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Resistant Starch: What It Is, Why It Matters, and How to Add More to Your Plate[1]

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Starch is a type of complex carbohydrate considered an integral part of diets around the world. While it is best known for providing energy, its source and structure can influence other health outcomes. This publication explains the benefits of resistant starch (RS), a type of starch that acts like dietary fiber and supports diets aimed at reducing the risk of chronic diseases. This publication is intended for Extension educators and nutrition professionals interested in understanding how different types of starch affect digestion and health.

What Are Starches?

Starch is a carbohydrate made up of many glucose units and is naturally found in familiar plant foods such as grains (e.g., rice, wheat), vegetables (e.g., corn, potato), legumes (e.g., cowpea, lentil), and some fruits (e.g., plantain, jackfruit). Starch is an essential source of energy in our daily diet. When eaten, it breaks down into glucose in the small intestine. Glucose, the main sugar used in the body, enters the bloodstream to fuel the brain, muscles, and other organs (Bobroff 2024).

Not all starches behave the same way in the body. Some are digested quickly, others more slowly; a portion resists digestion altogether. These differences depend on how tightly the starch molecules are packed or bonded within foods. Depending on how easily they are digested, starches can be classified into three groups: rapidly digestible starch, slowly digestible starch, and resistant starch (RS). The difference in digestibility plays an important role in how starches influence blood sugar levels after a meal (Bojarczuk et al. 2022).

Beyond its nutritional role, starch is also valued by the food industry for its ability to thicken and give consistency to many products, from gravies to baked goods. Because of these properties, starch is often extracted from grains, tubers, and legumes to enhance the quality and consistency of various food products.

Key Definitions

amylose: One form of starch that is more likely to form resistant starch when foods cool, making it more resistant to digestion.

glucose: A simple sugar the body uses as its main fuel.

fermentation (in the gut): When gut bacteria break down resistant starch and fiber.

enzymes: Natural proteins in the body that help break down food during digestion.

fiber: Parts of plant foods your body cannot fully digest that support digestion and heart health.

prebiotic: A type of fiber or starch that feeds beneficial gut bacteria.

probiotics: Live beneficial bacteria found in some foods and supplements.

retrogradation (cook-and-cool effect): When cooked starch cools and changes into a form that resists digestion.

short-chain fatty acids: Helpful compounds made when gut bacteria ferment resistant starch and fiber.

Resistant Starch and Where to Find It

Unlike rapidly or slowly digestible starch, RS is not fully broken down in the small intestine. Instead, it advances to the colon, where beneficial bacteria ferment it in a process that produces compounds supporting gut health (Lockyer and Nugent 2017).

This resistance to digestion is often due to the way RS is naturally arranged in plants. In some cases, starch is trapped inside intact plant cells or tightly packed into small granules, which makes it harder for digestive enzymes to reach. RS is classified into five types, RS1–RS5, based on its organization and processing in foods (**Table 1**). Understanding the differences among these five types can be useful for developing personalized nutrition plans (Cione et al. 2021). Figure 1 illustrates the different types of RS.

Table 1. Types of resistant starch.

Type	Definition	Sources
RS1	Physically inaccessible starch trapped within plant cell walls	Whole grains and seeds
RS2	Naturally resistant starch due to its crystalline structure	Raw starchy foods, like raw potatoes, green bananas, and high amylose[1] maize
RS3	Retrograded[2] starch formed when starchy foods are cooked and then cooled	Cooked and cooled potatoes, rice, and bread
RS4	Chemically modified starch through industrial processing	Processed foods using chemically modified RS4, such as baked goods and snacks
RS5	Formed when a starch component (e.g., amylose) binds to fats	Foods in which starch and fats are cooked together or processed foods using chemically modified RS5

[1] Amylose is a type of starch.

[2] Retrogradation is when cooked starch cools, firms up, and becomes harder for the body to digest.

Source: Modified from Lockyer and Nugent (2017).

