THE BENEFITS AND GENETICS OF VITAMIN E IN MEAT.

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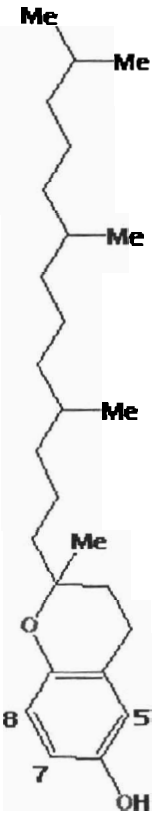
The benefits of adding vitamin E supplements to the finishing diets of meat animals have been well documented to improve meat quality, animal fertility and animals health[5]. Vitamin E is essential for providing antioxidant protection. Alpha-tocopherol, a lipid-soluble antioxidant found in cell membranes is the main bioactive form of vitamin E [12]. Vitamin E deficiency (AVED) reduces fertility and can lead to ataxic muscular dystrophy [9]. In contrast, excess vitamin E appears to pose no toxicity [7]. In the meat animal industry, feeding ~10-fold higher than maintenance doses of vitamin E has been shown to increase muscle concentrations >200%, improve oxidative stability, color, and improve overall meat quality from pigs [8], poultry [11], salmon [2] and cattle [1].

Feedlot cattle typically received between 0 to 150 IU of vitamin E/d. However, due to the recognized benefits of supranutritional doses of vitamin E, some food processing companies are offering a bonus for cattle finished on diets supplemented with 500 IU/d vitamin E for the last 100d. The general consensus amoung meat scientist is that a meat concentration of >3.0 ug (~0.002 IU) of α-tocopherol per gm of muscle is required to get the maximum color and flavour enhancements[1,10]. Unfortunately, due to a high variance in absorption rates, producers would need to supplement vitamin E at >1800 IU/d for at least 50 days to ensure that an entire average mixed herd meets the meat concentration requirements[3]. Vitamin E is not considered toxic at these high dose rates and the average cost for a vitamin E supplement would be ~$10/head at the full dose of 1800 IU/d. However this dose could be reduced to ~$2/head by applying some genetic selection to the herds, so the cattle could achieve adequate meat vitamin E levels when supplemented at 500 IU/d.

In a recent research trial performed at the Lacombe Research Centre –AAFC, it was found that most feedlot cattle would not retain enough



vitamin E for meat quality when fed the standard vitamin E maintenance dose of 100 IU/d for 130d. In the trial, even some of the cattle supplemented with 1000 IU/d did not reach the desirable minimal limit of 3.0 ug/g. Only 25% of the cattle supplemented with 500 IU/d had sufficient muscle vitamin E concentrations. The poor absorption or retention of α-tocopherol in these cattle was believed to be partially related to genotype and limited segregation analysis indicated that the physiological level of vitamin E could be under the influence of just a few major genes. Hepatic gene expression was examined to search for genetic factors which might explain the differences in the physiological concentration of vitamin E among animals. Hepatic tocopherol associated protein (TAP) mRNA (GenBank accession # AF487977; Meadus et al. 2002) was significantly increased by the level of dietary vitamin E which suggested that the TAP gene has potential as a genetic marker to identify cattle which will retain superior levels of vitamin E in their muscle. The TAP protein is believed to also be a transcriptional factor[14]; therefore, our research also suggested that gene expression may be regulated by changing dietary vitamin E levels.

Enhancing meat products with vitamin E provides positive marketing and advertising claims for colour, shelf life, and nutritional benefits. Branded meat products with nutritional quality attributes will help improve the public perception of beef as a necessary food ingredient of a healthy life style. The benefits of increasing vitamin E in meat is even more pronounced in the emergent dominating markets of processed foods like hamburger and irradiated patties, where shelf life and appearance are easily doubled when the animals are given supranutritional 1000 IU/d

doses of vitamin E[4]. The improved flavour profiles in pasture fed animals are due in part to the much higher natural levels of vitamin E in fresh grasses[13]; through nutrition, selective breeding and genotyping, beef quality from feedlot cattle may be raised to the same standard.

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