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# Could Sucker Piglet Anaemia be a Pre-Disposing Factor for Peri-Weaning Failure to Thrive Syndrome? – Pilot Study

## Final Report
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## Executive Summary


Peri-weaning failure to thrive syndrome (PFTS) is a condition in which otherwise healthy weaner pigs become anorexic, resulting in starvation or euthanasia. Its incidence is highly variable between batches, and observations in the US suggest it ranges from 1-20% Anecdotally, veterinarians have observed weaner pig wasting within Australia but have been unable to determine an infectious origin and it is often hard to detect until wasting is severe, rendering early intervention difficult.

Iron deficiency, where the concentration of haemoglobin (Hb) and the number of red blood cells decline, is a primary cause of anaemia. Sucking piglets are susceptible to an iron deficiency or anaemia as at birth their reserves do not meet daily demand and they receive only 10% of their postnatal iron requirement from milk. The early stages of anaemia can be difficult to detect, with larger piglets more likely to be iron deficient with their increased requirement for growth. A major symptom of anaemia is anorexia, which coupled with the fact that large piglets are more likely to be anaemic, suggests a possible link with PFTS.

We hypothesise that pigs suffering from PFTS are anaemic, and that a double iron dose in lactation will reduce the incidence of PFTS in the nursery.

This pilot study investigated the Hb profile of piglets to determine the degree of iron anaemia present and identify intervention points for the delivery of a second iron dose to inform a larger study to investigate whether iron deficiency in pigs at weaning is linked to PFTS and if a second intervention of iron supplementation is an effective mitigation strategy for the condition

Sows and a subset of their piglets had their Hb levels measured via point-of-care meter on a regular basis prior to farrowing (sows), throughout lactation (sows and piglets) and after weaning (piglets) to determine the pattern of Hb concentration as time progressed and to understand the relationship between measures over time. Whilst an assessment of the accuracy of the point-of-care meter was also undertaken.

This study showed that the Hb levels of sows and piglets within this study fall, generally, within the classically defined iron deficiency (< 11 g/dL) band, which is not dissimilar to previous studies in Australia on other herds. Haemoglobin levels of piglets declined after birth in line with expectations of depletion of their limited body reserves, but readily responded to treatment with the industry standard intramuscularly injected 200 mg of iron dextran shortly after birth. However, in contrast to studies overseas, post-weaning these piglets continued to deplete iron reserves with falling levels of Hb not being offset by dietary inclusion of iron (70 mg/kg), suggesting that a second intervention within lactation would be of benefit.

The lack of relationship between Hb levels in the sow pre-farrowing and the piglet at birth does not suggest that additional sow interventions would result in improvements in piglet Hb status and therefore direct interventions with the piglet are required to improve Hb status and thus performance. This pilot study therefore supports the objectives of the larger project to intervene directly to improve piglet Hb status with the aim of reducing the number of piglets that fail to thrive after weaning.

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## 1. Background to Research

Peri-weaning failure to thrive syndrome (PFTS) is a condition in which large, healthy weaner pigs become anorexic, resulting in starvation or euthanasia. Its incidence has only really been described in the US and is highly variable between batches, ranging from 1-20% (Perri, 2015). The incidence of PFTS in Australia is currently unknown. Anecdotally, veterinarians have observed weaner pig wasting and have been unable to determine an infectious origin. The clinical symptoms of PFTS are often hard to detect until wasting is severe, rendering early intervention difficult.

Iron deficiency, where the concentration of haemoglobin (Hb) and the number of red blood cells decline, is a primary cause of anaemia. Sucking piglets are susceptible to an iron deficiency or anaemia as at birth, piglets' hepatic iron reserves do not meet their daily demand and they only receive 10% of their postnatal iron requirement from sows' milk. The early stages of anaemia can be clinically difficult to detect, with larger piglets at weaning more likely to be iron deficient with their increased requirement for growth (Perri 2015). One of the main clinical symptoms of anaemia is anorexia, which coupled with the fact that large piglets are more likely to be anaemic, potentially provides a link between this condition and PFTS.

