Using umami peptides in creep/weaning piglet diets

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At weaning, piglets exhibit a marked reduction in feed intake that can last from 12-48 hours. Coupled with the stress of dietary changes, environment changes and pathogen loads, piglet performance and survivability can be significantly impaired.

This reduction in feed intake can reduce potential gain by 2.26kg or one week to market.

The selection of ingredients for first stage piglet feeds can be key to reducing the time to get piglets onto new diets. Sweeteners used in first stage feeds may range from simple carbohydrates to saccharin. However, research has shown that piglets are more sensitive and prefer the umami (pleasant savoury taste) flavour coming from specific amino acids. This same research noted that humans and piglets consider the same amino acids differently. For instance, humans may taste the amino acid Alanine as sweet, while pigs taste it as umami.

Table 1 summarises the taste response in humans and piglets. Table 2 summarises the basic taste categories.

Ingredients demonstrating umami flavour include fish meal as well as plasma proteins.

Both have been traditionally used in piglet feed formulations, in part due to a positive feed intake by the piglet.

Recent advances in membrane extraction technologies applied to marine-sourced hydrolysates now provide the means to economically isolate low molecular weight peptides with an amino acid profile that has a high content of umami flavour.

In addition to the taste preference, amino acids in the form of peptides are rapidly absorbed from the gut. Low molecular weight peptides that have combinations of two or more amino acids known as di-peptides, tri-peptides or poly-peptides are efficiently absorbed by the gut aided by the pepT1 transporter molecule.

The mechanism of the absorption by the gut mucosal cell is noted in Fig. 1.

One particular marine sourced peptide, (PerfectDigest FPI, Bluewave Marine Ingredients, Lima, Peru) has been analysed to contain over 20% of the product to have a molecular size below 500 daltons therefore a large percentage of di and tripeptide molecules (Fig. 2). In addition, the amino acid profile of the FPI as compared to an average of fish meals (Table 3) has significantly higher levels of amino acids that are classified as umami.

As such, using peptides with a high level of umami amino acids in piglet feeds should provide for a highly palatable feed and an efficient and

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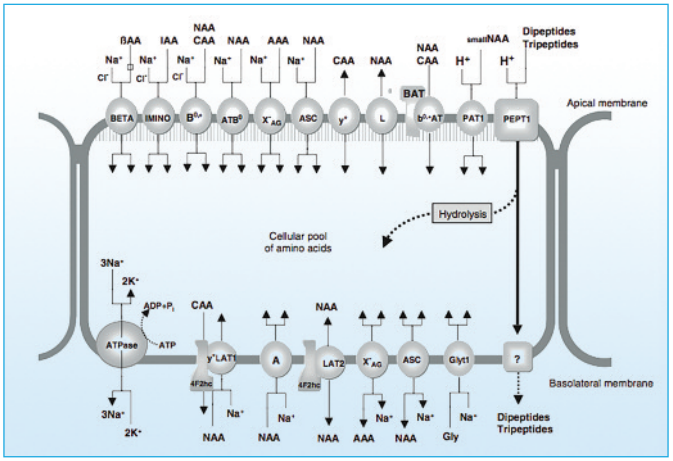

Fig. 1. Amino acid and peptide transporters in apical and basolateral membranes of intestinal epithelial cells responsible for transepithelial amino acid translocation. Dashed lines indicate the intracellular hydrolysis of di- and tripeptides by cytosolic peptidases. NAA, neutral amino acids; CAA, cationic amino acids; AAA, acidic amino acids; IAA, imino acids; βAA, β-amino acids; Gly, glycine (H. Daniel, 2004).

	Source of taste
Sweet	Carbohydrates and sugars
Umami	dietary protein, L-amino acids and peptides
Salty and sour	Sodium or acids
Bitter	anti-nutritional factors

Table 2. Taste categories.

Table 1. Taste response to specific amino acids in piglets and humans (adapted from Roura and Tedo, 2009).

L-Amino acid	Human response	Piglet response
Alanine	Sweet	Umami
Arginine	Bitter	Umami
Glutamic acid	Umami, salty	Umami
Glutamine	Sweet, umami	Umami
Threonine	Sweet	Umami
Proline	Sweet	Umami

Table 3. Protein source comparison (all data expressed as % of protein).

Amino acid - TAA analysis	Piglet response	Evonik fishmeal survey	FPI AA analysis (source: Evonik AminoLab)	FPI TAA vs fishmeal (%) (Degussa survey)
Lysine		6.86	8.21	120
Methionine		2.56	2.01	78
Cystine		0.865	0.74	86
Meth. + Cystine		3.43	2.75	80
Threonine	Umami	3.90	4.16	107
Tryptophan	Bitter	0.979	0.77	78
Isoleucine		3.85	4.42	115
Leucine		6.81	6.66	98
Valine		4.60	4.98	108
Histidine		2.46	4.36	177
Phenylalanine		3.79	2.95	78
Glycine		6.82	7.13	104
Serine		3.74	3.65	98
Proline	Umami	4.47	5.17	116
Alanine	Umami	6.11	5.95	97
Arginine	Umami	5.60	4.88	87
Aspartic acid	Umami	8.59	9.35	109
Glutamic acid	Umami	12.14	14.04	116

