Recent advances in energy evaluation in pigs

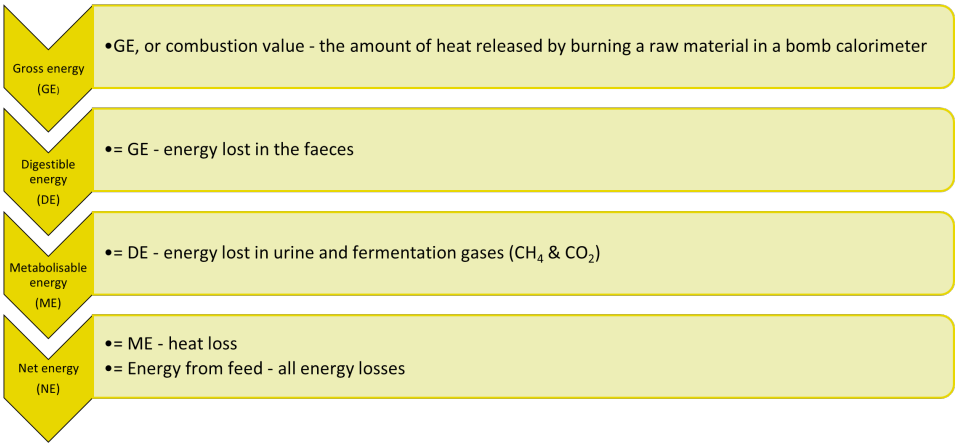
Conference Report

During the recent EW Nutrition Swine Academies in Ho Chi Minh City and Bangkok, Dr. Jan Fledderus, Product Manager and Consultant at Schothorst Feed Research, discussed that much money is involved in a correct energy evaluation system. “Net energy is 70% of feed costs, and feed is about 70% of total costs.” Therefore, an accurate energy evaluation system is important as it will give:

- Flexibility to use different raw materials
- Reduction of formulation costs
- Best prediction of pig performance
- Match the available dietary energy requirement of the feed to the pig’s requirement

Energy evaluation systems for pigs

The energy value of a raw material or complete feed can be expressed using different energy evaluation systems. Net energy (NE) in pigs refers to the amount of energy available for maintenance and production after accounting for energy losses during digestion, metabolism, and heat production. It is a crucial concept in swine nutrition as it provides a more accurate measure of the energy value of feed ingredients compared to other systems like digestible energy (DE) and metabolizable energy (ME). Diets formulated using NE are lower in crude protein than those using DE or ME because the heat lost during catabolism and excretion of excess nitrogen is considered in the NE system.



Effect of energy

Energy is derived from three nutrients: lipids (fats and oils), carbohydrates, and proteins. Using NE values instead of DE or ME values can lead to changes in ingredient ranking when formulating diets. For example:

- Ingredients high in fat or starch may be undervalued in DE systems but receive appropriate recognition in NE evaluations.
- Conversely, protein-rich or fibrous ingredients may be favored in DE systems.

Table 1: Energy values (kcal/kg) of nutrients

Nutrient	Energy	Starch	Protein	Fat
Gross energy	GE	4,486 (100)	5,489 (122)	9,283 (207)
Digestible energy	DE	4,176 (100)	4,916 (118)	8,424 (202)
Metabolizable energy	ME	4,176 (100)	4,295 (103)	8,424 (202)
Net energy	NE	3,436 (100)	2,434 (71)	7,517 (219)
Heat production (kcal/kg)		740	1,861	907
Heat production (% of NE)		22%	76%	12%

Calculation of net energy

Net energy (kcal/kg dry matter) is calculated as:
= 2,577 x digestible crude protein
+ 8,615 x digestible crude fat
+ 3,269 x ileal digestible starch
+ 2,959 x ileal digestible sugars
+ 2,291x fermentable carbohydrates

Factors affecting nutrient digestibility

This raises the obvious question, ‘What is the nutrient digestibility of your raw materials?’ Dr. Fledderus considered several factors that affect nutrient digestibility and, therefore, NE values, including

- **Age:** as pigs grow, their digestive systems mature, leading to improved nutrient digestibility. Younger pigs typically have lower digestibility rates due to an underdeveloped gastrointestinal tract. Older pigs typically exhibit higher digestibility, especially for fibrous diets, as their digestive systems become more efficient at breaking down complex nutrients.
- **Physiological stage:** the digestibility of diets can vary between pregnant and lactating sows. Digestibility is generally higher for gestating sows; lactating sows may have slightly lower digestibility due to higher feed intake. Also, lactating sows do not consume enough feed to meet their energy needs, leading to body tissue mobilization and weight loss.
- **Feed intake and number of meals per day:** Increased feed intake and more frequent meals can enhance nutrient digestibility. Regular feeding helps maintain gut motility and reduces the risk of digestive disturbances. Studies indicate that pigs fed multiple smaller meals exhibit better nutrient absorption than those fed larger meals less frequently.