We propose to investigate the presence of iron deficiency in pigs at weaning, whether this deficiency is linked to PFTS, if iron levels of the sow are correlated to piglet anaemia and/or PFTS and if a double iron dose is an effective mitigation strategy for the condition. We hypothesise that pigs suffering from PFTS are anaemic, and that a double iron dose in lactation will reduce the incidence of PFTS in the nursery. This pilot study will investigate the Hb profile of piglets to determine the degree of iron anaemia present and identify the best intervention point for the delivery of a second iron dose.

## 2. Objectives of the Research Project

Planned outcomes for the larger project include the identification of the incidence of PFTS in weaned pigs, the identification of incidence of iron deficient anaemia in piglets and any correlation with sow iron levels and the ability of additional iron treatments to reduce the incidence of PFTS in nursery pigs.

The ability to influence the incidence rate of PFTS would be of significant benefit to producers with up to two-thirds of mortality in the immediate post-weaning phase being related to wasting that does not respond to any current treatment practice.

The specific objectives of the larger project are:

- To determine the correlation between piglet iron levels at weaning and the rate of PFTS incidence in the post-weaned pig.
- To determine the incidence rate of PFTS in weaner pigs.
- To determine the range of piglet iron levels at weaning, and the ability to influence these iron levels through additional treatment.

The objective of this pilot study is to establish pattern of Hb concentration within sucker and weaned piglets to identify if iron deficient anaemia is present and identify when the best intervention point is for a second dose of supplemental iron.

## 3. Introductory Technical Information

Pigs exhibiting the clinical signs of PFTS have been observed by piggery staff and veterinarians, with no infectious origin being determined. Mortality within some nursery systems are consistently in the range of 3 to 5%, and at least two-thirds of this mortality is attributed to wasting – 65.7% YTD of mortality at one nursery site is associated with hospital pen euthanasia.

Investigations of thin piglets displaying the typical behavioural patterns of PFTS recorded beta hydroxybutyrate (BHB) levels of >0.2mmol/L on day 4 suggesting this measure of ketosis could allow for an early diagnosis (Perri 2015), measurement of BHB levels on day of weaning could identify at risk pigs needing additional interventions. Whilst they also found 28% of piglets iron deficient and 8% anaemic at weaning, and 43% iron deficient and 18% anaemic three weeks post weaning.

Whilst there is no current literature relating the two issues, iron deficiency anaemia is associated with decreased appetite and several studies have implemented various iron supplementation strategies and by measuring red blood cell indices and/or iron status have proven to correct iron deficiency and associated anaemia. A split method of iron supplementation where 150 mg Fe/kg BW was administered as an intramuscular injection at day 1 and 40 mg Fe/kg BW given at 21 days after birth rectified iron related anaemia by maintaining high plasma iron levels through to weaning (Starzynski et al. 2013).

## 4. Research Methodology

Twenty-one mixed parity sows were randomly selected upon entry to the farrowing house and had a blood sample taken via ear-vein prick with the sample analysed for haemoglobin (Hb) utilising a HemoCue® Hb 201+ (HemoCue AB, Ängelholm, Sweden) point-of-care Hb meter. Eleven of these sows farrowed on the same day, and were continued in the study – the pre-farrowing Hb measure occurred 4 days prior to farrowing, with blood samples measured for Hb as per Table 1. Three piglets were randomly selected from each of these 11 sows, were ear-tagged to allow for individual identification and also had blood collected via ear-vein prick starting from day 1 (within 24 hours of farrowing) with blood samples measured for Hb as per Table 1. Five sows were weaned at day 22 of lactation, and the remaining 6 were weaned at day 25 of lactation, post-weaning measures were taken on piglets relative to their day of weaning. Piglets were also weighed at weaning, whilst parity and total born of sows was also recorded.

On day 12 of lactation blood samples were also collected via jugular venepuncture and were laboratory analysed on the same day as collection for Hb and free iron (Veterinary Diagnostic Lab, The University of Adelaide, Roseworthy SA), to allow for a standard curve to be created for the HemoCue reading.

Descriptive statistics were analysed at each collection point on all collected measures. To allow for correlations to be determined the three piglet measures for each sow were averaged and this data was then assessed via Pearson correlation (GenStat 21st Edition, VSN International Ltd, Hemel Hempstead HP2 4TP, UK).

