

*Director's
Digest*

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EMULSIFIED FATS ARE HIGHLY DIGESTIBLE

Both animal and vegetable fats are highly digestible in the presence of an emulsifying agent according to a dissertation entitled "Chemical, Nutritional and Physiological Aspects of Animal and Vegetable Fats in Milk Replacers for Veal Calves"^{1,2} by a Dutch scientist. Dr. W. A. G. Veen of the C. L. O. - Instituut voor de Veevoeding "de Schothorst" of Hoogland, Netherlands formulated calf milk replacers containing beef tallow, lard, palm kernel oil, partially hydrogenated fish oil and their mixtures with soy lecithin as an emulsifier. Apparent digestibility of all fats tested was greater than 94% and there were no significant differences in the digestibility of animal and vegetable fats.

As fat is the most important source of energy for veal calves, numerous investigators have sought more economical and higher energy replacements for whole milk. Beef tallow and lard as sources of fat in milk replacers gave good weight gains but vegetable fats with a high content of polyunsaturated fats only became useful after partial hydrogenation. An important factor in the utilization of dietary fat is its physical form where a high degree of dispersion of the fat into small globules facilitates the hydrolytic action of digestive fat-splitting enzymes, the lipases, and consequently improves digestion and absorption of the fat. Raven and Hamilton³ delineate the digestion of fat in the young calf into four separate steps: 1) transport of the nutrients in the digestive tract, 2) hydrolysis of fat to diglycerides, monoglycerides and free fatty acids, 3) emulsification and solubilization in bile salt micelles and finally, 4) the absorption of lipids from the micellar solution. It is evident that the more finely that the emulsifier can disperse the fat component, the more accessible it becomes to enzymatic hydrolysis. The young calf still functions as a monogastric animal and it is not unreasonable to extrapolate the conclusions of Veen to the feeding of milk replacers to baby pigs and other young animals.

Table I summarizes the average apparent digestibility coefficients of spray-dried milk replacer formulations containing 20% and, in one instance, 10% total fat.

TABLE I
Average Apparent Digestibility Coefficient of Total Fat
(Unless otherwise stated the dry milk replacer contained 20% fat, of which 1.25% was soy lecithin)

<u>Composition</u>	<u>Apparent Digestibility Coefficient</u>
Palm kernel oil	96.6%
Lard	97.7
Beef tallow	96.8
Beef tallow, lard-1:1	96.1
Palm kernel oil, beef tallow, lard-2:1:1 or 1:1:1	97.2
Palm kernel, beef tallow, lard-2:1:1 (10% fat)	95.7
Partially hydrogenated fish oil (18%), soy lecithin (2%)	94.7

Table II compares the effect of soy lecithin and linoleic acid content on the digestibility of beef tallow and of palmitic and stearic acids in a dry milk replacer.

TABLE II

Digestibility of beef tallow and of free palmitic and stearic acids

<u>Fat in milk replacer</u>			<u>Nominal linoleic acid content (%)</u>	<u>Digestibility (%)</u>		
<u>Beef tallow</u>	<u>soy lecithin</u>	<u>lard</u>		<u>fat</u>	<u>palmitic acid</u>	<u>stearic acid</u>
23	0.7		0.9	87 ⁷		
20			0.4	87 ⁸		
20			0.4	88 ⁹		
20			0.4	90 ¹⁰	86	81
19	1.25		1.2	96 ^{2a}		
9.5	1.25	9.5	1.1	94 ^{2b}	87-89	78-97

In general, these results agree with the conclusions of Raven and Robinson³, Amich-Gali, et al.,⁴⁻⁶ and others⁷⁻¹⁰ who demonstrated improved utilization of dietary fat in the presence of lecithin, sugar fatty acid esters, Tween-Span combinations and other emulsifying agents.

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