



GRAPE ANTIOXIDANTS IN MEAT AND MEAT PRODUCTS

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Abstract

Lipid oxidation is one of the biggest important problems that reduce the shelf life of meat and meat products. Delaying the oxidation of lipids and development of unpleasant odors, as well as improving color stability is done with the help of antioxidants. Antioxidants are divided into two groups - natural and synthetic. Synthetic antioxidants intake leads to cancer and acute toxicity. Therefore, in recent years, the food industry prefers natural to synthetic antioxidants. This review presents current trends in the use of antioxidants from grape extracts to inhibit lipid oxidation of meat and meat products. The results show that grape seed contains effective antioxidants for use in meat and meat products and those natural antioxidants can completely replace synthetic ones.

Lipid Oxidation in Meat and Meat Products

Lipid oxidation can take place in 3 stages: before slaughter (live muscle), during slaughter (conversion of muscle into meat) and after slaughter (processing and storage), Table 1. In living animals, there are inherent factors that can control the oxidative reaction in muscle tissue, such as enzymes (superoxide dismutase, catalase, etc.) and certain proteins and their mechanisms (transport proteins) or antioxidants that disrupt the oxidative reaction (vitamin E and C), (Thurnham 1990). After slaughter, these factors lose their antioxidant potential due to various post-slaughter conditions, such as anaerobic environment, presence of pro-oxidants and lack of enzymatic antioxidant mechanisms (Carlsen et al. 2005). Hemoglobin and myoglobin, which are also considered pro-oxidants (Maqsood and Benjakul 2011b; Maqsood et al. 2012), together with other processing parameters, lead to lipid oxidation during processing and storage of meat and meat products. The complex process of lipid oxidation is influenced by many factors, such as the chemical structure of the meat, access of oxygen and light, storage temperature, and some technological procedures during processing

Table 1. Factors affecting the oxidative stability of meat at various stages

1. After slaughtering	2. During processing	3. During storage
Anaerobic condition	temperature	atmospheric conditions – vacuum, aerobic, MAP etc.
loss of intrinsic antioxidant mechanisms	pressure	packaging conditions antioxidant active etc.
loss of intrinsic antioxidant enzymes activity	presence of O ₂	temperature
presence of pro-oxidants	cutting/chopping (shear rate)	lighting conditions – fluorescent, UV, sunlight, dark etc.
composition of meat	ingredients (NaCl)	antioxidant treatment
degree of unsaturation	processing equipment	
myoglobin/hemoglobin content	antioxidant treatment	
vitamin E/C content etc.		

Table 2. Synthetic Antioxidants in meat and meat products

butylated hydroxyanisole (BHA)
butylated hydroxyl toluene (BHT)
propyl gallate (PG),
tert-butylhydroquinone (TBHQ)

Grape seeds and skins are by-products of wine production. In wineries, residues represent approximately 30% of the total volume of grapes and waste poses serious problems in their storage, processing and disposal in environmental and economical terms. The utilization of these waste products for inhibition of lipid oxidation of meat and meat products is a very significant advantage. Antioxidants from red grape seeds and skins are suitable for red meat, as their red color does not interfere with or impair the sensory characteristics of meat products. For this reason, they are important for preserving the organoleptic properties of raw-dried sausages for a longer period of time, and thus for extending their shelf life, as they have the ability to slow down the fat oxidation (rancidity) processes in meat. Grape seeds are preferred because they contain more phenolic compounds. They are extracted as a by-product of grape juice and wine production. They are ground, dried and an extract containing phenolic compounds is extracted from them. Clinical data show that the antioxidant potential of grape seeds is twenty-five times greater than that of vitamins E and C.

Table 3. Antioxidants from red grape seeds and skins

Grape seeds	Grape skins
dimers of proanthocyanidins B2, B3 oligomers of flavan-3-ol: (+) - catechin, (-) - epicatechin, epicatechin gallate	quercetin- 3-O-galactoside quercetin- 3-O-glucolyside quercetin-3-O-rhamnoside trans-resveratrol and e-viniferin

Table 4. Antioxidants from red grape seed with the potential applications in meat and meat products

Natural antioxidants from grape seed	Meat and meat products	References
red grape seeds and skins extract	boiled beef	Ahn et al., 2002
grape seed extract	systemic sausage	Kulkarni et al., 2011
red grape seeds	chicken dumplings	Brannan, et al., 2008
grape seed extract	sausages "chorizo"	Lorenzo et al. 2013
grape seed extract and chestnut	sausages	Mielnik et al. 2006
grape seed extract	raw and cooked beef dumplings	Colindres and Brewer, 2011
grape seed extract and rosmarine	turkey meat	Lau and King 200