Feedstuffs. Reprint

Fat digestibility differs between extracted oils, intact feedstuffs

IN most cases in the U.S., energy values for feedstuffs are assigned a static value in formulation systems. These "values" are, in general, taken from a reference such as the National Research Council (NRC) publication or some other comparable document.

NRC's 2012 swine nutrition recommendations, as an example, list metabolizable energy values for most commonly used raw materials; however, these energy estimates are provided as static empirical values without a mechanistic equation to alter the value as changes to energy-providing nutrients occur within the raw material.

While generally correct and valuable to the industry, this approach is markedly contrasted by the CVB (Dutch) method, whereby an equation-driven approach to energy is used to mechanistically update formulation values for raw materials.

As formulation procedures move more toward mechanistic systems that correct energy to account for the actual nutrient composition of each raw material, an understanding of nutrient digestibility becomes more important to the formulation system.

In a recent report by Li et al. (2017), the authors explored the digestibility of fat found in intact raw materials — dried distillers grains plus solubles (DDGS), full-fat soybeans or high-fat rice bran — compared to the corresponding extracted oils — corn oil, soybean oil or rice oil.

In this study, the authors formulated experimental diets containing fat derived from the six sources, and these diets were fed to animals housed in metabolic crates that allowed for capture and quantification of all excreta such that a chemical analysis could determine the extent of digestibility of fat from each treatment.

Considering the digestibility of fat biologically, it is reasonable to expect that pure oils should have improved digestibility compared to the intact counterpart fats that are not extracted from the plant matrix fully prior to consumption.

Fat digestion relies largely upon physical development of an emulsified mix of fats within the digestive tract, which are then absorbed by movement into the lymphatic system. This physical interaction to package oils into a format that can be transported into the lymph system is initiated in the upper portion of the small intestine, so any competing feed matrix components that reduce immediate oil interaction to initiate micelle formation will reduce digestibility.

Bottom Line

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Extracted oils, by definition, are not integrated into a fiber and feed matrix, as is found with intact oils; this makes the extracted oils available for that physical interaction to initiate fat absorption.

Compared to the digestibility of fat referenced by the CVB (2016), Li et al. showed similar digestibility of the pure oil treatments. It should be noted that rice oil digestibility is not referenced within the CVB tables, so that comparison is not possible.

The study is interesting, however, when looking at intact raw material fat digestibility. The current study shows a range of fat digestibilities in each intact raw material, depending on the usage level of the material in the diet. It is likely that some biological reality exists in the change in digestibility based on the level of raw material. This is due to a more efficient digestion process associated with the higher fat content of the diet.

In most formulation systems, it is difficult to accommodate a changing value that is dependent on usage level; however, it is likely that digestibility is affected by how much of the raw material is included in the mix.

When comparing the fat digestibility values of the intact raw materials to the CVB reference (Table), the apparent fat digestibilities of DDGS and high-fat rice bran in this study were markedly lower than the referenced levels from CVB. However, the full-fat soybean value noted in the study was markedly higher than the CVB levels.

It is unfortunate that better descriptions for the types of full-fat soybeans are not made in either of the publications. Since soybeans store fat within encapsulated parts of the seed, mechanical and or chemical processes can disrupt the vesicles containing oil and markedly affect the accessibility of the oil to the enzymatic and digestive processes.

As it stands, the two contrasting full-fat soy digestibility values serve only to illustrate that a marked difference can exist in whole-soybean fat digestibility.

The differences noted in this current study versus CVB for rice bran and DDGS fat digestibility are less easily explained. Moreover, it should be noted that the levels of both byproduct sources used in the diets were higher than levels that are practically fed (51% and 42% of the diet for the high-DDGS and rice bran diets, respectively).

The Bottom Line

Formulation systems in use today tend to often rely on static energy matrix values. As co-product processing changes the nutrient composition of raw materials in the marketplace or as efforts to improve precision to more accurately capture nutrient value develop, an increased reliance on accurate digestibility measures will become more important.

This study serves to illustrate that intact oil sources are lower in apparent digestibility compared to the corresponding pure oils, and the comparison versus the CVB reference illustrates that differences in valuation exist and must be managed to capture the value of accurately monitoring raw material nutrient shifts.

For corn DDGS, a practical fat digestibility value of approximately 66-70% would be appropriate for normal levels of DDGS used in finishing pig diets. For rice bran, a practical digestibility value of 48-50% would be appropriate for levels of rice bran that are typically used in

Apparent acid hydrolyzed ether extract digestibility of fat* in each treatment

	Corn oil	Soybean oil	Rice oil	Corn DDGS**	Full-fat soybeans**	High-fat rice bran**
CVB, 2016	95	95	NR	85	52	86
Li et al., 2017	96.8	97.7	87.0	66.4-76.3	68.6-75.3	47.7-52.5

*Adapted from referenced source.
**Fed at three differing amounts of the diet, leading to a range of digestibilities.
NR = not reported.

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finishing diets.

References

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