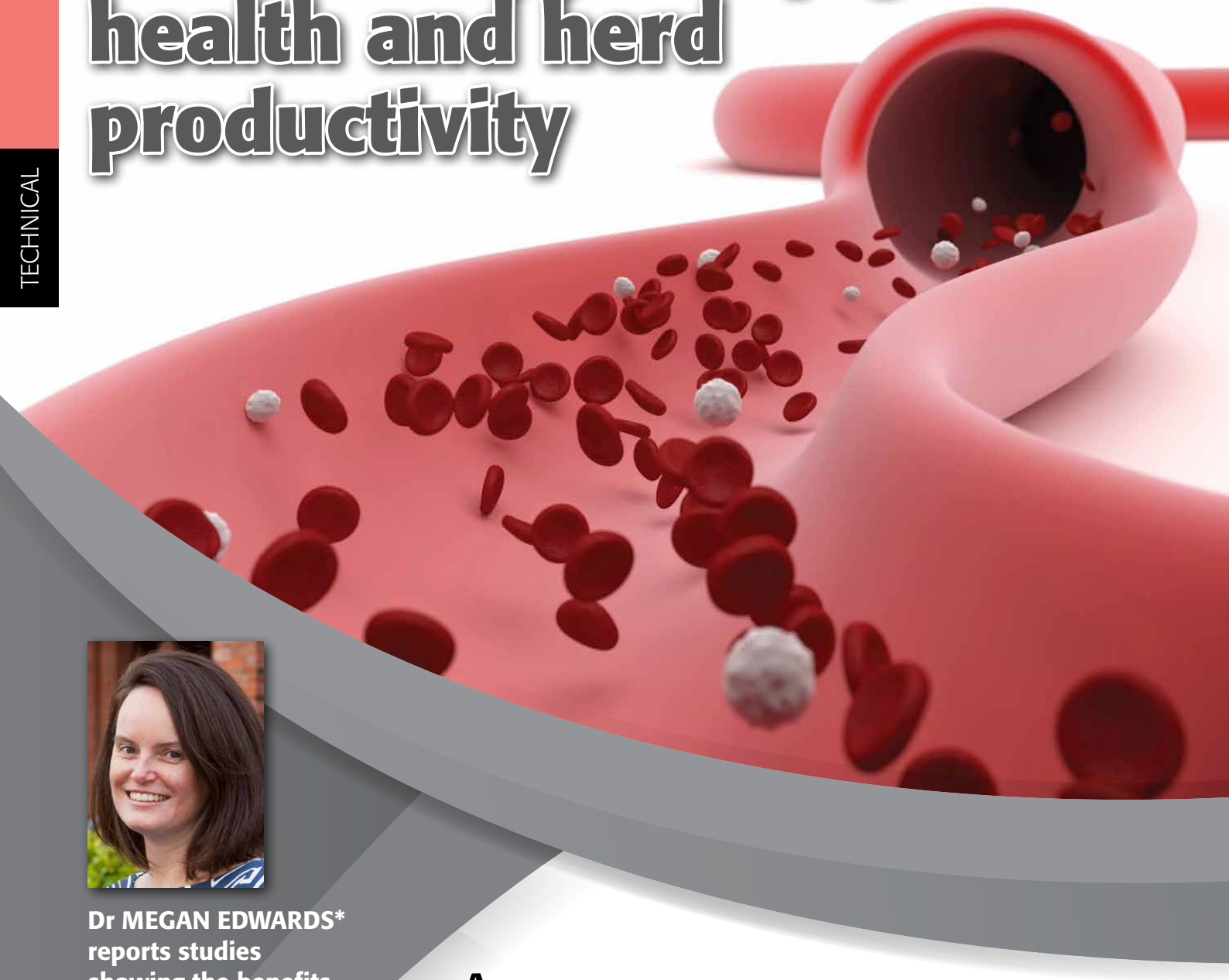
Plasma supports pig health and herd productivity



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reports studies showing the benefits of spray dried plasma proteins in sow and piglet diets.

African Swine Fever has significantly reduced the commercial pig herd in Asia. There are now great opportunities for those investing to restock their swine herds. Challenges that the swine industry must navigate through in the short to medium term include; having large numbers of gilts entering our herds, addressing social pressures to reduce reliance on antibiotics for growth promotion, and coping with the consequences that come with genetic advances in relation to the resilience or robustness of the modern lean pig.

