# THE RESPONSE OF VILLOUS HEIGHT AND CRYPT DEPTH TO NUTRITION IN THE WEANED PIG

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The small intestine of the weaned pig undergoes marked changes in villous height and crypt depth that have generally been associated with a reduction in the digestive and absorptive 'capacity' of the gut. These changes are concomitant with low food intake and poor growth, and the pig often fails to eat enough food to meet its daily maintenance requirement. Villous atrophy occurs in the weaned pig but this is generally accompanied by an increase in crypt depth (Hampson 1986). The likely contribution of food intake per se, or luminal nutrition, as a mediator of changes in gut architecture has often been ignored. In this study we overcame the confounding influence that temporary starvation may have on the gut by coaxing pigs to drink cow's milk. Our hypothesis was that villous height and crypt depth in the gut of weaned pigs depend on the amount of food eaten.

Forty-two piglets weaned at 29±0.2 days and weighing 9.1±0.29 kg were allocated to one of five treatments: (i) unweaned controls killed at weaning (UW); (ii) starter diet (15 MJ DE/kg, 21% CP, 1.4% total lysine) fed ad libitum (Starter); (iii) cows' liquid milk fed at maintenance (M); (iv) cows' liquid milk fed at 2.5 M (2.5 M); and (v) cow's liquid milk fed ad libitum (AL). Piglets were offered fresh milk every two hours. On the fifth day all pigs were killed and samples were taken at 25, 50 and 75 % along the small intestine. Samples were fixed in 10% phosphate-buffered formalin, and 5 µm sections were cut and stained with haematoxylin and eosin. Measurements of villous height and crypt depth were made on 10 well-oriented villi.

| | % of intestine | Treatment | | | | | SED | P |
|---|---|---|---|---|---|---|---|---|
| | | UW | Starter | M | 2.5M | AL | | |
| Villous height (µm) | 25 | 569a | 413b | 379b | 458bc | 508ac | 47.7 | P<0.001 |
| | 50 | 445ab | 384a | 363a | 494bc | 547c | 50.6 | P<0.01 |
| | 75 | 333a | 300ab | 249b | 342a | 442c | 37.9 | P<0.001 |
| Mean± | | 449a | 366b | 330b | 432a | 499c | 27.0 | P<0.001 |
| Crypt depth (µm) | 25 | 122a | 161b | 122a | 151b | 148b | 13.5 | P<0.01 |
| | 50 | 116a | 169b | 128ac | 144bc | 157b | 14.4 | P<0.01 |
| | 75 | 102a | 141b | 107a | 126ab | 148b | 16.4 | P<0.05 |
| Mean± | | 114a | 157c | 119a | 141b | 151bc | 8.7 | P<0.01 |

± Mean of all three sites.

a,b,c Within rows, means not followed by a common superscript differ.

Villous height and crypt depth increased with increasing intake of cow's fresh milk. Feeding pigs at M reduced villous height and crypt depth in comparison to pigs fed milk at 2.5 M and AL. Mean villous height in pigs fed the starter diet was equivalent to that of pigs fed milk at M but lower than that of pigs fed milk at 2.5 M and ad libitum. Despite consuming an equivalent amount of energy to pigs fed cows milk at 2.5 M, pigs eating the solid diet had shorter villi and deeper crypts. These data suggest that although gut structure responds linearly to the quantity of milk received after weaning, the type of diet fed to pigs also influences villous height and crypt depth independently of energy intake.

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