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Açaí: An ally for Human Health?

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Abstract:

Nutrition is one of the oldest sciences that aims to study the interactions between food, nutrients and human health. This fact can be checked from the famous citation of Hippocrates, considered the father of the modern medicine “Let food be thy medicine and medicine be thy food”. In the last decades several studies have attributed to foods the ability to provide benefits which go beyond its macronutrient content, being able to act on cellular signaling pathways reducing the incidence of many chronic diseases, including cardiovascular diseases (CVD) (1).

Keywords: Food nutrients, human health, nutritional value, açaí pulp, lipoproteins

Introduction

It is estimated that 17.7 million people die each year from CVD, which equates to approximately 31% of all deaths in the world (2). The main clinical manifestation of CVD is atherosclerosis, a chronic inflammatory disorder. It occurs in response to endothelial aggression, lipid deposition, migration of muscle cells and calcification, affecting the intimate layer of arteries (3). High concentrations of low density lipoprotein cholesterol (LDL) may promote its accumulation in the subendothelial space and increase the permeability of the vascular endothelium to lymphocytes and monocytes (4). In addition, these lipoproteins can undergo chemical modifications, such as oxidation by reactive oxygen species, and it can become something even worse: oxidized LDL. Macrophages recognize the oxidized LDL particles through scavengers-type receptors leading to the formation of foam cells (5). Then, a fibrous layer containing smooth muscle cells and collagen begins to form, giving rise to the atheromatous plaque.

Studies have shown that dietary factors are important in the pathogenesis of atheromatous plaque (6,7) and an increment in fruit and vegetable consumption is associated with a decrease in the incidence of CVD (8,9). Its effects have been related to the presence of phenolic compounds and some nutrients, as unsaturated fatty acid and fibers. The pathways associated with the dietary compounds benefits seems to involve effects on oxidative, inflammatory and lipid metabolism (10).

A food that has been extensively studied is açaí, fruit of the palm tree *Euterpe oleracea* Martius, native of the Amazon region. Açaí is a small and rounded fruit with a dark-purple color in function of the presence of natural pigments. The consumption of açaí in Brazil is important, but it gained worldwide fame from the 2000s (11). Today Brazil is positioned as the largest producer, consumer and exporter of this product. Açaí is consumed in almost all Brazilian states and in some countries in Europe and in the United States, Japan and China, which has generated new forms of commercialization, such as pulp, juice, capsules and instant powder (12).

The exotic flavor and possible benefits of açaí attract more consumers and researchers. There are studies describing effects in neutralizing free radicals, but also anti-inflammatory, anti-carcinogenic, antiproliferative, antilipidemic and hepatoprotective activity (13–17). These effects are attribute to the peculiar nutritional and bioactive characteristics of the açaí. The phytochemical composition of this fruit displays a variety of phenolic compounds, highlighting five main anthocyanins: cyanidin-3-sambubioside, cyanidin-3-glucoside, cyanidin-3-rutinoside, peonind-3-glucoside, and peonind-3-rutinoside. Regarding to the nutritional composition, the açaí still has an expressive amount of lipids (monounsaturated and polyunsaturated), fiber content and phytosterols (18).

Considering the nutritional value, the phytochemical composition and the increase in the consumption of this fruit, studies evaluating the effect of açaí began to appear aiming to verify if it actually has functional health properties.

One of the first published studies evaluated the effect of açaí pulp in rats fed a hypercholesterolemic diet. After the experimental period, serum markers of oxidative stress, carbonylated protein, and sulfhydryl groups, decreased in the group of animals supplemented with açaí pulp. Furthermore, this group had a reduction in serum levels of total cholesterol and non-HDL fraction, as well as increased activity of the enzyme paraoxonase (19).

Afterward, Guerra (2011) studied in an animal model, two groups of rats (control and diabetic) that received diet supplemented with açaí and observed a decrease in the production of reactive oxygen species by neutrophils in both groups. There was also an increase in hepatic glutathione in the groups supplemented with açaí pulp. The concentrations of thiobarbituric acid (TBARs), the marker for lipid peroxidation, and carbonylated protein, the marker of protein modification, were decreased in the diabetic group with açaí supplementation. These results suggest an antioxidant effect of açaí, both in the production of ROS by neutrophils and in the antioxidant defense system (20).

