HIGH QUALITY FATS FOR HIGH QUALITY FEEDS

ANIMAL FATS

This leaflet is meant to review the nutritional benefits and update the knowledge on using animal fats for animal feeds. The changed legislation raised by the BSE problem around animal derived products also had its impact on the production and composition of animal fats: animal fats have become more and more 'single species' products, e.g. poultry fat, swine fat (lard), bone fat (pigs), tallow (bovine) but also blended products (like mixed animal fat), can still be found. Sonac produces a wide range of different animal fats differing in origin and application (food, pet food, feed, biofuels and oleo-chemistry).

Natural Ingredients. Smart Solutions.

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DARLING INGREDIENTS

ENERGY VALUES

As can be seen from the table on the next page. The calculated energy values differ depending on the energy system used (NE or ME) but also on how sophisticated the energy estimation has been made. Some of the following factors play a role:

ELUTION-% (OR SUM OF FATTY ACIDS)

This describes which part of the fat is made up by fatty acids. This determines the basic nutritional value. Water, impurities, polymers, waxes, sterols and oxidation products are not seen as nutritional. Note: also glycerol (natural part of triglycerides and makes up 4-5%) is not calculated into this fraction but of course adds energy to the fats. Elution-% in animal fats varies between 92-94%, in palm oil 94%, blends of fatty acids may vary from 75 to 95%.

US-RATIO

The digestibility of fats is greatly influenced by the US-ratio (the ratio of Unsaturated versus Saturated fatty acids). The digestibility of fat is lowest for young birds (1,5 wks old) but can be increased the most by improving the US-ratio. In fact, in a blend with a minimum level of unsaturated fatty acids a better digestibility of the saturated fats is observed than would be expected from the digestibility of the individual fats (see figure). A minimum US-ratio of 2.25 is required for layers and pigs. For broilers 2.75 is advised.

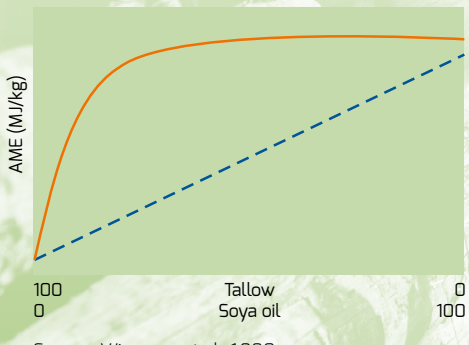
% FREE FATTY ACIDS (FFA) OR % TRIGLYCERIDES

During the fat digestion in the intestinal tract both outer fatty acids are split off by lipase from the triglyceride molecule leaving a monoglyceride. This monoglyceride is very important in the micel formation prior to absorption: it helps building micels. It is therefore beneficial in the fat digestion, especially when high levels of fat are offered in the feed, like in broiler diets. The graphs on the next page illustrate the influence of the FFA-content of dietary fats on the available energy content (= digestibility) of these fats.

THE ADVANTAGES OF ANIMAL FATS

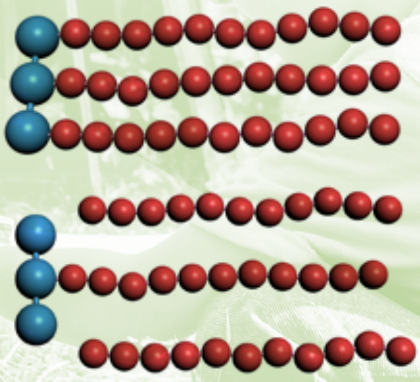
- species specific (one source) fats are possible
- stable products with low levels of undesired, non nutritional substances
- the fats are high digestible
- high net and metabolisable energy values
- wide range of fatty acid patterns
- products with different melting points and therefore application characteristics
- all animal fats contain a high level of healthy oleic acid (C-18:1)
- natural and sustainable products
- animal fats can be used in non-GMO feed

Synergism



Source: Wiseman et al, 1998

Triglycerides



Lipase induced hydrolysis of a triglyceride

EU LEGISLATION

Category 3 animal fats are allowed for all species. However in Germany animal fats are not allowed in ruminant feeds and this also includes calf milk replacers and feeds for veal calves.