RS content in foods varies, typically ranging from 1% to over 30% depending on the food type and preparation. RS can be found in many everyday foods, especially in whole grains, legumes, tubers, roots, vegetables, and fruits. Whole grains are preferred over processed grains because they retain the entire grain kernel, preserving essential nutrients such as fiber, vitamins, and minerals. Grains like barley, oats, and whole wheat are particularly good sources of RS (Chen et al. 2024).

Legumes like lentils, chickpeas, and cowpeas (e.g., black-eyed peas) contain relatively high levels of RS, although they are less frequently highlighted as a major source of RS (Ratnaningsih et al. 2020). Tubers such as potatoes, yams, cassava, and taro are examples of starchy vegetables that have some RS but more slowly digestible starch, especially when cooked and cooled. Tubers like potatoes develop higher levels of slowly digestible and resistant starch when cooked and then cooled (e.g., RS rises from ~3.3% to 5.2% in boiled potatoes upon cold storage) (Leeman et al. 2005). White corn is another starchy vegetable that not only offers more fiber than yellow corn but also contains RS, particularly when eaten in cooled preparations (Rojas-Molina et al. 2024).

Plantains and green bananas are also excellent sources of RS and are dietary staples in many tropical and subtropical regions, including parts of Florida and most of the Caribbean and South America. These fruits are harvested and consumed before they fully ripen, when their starch content is highest. In their unripe stage, plantains and green bananas can contain up to 50% RS by dry weight, making them valuable for gut health and blood sugar control (Bomfim et al. 2024). Traditionally, these are boiled, steamed, or fried and served as a starchy side dish. Cooking breaks down (gelatinizes) the starch granules, making them easier for the body to digest and temporarily reducing RS levels. However, when the cooked food is cooled before eating, such as in potato salad or pasta salad, some of the starch re-forms into something that resists digestion, restoring part of the RS content (Patterson et al. 2020).

Jackfruit is also a source of RS that has been gaining popularity in south Florida, where the humid subtropical climate meets the requirements for growth and fruiting (Rezazadeh 2021). For a tropical fruit tree, jackfruit produces large quantities of fruit with a high volume of seeds. Though jackfruit may seem new to Western diets, its seeds are traditionally consumed in parts of South and Southeast Asia (Suzihaque 2022). To prepare them, the seeds are typically boiled or roasted until soft. After cooking them, you can peel each seed's outer layer to reveal a meaty interior, which has a nutty, potato-like flavor. The raw seeds can contain up to 30% RS, and their physical structure protects them from losing a significant amount of RS when cooked (Zhang et al. 2021; Kittipongpatana and Kittipongpatana 2015).

