Gross Morphology of Jejunal Peyer's Patches and the Relationship Between Increasing Numbers and Diarrhoea in Hand-reared Calves

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Gut-associated lymphoid tissue (GALT) is the primary lymphoid organ located in the small intestine. Peyer's patches (PPs); the major immune centres of GALT, are important in young ruminants in innate defence as well as primary production of B-cells in the gut (Yasuda *et al* 2006). Young calves are particularly susceptible to infection via the small intestine; resulting in significant episodes of diarrhoea and death. Thus, the development, involution and function of discrete PPs in the jejunum (JPPs) are likely to influence the incidence of diarrhoea and mortality rates. Nucleotides have been shown to be effective in altering the histology of PPs and increasing immune response in babies and young animals (Carver 1999). A field study to investigate this effect in calves did not show any significant changes in the number, or gross morphology of JPPs between treatment groups (Kentler *et al* unpublished data). However, a significant ($p < 0.01$) negative correlation (coefficient = -0.481) existed between the total number of JPPs and the percentage of days calves presented with diarrhoea. Therefore, the current analysis aimed to investigate this relationship by examining any differences in gross morphology, length and the percentage of PP tissue in calves considered to have high (H) or low (L) numbers of JPPs.

Forty AI-bred Friesian bull calves were obtained at 2-4 days of age from the Dept of Primary Industry (Vic) and hand-reared to 3 weeks of age. At 20-22 days of age, calves were euthanized with an overdose of barbiturate. Intestines were stored whole at -20°C or 4°C for later examination of PPs. Small intestines were cut along the mesenteric border from approximately the duodeno-jejunal junction to the ileocaecal junction and washed in running water before being soaked for 24-72 hours in 10-40% acetic acid solution. Intestines were then laid flat without stretching and total intestinal length, total jejunal length and lengths of all visible JPPs (rounded to the nearest 0.5cm) were recorded. This data also included a total of JPPs less than 0.5cm in length. For statistical analyses, calves with a total number of JPPs above the median 46, were considered H calves.

Thirteen calves in the H group ($n = 20$) presented with diarrhoea on 16.6 ± 3.3% of treatment days, whilst 17 L calves ($n = 18$) presented with diarrhoea on 31.5 ± 5.0% of treatment days; (expressed as means ± standard error). The mean number (23) of JPPs below 0.5cm in length in H calves was significantly greater ($p < 0.01$) than the mean number (1) in L calves. Similarly, numbers of JPPs between 0.5 and 6cm in length were greater ($p < 0.01$) in H calves (mean = 36) than L calves (mean = 18). There was no difference between H and L calves in the numbers of JPPs between 6.5 and 9cm (mean = 9.5) or greater than 12.5cm (mean = 1), however, H calves had significantly smaller numbers (mean = 2) of JPPs between 9.5 and 12cm compared to L calves (mean = 4) ($p < 0.01$). When intestinal length was expressed as a percentage of liveweight (LW), H calves had shorter intestines (mean = 4.5% of LW) than L calves (mean = 5.1% of LW) ($p < 0.01$). Consequently, H calves also had shorter jejunums (mean = 1990.2cm) in comparison to L calves (mean = 2376.8cm) ($p < 0.01$). Calves in the H group also had a greater percentage of JPP tissue (mean = 10.4% compared to 8.5%) ($p < 0.01$), despite there being no difference in JPP total length between H and L groups ($p > 0.05$) (mean = 203.5cm).

The data show that a large number of JPPs resulted in a more effective response to infection and a reduction in diarrhoea. However, it cannot be determined whether the total number, or length of JPPs is influenced by the persistence of diarrhoea, or if the opposite occurs. Persistent diarrhoea in calves can retard growth and development. Therefore, further investigation into this relationship could potentially affect the economics of calf rearing in terms of improving calf health, subsequent growth rates and heifer development. In addition, further examination of the mechanism and environmental influence of JPP growth and involution in young calves is vital to enable production of feed supplements, or improved management techniques, to promote the development and function of JPPs as part of an effective immune system.

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Carver J.D. (1999). *Acta Paediatr. Suppl.* **88**, 83.
Yasuda M., Jenne C.N., Kennedy L.J. and Reynolds J.D. (2006). *Vet. Res.* **37**, 401.

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