- **Use of antibiotics and feed additives:** including exogenous enzymes and other additives can improve nutrient breakdown and overall digestibility of complex feed components, further influencing ingredient rankings within different energy evaluation systems. Antibiotics can lead to dysbiosis, negatively impacting overall gut health and digestion.
- **Feed processing:** gelatinized starch is more easily broken down by digestive enzymes, resulting in higher and faster digestibility compared to raw or unprocessed starch. This increased digestibility leads to a greater proportion of energy being absorbed in the small intestine, contributing positively to the NE value of the feed. As the particle size of feed ingredients decreases, the NE increases. While smaller particles generally improve digestibility, excessively fine grinding can lead to adverse effects such as increased risk of gastric ulcers in pigs.
- **Intestinal health:** a healthy gut is crucial for optimal nutrient absorption. Factors such as the presence of beneficial microbiota and the integrity of the intestinal barrier play significant roles in nutrient digestibility. Conditions like inflammation or dysbiosis can impair nutrient absorption and decrease overall performance.

NE system shows better the “true” energy of the diet

Dr. Fledderus concluded that the NE system offers a closer estimate of pigs’ “true” energy available for maintenance and production (growth, lactation, etc.). This leads to better ingredient rankings, reduced crude protein levels, which decreases nitrogen excretion, and enhanced nutrient utilization, contributing to more sustainable pig production practices. This aligns with increasing demands for environmentally responsible farming methods.

EW Nutrition’s Swine Academy took place in Ho Chi Minh City and Bangkok in October 2024. Dr. Jan Fledderus, Product Manager and Consultant at the S&C team at Schothorst Feed Research, one of the founders of the Advanced Feed Package and with a strong focus on continuously improving the price/quality ratio of the diets for a competitive pig sector, was a reputable guest speaker in these events.

Phytogenic additives: An ROI calculation

*By **Ruturaj Patil**, Global Product Manager – Phytogenics, EW Nutrition*

Global trade in agricultural products has a direct impact on the added value in regional broiler production. Due to fluctuating meat and feed prices, a tight profit margin can melt away quickly. Changes such as the use of cheaper raw materials, implemented to deal with reduced margins, may negatively affect flock health, creating a vicious cycle: If the flock also experiences increased disease pressure, the financially critical situation worsens.

What can the right phytogenic feed additive deliver for broiler producers?

It is essential to improve broiler gut health, as only healthy birds will perform and allow producers to be profitable. Producers can maintain flock performance through preventive management measures, a consistent hygiene concept, and the use of high-quality feed. For unproblematic flocks, the same measures also positively affect profit, generating a healthy return on investment (ROI).

What affects your return on investment?

In broiler production, the cost of feed is highest, with a share of 60 – 70 % of the total production costs. The proportion tends to be higher in markets that rely on importing feed raw materials (Tandoğan and Çiçek, 2016).

Let us take an example: With a compound feed price of 300 € / t as the basis, an increase of 10 € / t results in a profit reduction of 0.016 € / kg live weight. On the other hand, an improvement in feed conversion from 1.60 to 1.55 results in a financial advantage of 0.015 € / kg live weight. The best possible feed efficiency is always desirable to keep production costs low.

Another risk factor for high-yield broiler production lives in the poultry intestines: the most significant “invisible” losses result from subclinical necrotic enteritis (*Clostridium perfringens*). This disease worsens

the feed conversion on average by 11 % (Skinner et al., 2010). In the previous example, this would reduce feed efficiency from 1.60 to 1.78 points and reduce the contribution margin by 0.054 € / kg live weight. In addition, a live weight reduction of up to 12 % can be observed (Skinner et al., 2010). It is, therefore, critical to stabilizing gut health to reduce the risk of subclinical necrotic enteritis.

Practice prevention for a secure return on investment

The prophylactic use of antibiotics in compound feed was a well-known reality for decades. With the EU-wide ban on the use of antibiotic growth promoters, the occurrence of multi-resistant bacteria, and a globally increased demand for antibiotic-free chickens, producers now have had to cut down on antibiotic use.

For this reason, a lot of research has been conducted into alternative measures for maintaining good broiler health. Studies have confirmed that setting up a comprehensive hygiene concept to reduce the formation of biofilms on stable surfaces and reduce the recirculation of pathogens is a solid basis. At every production stage, irregularities can be detected through a meticulous control of performance parameters and illness symptom-centered health monitoring. Diseases can either be avoided or at least recognized earlier through targeted measures, and treatment can be carried out more efficiently.

A thorough hygiene concept and careful monitoring at every production stage are key to ensuring broiler performance.

