

**ANSC (NUTR) 618
LIPIDS & LIPID METABOLISM**

Fatty Acid Peroxidation

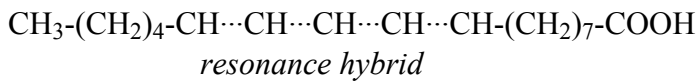
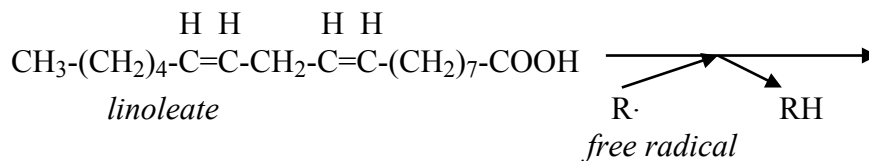
I. Nonenzymatic peroxidation of fatty acids

A. General

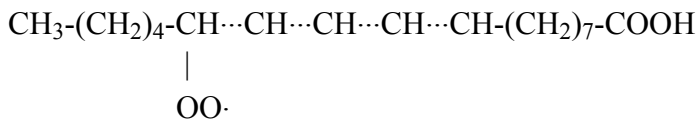
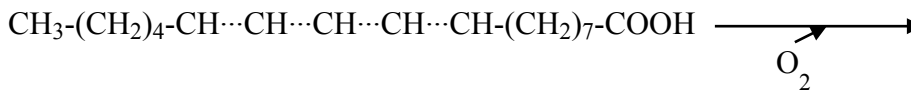
1. Peroxidation = production of peroxides and their degradation products.
2. Polyenoic acids (PUFA) are susceptible to peroxidation.

B. Mechanism of peroxidation:

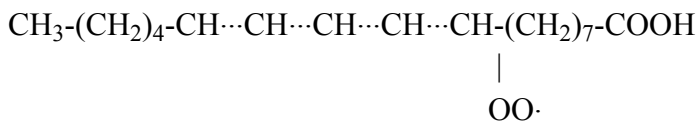
Initiation



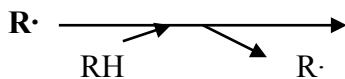
Propagation

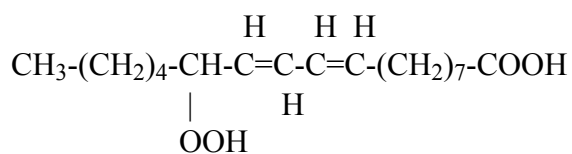


or



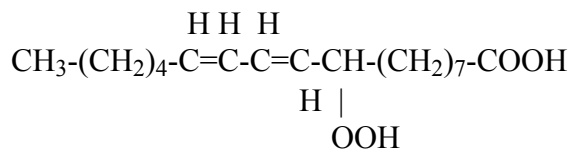
fatty acid free radicals (alkyl radicals; R·)





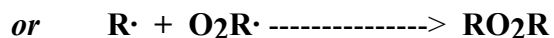
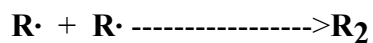
13-hydroperoxy-9-cis, 11-trans-octadecadienoic acid

or



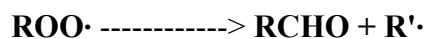
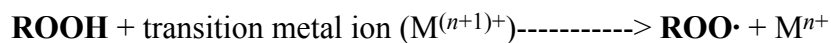
9-hydroperoxy-10-trans, 12-cis-octadecadienoic acid (hydroperoxides; ROOH)

