Nutritional scientist studies blackcurrant health benefits and obesity-related disease prevention

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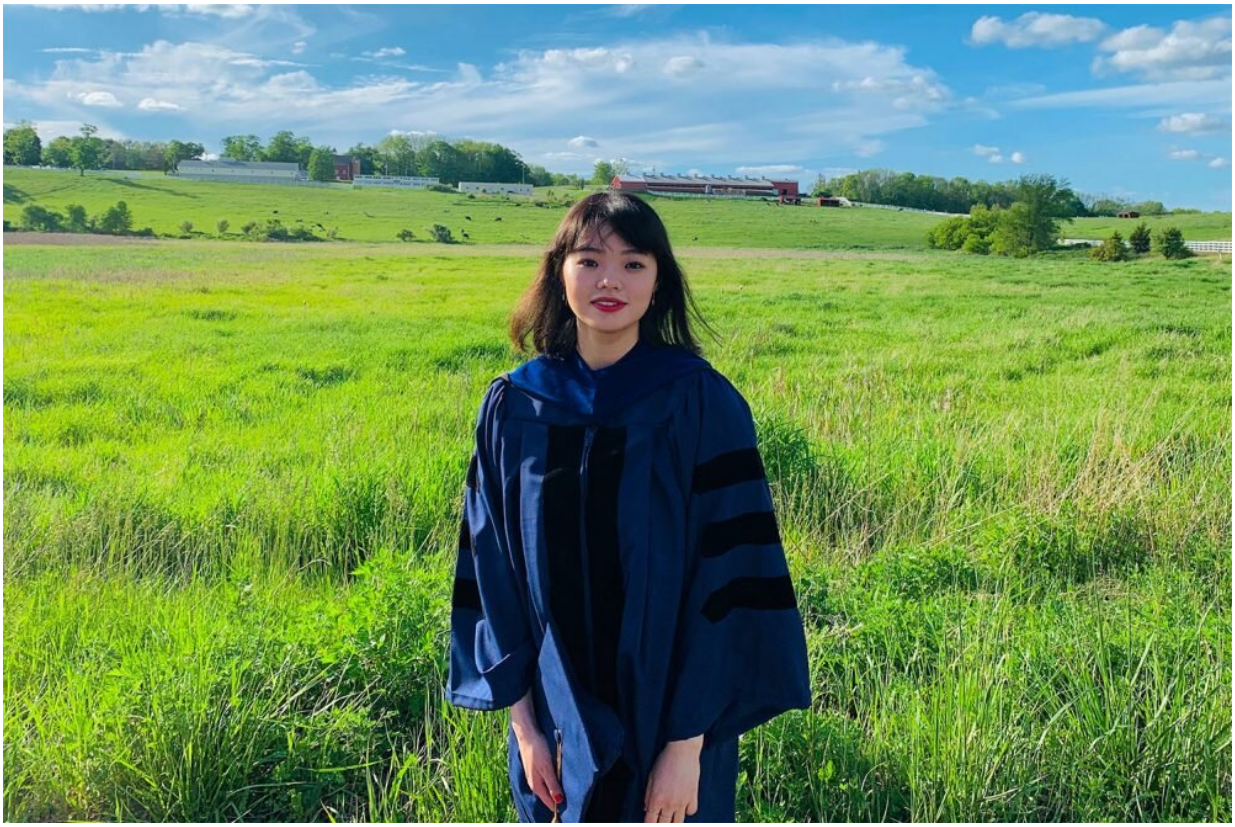

Credit: Yoojin Lee

Yoojin Lee studied food science and engineering in South Korea. A growing interest in how nutrients affect the body led her to the

Department of Nutritional Sciences in the College of Agriculture, Health and Natural Resources where her research focused on the relationship between obesity-associated diseases and foods that might have protective effects and other positive health benefits.

Obesity, a state caused by an imbalance between energy intake and expenditure, is an established risk factor for non-alcoholic fatty liver disease (NAFLD). NAFLD refers to a range of conditions concerning the accumulation of excess fat in the liver of people who drink little or no alcohol. There is an increasing prevalence of NAFLD. It is estimated to be the most common liver disease in the world and affects 80 to 100 million in the US alone. With the obesity rate of US adults recently found to be 42 percent, the impacts of health are far-reaching.