Spray dried plasma proteins (SDPP) are functional protein sources which can be used in sow and piglet diets to enhance health, efficiency and profitability. As well as being a highly digestible and palatable source of protein, they also contain over 250 bioactive peptides, functional proteins (including immunoglobulins), albumin and growth factors. The general benefits of SDPP in piglet diets are well accepted. Considering the direct and indirect benefits of SDPP, there are more life-cycle production opportunities to use SDPP technology to boost health, productivity and ultimately profitability.

Mating and early-mid gestation

The peri-mating period can be a stressful period which includes mixing stress, mating stress, and aggression that can result in localized and

Table 1: Summary of plasma protein (0.5%) effect on reproductive outcomes.

Reference	Plasma effect on progeny
Campbell *et al.*, 2006	+0.40 pigs born alive and weaned per sow served
Crenshaw *et al.*, 2007	+0.40 full value pigs weaned per litter
Crenshaw *et al.*, 2010	+0.33 full value pigs weaned per litter
Van Iersel *et al.*, 2011	+0.48 pigs weaned per litter
Crenshaw *et al.*, 2020 submitted	-0.44 stillborn pigs per litter
Crenshaw *et al.*, 2020 submitted	+0.50 pigs born alive in subsequent litter

systemic inflammation. Inflammation is a common cause of failure to establish pregnancy and interferes with pregnancy maintenance, fetal growth, fetal survival, and successful implantation of embryos.

Oral supplementation of rodents with 1% SDPP has been shown to benefit pregnancy outcomes through manipulation of cytokine expression within the uterus. Cytokines like interferon (IFN)-γ are important for modulation of inflammation, but also for uterus dilation, blood flow and implantation. Whereas, transforming growth factor (TGF)-β1 expression in the uterus supports cell growth, cell differentiation and wound healing. Both of these cytokines are up-regulated when SDPP is fed.

Feeding relatively low doses of (0.5%) SDPP throughout gestation has been shown to increase farrowing rates and live born piglets (Table 1). Another interesting finding was that suckling pigs from sows fed 0.5% SDPP in gestation grew faster and weaned fewer light pigs, indicating better uniformity. The benefits appear to be more pronounced in PRRS positive herds with known health and sanitation challenges.

Late gestation/transition period

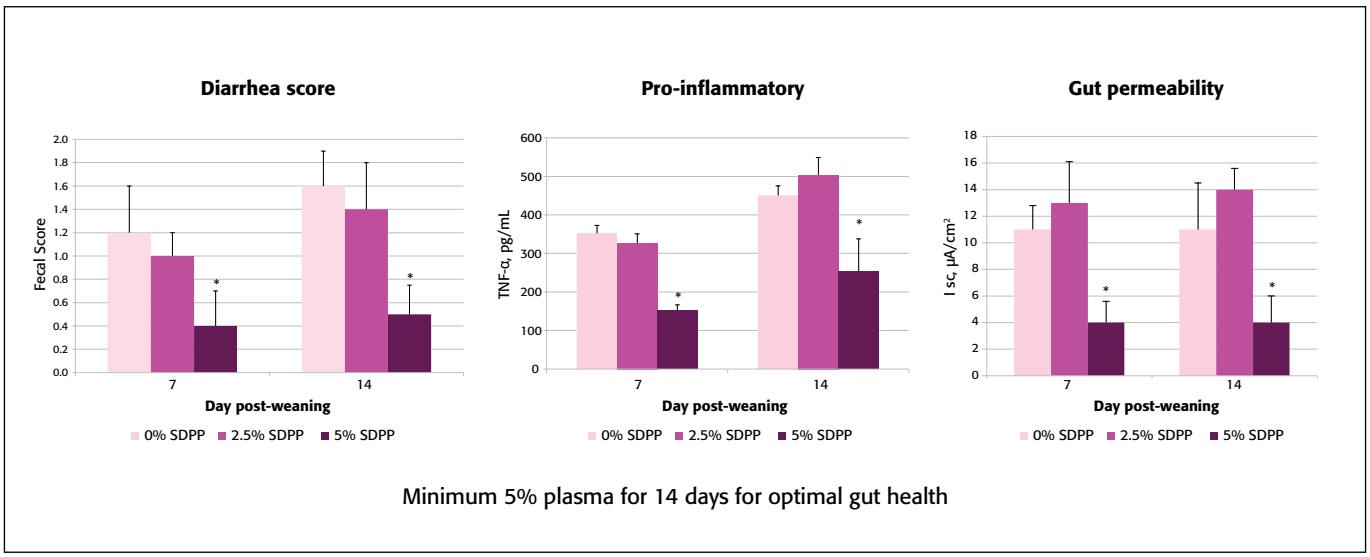
During the last three weeks of gestation the sow and her fetuses undergo many drastic changes. Litter growth is exponential with huge demand for amino acids and minerals. The immune properties to be transferred from sow to her progeny via colostrum are determined and the sow undergoes hormonal shifts and calcium mobilization. During this period the sow's immune system is lowered to support litter requirements and the antioxidant status of the sow declines rapidly.

