

Concurrent Session 7: Comparative Nutrition – Production animals relevant to human nutrition

Endocrine control of feeding behaviour in the pig: how does it differ from the human?

PC Wynn, M Gresham, K Scrimgeour and RE Newman

Faculty of Veterinary Science, University of Sydney, Camden, NSW 2570

Background – The major advances in our understanding of the central and peripheral regulators of energy homeostasis has provided new pathways for exploitation for controlling weight gain and obesity in humans and boosting feed intake and productivity in the pig industry. These factors are directed by both chronic and acute mechanisms designed to co-ordinate energy balance and the flow of substrate between tissues. The identification of a role for the endogenous ligand for the hypothalamic/pituitary GH secretagogue receptors, ghrelin, in the regulation of feeding provides an important functional link between the actions of a key anabolic hormone and the flow of energy substrate required to meet biosynthetic demands. Thus as a regulator of feeding, ghrelin was targeted for pharmacological intervention to control obesity irrespective of species.

Review – Numerous studies (1) have shown distinct diurnal rhythms in ghrelin characterized by a pre-prandial rise and a post-prandial fall in circulating ghrelin consistent with the hormone contributing to the pre-prandial orexigenic drive in humans. In many of these studies ghrelin status is positively associated with the adipocyte hormone leptin and negatively associated with insulin status as energy substrate is partitioned according to need and then assimilated to support tissue metabolism. In contrast feeding animals for production purposes is associated with maximizing feed intake and its efficiency of conversion into liveweight. Our recent studies have shown that feeding high protein/energy diets to pigs *ad libitum* results in dissociation of ghrelin status and feeding behaviour irrespective of the number of meals the feed is offered over. In contrast insulin concentrations continued to track the glycaemic status of the animal in line with its obligatory glucoregulatory role. Similarly we have found that fasting of day-old piglets for 12 hours did not alter circulating ghrelin status suggesting that this hormone plays little role in the initial suckling response for colostrum intake. However circulating ghrelin status decreased significantly between days 1 and 4 *post-partum*, although levels of expression in both the gastric fundus and the pancreas remained at similar levels. In contrast, in the human ghrelin status increases from birth to day 4 of life, although as with the pig at this age ghrelin is not responsive to feeding (2). These differences may be related to differences in thermogenic mechanisms between species as infants rely on brown adipose tissue whereas this is absent in the newborn piglet. The strong relationship between circulating ghrelin status in humans and anthropometric and metabolic parameters through development (3) suggests that ghrelin plays a chronic role in maintaining energy balance and body composition. And yet circulating ghrelin status responds acutely to amino acid and glucose infusions more readily than to fat at least in rodents.

Conclusion – Hormones regulating feeding behaviour acutely also play a role in regulating energy balance over the life of the animal. It is important that species differences in these mechanisms are elucidated to see how the pig can be used for studying the orexigenic drive in humans.

References

- 1 Cummings DE, Purnell JQ, Frayo RS, Schmidova K, Wisse BE and Weigle DS(2001) Diabetes 50, 1714-1719.
- 2 Bellone S, Baldelli R, Radetti G, Rapa D, Vivenza D, Petri A, Savastio S, Zaffarano M, Broglio F, Ghigo E and Gona G(2006) J Clin Endocr Metab 91, 1929-1933.
- 3 Soriano-Guillen L, Barrios V, Chowen JA, Sanchez I, Vila S, Quero J, Argente J (2004) J Pediatr 144, 30-35