NUTRITIONAL INFORMATION

Fatty acid		Poultry fat Burgum	Pork fat Lingen	Mixed fat Burgum	Porcine bone fat Vuren	Bovine tallow Eindhoven	Soybean Oil	Palm oil	Rapeseed Oil (low in Erucic acid)
C-12:0	Lauric	0,4	0,1	0,4	0,1	0,1	0	0,2	0,2
C-14:0	Myristic	1,2	1,6	2,2	1,2	3	0,2	1	0
C-16:0	Palmitic	19	20,9	23,5	22,2	25,7	10,5	43	4,5
C-16:1	Palmitoleic	5,1	2,1	3,3	2,5	3,1	0,2	0,2	0,5
C-18:0	Stearic	6,9	14,2	14,6	12	21,3	4	5	1,5
C-18:1	Oleic	33	33,8	39,2	39,4	33,2	22	38,5	58
C-18:2	Linoleic	22	8,2	11,1	10,7	2,4	54,5	11	20
C-18:3	Linolenic	1,9	0,6	1,1	0,9	0,5	7,5	0,2	9
> C-20		1,3	1,7	2,4	2,7	0,8	0	0	1
US-ratio		2,4	1,3	1,4	1,6	0,8	5,8	1,0	14,6
Slip melting point		29	39	37	38	43	-8	43	-10

ENERGY VALUES

Poultry	Source	Unit								
ME Poultry	CVB	MJ/kg	34,8	34,5	34,5	35,5	35,6	37,5	35,5	35,5

Pigs	Source	Unit								
NE pigs	CVB	MJ/kg	33,4	32,8	33,2	33,7	33,8	33,9	33,9	33,9
	☐									
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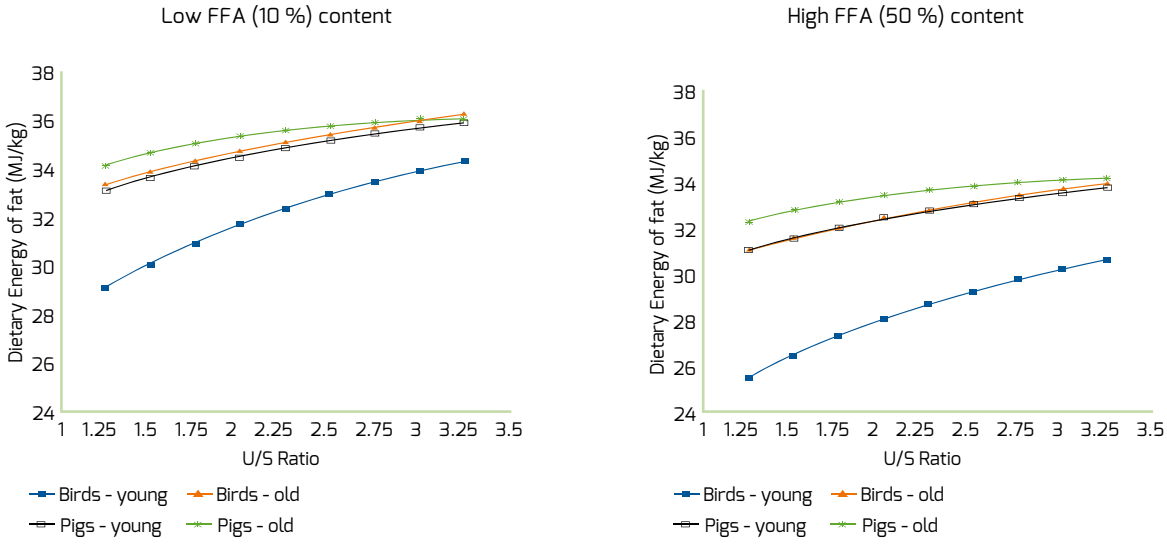
ME Schweine	DLG	MJ/kg	36,8	36,1	36,6	37,2	37,3	37,3	37,2	36,7
	☐									
	☐									

Once again the young broilers suffer the most from the high FFA-content of the fat: the ME-content of the fat dropped from 32 MJ/kg to 28 MJ/kg (-/- 12, 5%) by increasing the FFA content from 10 to 50%. For piglets the DE-level went from 34 to 32 MJ/kg (-/- 6%). All taken at a US-ratio of 2.25.

