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Effect of Boiling and Frying on the Total Carbohydrate, Vitamin C and Mineral Contents of Irish *(Solanun tuberosum)* and Sweet *(Ipomea batatas)* Potato Tubers

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ABSTRACT

In a study aimed at ascertaining whether boiling or frying best conserves nutrients; since the two methods are commonly adapted in Nigeria, the effect of boiling and frying on total carbohydrate, vitamin C and mineral contents of Irish *(Solanum tuberosum)* and sweet *(Ipomea batatas)* potato tubers were investigated. The determination of total carbohydrate was carried out using the phenol-sulphuric acid method and the spectrophotometric method was used to determine vitamin C content at 520 nm. The minerals evaluated are iron, zinc, magnesium, sodium, calcium and copper. These were determined by the atomic absorption spectrophotometric method. There was no significant difference ($p > 0.05$) in the total carbohydrate content of the boiled and fried sweet and Irish potatoes compared with their raw tubers. There was significant difference ($p < 0.05$) in the vitamin C content of the boiled and fried potato tubers. Boiling and frying of Irish potato resulted in a loss of 37.34 mg/100 ml (63.90%) and 30.44 mg/100 ml (53.90%) vitamin C respectively. Boiled sweet potato lost 51.16 mg/100 ml (72.37%) and fried lost 43.05 mg/100 ml (60.90%) of vitamin C. The mineral compositions of the boiled and fried Irish and sweet potatoes were significantly different ($p < 0.05$) from their raw tubers. Boiling retained more iron and copper while frying retained more zinc, magnesium, sodium and calcium in both Irish and sweet potato tubers. Boiling retained more carbohydrate while frying retained more vitamin C and minerals.

Keywords: Cooking, frying, total carbohydrate, vitamin C, mineral content, potato.

Introduction

Potato is a tuberous dicotyledonous crop grown all over the world because of the special role that it plays in human diet. It is a source of raw material for the cook, can be eaten as vegetable and is cheap and nutritious. Potatoes are sensitive to heavy frosts, which damage them in the ground. Even cold weather makes them more susceptible to bruising and possibly later rotting which can quickly ruin a large stored crop (Alison, 2008). Irish potato *(Solanum tuberosum)*, named after the Irish who were among the first to accept the potato, proved to be a source of protein, carbohydrates, minerals and vitamins *(*Hamilton *et al.*, 2004*)*. Irish potato can also be referred to as 'white potato'. It is probably one of the most common and an abundant form of this popular tuber and it is a major source of starch worldwide. Most markets stock Irish potatoes along with an assortment of other potato varieties. Like other tubers, the Irish potato keeps well when it is stored in cool, dry conditions, and as a result it is usually available all year round. When selecting Irish potatoes for eating, it is advisable to look for the tubers that do not have soft spots or slimy areas (Pawanexh, 2009).

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Sweet potato *(Ipomea batatas)* belongs to the family *Convolvulaceae*. It is an irregularly shaped oblong tuber that has sweet taste (Purseglove, 1991; Woolfe, 1992). The young leaves and shoots are sometimes eaten as greens.

Potatoes are used to brew alcoholic beverages such as vodka, potcheen or akavavit. They are also used as food for domestic animals. Potato starch is used in the food industry as thickener and binder of soups and sauces, in the textile industry as adhesive and for the manufacturing of papers and boards (Abidin, 2004; Verrill, 1973). They can be boiled, fried or grilled, steamed, braised, baked and roasted (Hampson, 1957). These different cooking methods vary in different countries. Potatoes are good sources of nutrients, such as carbohydrate, lipids, protein, vitamins and minerals. They are also rich in enzymes and acids.

Two most common ways of consuming potato in Nigeria are boiling in water and frying in refined vegetable oil or palm oil. These methods of processing potatoes for consumption make them palatable but also have adverse effects on the nutrients. Cooking can be detrimental to micronutrient but beneficial to macronutrient contents of food (Chukwu *et al*., 2010). Cooking of foods leads to the improvement of microbiological and organoleptic qualities, destroys toxins and antinutritional factors, increases digestibility and nutrients bioavailability (Erdman and Schneider, 1994). Unfortunately, these procedures cause the loss of some of the micronutrients (Yang and Gadi, 2008). Macronutrient such as carbohydrate though not thermo-sensitive is important in providing the body with energy and spare protein so that they concentrate on building, repairing and maintaining body tissues instead of being used up as energy sources. It is the only source of energy for the brain. Some carbohydrates are high in fibre, which help to lower the risk of certain diseases such as cancer, heart diseases and diabetes (Gordon, 1999). Micronutrient such as vitamin C though thermo-sensitive, is required for the growth and repair of tissues in the body, necessary to form collagen, aid iron absorption and essential for healing of wounds and for repair and maintenance of cartilage (Sweetman, 2007). