

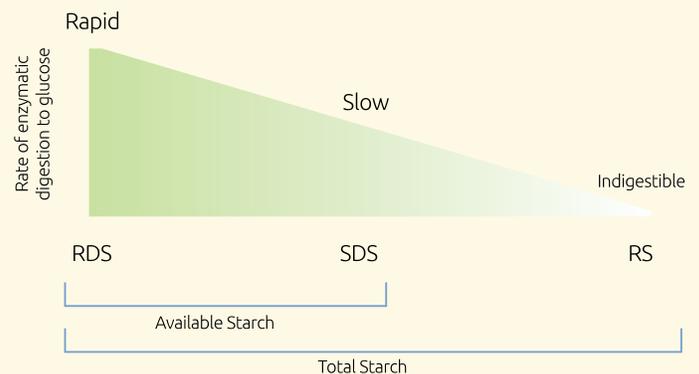
## Fact Sheet **SLOWLY DIGESTIBLE STARCH** (A Slow-Release Carbohydrate)

### WHAT IS SLOWLY DIGESTIBLE STARCH (SDS)?

Starch is a naturally occurring dietary carbohydrate. In plants its primary role is to store energy from photosynthesis in the form of long chains of glucose, so that it can be used later to fuel important processes including seed germination [1]. It occurs naturally in a granular form with a semi-crystalline structure, which may be transformed into Rapidly Digestible Starch (RDS) upon exposure to heat, pressure and/or moisture during food processing [2]. Slowly digestible starch (SDS) takes longer to breakdown by digestive enzymes compared to RDS because it is higher in this semi-crystalline structure and therefore less accessible to the action of enzymes [3]. This results in a moderate and steady release of glucose in the blood. Foods with high SDS content elicit lower post-meal blood glucose and insulin responses as compared to foods with low SDS content. Inversely, RDS is a dietary carbohydrate that is more quickly broken down due to increased enzymatic access, resulting in a more rapid release of glucose in the blood [4-6].

### HOW DOES SDS DIFFER FROM RDS OR RESISTANT STARCH (RS) IN TERMS OF DIGESTIBILITY?

Total starch is the sum of SDS, RDS, and RS. Starch can be classified by the rate and extent of its digestibility (Figure 1). SDS has a slower rate of digestion compared to RDS. Because RS is a fraction of starch which resists enzymatic digestion and is fermented in the large intestine, it is considered a type of dietary fiber. Only SDS and RDS are considered to be “available starch.”



**Figure 1:** Classification of starch by the rate of enzymatic digestion to glucose in the small intestine. RDS, rapidly digestible starch; SDS, slowly digestible starch; RS, resistant starch.

### WHICH FOODS CONTAIN SDS?

SDS is naturally found in certain uncooked grains such as wheat, rice, barley, rye and corn [7]. The starch in such grains is present in the form of granules with a semi-crystalline structure, relatively protected in its raw state from digestive enzymes. The SDS content in starchy foods is mainly influenced by the gelatinization phenomenon. Exposure to heat, pressure and/or moisture decreases SDS content by converting it to RDS, making it more accessible to digestive enzymes. The conversion can be minimized by controlling the cooking conditions to limit starch gelatinization [3]. Therefore, the original SDS content in food can vary depending on the way it is prepared. Foods that contain high levels of SDS include some al dente pastas, parboiled rice, pearled barley and certain crackers and biscuits, whereas puffed breakfast cereals and breads usually contain low levels of SDS [3, 8].

## HOW DO I KNOW IF A FOOD PRODUCT CONTAINS SDS? WHAT SHOULD I LOOK FOR ON THE LABEL?

The challenge is that you will not find “slowly digestible starch” or “rapidly digestible starch” listed on the nutrition facts panel or in the ingredient list. In general, certain types of grain-based products are more likely to contain SDS. Look for phrases like “steady release of carbohydrates” or “slow-release carbohydrates” on the label of cereal-based foods. This may be an indication that a food is high in SDS.

## WHAT METHOD IS USED TO ANALYZE SDS CONTENT IN A FOOD PRODUCT?

A food’s SDS content can be determined using the in vitro SDS method developed by Englyst and co-workers<sup>[4,7]</sup>. It is designed to simulate the enzymatic digestion of starch that occurs in the small intestine<sup>[9]</sup>. A sample of the food is added to a tube containing starch digestion enzymes, and the appearance of glucose is assessed over 120 minutes. This method can differentiate between:

- Rapidly available glucose (RAG), including free glucose and rapidly digestible starch (RDS)
- Slowly digestible starch (SDS) which corresponds to slowly available glucose (SAG) when all slowly digestible carbohydrates are provided by starch

- Resistant starch (RS), the fraction resisting digestion by human enzymes

## WHAT BODY OF EVIDENCE SUPPORTS THE MECHANISM OF ACTION OF SDS?

The results of several randomized controlled trials have been published. These studies have shown that consumption of foods with high SDS content results in moderate and stable rates of glucose appearance from foods into the bloodstream, as measured using a double stable isotope labeling method<sup>[4-6]</sup> and lower post-meal blood glucose and insulin responses compared to foods with low SDS content.

## WHAT IS CONSIDERED A HIGH SDS CONTENT?

Carbohydrate-rich foods containing more than 55% of the available carbohydrates from starch, at least 40% of which is SDS, are considered high-SDS foods, and their consumption has been shown to result in lower blood glucose and insulin responses compared to foods with low SDS content<sup>[10]</sup>.

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