Feed additives for intestinal stabilization

Hygienically impeccable compound feed is the wish of every animal producer to promote the development of a balanced intestinal flora. However, the quality of the available raw materials is subject to fluctuations and can therefore not be 100 % anticipated. Consequently, producers are now commonly balancing these uncertainties by using feed additives, which positively influence the intestinal flora. These products must prove their positive effects in scientific studies before they can be used in practice.

An effective solution: Encapsulated phytogenic feed additives

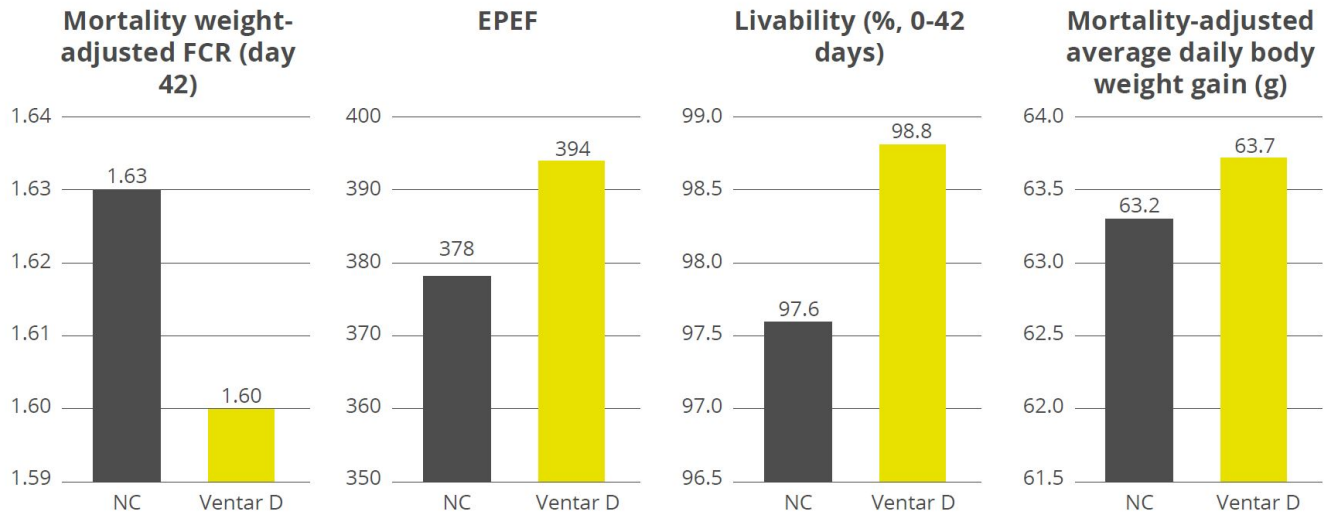
Studies have found that certain phytomolecules, which are secondary plant metabolites, can support broiler gut health. By stimulating digestive enzyme activities and stabilizing the gut microflora, feed utilization improves, and broilers are less prone to developing enteric disorders (Zhai et al., 2018).

The encapsulation of these naturally volatile substances in a high-performance delivery system is critical for the success of a phytogenic feed additive. This protective cover, which is often a simple coating, provides good storage stability in many cases. However, in addition to the high temperatures, mechanical forces also act on these coatings during pelleting. The combination of pressure and temperature can break the protective coating of the product and lead to the loss of active substances.