Termination

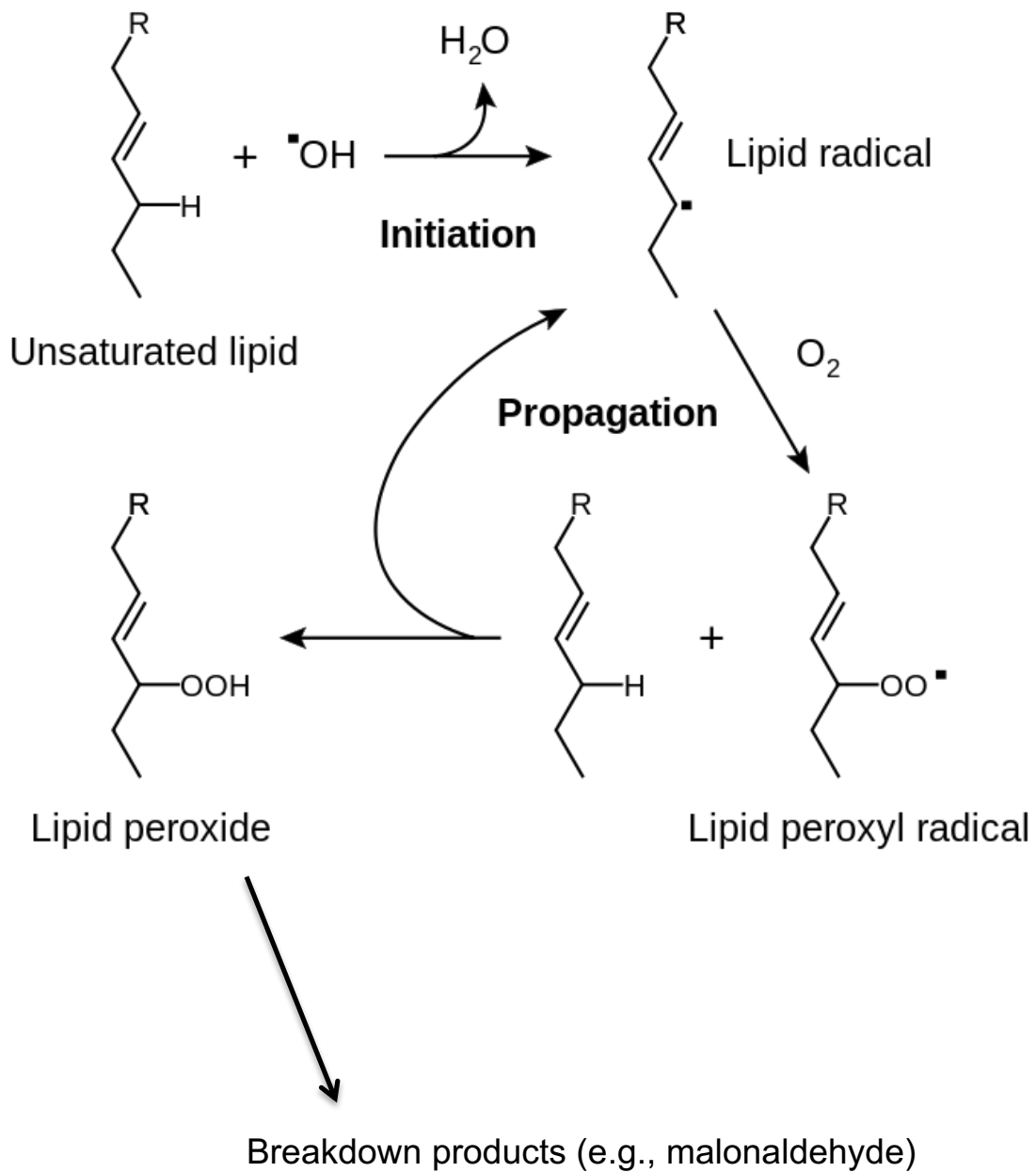


C. Decomposition of fatty acid peroxides

