such metabolic challenge.

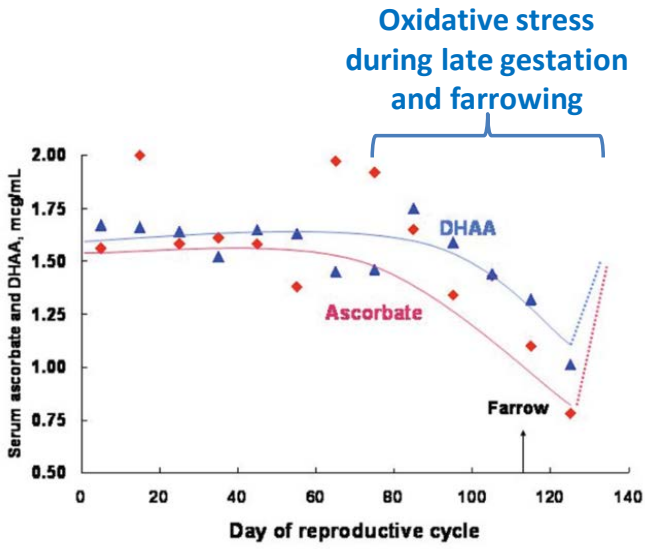

Figure 5. Development of oxidative stress indicators in sow's blood (Adapted Mahan, 2007)

Several antioxidants can be used to help overcome oxidative stress. Vitamin E is probably most applied for this. In recent years, it was proven that Polyphenolic compounds can have a direct antioxidant effect, but also help regenerate vitamin E that has been oxidized. This combination can thus improve the antioxidant status of an animal. One such antioxidant product is Proviox, a blend of selected polyphenols from grapes and onions. In trials conducted with the University of Warmia and Mazury in Poland, we could show that vitamin E and Proviox help improve the anti-oxidant status of sows and increase piglet birth weight and

weaning weight. In an internal Cargill trial, we could also show the same effect on birth weight, and a strong trend (P= 0.06) for better livability when feeding Proviox during the last third of gestation. We found significant post-weaning performance improvements using polyphenols in sow feed during lactation, a so called trans-generational effect.

Stool Quality

Another factor recognized to influence birth process is stool hardness/constipation. In a recent trial performed at our sow innovation center, we have shown the correlation between stool hardness/constipation and still-borns, as well as livability. In Figure 6, the relation is shown between stool quality (ranging from score 0 = hard to 4 = very soft/falls thru slats) and livability parameters.

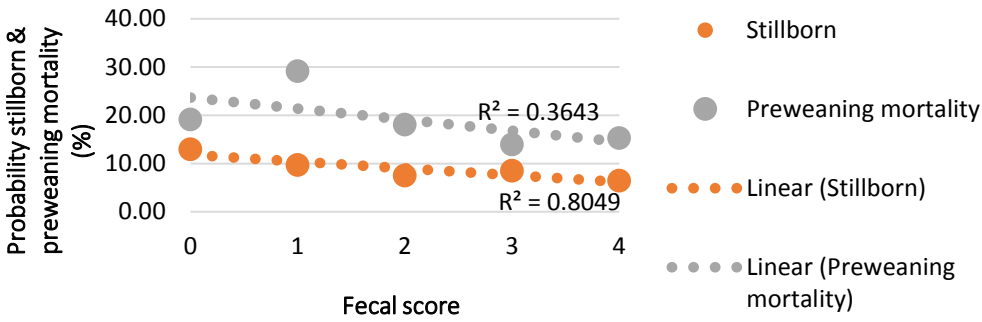

Figure 6. Relation between fecal score (0 being hard to 4 being very soft), and mortality and still born (source Cargill Research 2016)

Since fiber nutrition is a good way to manipulate stool quality we recommend formulating feeds with the right fiber amount and composition (fermentable vs. structural fiber).

Sow Body Condition

A high performing sow needs the right body reserves at the end of gestation and during the start of lactation. For gilts and parity 1 animals, we believe protein mass and size of the animal is key. In older animals it is mainly back-fat that needs to be in the optimal range. Research shows that sows with not enough back-fat will have piglets with lower birth weights, have lower milking persistency and have a longer weaning to estrus interval. On the other hand, sows with too much back-fat will have prolonged farrowing time, lower colostrum yield and lower lactation feed intake. It is clear that several of these factors influenced by sow back-fat have a proven relation with piglet livability. What the “sweet spot” is for back-fat at the end of gestation, depends on production level, environment (e.g. heat stress) and genetics of the sow. As a nutritionist, we can influence the back-fat by feeding schedules used in combination with manipulating the amino acid/net energy ratio of the feed.