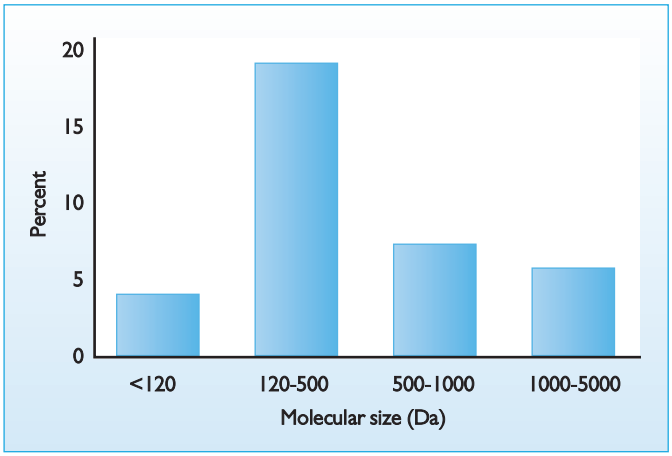

Fig. 2. Molecular size distribution in PerfectDigest FP1.

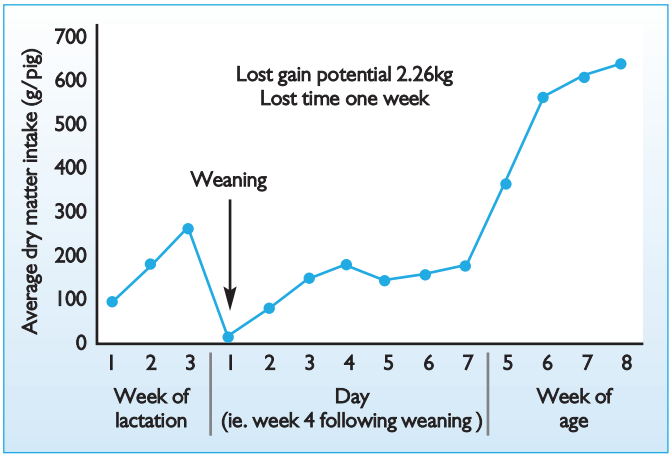

Fig. 3. Impact of weaning on feed intake (Brooks and Tsourgiannis, 2003).

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available source of amino acids for the young piglet.

A recent trial was conducted in Australia to evaluate feed intake responses in piglets comparing piglet feeds containing a source of fishmeal (3%), spray dried plasma protein (3%) to a membrane-purified spray dried fish protein isolate (FPI).

Diet specifications can be found in Table 4. The piglets on trial (weaning age 23 days) with an average weaning weight of 5.6kg were allocated to three treatments using a randomised block design.

All medication treatments were standardised across the groups.

Results from the trial (Table 5) showed a significant increase ($P<0.05$) in feed consumption of the FPI SD diet in the first week after weaning as compared to control. Average daily gain was also significantly improved for the FPI and SDPP diets over control.

Based on the results, there is a benefit for using the FPI as a functional ingredient in first stage diets to increase feed intake during the critical weaning period.

In conclusion, the results from the trial conducted and reported by Dr van Barneveld, were a significant increase in feed intake in the first week after weaning when the FPI was included in the diet, in line with previous research on the taste preferences of piglets. The higher feed intake supported higher average daily gain. As a result of the new commercial FPI peptides from the marine source, feed and swine producers now have a new solution to help address the critical period in the piglets' life. ■

References are available from the author on request

Table 4. Diet specifications for piglet feed trial (Dr van Barneveld, Australia 2013).

Raw material	Diet NC	Diet SDPP	Diet FPI SD
Protein (%)	23.3	23.25	23.39
Crude fibre (%)	2.34	2.28	2.17
DE pig (MJ DE/kg)	15.2	15.2	15.2
Lysine (%)	1.577	1.585	1.577
Fishmeal 60.0 (%)	3	0	0
SDPP (%)	0	3	0
FPI SD (%)	0	0	3

Table 5. Feeding trial results for piglet feed trial (Dr van Barneveld, Australia 2013).

Parameter	Control	FPI 3%	SDPP 3%	SED	P Value
Piglets	140	140	140		
Entry weight (kg)	5.7	5.7	5.5	0.25	0.658
Exit weight (kg)	14.1	14.3	14.4	0.53	0.969
ADG (kg/d)	0.3	0.309	0.32	0.014	0.61
ADFI (kg/d)	0.41	0.42	0.43	0.014	0.573
FCR (kg/kg)	1.37	1.37	1.34	0.042	0.71
ADG 0-7 days (kg/d)	0.135[a]	0.164[b]	0.171[b]	0.012	0.035
ADFI 0-7 days (kg/d)	0.15[a]	0.18[b]	0.16[ab]	0.01	0.005
FCR 0-7 days (kg/d)	1.11	1.12	0.95	0.076	0.168