Despite the effects found with addition of açaí in animal models, studies with humans beings were still limited. Udani et al. (2010) in their pilot study with 10 overweight individuals evaluated biochemical parameters, protein C reactive and nitric oxide. After consuming 200g of açaí pulp per day for a period of 30 days, the authors observed a decrease in glycemia and in concentrations of insulin and cholesterol, suggesting a possible effect of açaí on classic risk factors, However the study included a small number of subjects, heterogeneity in the sample and the subjects were advised to exclude some foods during the study period (21).

In face of the beneficial effects found in animal models, which were reinforced by researchers worldwide and stimulated by the existence of few studies in the scientific literature about the effects in humans, we decided to evaluate the effects of the intake of commercially available açaí pulp on health parameters of young healthy women.

The first data reported by our research group evaluated the effect of the dietary intake of 200 g of açaí pulp on markers of oxidative stress and enzymes of the antioxidant system. The results of this study show that after four weeks of açaí intake, the volunteers had a reduction in the serum concentrations of carbonylated protein and an increase in sulfhydryl groups. In addition, there was an increase in catalase enzyme activity and total antioxidant capacity, as well as a reduction in the production of reactive oxygen species by polymorphonuclear cells. These findings reinforce the initial prerogative that açaí can act on oxidative metabolism by preventing the action of free radicals on macromolecules (22).

In order to better understand the effects of dietary intake of açaí, we studied the effect on lipid metabolism in the volunteers (23). After consumption of açaí pulp for four weeks, no changes were observed in the lipid profile, such as serum levels of cholesterol, triglycerides, LDL and HDL. However, we observed modifications on variables associated with lipid metabolism, evidenced by the increase Apo A-1 and activity of the enzyme paraoxonase, and decreased oxidized LDL. In addition, it was seen an increase of the transfer of cholesterol ester and phospholipids to the HDL fraction. Thus, açaí modified the capacity of the HDL molecule to receive lipids which is a beneficial physiological effect, once the increase in cholesterol influx facilitates the cholesterol withdraw by bile, reducing the accumulation of cholesterol in the arteries and preventing the evolution of atherosclerosis.

It is important to consider that the açaí used in our study is a fruit that has different nutrients: lipids, fiber, and also non-nutrients as flavonoids. Each compound is known to play roles in human health with effects on the prevention of CVD.

Flavonoids are bioactive compounds found in various fruits which can reduce the risk of developing CVD through various mechanisms. One of them is by an antioxidant activity having direct or indirect effects. They can neutralize the ROS directly, via the transfer of hydrogen atoms. Indirectly, it may participate in the activation of the antioxidant defense system and/or by the inhibition of oxidative enzymes that produces ROS (24,25). Another mechanism might be its effect on lipid metabolism through the prevention of hypercholesterolemia. Flavonoids promote the reduction of cholesterol absorption by interacting with carrier molecules on the brush border or by promoting an increase in the excretion of bile acids (26,27).

Açaí has a high fiber content, of which more than 30% is of the soluble type (28). The fibers are known to promote a lower intestinal absorption of cholesterol from the diet and, consequently, increase the release of this sterol through the chylomicrons (29). Dietary fiber has been shown to be responsible for the increased biliary excretion in rats, thereby reducing serum cholesterol and blocking the enterohepatic circulation preventing reuse of bile acids by the liver (30). In addition, the fibers seem to act indirectly in the expression of genes involved in the metabolism of hepatic cholesterol through secondary signals generated by the metabolites produced in the intestine during the fermentation, however this mechanism has not yet been fully elucidated (31).

The high content of lipids present in açaí can also be an ally in the prevention of CVD. The açaí has 60% of monounsaturated fatty acids (MUFAs) and smaller amount of polyunsaturated fatty acids (PUFAs), around 12% (18). The proposed mechanism to explain the hypocholesterolemic effect of unsaturated fatty acids refers to the ability of these fats to provide an increase in the expression and activity of the LDL receptors in the liver (32). In addition, PUFAs found in greater amounts in açaí can act as potent activators of the peroxisome proliferator-activated receptor family (PPARs) that regulate genes involved in lipid metabolism (33).

Therefore, we believe that the effects found in our work and reinforced by other studies that continue to be published (34–37), make açaí an important ally to human health. It is worth mentioning that the studies carried out by our group had as objective to evaluate a free-living context, without modifications in the diet or level of physical activity. As recommended by WHO/FAO, the ingestion of fruit and vegetables per day should be around 400g in order to prevent chronic non-communicable diseases (38). Açaí is a fruit, which can be added in daily life once that its consumption may be associated with health promotion.

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