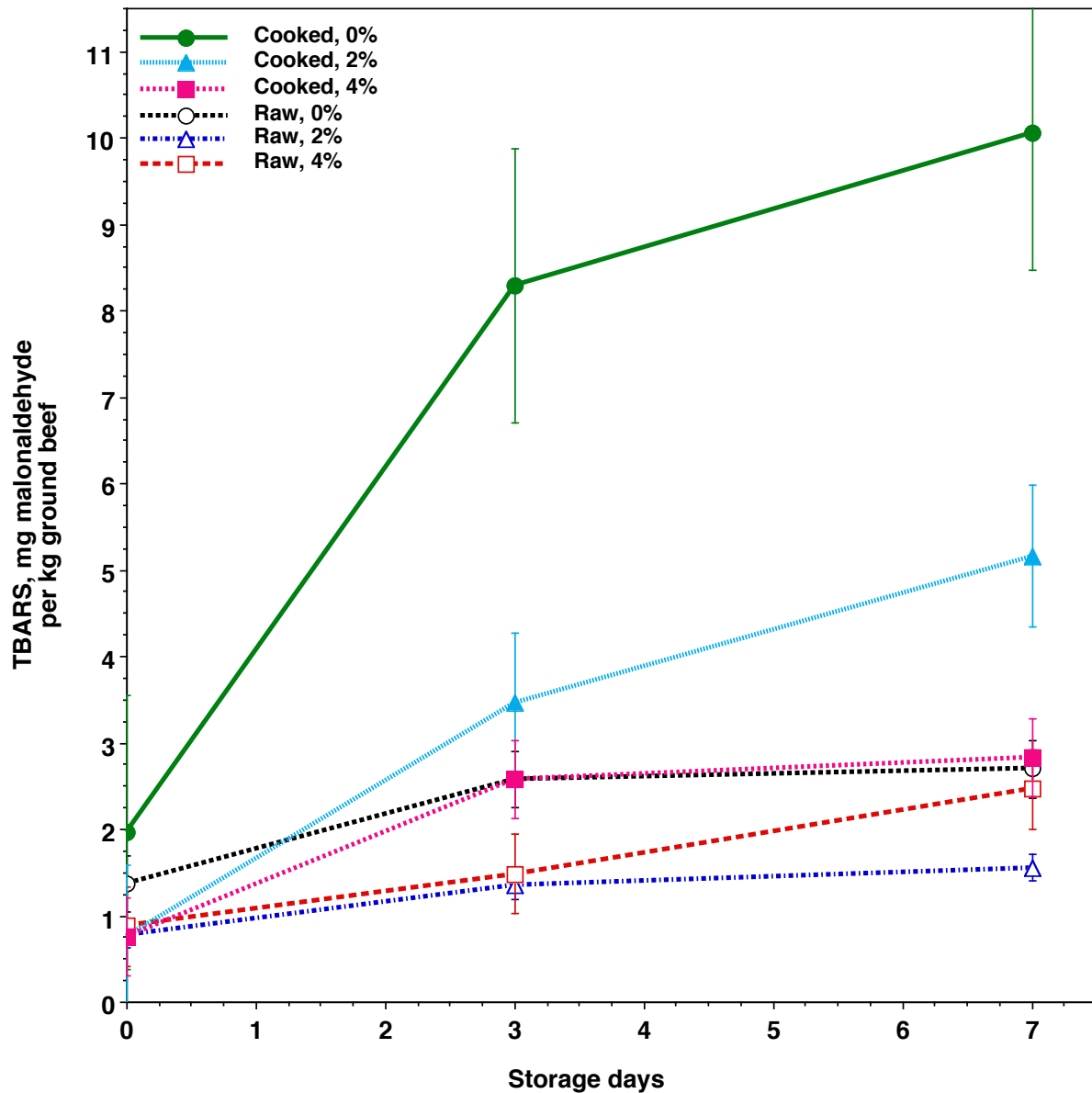
1. Cause of rancidity (warmed-over flavor)
2. Forms aldehydes (homolysis)