***Table 1.*** *Schedule of haemoglobin (Hb) samples taken for 11 sows and 3 of each of their piglets.*

| Day | | Sow | Piglet |
|---|---|---|---|
| -4 | Pre-farrow | X | |
| 1 | Lactation | X | X |
| 4 | | | X |
| 8 | | X | X |
| 12 | | | X |
| 16 | | | X |
| 20 | | X | X |
| 22 | | | X |
| Wean | | X | X |
| +3 | Post-weaning | | X |
| +7 | | | X |
| +14 | | | X |
| +35 | | | X |

## 5. Results

There was a very strong significant relationship between Hb levels measured via the point-of-care HemoCue meter and laboratory determined levels of Hb ($r = 0.97$, $P < 0.001$, Table 2, Figure 1) from piglet blood samples taken at day 12 of lactation. Free iron levels within the blood samples had a poor relationship with Hb ($r = -0.38$, $P = 0.46$).

***Table 2.*** *Piglet blood haemoglobin (Hb) levels as measured by HemoCue point-of-care meter and Laboratory analysis and Laboratory Iron of sample piglets at day 12 of lactation.*

| **Sample** | **HemoCue Hb** (g/dL) | **Laboratory Hb** (g/dL) | **Laboratory Iron** (umol/L) |
|---|---|---|---|
| 1 | 9.2 | 10.0 | 57.0 |
| 2 | 12.1 | 13.1 | 28.0 |
| 3 | 10.8 | 11.1 | 38.0 |
| 4 | 8.9 | 9.9 | 38.1 |
| 5 | 11.0 | 11.6 | 32.4 |
| 6 | 7.6 | 9.1 | 29.8 |

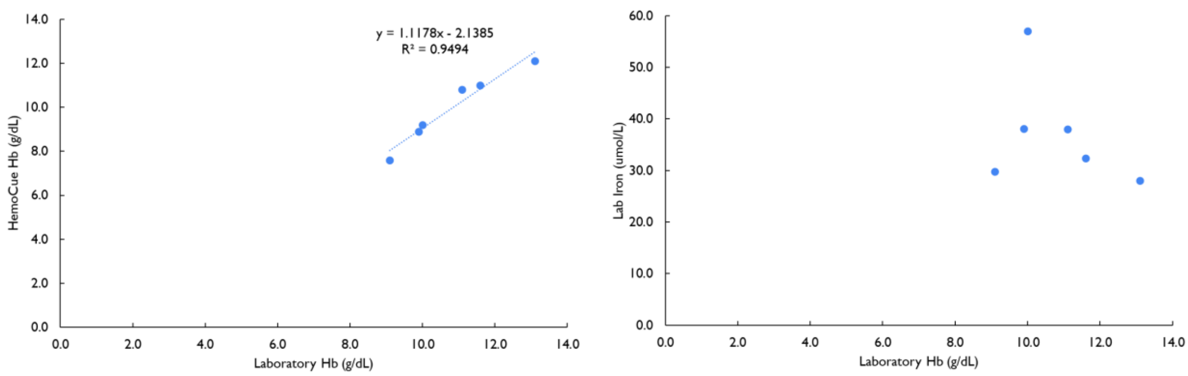


***Figure 1.*** *Regression curves of HemoCue Hb (left) and Laboratory Iron (right) compared with Laboratory Hb.*

Sow Hb levels were relatively consistent across the study period, with mean values ranging from 10.2 to 11.0 g/dL depending on the day of measurement, with no obvious pattern of movement across the lactation period (Table 3). These mean levels are suggestive of borderline iron deficiency, based on standard references of 11.0 g/dL indicating iron deficiency (Bhattarai and Nielsen, 2015; Nielsen et al., 2013). The lower levels of sow Hb would suggest a level of anaemia is present (<9.0 g/dL), with 3 of the 11 sows having Hb levels less than 9 g/dL at weaning.

Piglet Hb levels tended to be lower than those of the sow until midway through lactation (Table 3), with a greater range of Hb levels observed. Low piglet concentration of Hb are expected with piglets being born with limited iron reserves, an approximate total body store of approximately 50 mg, primarily in haemoglobin (Venn et al. 1947), which is depleted over time unless supplementary or dietary sources of iron are available, as observed by the lower level of Hb at day 4 of lactation. The intramuscular injection of 200 mg of iron dextran at day 3, saw mean levels recover to birth levels by day 8, with levels rising through to weaning. There was again a range of values measured that showed a proportion of pigs fell below both the iron deficient and anaemic reference levels.

