

Farm-to-table study reveals why whole grains are healthiest

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Samples of raw wheat kernels (top left), flours made using different milling processes (top row) and breads baked using different types of flour for nutrient assessment. Credit: David Killilea, UCSF

What does whole wheat have that refined flour lacks? A new study reveals key differences in nutrient content along with exactly where

nutrients are lost—and sometimes gained—along the journey from farm to table.

While previous studies have assessed the nutrients contained in various crops or in food products, the new study is among the first to bridge the two by tracing how processing and baking influence nutrient composition at each step.

Researchers report that levels of major minerals were cut by nearly three-quarters in refined flour and breads made with refined flour compared with whole wheat. Additionally, milling and baking markedly reduced the amount of other nutrients, such as [vitamin E](#), in both refined and whole wheat products compared with raw wheat kernels.

"Tracking [nutrient content](#) from farm to table is key for appraising what agricultural products actually contribute to the diet," said David Killilea, Ph.D., a researcher at the University of California San Francisco. "Our experimental approach revealed that both milling and baking had significant impacts on multiple nutrient levels within wheat flour and [bread](#)."

Killilea presents the findings at [NUTRITION 2024](#), the flagship annual meeting of the American Society for Nutrition held June 29–July 2 in Chicago.



David Killilea, Ph.D., a researcher at the University of California San Francisco, processes samples to study the nutrient contents of wheat kernels, flours and breads. Credit: Holly Duden, UCSF

The Dietary Guidelines for Americans recommend that [whole grains](#) constitute at least half of the total grains we consume, but research shows that most people do not meet this recommendation. By revealing the stark differences in [nutritional value](#) between more refined and less refined wheat products, the study underscores the importance of a diet rich in whole grains.

"Whole grains have an important role to play in the nutritional palette of the Western diet, and we strongly support the promotion of whole grain consumption," said Killilea. "Processes that enrich the nutrient density of

wheat-based foods should be encouraged, while processes that deplete nutrient density should be understood."

For the study, researchers obtained raw wheat kernels from a single farm source, milled the kernels to produce three different types of flour and then used the flours to prepare breads. They assessed the levels of major minerals (calcium, magnesium, phosphorous, potassium), trace minerals (copper, iron, molybdenum, zinc), carotenoids (vitamin A-like compounds) and vitamin E at each step.



Samples of test breads baked using whole wheat flour, reconstituted whole wheat flour and refined white flour for nutrient assessment. Credit: David Killilea, UCSF



Wheat kernels, the edible seed of the wheat plant, were used in this study to assess how nutrient levels change from kernel to bread. Credit: David Killilea, UCSF

The three flour types were intact whole wheat flour (produced by stone-milling), reconstituted whole [wheat flour](#) (produced by roller-milling) and refined white flour (produced by roller milling with bran and germ removed).

In the two types of whole wheat flours, levels of major minerals remained virtually unchanged from [kernel](#) to flour to bread, while the

levels of some trace minerals actually increased during processing. In refined flours and breads, major minerals were reduced by up to 72% and trace minerals were reduced by up to 64% compared with wheat kernels.

Vitamin E levels dropped substantially with each processing step, regardless of the type of flour used to prepare the breads. Ultimately, breads made with all flour types contained less than one-fifth the amount of vitamin E as wheat kernels. Levels of carotenoids were also reduced when the flours were baked into breads, with all breads containing less than one-quarter the amount of carotenoids as wheat kernels.

Next, the researchers plan to study how different farming or processing practices could influence the nutrient density of wheat and wheat products. Since inadequacies of vitamins A and E are a significant health concern in the U.S., they plan to focus particularly on whether fermentation or other processes could help to preserve the vitamin content of wheat products.

More information: Killilea presents this research at 2:12–2:24 p.m. CDT on Monday, July 1, during the Food Science and Nutrition session in McCormick Place ([abstract](#); [presentation details](#)).

Provided by American Society for Nutrition

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