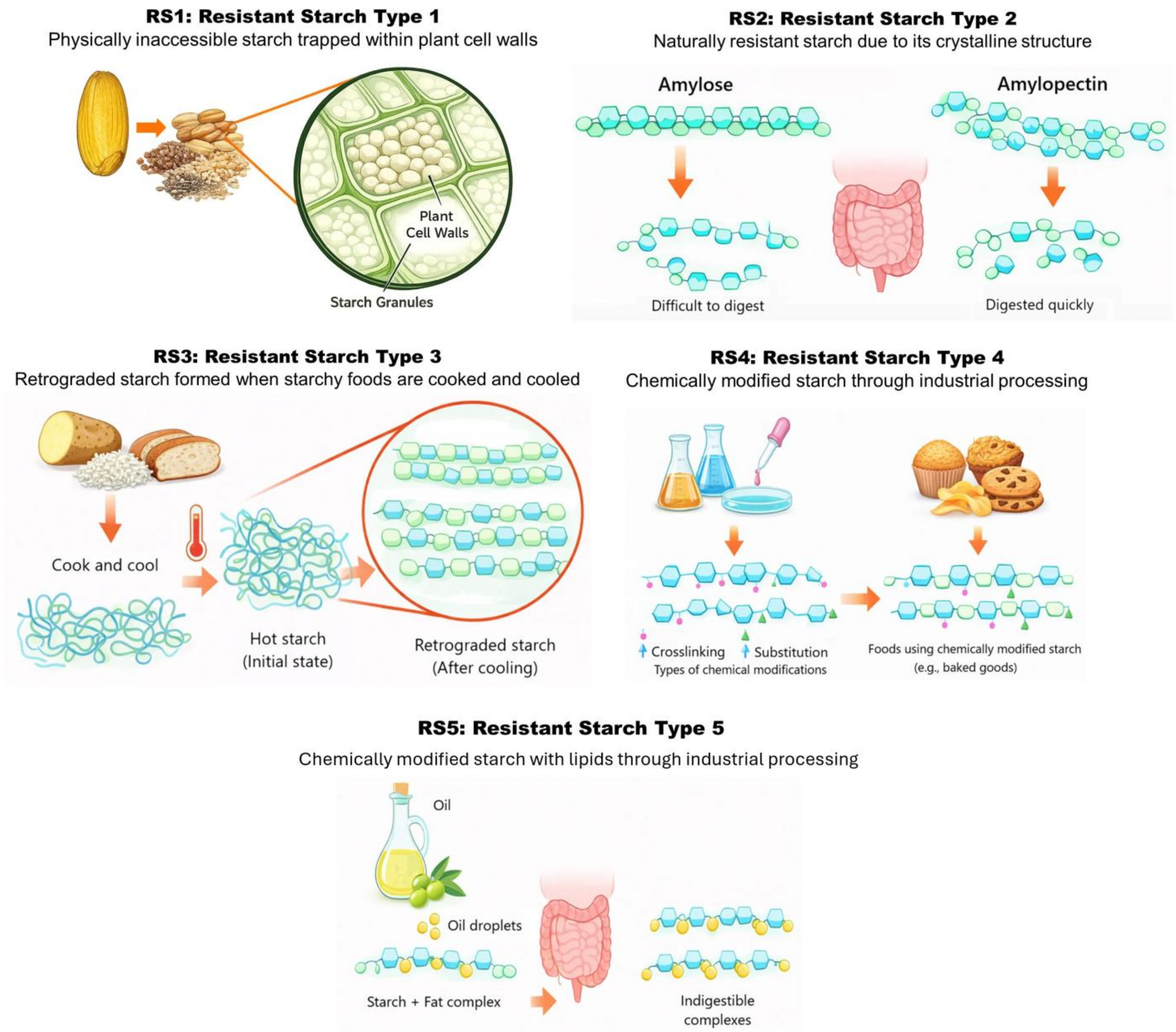

Figure 1. Different types of resistant starch.
Credit: Image generated by DALL·E in Microsoft Copilot, January 2026, from the prompt "Illustrated scientific diagram showing the five types of resistant starch (RS1–RS5) with structural and food examples, rendered in a clean educational style." Edited and reviewed by the authors.

Why Does Resistant Starch Matter to Health?

RS has gained attention for its role as a dietary fiber and its prebiotic potential (Dahl et al. 2017). Diets high in fiber, including RS, are known to help reduce the risk of chronic conditions like type 2 diabetes, heart disease, and obesity (Bojarczuk et al. 2022). Because RS resists digestion in the small intestine, it reaches the large intestine mostly intact, where it is slowly fermented by beneficial bacteria. This gradual fermentation results in compounds that support gut health and may promote a longer-lasting feeling of fullness and more stable energy levels (Amaral et al. 2022). RS intake has also been associated with improved blood sugar control, better weight management, healthier cholesterol levels, and overall digestive wellness.

Blood Sugar Regulation

RS may help regulate blood sugar levels after meals. This food component leads to lower glycemic loads, which means RS can be consumed regularly and within typical serving sizes, while having a significantly smaller impact on blood sugar levels compared to other carbohydrate sources (Pugh et al. 2023). Foods with a lower glycemic load cause smaller spikes in blood sugar (Rivero-Mendoza and Dahl 2020).