*Table 3. Descriptive statistics of sow and piglet blood haemoglobin (Hb) levels. Sow parity and total born and piglet weight at weaning.*

| | | Sow | | | Piglet | | |
|---|---|---|---|---|---|---|---|
| **Day** | | **Mean** | **SE** | **Range** | **Mean** | **SE** | **Range** |
| | Parity | 2.6 | 0.38 | 1 – 5 | | | |
| | Total Born | 13.5 | 0.77 | 8 - 17 | | | |
| -4 | Pre-weaning | 10.8 | 0.29 | 8.9 – 12.1 | | | |
| 1 | Lactation | 10.2 | 0.35 | 8.8 – 12.2 | 9.1 | 0.29 | 5.2 – 12.5 |
| 4 | | | | | 7.8 | 0.17 | 6.1 – 9.5 |
| 8 | | 11.0 | 0.43 | 9.5 – 13.6 | 9.1 | 0.21 | 7.2 – 12.0 |
| 12 | | | | | 9.7 | 0.19 | 7.6 – 12.7 |
| 16 | | | | | 10.4 | 0.20 | 8.2 – 12.4 |
| 20 | | 10.4 | 0.35 | 8.9 – 12.2 | 10.8 | 0.23 | 8.5 – 12.8 |
| 22 | | | | | 10.8 | 0.24 | 8.2 – 13.7 |
| Wean | | 11.0 | 0.62 | 8.1 – 14.1 | 11.0 | 0.26 | 8.3 – 14.0 |
| +3 | Post-weaning | | | | 11.7 | 0.21 | 9.1 – 13.9 |
| +7 | | | | | 11.8 | 0.20 | 10.1 – 13.8 |
| +14 | | | | | 10.7 | 0.26 | 8.3 – 13.2 |
| +35 | | | | | 9.3 | 0.15 | 8.1 – 10.7 |
| | Wean weight (kg) | | | | 5.4 | 0.21 | 3.3 – 8.1 |

Post-weaning Hb levels declined after 7 days post-weaning and this continued through to the transition to the next phase of production at 35 days after weaning, despite the diet containing 70 mg/kg of iron from ferrous sulfate. A comparison with a recently completed study at the University of Kentucky (Chevalier et al., 2021) showed a roughly similar pattern of change, although post-weaned pigs improved their Hb levels as they aged – diet containing 100 mg/kg of iron from ferrous sulfate.

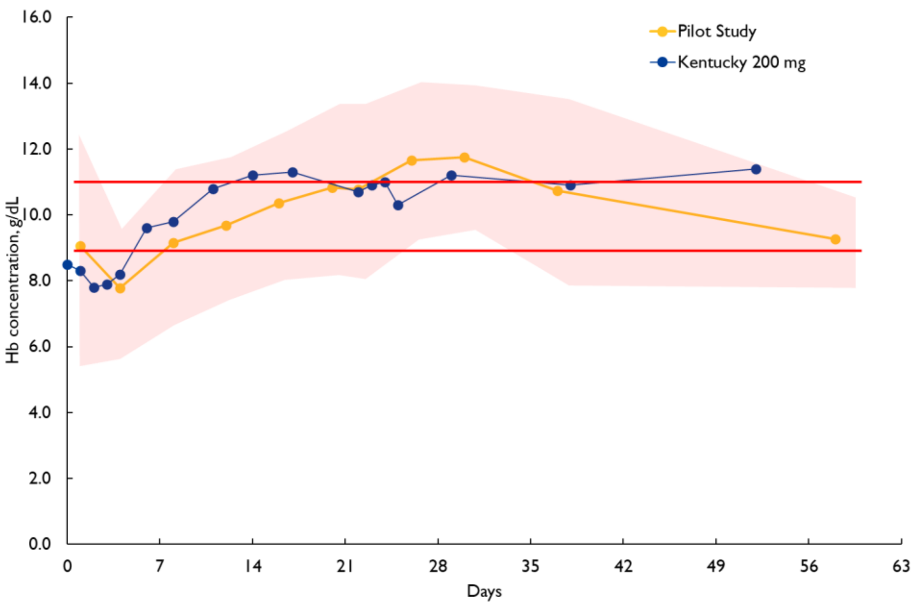


***Figure 2.*** *Mean haemoglobin (Hb) concentration (g/dL) of piglets in the pilot study (●) injected with 200 mg of iron dextran at day 3, compared to the same iron dose in the University of Kentucky study (● Chevalier et al. 2021). The red lines represent the indicative levels of iron deficiency (11 g/dL) and anaemia (9 g/dL, Perri et al. 2015). The red-shaded area shows the area within two standard deviations of the mean.*

