ARS Grape and Wine Industry Workshop
Health and Nutrition Presentation
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In order to discuss the issue of health and nutrition in relation to grape and grape products, it is important to have a working definition of what qualities are under consideration. To that end, it is proposed that this include components of grapes/wine that can enhance human health and provide for the nutritional needs of the American public. It may be necessary to deliver these health promoting compounds as a package to derive maximal benefit.

Health and nutrition concerns will be strong drivers for the market of both traditional and innovative grape products. The issue most familiar and influential in consumer food and health decisions now that is relevant to the grape/wine market is antioxidants. Although most consumers do not have a clear idea of what antioxidants are or how they help in the body, they are currently being used to position numerous products including tea, chocolate, and berries. Red wine and grape juice have well documented, high levels of antioxidants that have been shown to reduce risk for chronic disease with published research on this dating back to at least 1981. Despite decades of research, the relationship of antioxidants in wine with lower incidence of heart disease remains controversial; the American Heart Association's official position is there is no specific link between consumption of red wine and lower risk of heart disease. Both red wine and grape juice consumption are linked to reduced blood clotting, but pure ethanol has a similar effect.

Current research within the Agricultural Research Service encompasses a number of projects at multiple locations. There are three studies on analysis of grapes being done at different labs. One study is examining metabolism of grape constituents. Several ARS scientists are using animal models for human diseases including aging, cardiovascular disease, cancer, diabetes, Alzheimer's disease, and Parkinson's disease. Finally, two vision studies that include assessment of wine intake are being conducted in humans. The studies are in several different ARS national programs.

ARS Scientist Penelope Perkins-Veazie, at the South Central Agricultural Research Lab in Lane, OK, is comparing phenolics and anthocyanins in muscadines grown in California and Mississippi. She has tested 16 varieties and found two with unusually high total phenolics. Working with grape breeders in Davis, CA and Poplarville, MS, she is selecting muscadine germplasm for increased levels of antioxidants. This research is within ARS National Program (NP) 306 – Quality and Utilization of Agricultural Products.

Ronald Prior, at the Arkansas Children's Nutrition Center in Little Rock, is measuring anthocyanins in grapes as part of NP107 – Human Nutrition. Dr. Prior adapted the oxygen radical absorbance capacity (ORAC) test for routine use that has become the most widely used measure for this function. He recently screened 25 fruits for anthocyanin content and found that 14 contained these compounds, with a range of 2 in peaches to 31 in Concord grapes; the latter is four more than in blueberries. There were 11 anthocyanins in red grapes, 13 in cranberries and 7 in strawberries. Many of the anthocyanins were identified for the first time. Anthocyanins are not only potentially important antioxidants, but their structure is very similar to the isoflavone,

genistein found in soybeans. Isoflavones have been shown to inhibit cancer, heart disease and osteoporosis by acting through more than 10 biological mechanisms. Anthocyanins have been documented to modify four mechanisms so far; because of the structural similarity to genistein, this is an area of potentially valuable research.

The Food Composition Lab at Beltsville, MD has two scientists working on improving methods for the extraction and measurement of phenolics, including polymeric tannins. They currently have a method that measures 13 at one time. In addition, a flavonoids database in foods was released in 2003. Twenty-seven flavonoids were determined but only 19 of the more common ones were published. Relevant products in the database include red, black and white grapes, grape juice, raisins, and red or white wine. Other food industry stakeholders have supported ARS to conduct flavonoid analysis of blueberries, dried plums, tea and chocolate. The database is available via the Web at http://www.nal.usda.gov/fnic/foodcomp

Metabolism of grape compounds is being studied by Michael Grusak and two ARS colleagues at the Children's Nutrition Research Center in Houston, TX. They designed and constructed growth chambers to label suspension cultures of grape and berry cells with radioactive carbon which was then fed to animals for tissue distribution studies.

The benefits of pterostilbenes from grapes are being studied by Agnes Rimando at the Natural Products Utilization Research Unit in University, MS. Pterostilbene is a much more active analog of resveratrol; using animal models for human conditions, it was found that pterostilbene lowers LDL cholesterol by 29% in hamsters and induces the transcription factor PPAR-alpha (important in metabolism and development of many diseases because it controls many genes) by 8 to14-fold. This work is within NP302 – Plant Biological and Molecular Processes. Dr. Rimando has collaborated with researchers at the University of Illinois to show that feeding Concord grape juice reduced breast cancer in rats and freeze-dried grape color extract inhibited growth of cancer cells in culture.

At the Western Human Nutrition Research Center (Davis, CA), Susan Zunino is feeding non-obese diabetic mice a diet containing one percent grape powder. This reduced the incidence of diabetes by more than 50% in the first seven months of the study. She plans to increase the amount of grape powder, study individual antioxidants from grape and identify specific grape varieties with the highest anti-diabetes activity. This is being done as part of NP107 – Human Nutrition.

Also in NP107, James Joseph at the Human Nutrition Research Center on Aging (Boston, MA) is studying grape juice and extracts in the same models of aging animals to test their neurological functions and motor skills that he used to show eating blueberries actually restored neurological functions in older animals. This research has had a major impact on consumer demand for blueberries both in the U.S. and in Great Britain. In grape studies, aging rats drank Concord grape juice for two months and showed improved coordination, strength and memory as well as improved dopamine release from brain tissue. Standardized tests of these animals show significant improvements in a variety of neuromuscular functions.

Wine as a factor in cataract formation is being analyzed by Allen Taylor at the Human Nutrition Research Center on Aging (Boston, MA). Using data from the Nurses Health Study at Harvard, he studied 556 women aged 53-74 years of age and found that ethanol increased risk of cataracts. Moderate wine consumption increased the risk of nuclear cataracts which account for about 20% of all cataracts while cortical cataracts (accounting for 60% of the total) were significantly less frequent in wine drinkers. This means the net effect of wine drinking was to reduce cataract formation even in the presence of alcohol. Another long-term study is following a larger number of participants for these and other tests related to vision but results are not yet available.

Although there may not be scientific unanimity, the consumer equates consumption of red wine with reduced risk of cardiovascular disease. The same may become true for consumption of other grape products if the message about antioxidants continues to resonate with the news media, with scientists and with consumers.