

THE ESSENTIAL FATTY ACIDS How Are the Essential Fatty Acids Stored in Bovine Tissues?

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THE ESSENTIAL FATTY ACIDS Storage of Essential Fatty Acids in Animal Tissues

Triglycerides (triacylglycerol)Phospholipids



THE ESSENTIAL FATTY ACIDS Essential Fatty Acids Stored as Triglycerides

Triglycerides are composed of — One glycerol backbone — Three long-chain fatty acids linked to glycerol by ester bonds H,C — 0 Triglycerides are the main storage form for fatty acids нс in adipose, muscle, liver, milk, etc. H.C -

Triglyceride Molecule

Right Top: Palmitic Acid

Left Part: Glycerol

Right Middle: Oleic Acid

Right Bottom: Alpha-Linolenic Acid



THE ESSENTIAL FATTY ACIDS Essential Fatty Acids Are Stored as Phospholipids

Phospholipids are composed of —One glycerol backbone
—Two long-chain fatty acids linked to glycerol by ester bonds
—An organic compound such as choline linked by a phosphate "bridge"



THE ESSENTIAL FATTY ACIDS Phospholipids in Animal Cell Membranes





THE ESSENTIAL FATTY ACIDS Fatty Acids are Stored as Triglycerides and as Phospholipids



Ponnampalam et al. 2001, J. Anim. Sci. 79:698-706



THE ESSENTIAL FATTY ACIDS Profile of Phospholipids in Tissue Membranes and Milk

Phospholipid	Liver, Bovine¹	Heart, Unweaned Calf²	Uterine Endometrium, Pregnant Ewes ³ — % of total phosp	Intestinal Brush Border Membrane, Rat ⁴ holipids ————————————————————————————————————	Milk, Bovine ⁵
Phosphatidyl- choline	52.5	45.5	36.8	32	19.1
Phosphatidyl- ethanolamine	30.5	29.4	34.4	32	42.0
Phosphatidyl- serine	7.0	N.G.	20.5	15	6.7
Phosphatidyl- inositol	Not Given	6.4	6.8	7.5	4.8
Sphingomyelin	8.2	6.9	N.G.	8	17.9

¹Ono et al. 1988. Japanese J. Vet. Sci. 50(4):900-907. ² Jenkins and Kramer. 1990. J. Dairy Sci. 73:2940-2951. ³ Zhang et al. 1995. Prostaglandins Leukotrienes & Essential Fatty Acids. 53:201-209. ⁴ Christon et al. 1991. Reprod. Nutr. Dev. 31:691-701. ⁵ Rombaut et al. 2005. J. Dairy Sci. 88:482-488.



THE ESSENTIAL FATTY ACIDS Profile of Fatty Acids in Phospholipids of Uterine Endometrium Tissue of Ewes





THE ESSENTIAL FATTY ACIDS Phospholipids Form a Bilayer in Outer Membrane of Animal Cells







THE ESSENTIAL FATTY ACIDS Essential Fatty Acids in Animal Cell Membranes Increase The Cell's Fluidity



Individual phospholipids can rotate and move laterally.



THE ESSENTIAL FATTY ACIDS Phospholipids (PL) in Animal Cell Membranes Aid Cell Function

- Certain protein bodies in the cell membrane only function in the presence of certain PL
- Migration of phosphatidyl-serine

from inner to outer part of bilayer of a cell helps identify that cell as dead. This signals macrophages to engulf and digest the dead cell.





THE ESSENTIAL FATTY ACIDS Storage of Essential Fatty Acids - Summary

Essential fatty acids are common components of all cell membranes in the form of phospholipids

- Tissues contain all or most of the many Phospholipids but in different proportions with different fatty acids
- The Phospholipids containing essential fatty acids
 - improve fluidity of cell membranes
 - influence functioning of cell-surface proteins
 - influence the ability of cells to "speak" with one another