Nepal Digest
LIFE. CULTURE. PEOPLE & NEPAL



FOOD / NEPALI FOOD

What Makes Gundruk Sour? The Science Inside a Familiar Food

Gundruk’s tang begins when bacteria transform sugars in leafy vegetables into acids. Research reveals a changing microbial community—and the limits of probiotic claims.

OCTOBER 29, 2026

What Makes Gundruk Sour? The Science Inside a Familiar Food

Gundruk’s tang begins when bacteria transform sugars in leafy vegetables into acids. Research reveals a changing microbial community—and the limits of probiotic claims.

By Nepal Digest - October 29, 2026 - Nepal

Gundruk gets its sourness from a transformation inside the leaves: bacteria turn plant sugars into acids. Lactic acid bacteria are central to that process. Their activity changes the food chemically, creating the tang that distinguishes fermented greens from leaves that have simply been dried. Research following gundruk fermentation has documented both the changing bacterial population and the accompanying rise in acidity.

That answer connects a familiar Nepali food to a less visible world. In the traditional process documented by the Food and Agriculture Organization, leafy vegetables undergo fermentation before the final drying stage. The sequence matters: drying and fermentation

are different operations, not interchangeable explanations for how gundruk acquires its character.

Understanding the distinction also makes the science easier to read. A study may measure acids, count bacteria or examine their DNA. Each reveals something useful, but none on its own describes everything happening in a serving of food.

The leaves become something new

Gundruk is not defined by a single vegetable. Research published in 1983 examined the acid-producing bacteria associated with a non-salted fermented product made from greens including mustard, rape and radish. That early work already treated acidity and the distinctive flavour of gundruk as related but separate features. The scientific interest is therefore not a recent discovery that a traditional food contains microbes; researchers have been investigating this transformation for decades.

The FAO account places gundruk within a practical household pattern: a harvest can provide more leaves than can be eaten fresh. Fermentation turns some of that seasonal abundance into a different food, and drying follows. This explains why describing gundruk only as dried greens misses the defining intermediate change. The leaves are not merely being put aside unchanged for another day.

The word “lactic” can sound as though milk must be involved. Here it describes the acid-producing activity of bacteria working on vegetables. No dairy ingredient is needed to explain the process documented in the leafy-vegetable experiments. The starting material and the microbes together matter.

A changing community, not one magic microbe

In their 2010 investigation, Buddhiman Tamang and Jyoti Prakash Tamang found that the bacterial community changed as fermentation progressed. Organisms identified in the paper as Lactobacillus brevis and Pediococcus pentosaceus were prominent early; Lactobacillus plantarum became important later. This is microbial succession: different organisms become more or less prominent over time. A list of bacteria from the beginning need not match a list from the end.

The label “lactic acid bacteria” also covers more than one species. A 2005 investigation of eastern Himalayan fermented vegetables included 25 gundruk samples among 65 samples of four foods. Researchers combined laboratory tests and genetic techniques to identify several important bacterial groups across those fermentations. The study provides another reason not to reduce a traditional food to a single organism with a memorable name.

For the reader, the useful distinction is between an ingredient list and a process. Naming a bacterium tells us who was detected. Following fermentation over time begins to show what the community was doing. Those are complementary questions, not competing explanations.

What a falling pH actually tells us

A 2020 study by researchers in Dharan followed mustard-leaf gundruk under laboratory conditions. Arjun Ghimire, Ajit Kumar Sah and Ranjana Poudel recorded a fall in pH from 6.59 to 3.71 during the experiment. They also measured increasing titratable acidity, reported as a lactic-acid equivalent. Together, the measurements show that the leaves were becoming more acidic rather than merely changing in appearance.

The two measurements are not synonyms. The chemical definition of pH concerns hydrogen-ion activity in a solution. It is a logarithmic scale, not a percentage of acid in the food. A lower reading indicates greater hydrogen-ion activity; it does not mean that a specified percentage of the leaves has turned into lactic acid.

Titratable acidity asks a different question, using a chemical measurement to express acidity in an agreed form. In the Dharan study, “as lactic acid” is how the result was reported. It should not be mistaken for a complete inventory of every acid present. The

researchers also observed that acid accumulation and bacterial population growth did not follow identical trajectories. Counting more cells is not the same measurement as detecting more acid.

These distinctions prevent a common reading error: turning one number into an explanation of the whole food. A pH reading is useful evidence, but it is not a tasting note, a catalogue of microbes or a description of every chemical change. The question should always be what was measured, in which samples and at which stage.

Why different studies find different communities

The leaves themselves are part of the story. A 2026 study comparing leafy substrates combined cultured bacterial isolates with DNA-based analysis. It reported acidification and differences in microbial communities between preparations. One recurring organism was Lactiplantibacillus plantarum, the species called Lactobacillus plantarum in older papers. The findings support a varied microbial picture, rather than a claim that every gundruk contains the same community in the same proportions.

Laboratory preparations are only one window. A 2024 investigation of traditionally prepared gundruk examined five samples collected in Darjeeling, Kurseong, Kalimpong, Mirik and Sikkim. It used both cultivation and DNA analysis and found a

range of bacterial groups. That geography matters: these are eastern Himalayan samples, not a representative survey of every household or producer across Nepal.

The methods matter too. Cultivation examines organisms that grow under the laboratory conditions provided. DNA analysis examines genetic material in the sample. Comparing the results can reveal a richer picture than either method alone. It does not justify treating a laboratory-grown isolate, a DNA signal and a measured effect in a person as interchangeable evidence.

For anyone comparing studies, three details deserve attention before the headline result: the vegetable used, the sampling stage and the measurement method. Without that context, apparently conflicting findings may describe different questions rather than a single disagreement about what gundruk is.

Sourness is only part of flavour

There is another step between acid in a food and sourness as an experience: detection by taste cells. In a 2019 experiment on sour-taste sensing, researchers studied mice with a disabled Otop1 gene. Responses to acidic stimuli were sharply reduced in taste cells and nerves. The work helped establish the role of a channel that allows hydrogen ions into sour-sensitive cells. It was a study of taste mechanisms, not a test of gundruk.

Yet sourness does not describe the entire eating experience. The US National Institute on Deafness and Other Communication Disorders explains flavour as a combination of taste, aroma, temperature, texture and other sensations. This distinction is useful when talking about gundruk: explaining acid formation answers why it is sour, but does not identify every substance responsible for its aroma or account for every difference between dishes.

A fermented food, not a promised cure

Finding lactic acid bacteria is not enough to call a food probiotic. The scientific consensus on fermented foods distinguishes fermentation from a demonstrated health benefit. A probiotic claim requires defined microorganisms and appropriate evidence; the presence of a familiar bacterial name does not supply that evidence. Fermented foods also need not contain living microbes at the time they are eaten. Later processing can change that without erasing their fermented origin.

Nor do these studies establish the safety of an untested household batch. Their measurements explain particular samples under particular conditions. They are not a substitute for a validated preparation method, and sour taste alone is not a safety certificate.

Gundruk does not need a miracle label to be interesting. Its sourness records a real transformation of leafy vegetables, one

that research can examine at several levels: the changing community, the acids it produces and the senses that detect them. Familiar food can carry complicated science without becoming less familiar.

Originally published by Nepal Digest - https://nepaldigest.com/what-makes-gundruk-sour-fermentation-science/