Correlations between Hb levels taken at different stages of lactation were analysed for sows (Table 4), piglets (Table 5) and between sows and piglets (Table 6). The pre-farrowing level of Hb was negatively correlated with post-farrowing levels, but there was significant correlation between Hb levels measured during lactation.

***Table 4.*** *Pearson correlation of sow haemoglobin (Hb) levels at different stages of lactation (4 days pre-farrow (-4), day 1, 8 and 20 of lactation and at weaning (Wean)), correlation coefficient (r) below the diagonal with P value above the diagonal. Significant correlations highlighted in bold.*

| | -4 | 1 | 8 | 20 | Wean |
|---|---|---|---|---|---|
| -4 | | 0.36 | 0.06 | 0.21 | 0.32 |
| 1 | -0.33 | | 0.18 | **0.036** | 0.55 |
| 8 | -0.61 | 0.46 | | **0.006** | 0.58 |
| 20 | -0.44 | **0.66** | **0.79** | | 0.35 |
| Wean | 0.35 | 0.21 | -0.20 | 0.33 | |

Piglet Hb levels showed a generally high level of correlation between specific measures (Table 5). Haemoglobin levels at day 1 and 4 were strongly and significantly correlated (r = 0.87, P=0.001), whilst Hb levels from day 8 through to 7 days post-weaning were strongly and significantly correlated with each other. These groupings of correlation are clearly an impact of supplementation with iron dextran.

***Table 5.*** *Pearson correlation of piglet haemoglobin (Hb) levels at different stages of lactation (day 1, 4, 8, 12, 16, 20, 22 of lactation and at weaning (Wean)) and post-weaning (day +3, +7, +14 and +35 post weaning), correlation coefficient (r) below the diagonal with P value above the diagonal. Significant correlations highlighted in bold.*

| | 1 | 4 | 8 | 12 | 16 | 20 | 22 | Wean | +3 | +7 | +14 | +35 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | **0.001** | 0.20 | 0.36 | 0.13 | 0.97 | 0.36 | 0.58 | 0.84 | 0.92 | 0.09 | 0.59 |
| 4 | **0.87** | | 0.05 | 0.14 | **0.015** | 0.51 | 0.10 | 0.18 | 0.23 | 0.61 | 0.10 | 0.79 |
| 8 | 0.44 | 0.63 | | **0.015** | **<0.001** | **0.025** | **0.001** | **<0.001** | **0.046** | 0.14 | 0.16 | 0.44 |
| 12 | 0.32 | 0.50 | **0.74** | | **0.009** | **0.021** | **0.040** | **0.009** | **0.034** | **0.046** | 0.09 | 0.35 |
| 16 | 0.51 | **0.74** | **0.88** | **0.77** | | **0.020** | **<0.001** | **<0.001** | **0.025** | **0.028** | 0.10 | 0.34 |
| 20 | 0.01 | 0.24 | **0.70** | **0.71** | **0.72** | | **<0.001** | **0.002** | **<0.001** | **0.007** | 0.05 | 0.21 |
| 22 | 0.32 | 0.55 | **0.87** | **0.66** | **0.90** | **0.87** | | **<0.001** | **0.004** | **0.026** | **0.038** | 0.25 |
| Wean | 0.20 | 0.46 | **0.90** | **0.77** | **0.87** | **0.86** | **0.93** | | **0.006** | **0.06** | 0.10 | 0.39 |
| +3 | 0.07 | 0.42 | **0.64** | **0.67** | **0.70** | **0.90** | **0.82** | **0.79** | | 0.030 | 0.07 | 0.37 |
| +7 | -0.04 | 0.18 | 0.50 | **0.64** | **0.69** | **0.79** | **0.70** | **0.62** | 0.68 | | 0.27 | 0.007 |
| +14 | 0.57 | 0.55 | 0.48 | 0.57 | 0.55 | 0.63 | **0.66** | 0.54 | 0.60 | 0.38 | | 0.74 |
| +35 | 0.19 | 0.10 | -0.28 | -0.33 | -0.34 | -0.43 | -0.40 | -0.31 | -0.32 | -0.79 | -0.12 | |