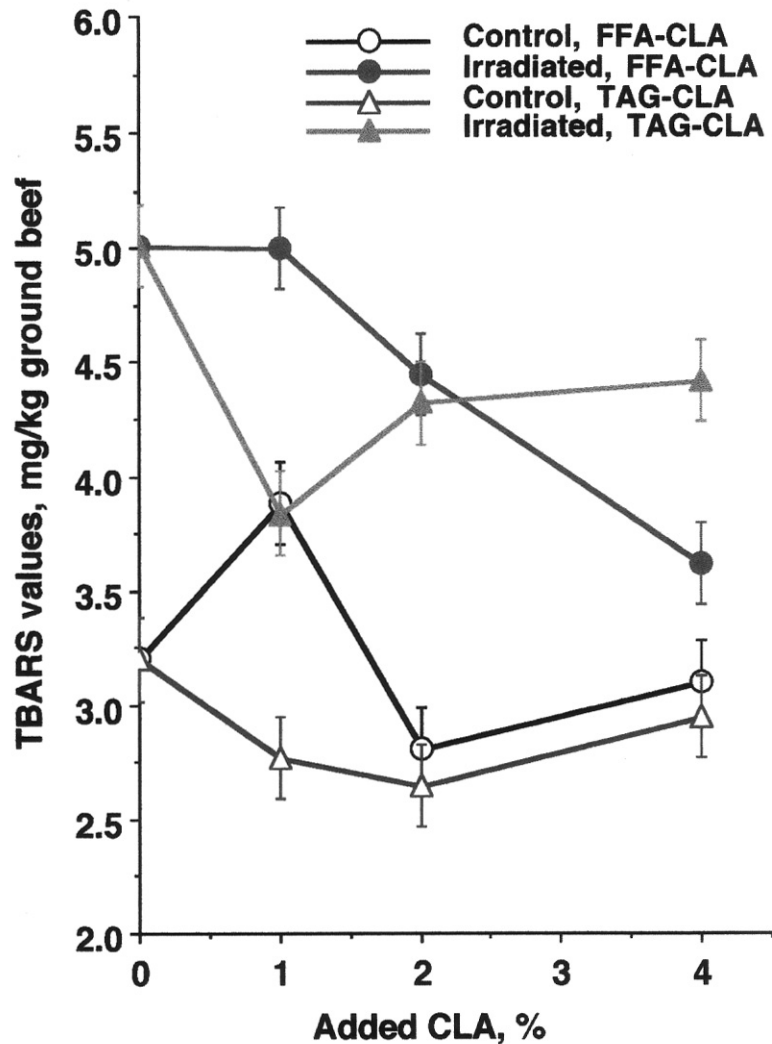
(e.g., malonaldehyde)



$\cdot\text{OH}$ is a Reactive Oxygen Species, byproducts of normal oxygen metabolism.



Addition of CLA (2 and 4% of total fatty acids) during the grinding process increased CLA isomers in both raw and cooked ground beef and decreased TBARS production ($p < 0.01$). CLA caused a greater reduction in TBARS over storage time in cooked patties than in raw patties ($p = 0.006$).



The free fatty acid (FFA-CLA) and triacylglycerol (TAG-CLA) preparations of CLA were added at 0, 1, 2, or 4% during the grinding process. Patties were irradiated at 1.5 – 2.0 kGy and frozen at -20°C . Subsequently, the patties were tempered to 4°C , cooked to 70°C and held at 4°C for 7 d. Enrichment of ground beef with CLA increased the *cis-9,trans-11* and CLA *trans-10,cis-12* CLA isomers in ground beef patties, even after cooking. Irradiation decreased the concentration of α -linolenic acid (18:3n-3) in the ground beef by over 60% ($P = 0.07$), whereas thiobarbituric acid reactive substances (TBARS) values were higher ($P = 0.004$) in irradiated beef patties than in control patties. The 1% concentration of added TAG-CLA reduced TBARS in irradiated ground beef patties, whereas 2 and 4% FFA-CLA depressed TBARS (CLA type x percent interaction $P = 0.04$).