THE POSITION ON THE GLYCEROL MOLECULE

In pig fat (lard) palmitic acid is predominantly found at the SN2-position (middle) on the glycerol. During the digestive process the palmitic acid stays at this position and is absorbed as a monoglyceride. In sow milk the same principle can be found: most of the palmitic acid is in the SN2-position. Sow milk fat provides 70% of the energy to a newborn piglet. Nature shows that this is a very efficient way to nourish the piglet. Palm oil and palm oil fatty acids are also rich in palmitic acid, but here it can not be found in this beneficial middle position on the glycerol molecule. The Schothorst found following digestibilities in fattening pigs in diets fed at the same US-ratio (8% addition of the tested fat):



DIGESTIBILITY OF ANIMAL FATS VERSUS PALM OIL IN PIGS

Type of fat	Lard	Tallow	Palm oil	Lsd (P<0,05)
Fat digestion %	92.4	91.4	90.7	1.55

INFLUENCE ON CARCASS/MEAT QUALITY

SWINE

Pigs deposit a lot of fat when they are growing, especially in the fattening phase: About 80% of the resorbed fat from diets is deposited as body fat (of course this depends on age, sex, feeding level and feed composition). Research has shown that pigs can very rapidly adjust the fatty acid composition of their fat tissue.

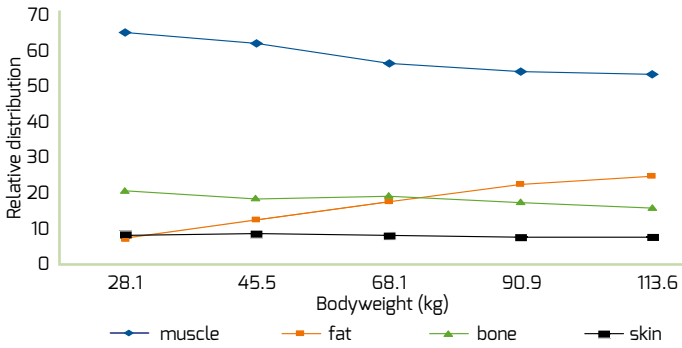


Fig. Changes in body composition of growing pigs.

The figure to the right shows the influence different dietary fats have on the saturated (and also unsaturated) fatty acid composition (reflected in softness) of subcutaneous fat of pigs. Ctrl group (corn-soybean meal), BT (5% Beef tallow), PF (5% poultry fat), SBO (5% soybean oil). The diets with added fat contained higher nutrient levels to maintain constant ME-to-nutrient profiles. The more unsaturated the added fats were the lower the level of saturated fatty acids in adipose tissue. And this is a fast mechanism: it took the pigs approximately 23 days to grow from 28.1 kg to 45 kg!