Nitric Oxide Manipulation

Inspired by the use of red beetroot juice by athletes, our researchers studied nitric oxide boosting concepts to help sow and piglets around birth. This has led to a new patent pending technology called Livapig™. Livapig™ increases nitric oxide in the sow’s blood the last days before farrowing. In multiple trials this new concept lead to an increase in piglet livability of on average 1.5%. As explanation of the mode of action we have shown a significant increase in placenta size, a better oxygen status, higher piglet birth weight, and better piglet vitality (Figure 7).

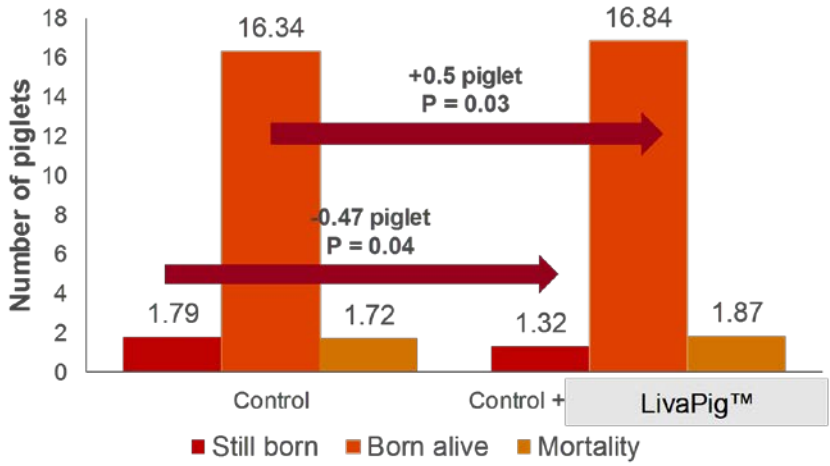

Figure 7. Effect of nitric oxide booster Livapig on piglet livability (van den Bosch, pending for publication)

Practical experience using this new concept after launch in the EU clearly shows the effect on total livability. It is interesting to see that some farms report the main improvement as less still-borns, while others observe the main effect on post-farrowing piglet mortality. The factor determining why we see this difference is subject to further research.

4. Conclusions

Piglet livability is of importance because of economic reasons, but also animal health and animal welfare aspects. Having more piglets per sow per year survive adds to improved sustainability. Livability can be influenced by sow and piglet nutrition in 3 periods; 1) Beginning of the reproductive cycle, so from estrus to implantation, 2) Around farrowing and 3) Neonatal piglet nutrition. Nutritional concepts around farrowing should target: increasing birth weight of the piglets,

prevention of oxidative stress in the sows, fast birth process without sows taking a pause, soft stool of the sow and prevention of piglet asphyxia. Nutritional concepts with proven effects on these aspects are: antioxidant systems combining vitamin E and polyphenols, fiber nutrition, feeding regime and amino acid/NE ratio manipulation and nitric oxide boosting.

References

Agrovision, 2011. Kengetallenspiegel Dutch pig farms July 2010 – June 2011.

Kappel Theil, P., 2011. Performance of lactating sows needs to be improved. PowerPoint presentation, 2011-07-05.

Lay, D.C. Jr., Matteri, R.L., Carroll, J.A., Fangman, T.J., Safranski, T.J., 2002. Preweaning survival in swine. Journal of Animal Science 80, E74-E86.

Mahan, D. C. Peters, J. C., and Hill. G. M., 2007. Are antioxidants associated with pig and sow mortalities. Swine Nutrition Conference Proceeding in Indianapolis, IN.

Ministry of Agriculture, Food and Rural Affairs, 2008. http://www.omafra.gov.on.ca/english/livestock/swine/facts/info_pm_prewean.htm, visited on 2012-10-19.

Pigprogress, 2012. Diseases: pre-weaning mortality. http://www.pigprogress.net/diseases/pre-weaning-mortality-d75.html, visited on 2012-10-19.

N. Qiuniou, J. Dagorn, D. Guadré, 2002, Variation of piglets' birth weight and consequences on subsequent performance

Van den Bosch et.al. Several paper for publication in 2018.