A complete solution: How Ventar D maximizes your ROI

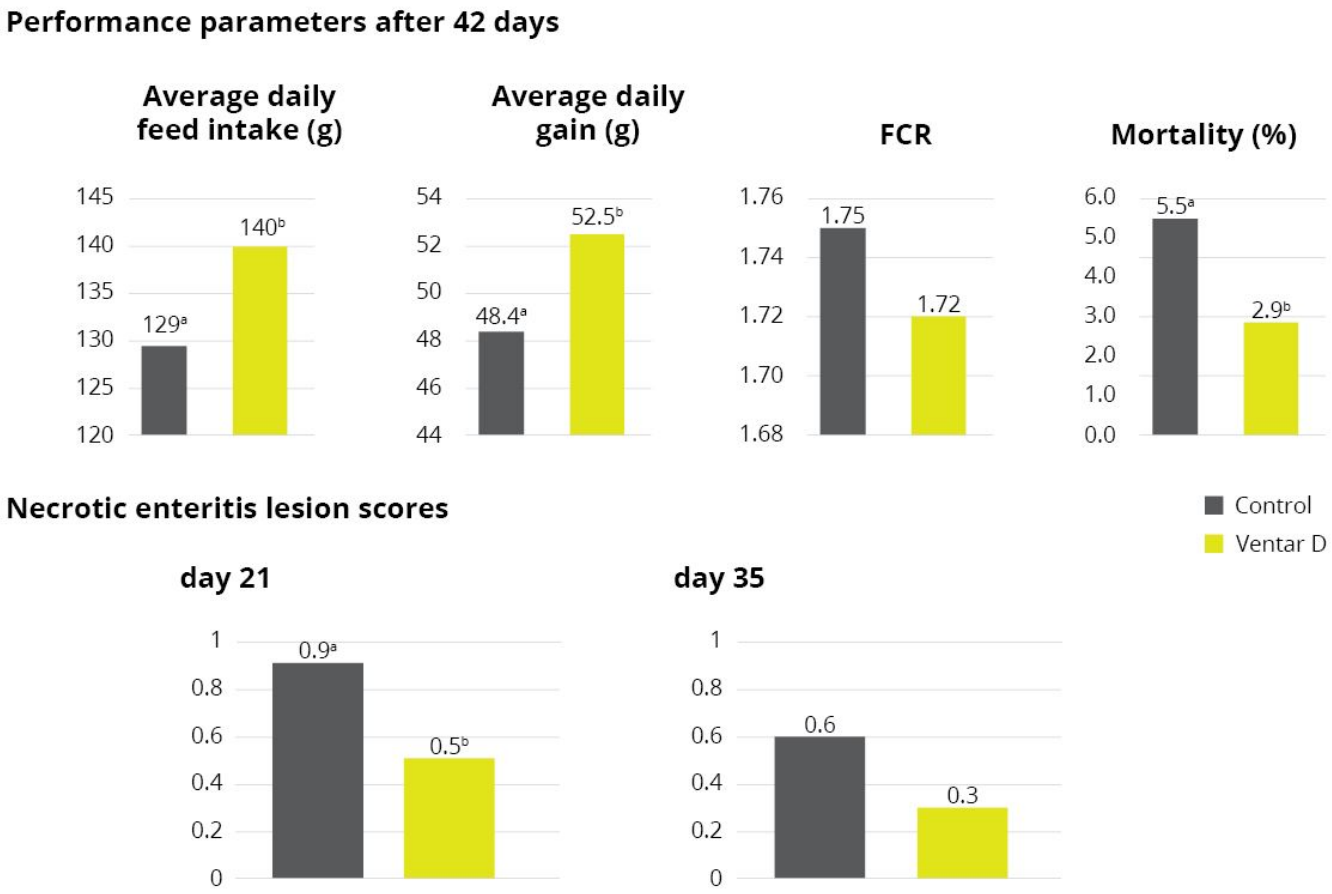
Because of the difficulties mentioned, the use of modern delivery system technologies is therefore necessary. EW Nutrition has many years of experience in the development of phytogenic products. Due to an original, innovative delivery system technology, Ventar D can offer high pelleting stability for optimal improvement of animal performance.

In particular, the positive influence of the phytogenic feed additive Ventar D on intestinal health under increased infection pressure was assessed in multiple studies. In two studies carried out in the United Kingdom, birds were challenged by being housed on used litter harvested from a previous trial. Moreover, increasing levels of rye were introduced into the diet, adding a nutritional challenge to provoke an increased risk of intestinal infections in the broilers. The use of 75 g of Ventar D per t compound feed increased the EPEF (European Production Efficiency Factor) by 4.1% and feed efficiency from 1.63 to 1.60.



With Ventar D use at 100 g / t compound feed under comparable conditions, EPEF increased by 8.9 %, and feed efficiency improved by 5 points (0.05), compared to a non-supplemented control group (NC).

Another study was carried out in the USA. In addition to performance parameters, data on intestinal health were also recorded. In the group fed with Ventar D (100 g / t compound feed), 50 % fewer necrotic enteritis-related lesions of the intestinal wall were found after 42 days. Compared to the group fed with Ventar D, the broilers of the control group showed a performance decrease of 11.8 % with an 8% lower final fattening weight and a 3 points poorer FCR.



Based on the results of the above studies, the ROI for Ventar D due to the improvement in feed efficiency by 3 and 5 points could be 1:3.5 and 1:6.5, respectively. Similarly, the net returns for using Ventar D could be 0.007 and 0.013 € / kg live weight, given the 3 and 5 points improvements in feed efficiency. The ROI for Ventar D use could be even higher thanks to additional benefits such as improvements in litter condition and foot pad lesions, reduced veterinary cost, etc., depending on the prevailing challenges.

The future of feeding is here

The first study results for Ventar D underscore that, if combined and delivered right, phytomolecules can transform broiler performance from inside the gut. Ventar D's stable delivery system ensures a constant amount of active molecules in targeted intestinal sites and, therefore, supports a favorable intestinal flora. With Ventar D supplementation, subclinical intestinal infections due to *C. perfringens* or other enteric bacteria can be very well kept in check, ensuring improved broiler productivity and production profitability.

References

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