

The Impact on the Consumption of Almidón from Leguminous: Health Benefits

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Received: October 30, 2019; Published: November 04, 2019

DOI: 10.31080/ASNH.2019.03.0524

Abstract

The human being obtains the necessary energy for the vital functions of the organism mainly from carbohydrates, starch is the main direct energy source. In current research it has been shown that the starch in food consumed in the diet is not assimilated or absorbed in the same way, because starches have different physicochemical and structural characteristics, they also depend on the biological source consumed. The starches in food as cereals and tubers when consumed have a similar postprandial response, they are assimilated in a short time (less than 30 min) and their absorption is complete (100%). By-products from these foods have as a characteristic the generation hyperglycemic peaks, because the starch is assimilated in its entirety in a short time, this characteristic is presented by foods such as bread, hot cakes, cookies, baked potatoes, etc. On the other hand, foods from legumes or whole grains, in most cases generate a gradual postprandial assimilation response with prolonged absorption time (between 30 to 120 min average), and in most cases their absorption is complete, and there are no peaks of hyperglycemia after food consumption, this type of postprandial glycemic response which generates food consumption with these characteristics is called healthy postprandial responses. This difference in the way of assimilation of starch food, depends on the differences in the physicochemical and structural characteristics of starch and has as a consequence that the postprandial metabolic response of the organism when consuming cereals or legumes be different. The benefits generated by foods whose starch is assimilated gradually are substantial for the body, which is of great importance for diabetic people who have a problem in the regulation of carbohydrate metabolism.

Keywords: Rapidly Digestible Starch; Lowly Digestible Starch; Glucose Metabolism; Gradual Energy; Health Benefits

Abbreviations

GI: Glycemic Index; QDS: Rapidly Digestibility Starch; LDS: Lowly Digestibility Starch; RS: Resistant Starch.

Introduction

The human being has to obtain all the necessary nutrients for the good performance of his physiological functions from the diet. From the food we consume we obtain the energy necessary for the vital functions of the organism from three basic macronutrients which are carbohydrates, proteins and fats. Carbohydrates are the main source of energy for the body and from all the carbohydrates

we consume, starch is the primary energy source [1,2]. This compound is mainly ingested from foods derived from cereals, legumes and tubers, and is contained within these cells in small particles called "Granules" [3].

Traditionally from the nutritional point of view, it was considered that the starch in food was assimilated in the same way, it would be digested in its entirety and produced a very similar metabolic response, regardless of the biological source from which it came (cereals, tubers or legumes) [1]. In current research it has

been shown that the starch of the food we consume in the diet is not assimilated or absorbed in the small intestine in the same way, because not all starches have the same characteristics and therefore are not all the same from the physicochemical and structural point of view. Starches that come from cereals and tubers are assimilated in a short time, compared to leguminous starches that are assimilated gradually, in addition there is in some foods a fraction of starch that is not assimilable, called "Resistant Starch", for example Japanese peanut, beans or spicy chickpeas and toasted tortilla [4,5].

The benefits generated by foods whose starch is assimilated gradually are substantial for the body, since they have as a metabolic response a lower postprandial glycemia (amount of blood glucose) at the time of consumption, which is of great importance in people diabetics who have a problem in the regulation of carbohydrate metabolism. This discrepancy in its assimilation represents the body's response to the differences in the physical, chemical and structural characteristics of the starch contained in food. Foods that generate a high glycemic response are considered high glycemic foods and foods that generate a moderate glycemic response are considered medium or low glycemic index (GI) foods. The consumption of foods with moderate to low GI, could contribute to diminish the incidence and prevalence of cardiovascular diseases, diabetes and obesity [6,7].

Almidon characteristics and its relationship with the postprandial glycemic response

From the nutritional point of view, the consumption of this macronutrient contained in food has distinct physical, structural and chemical characteristics that depend on the biological source from it comes. Physically the starch is contained in the form of granules inside the endosperm cells in the cereals and inside the cotyledon cells in the legumes and these starch granules are characterized by having size and shape, they also have a rough surface and porous, which makes them permeable to water. Structurally, the granules are constituted by amorphous and crystalline sheets alternated with one another in a sequential and concentric manner, constituting a heterogeneous material [8,9].

The chemical composition of starch is made up of two compounds called polysaccharides, one amylose and another amylo-

pectin. The way in which each polysaccharide in the granules is constituted is different, while amylose has the structural characteristic of being linear (similar to a chain), amylopectin is branched (similarity to a bunch of grapes). The content of amylose and amylopectin in each type of starch varies, in cereals it has a lower amylose content (30%) compared to legumes (40%) [3,10].