"NAFLD is an obesity-associated disease and globally affects about 25 percent of adults," says Lee. "There is no single FDA-approved drug to treat the disease. As of now, only lifestyle changes and dietary means are recommended. As a nutritional scientist, I believe part of my work is to identify dietary factors to prevent disease."

One of the foods Lee chose to study was blackcurrant (Ribes nigrum), a small berry with a strong, tart flavor and an abundance of antioxidants. Antioxidants have been found to produce anti-inflammatory effects, convincing her that blackcurrant could be a part of suggested dietary changes to prevent obesity or help those with obesity-associated diseases. While blackcurrant's uses are diverse, including jams, juices and syrups, and it is popular in many parts of the world, it is quite likely many Americans are less familiar with the berry.

The commercial growth of blackcurrant was banned by the United States Department of Agriculture from 1911 to 1966. Blackcurrant was found to be responsible for spreading a fungus (Cronartium ribicola). The fungus causes white pine blister rust, a tree-killing disease which

affected the country's timber industry. Even after the federal ban ended, many states continued to prohibit cultivating blackcurrant, including Connecticut until 1983. Research into fungicides and varieties of pine with immunity from the disease, in addition to research that found blackcurrant could safely be grown with enough distance from white pines, all led to relaxed restrictions by most states in the early 2000s.

This fascinating history intrigued Lee. She saw a potential opportunity to re-introduce an unfamiliar berry and flavor as a healthy food into American diets.

The study examined the effects of blackcurrant consumption on macrophage phenotypes, white blood cells that adapt to different tissue environments. M1-type macrophages are common in inflamed tissue and their presence exacerbates inflammation. Lee compared mice on a lean diet and a high-fat/high-sugar diet with both consuming blackcurrant. While the mice on a lean diet showed no changes in the M1 macrophage when eating blackcurrant, the mice on the obesogenic diet were found to have reduced expression of pro-inflammatory genes. The study even further suggested that while blackcurrant might not alter macrophage phenotypes, it may inhibit many factors of obesity-associated inflammation beyond macrophages.

"Blackcurrant is rich in polyphenols, a common type of antioxidant found in plants. It led me to study more about other types of polyphenols and understand their roles in NAFLD," says Lee.

Polyphenols are common in plant-based foods and drinks. The role of polyphenols has been extensively studied in preventing various diseases, so Lee began to learn more about them to build a concept of how they may offer protective qualities in NAFLD. Her research and growing expertise in polyphenols led to her authoring a chapter in a book on dietary interventions and liver disease.

"It was a great opportunity to learn about different types of polyphenols. I read the research and reviewed the literature and summarized a concept of how obesity is affected by polyphenols and how they protect against disease. I started writing it early in my Ph.D. program. It really helped me with my writing and learning to keep revising and to work closely with my advisor, Professor Ji-Young Lee. The experience helped me to think about ways to look at the same data from different angles."

One of those new directions was to examine the role of histone deacetylase 4 (HDAC4), an enzyme that removes acetyl groups from histone proteins, altering DNA accessibility for gene expression. Obesity causes many changes in gene expression, the process that instructs DNA to assemble a product, most often a protein, in our bodies. Lee was curious how HDAC4 contributed to the development of obesity-associated diseases.

"The experiment was about epigenetic regulation, gene expression that is modulated, while the DNA remains unchanged. If we know how HDAC4 behaves in obesity, then we can learn more about how it contributes to the development of obesity-associated diseases," says Lee.

Lee is continuing to study the mechanisms of disease development as a postdoctoral research fellow at Harvard Medical School and Massachusetts General Hospital.

"During my time at UConn, I was finding and providing scientific evidence to the nutritional community. That work is directly connected to the public through the sharing of information and knowledge to improve health. I was happy to find and provide scientific evidence for why blackcurrant could be used as a dietary means to prevent disease. I'm carrying on the research questions from UConn and searching for ways to reduce the incidence of NAFLD."

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