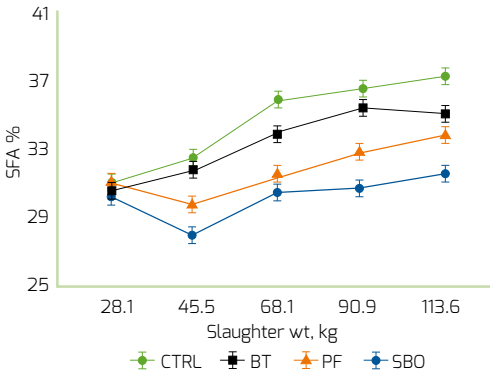


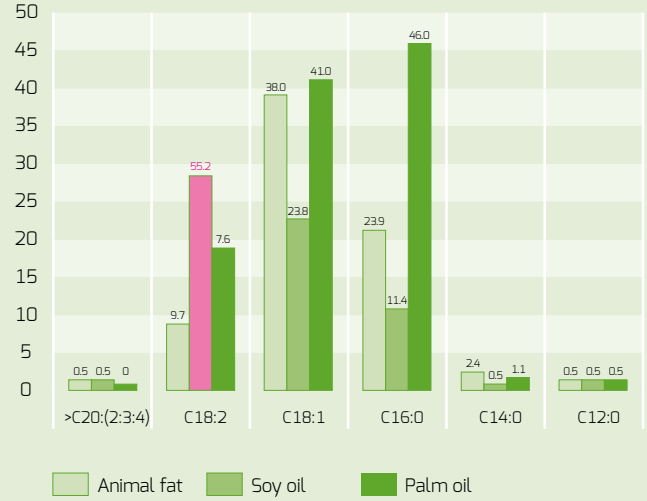
Fig. Saturated Fatty Acid content of subcutaneous fat of pigs fed Beef Tallow, Poultry Fat or Soybean Oil.

Wiseman and Agunbiade (1998) did an experiment with pigs where they changed from soybean oil (6%) to tallow (6,5%) in the diet at a live weight of 55 kg. They measured a drop in linoleic acid content of the inner backfat layer from 387 to 306 (g/kg fat) in only 15 days! At the end of the trial (92,5 kg slaughter weight) the linoleic acid content was lowered to 260 g/kg fat. This principle shows that the composition of the fat in the diet can influence the bacon quality to a great extent: too high unsaturated fatty acid levels will cause bacon to become too soft.

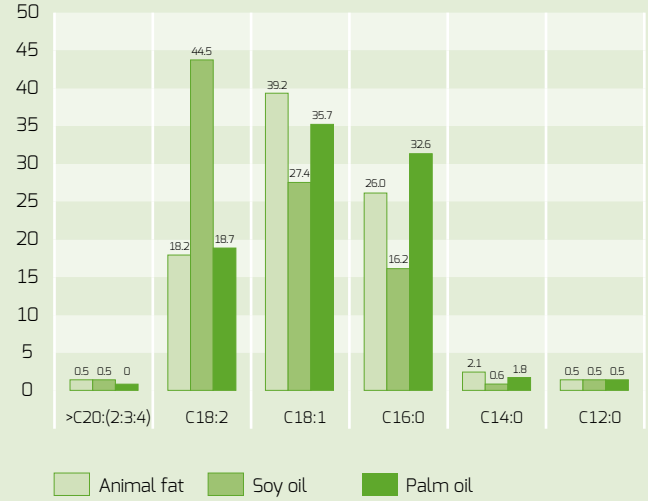
BROILERS

The fat content of edible parts of poultry varies considerably. White meat (breast) contains 0,9% fat, dark meat 2,2% whereas it may be above 30% in/under the skin. The influence of dietary fat is therefore largest on these adipose tissues in and around the skin.
This is shown in next graphs taken from a research done at De Schothorst. Dietary fat was added at 6%, other feed stuffs contributed 3% (corn, soybean meal) in added fat level.

Fatty acid composition in fat source



Fatty acid composition of adipose tissue



As can be seen linoleic acid is 'accumulated' in the adipose tissue of the birds. Of course this influences the behavior of carcasses during processing after slaughtering (oily bird problem) and it affects the taste of the meat (and fat): fishy smell and higher change of rancidity. Tenderness and juiciness of thigh meat however increases with higher amounts of linoleic acid.

Sonac is a leading manufacturer of reliable ingredients of animal origin. With an active R&D program, reliable processes and sustainable end products Sonac continuously adjusts to market needs. A good geographical spread of locations and a broad portfolio of fats, proteins, minerals and specialties make Sonac a trusted partner for many international producers in food, pet food, feed and fertilizers, worldwide. Sonac is part of Darling Ingredients.

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