For a nutrient to be bioavailable (assimilated by the organism) such as starch, it must be contained on the food in a gelatinized form, this phenomenon occurs when the food is subjected to the cooking process. In recent research it has been scientifically reported that all cereals and legumes derived foods we consume produce distinct metabolic response based on their bioavailability, that is, the way they are assimilated in terms of quantity and time, generate differences in the postprandial glycemic response [1,7]. Food starches from cereals are absorbed completely (100%) and in a short time (30 to 40 min average) in most cases, for example bread, cookies, tamale, oat atole, among others ; legume starches have a tendency to be digested in a longer time (between 30 to 120 min), and almost entirely, about 80% on average, for example lentil soup, tlacoyos, pot beans etc., the other remaining fraction is not digested and/or absorbed. The starch that is assimilated quickly or in a short time and in its entirety is called "Rapid Digestibility Starch" (QDS), the starch that is assimilated gradually and in a longer time and almost or in its entirety It is called "Lowly or Slow Digestibility Starch" (LDS), the fraction that is not digested is called "resistant or indigestible starch" (RS), this difference is determined by its nutritional classification according to the degree and time of assimilation [11,12]. In this sense, food starches from cereals behave as fast digestible starches and have a high GI, while legume starches behave like slow or lowly digestibility starches and have a medium or low GI. This difference in the bioavailability of starches in food has a direct relationship with the metabolic response in the body, which is mainly due to differences in physical (size and shape), structural (quantity and type of amorphous and crystalline sheets) and chemical composition (amount of amylose and amylopectin) of the grain granule compared to legumes, these attributes and properties that starch has in food influence how the form of assimilation and type of metabolic response will be in terms of its bioavailability. This means that the amount of energy and the way in which the body obtains it produces a different impact on carbohydrate metabolism [1,4-6].

Health benefits of low digestibility food consumption

It has been scientifically reported that starch in food do not have the same physicochemical characteristics, and this gives them a distinction in terms of the metabolic response that the organism presents when consumed. Foods that have a high GI contain predominantly “rapidly Digestibility” starches, this represents from the metabolic point of view a high glycemic load in a short time. The consumption of foods with these characteristics has negative consequences for diabetic people, since it complicates the regulation of carbohydrate metabolism due to the lack of insulin (a hormone that regulates carbohydrate metabolism) and this affects the way it lowers the glycemic load in terms of blood glucose concentration over time. Another disadvantage that occurs dietary is that the consumption of foods with starches of rapid digestibility in terms of frequency and quantity, that is, greater or high consumption for prolonged times, favor obesity [7,11,13]. This is explained because the surplus of glucose found in blood is stored as energy in the body in two ways, the short-term glycogen in the liver and another part that is not used as energy expenditure is stored in the form of fat in adipose tissue and results in a substantial increase in weight [7,13]. Many of the foods we consume on a daily basis with the aforementioned attributes or properties are mainly derived from cereals and tubers, these products in most cases are consumed as processed products (refined foods) example: bakery products (bread, cookies, cupcakes etc), atoles, breakfast cereals, rice soup, among others.

Legumes, on the other hand, are consume them in the form of whole grains, they are little processed foods through culinary processes. The consumption of these foods produces a metabolic response, in which the speed of starch digestion and blood glucose is gradual, which prevents the generation of high concentrations of postprandial glucose in a short time favoring that the obtaining of energy is gradual and in a longer period of time, this would allow the pancreas to produce insulin gradually, favoring the uptake of glucose by the cells and thus avoiding hyperglycemia. These starches, due to the type of metabolic response they produce, could be considered as starches with low digestibility [6,7,13,14].

The potential benefits of food which contains lowly digestibility starch are linked to the stability of glucose metabolism, diabetes and satiety. Recent research has considered that medium to low GI diets reduce glycemic load and this is associated with a decrease

in the risk of developing diabetes, cardiovascular diseases, among others. In obese and diabetic patients it has been reported that the intake of starches that provide glucose slowly to blood improves the metabolic profile, by influencing the levels of triglycerides in blood, in addition, the consumption of breakfast foods containing starches of lowly digestibility improves carbohydrate metabolism and produces a reduction in insulin requirements in type 2 diabetic patients. As glucose is the main fuel for the brain, it has been observed that obtaining glucose gradually in blood from foods with LDG can influence cognitive performance (memory and analytical reasoning), since the brain demands up to 50% of the energy ingested, in the case of schoolchildren this is essential since they can improve their academic performance [13,14].

Due to the above, the health benefits of eating foods with contain lowly digestibility starches are: promoting nutritionally the consumption of foods with moderate GI, avoid maintaining a high concentration of blood glucose by longer time, and this is a factor that favors the onset of cardiovascular diseases, diabetes and obesity.

Conclusion

The type of postprandial response that generates the different foods from cereals, tubers and legumes, depends on the fiscal and structural characteristics from the food itself, in addition, on the microstructure and physicochemical properties of the starch contained in the food. This bioavailability is directly related to the digestibility level of this macronutrient, in terms of quantity and rate of absorption. The digestibility level of starch on one hand depends on the physico accessibility of digestive enzymes to hydrolyze starch as a result of the structure of the food matrix, and on the other, the degree of structural level that starch itself presents. In this context, all these factors and elements considered determine the type of postprandial response generated in the individual by consuming the starch contained in the food. Thus, promoting foods with a healthy postprandial response is recommended to improve the quality of life, especially in people who have problems with carbohydrate metabolism such as diabetic people.

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Volume 3 Issue 12 December 2019

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