Invited Speaker Plenary 1: Functional Foods

Enhancing health active compounds in milk through cow management

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Background - Milk and dairy products provide a range of essential nutrients and also contain health active compounds. The concentrations of some of these compounds in dairy products can be enhanced by fortification, through cow genetics or by nutritional management of the herd. Consumers in some markets prefer ‘natural’ as opposed to fortified products. Successful on-farm manipulation of the concentrations of physiologically functional compounds requires systems that produce consistent concentrations in milk. Opportunities to increase the concentrations of protein bound organic selenium (Se), calcium (Ca) and conjugated linoleic acids (CLA) through cow management are discussed.

Review - A growing body of evidence suggests that protein bound organic Se is protective against some cancers. For example, McIntosh et al. (2004) reported reductions in colonic tumour incidence and burden in rats consuming selenised casein (1 ppm) relative to control and equivalent Se yeast treatments. This has increased interest in delivering Se in organic forms in enriched dairy products, to provide base nutritional requirements in countries where Se intake is low, and to provide intakes above recommended daily intakes for health benefits to people at risk of colon or other cancers. For the later purpose, concentrations in food or supplements need to be consistent and specified to avoid toxicity. Feeding supplemental Se-yeast complexes can increase concentrations in milk from around 10 µg/kg to in excess of 100 µg/kg with peak concentrations occurring within 1 week of feeding the supplement (McIntosh and Royle 2002; Heard et al., 2004). More recently, Heard et al., (unpublished data) have defined the effects of Se concentration in grain supplements on responses in milk Se concentration to organic Se supplements, and it is possible to produce protein products with 2 to 6 ppm Se. Epidemiological studies have shown an association between both milk and Ca intake and a reduced risk for colon cancer. In rats, a high Ca WPC80 (diet Ca content 0.8%) was more efficacious in decreasing AOM induced tumours than a low Ca WPC80 (diet Ca content 0.2%) (McIntosh and Royle, unpublished). Also, Ca from dairy sources appears to be more efficacious than Ca from other sources. On-farms, Ca supplementation has greater effects on the Ca concentration in milk than stage of lactation at key times of the year (G Walker unpubl. data). The predominance of Holstein-Friesian genetics and associated declines in the Jersey and crossbred proportions in the Australian dairy herd may have contributed to a decline in Ca concentration in milk. Effective supplementation strategies may lead not only to higher Ca in milk and the potential for producing functional dairy proteins, but could have benefits for cow health and longevity. CLA and trans vaccenic acid (TVA) occur naturally in milk fats and have been found to be protective against cancers in animal and in vitro models, with some supporting epidemiological evidence in humans. CLA and TVA concentrations in milk fat are higher in cows consuming pasture and are affected by pasture and supplement intakes (Dunshea et al. 2005). Improvements in understanding of rumen and mammary metabolism mean that it is theoretically possible to supplement the unsaturated fats consumed in pasture with those from oil seeds and fish oil to produce milks with high CLA and TVA. These approaches may also be used to enhance omega 3 fatty acids in dairy products.

Conclusions - Strategies exist to enhance concentrations of physiologically functional compounds in milk through cow nutrition. They need to be tested under commercial conditions and are only likely to be implemented where payment systems reward farmers for the increased value of the raw material.

References