Weight and Cholesterol Management

Unlike simple carbohydrates (e.g., juice, sodas, candy), RS is not digested or absorbed in the small intestine. This means it provides fewer calories while still adding bulk to your meal, which helps you feel full for longer after eating (Bojarczuk et al. 2022; Amaral et al. 2022). Additionally, when these starches reach the large intestine, they can be fermented by beneficial gut bacteria, producing short-chain fatty acids. These compounds may help burn fat even when you are not exercising (Bojarczuk et al. 2022). They also help the body process cholesterol more efficiently and reduce levels of "bad" cholesterol in the blood (Bojarczuk et al. 2022). This could be especially beneficial for individuals who are at greater risk of heart disease.

Gut Health and Microbiota Support

RS also plays a major role in supporting a healthy gut microbiota, the community of bacteria that lives in the colon (Liu et al. 2020). The "good" bacteria, also known as probiotics, play a vital role in supporting your overall health. When well-nourished, probiotics can help reduce bloating, ease inflammation, improve bowel regularity, and support immune function (Zhang et al. 2015). A healthy gut microbiota can also help reduce your chances of developing obesity, diabetes, inflammatory bowel disease, and even some types of cancer (Clemente-Suárez et al. 2022; Zhang et al. 2015).

How to Turn Starches into Resistant Starches at Home

Some whole foods like plantains, cassava, and russet potatoes are naturally rich in RS2. Like most starchy foods, they typically need to be cooked before you eat them. However, much of the RS2 can be lost during cooking, as heat disrupts the starch's structure (Wang et al. 2023). For this reason, selecting foods that are naturally high in RS content can help ensure a good intake even after cooking.

Researchers are also exploring ways to preserve or even increase RS during everyday cooking. A simple and effective method to boost the amount of RS in your meals is through a process called starch retrogradation. This happens when you cook starchy foods and then let them cool down in the refrigerator. As mentioned earlier, cooking disrupts the structure of starch, but cooling allows it to reshape into a form that resists digestion, creating RS3. When cooked potatoes are cooled for 24 hours, their RS content increases (Narwojsz et al. 2020). According to Sonia et al. (2015), cooling rice at refrigeration temperature (39°F/4°C) for one day, followed by reheating, increased its RS content by about 2.5 times compared to freshly cooked rice. The study observed 15 healthy adults whose glycemic response significantly decreased, suggesting potential benefits for blood sugar control (Sonia et al. 2015). Legumes like beans and lentils have also shown benefits from this method. Boiling and chilling legumes demonstrated a 6% increase in RS (Cione et al. 2021).

Note that not all foods hold onto their RS when reheated. For example, rice can be reheated without losing a significant amount of RS (Sonia et al. 2015), while foods like bananas and plantains tend to lose more during reheating (Patterson et al. 2020). Although more research is needed to fully understand these differences, the cook-and-cool method is a simple way to enrich your meals with RS. Whether or not you reheat the food afterward, the key step is chilling because cooling changes starch back into a form that resists digestion. It is an easy and flexible strategy to boost the health benefits of your everyday starchy meals.

To help you identify foods that naturally contain RS, the USDA's FoodData Central now includes RS values for several common foods. For example, a 100-gram serving (3.5 ounces or 2/3 cup sliced) of overripe raw plantain contains 7 grams of RS, while a 100-gram serving (3.5 ounces or 1/2 cup) of canned black beans offers around 2 grams (USDA-ARS 2025). If you are looking to boost your fiber or RS intake, FoodData Central is a great resource for comparing and finding sources.

Conclusion

Resistant starch is a unique carbohydrate that escapes digestion in the small intestine and instead ferments in the colon, where it supports beneficial gut bacteria and contributes to overall health. Unlike rapidly digestible starches, which cause spikes in blood sugar, RS behaves more like dietary fiber, helping regulate glucose levels, manage weight, and improve digestive function. Although cooking can reduce its content in some foods, simple strategies like choosing naturally rich sources and using cooling techniques can help preserve it. Ongoing research continues to explore new methods for preserving RS during cooking and processing. Understanding what sets RS apart from rapidly digestible or refined carbohydrates is a powerful step toward making healthy food choices and supporting long-term health.

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