Performance enhancements so far seen through the supplementation of SDPP at 0.5-1.0% in sow feed during this period have demonstrated reductions in the occurrence of stillbirths as well as increases in the subsequent litter size for young sows resulting in a reduction of the common commercial phenomenon of the second parity syndrome. Whilst our understanding of the mode of action remains incomplete there is evidence to demonstrate a reduction in inflammation in both sows and her progeny in the week after farrowing. This outcome implies there may be systemic benefits passed from the sow to her progeny when feeding plasma to sows during gestation.

Lactation

Lactation can be compared to a metabolic marathon and is not without immune challenges. The transition from pregnancy to lactation is known to cause hepatic, uterine and systemic inflammation as well as oxidative stress. These consequences repartition energy and amino acids away from milk production and

Figure 1: Level of plasma in feed benefits gut health.



Adapted from Peace *et al.*, 2011 $^{*}p<0.05$, n = 8 pigs/trt

towards mounting an immune response, and therefore reduce feed efficiency.

Younger sows (parity 1 and 2) often under-perform relative to peak performing sows (parity 3-5) due to lower feed intake and less immune competence. This deviation in performance is further exacerbated under heat stress conditions. Low inclusions rates of SDPP (0.5%) have been shown to enhance feed intake of young sows by 11.7% in heat stress conditions and significantly reduce the wean to estrous interval (8.1 vs 5.7, p=0.02). In mature sows exposed to health stress supplementing SDPP improved litter weights due to improved protein utilization efficiency.

Older parity sows (≥ 4) also appear to benefit from the supplementation of SDPP where improved numbers of piglets weaned, and improved litter gain have been observed.

Nursery

The global adoption of SDPP in nursery diets has been popular for over 30 years. Piglets are weaned when their digestive and immune systems are immature, and the passive immune protection provided by plasma to young pigs is of great benefit. Oxidative stress and inflammation are undesired consequences of the weaning process together with the abrupt changes to intestinal microflora and the physical integrity of the gastro-intestinal tract.

The magnitude of the benefit provided by plasma is strongly influenced by the inclusion rate and application period, weaning weight and age, health status and sanitary conditions. In well-balanced diets fed to piglets between 21 and 35 days of age 4-6% SDPP in stage 1 diets can be used to enhance feed intake, growth, and feed efficiency, lower immune activation, maintain gut barrier function, reduce inflammation and eliminate pathogens. A step-down approach is recommended, with the objective of maintaining passive immune support until pigs reach immune maturity at approximately 7 weeks of age. Improved vaccine response is another benefit observed in pigs offered plasma in the nursery where vaccination commonly occurs. These benefits have been demonstrated to improve wean to slaughter outcomes for pigs. The broad benefits offered by SDPP explain why it is proposed as both a welfare tool and is a stronger contender as a replacement for in-feed antibiotics.

Conclusions

Inflammation and oxidative stress are normal responses seen in commercial pigs. These stressors negatively impact reproductive performance of sows and piglets in commercial swine operations. Using functional feed ingredients like SDPP which have been scientifically proven to positively influence the inflammatory and oxidative status of sows and piglets, make sense in terms of improving welfare, health status, performance and the efficiency of commercial farms. AP

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