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Review

Health benefits of the potato affected by domestic cooking: A review

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ABSTRACT

Potato (*Solanum tuberosum* L) is an important food crop worldwide and a good source of vitamins, minerals and dietary fiber as well as phytochemicals, which benefits human body as nutrients supplementary and antioxidants. However, cooked potato is also considered as a high-glycemic-index food because of its high content of rapidly digestible starch, long-term consumption of which will increase the risk of cardiovascular disease and type-2 diabetes. Domestic cooking (boiling, frying, steaming, etc.) are usually adopted before potato consumption. The chemical, physical and enzyme modifications that occur during cooking will alter the potato's antioxidant capacity and digestibility, which subsequently affected on the bioavailability of phytochemicals and the postprandial glycemic response of the human body. We reviewed the recent publications on the effects of domestic cooking on the nutrition, phytochemicals and the glycemic index changes of the cooked potato. Furthermore, the possible mechanisms underlying these changes were discussed, and additional implications and future research goals were suggested.

Contents

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1. Introduction

1.1. Beneficial and adverse effects of the potato

As a globally consumed food crop in qualities that follow only rice, wheat, and maize, potato (*Solanum tuberosum*) is not only an important supplier of carbohydrates in the human diet (Fig. 1a) (King & Slavin, 2013) but also a key supplier of nutrients in the diet, including minerals, protein, vitamins and others (Burlingame, Mouillé, & Charrondière, 2009; Love & Pavek, 2008). Additionally, phytochemicals are bioactive components in potatoes that should not be overlooked because high contents of phenolic acids, anthocyanins, and carotenoids has been reported in its peel and flesh (Ezekiel, Singh, Sharma, & Kaur, 2013). Extensive research has indicated that these phytochemicals are closely associated with antioxidants and play an essential role in the prevention of many chronic diseases, such as atherosclerosis and cancers (McGill, Kurilich, & Davignon, 2013; Williams et al., 2013). A recent study showed that due to the high daily consumption, potatoes contribute the third highest total phenolic content to the diet among fruits and vegetables, listed after only the orange and the apple (Fig. 1b) (Camire, Kubow, & Donnelly, 2009; Song et al., 2010).

Apart from the benefits, the adverse effects of the potato should be noted. Both in vitro and in vivo investigations of different potato cultivars have indicated that the cooked potato has the mostly rapidly digested starch, which will be absorbed quickly in the human body, resulting in high postprandial blood glucose levels (Soh & Brand-Miller, 1999). Over a long term period, this has been associated with increased risks of obesity and diet-related diseases, including type-2 diabetes and cardiovascular disease (Zaheer & Akhtar, 2014). In addition to the high glycemic index (GI), allergy-causing proteins and glycoalkaloids present in the potato are also deemed unfavorable to human health and have been reported to induce anaphylaxis, intestinal inflammation or nausea (Knuthsen, Jensen, Schmidt, & Larsen, 2009; Lynch et al., 2012; Seo, L'Hocine, & Karboune, 2014).

1.2. Modifications during domestic cooking

Prior to consumption, most dietary components are cooked using different methods according to the recipes and the culinary traditions of various countries. The application of heating during household cooking encompasses a variety of processes, i.e., boiling, frying, steaming, baking and roasting, in traditional and microwave ovens (Palermo, Pellegrini, & Fogliano, 2014). The biological, physical and chemical modifications that occur during cooking lead to sensory, nutritional and textural changes of food that may be beneficial or detrimental to human health. For example, cooking inactivates the microorganisms and anti-nutritional factors and enhances the digestibility of food and the bioavailability of nutrients. Additionally, cooking is involved in the formation of structural and desirable compounds, such as those that confer crispiness, flavor, antioxidants and coloring agents to the food. Domestic cooking also induces adverse effects, such as the loss of certain nutrients and the formation of undesired compounds (e.g., acrylamide or other toxic molecules) (VanBoekel et al., 2010). As the only major tuber food crop worldwide, most potatoes are consumed after cooking. The cooking methods are important factors affecting not only the chemical composition and physical structure of the potato but also the intake of bioactive compounds under normal dietary conditions. Thus, it may be interesting to analyze the changes that potatoes undergo during domestic cooking.

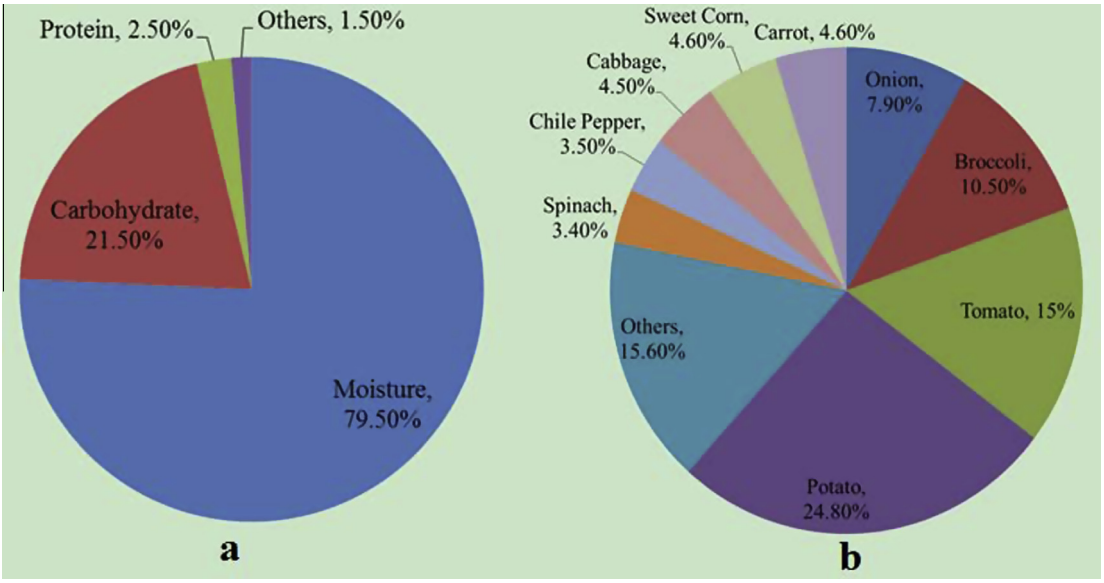

Fig. 1. (a) General composition of raw potatoes. Adopted from Burlingame et al. (2009); (b) Contribution of total phenolics from vegetables consumed by Americans. Adopted from Song et al. (2010).