There was a general lack of correlation between Hb levels of the sow and piglet (Table 6). The Hb level of sows prior to farrowing (-4) were negatively correlated with piglet Hb at the start of lactation, however, they were positively correlated with measures later in lactation (post-supplementation) with a significant moderately strong correlation with piglet Hb levels at weaning (r = 0.67, P = 0.034). Conversely, sow Hb levels at day 8 of lactation showed a significant moderately strong correlation with piglet Hb levels at day 1 (r = 0.64, P = 0.048), with poor correlation with later measures. Post-weaning levels of Hb were also poorly correlated with sow Hb levels, although day 20 sow Hb explained piglet Hb levels at day 35 well (r = 0.75, P = 0.013).

***Table 6.*** *Pearson correlation of sow haemoglobin (Hb) levels at different stages of lactation (4 days pre-farrow (-4), day 1, 8 and 20 of lactation and at weaning (Wean)) with piglet haemoglobin (Hb) levels at different stages of lactation (day 1, 4, 8, 12, 16, 20, 22 of lactation and at weaning (Wean)) and post-weaning (day +3, +7, +14 and +35 post weaning). Significant correlations highlighted in bold.*

| Sow… | -4 | | 1 | | 8 | | 20 | | Wean | |
|---|---|---|---|---|---|---|---|---|---|---|
| Piglet | r | *P* value | r | *P* value | r | *P* value | r | *P* value | r | *P* value |
| 1 | -0.39 | 0.27 | 0.24 | 0.50 | **0.64** | **0.048** | 0.30 | 0.40 | -0.52 | 0.12 |
| 4 | -0.17 | 0.64 | 0.38 | 0.28 | 0.60 | 0.06 | 0.34 | 0.33 | -0.46 | 0.18 |
| 8 | 0.41 | 0.24 | 0.00 | 1.00 | 0.15 | 0.68 | -0.21 | 0.57 | -0.45 | 0.19 |
| 12 | 0.41 | 0.24 | 0.01 | 0.98 | 0.12 | 0.75 | 0.01 | 0.98 | -0.09 | 0.81 |
| 16 | 0.43 | 0.22 | 0.19 | 0.59 | 0.12 | 0.74 | -0.08 | 0.83 | -0.23 | 0.52 |
| 20 | 0.54 | 0.10 | 0.26 | 0.47 | -0.24 | 0.50 | -0.26 | 0.47 | 0.03 | 0.93 |
| 22 | 0.48 | 0.16 | 0.23 | 0.52 | -0.12 | 0.75 | -0.29 | 0.41 | -0.29 | 0.41 |
| Wean | **0.67** | **0.034** | 0.08 | 0.83 | -0.14 | 0.69 | -0.25 | 0.48 | -0.17 | 0.63 |
| +3 | 0.41 | 0.24 | 0.40 | 0.25 | -0.09 | 0.80 | -0.07 | 0.84 | -0.01 | 0.97 |
| +7 | 0.44 | 0.21 | 0.09 | 0.80 | -0.31 | 0.39 | -0.35 | 0.32 | 0.06 | 0.88 |
| +14 | -0.06 | 0.87 | 0.42 | 0.22 | 0.09 | 0.80 | 0.02 | 0.96 | -0.32 | 0.36 |
| +35 | -0.30 | 0.40 | 0.40 | | 0.56 | 0.09 | **0.75** | **0.013** | 0.24 | 0.50 |

## 6. Discussion

Previous study results (APL 2018-0026), where piglet haemoglobin (Hb) levels were measured as a part of a project investigating alternative delivery methods for early piglet treatments, gave an indication that piglet Hb levels were lower than standard thresholds associated with anaemia (<9.0 g/dL) and iron deficiency (<11.0 g/dL, Bhattarai et al. 2015) despite no clinical signs (pallor, weakness, lethargy, etc…) of anaemia being observed. This led to questions around whether these results were accurate or whether the point-of-care meters were suitable for determining piglet Hb levels. This study was able to show a significant and strong correlation between the point-of-care meter used (HemoCue® Hb 201+) and laboratory determined Hb levels, with a similar correlation coefficient r=0.97 to that of Karlsen et al. 2014. We are therefore confident that the levels being observed are an accurate and true reflection of what is being observed in piglets in Australia.

The mean Hb levels of sows and piglets measured during lactation in this study consistently showed levels that would be considered on the border of being iron deficient, which is consistent with previous large Australian studies that measured mean levels of 10.66 g/dL at 5 weeks of age and 10.56 g/dL at 21 weeks of age (Hermesch and Jones, 2012) and 10.66 g/dL, with a range of 6.0 to 14.5 g/dL, at 5 weeks of age (Jones and Hermesch, 2010). It is generally considered that an optimal Hb status of >11 g/dL at weaning will lead to improved growth performance in the subsequent period (Fredericks et al. 2018; Chevalier, 2019), therefore these results raise concern about the haemoglobin/iron status of our piglets.
Post-weaning Hb status of pigs showed a different pattern compared to the recent University of Kentucky study (Chevalier et al. 2021) when the same dose of exogenous iron (200 mg iron dextran) was considered. Whilst both studies showed the initial dip in Hb levels after birth and the recovery in levels of Hb after the administration of exogenous iron, post-weaning levels of Hb fell in this study, whilst levels stabilised in the University of Kentucky study. There were differences in the level of supplemental iron included in the post-weaning diets, 70 mg/kg in this study compared with 100 mg/kg. There is clear evidence of an intervention required to maintain Hb levels in post-weaning pigs.

Correlations between Hb levels across lactation yielded some interesting outcomes. Within sows, there was an inverse correlation between Hb levels prior to farrowing with those measured during lactation, whilst a general agreement between values was observed for those measures taken at different stages of lactation – suggesting that sows with high Hb pre-farrowing have low Hb during lactation. Kopperud et al. (2014) showed a similarly poor relationship between Hb levels taken in the sow 3 weeks prior to farrowing and at day 1 of lactation.

Piglet correlations in Hb levels during lactation heavily reflected the intervention of iron supplementation at day 3. Hb levels at day 1 and day 4 were significantly highly correlated, whilst piglet measures from day 8 to weaning were significantly highly correlated, however, there was very little relationship between these two groups. This strong correlation of measures after exogenous iron delivery continued through to the first 7 days post-weaning but fell away as the animal aged. At day 35 there was almost no relationship between Hb levels in lactation or the earlier post-weaning phase – given the substantial fall in Hb concentration in this later nursery stage, there is a clear need for additional intervention to maintain Hb status.

Correlations between sow measures of Hb and those in the piglet would appear to support an argument that there is a "potential" that exists in Hb level, with a strengthening relationship between sow Hb levels pre-farrowing and piglet measures after supplementation, although Hermesch and

Jones (2012) suggest that the heritability of Hb levels were low, ranging from 0.04 ± 0.20 to 0.18 ± 0.04. The poor relationship between day 1 piglet levels and sow levels pre-farrowing or at day 1 observed in this study supports that of Kopperud et al. (2014)

These results support that the suggestion that the Hb status of the modern pig is lower than classical literature would classify as being adequate and is below what is likely to be required for optimum post-weaning performance. The further fall in Hb status post-weaning is of significant concern and supports a need for an intervention to take place to maintain the level of Hb at weaning that results from the administration of iron dextran shortly after birth.

## 7. Implications & Recommendations

Piglets are born with finite stores of iron transferred during gestation, that is quickly depleted after farrowing. The use of exogenous iron in the days immediately after birth has been shown to return the haemoglobin (Hb) concentration in the piglet such that, generally, adequate levels of Hb are seen at weaning. However, this study has shown that maintenance of Hb levels post-weaning does not appear to be adequately maintained through iron fortification of the nursery diets.

The lack of relationship between Hb levels in the sow pre-farrowing and throughout most of lactation does not suggest that additional sow interventions would result in improvements in piglet Hb status and therefore direct interventions with the piglet are required to improve Hb status and thus performance. This pilot study supports the objectives of the larger project to intervene to improve Hb status with the aim of reducing the number of piglets that fail to thrive after weaning.

## 8. Intellectual Property

There has been no protectable intellectual property developed or discovered as part of this current pilot study.

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## 10. Publications Arising

There are currently no publications arising from this pilot study.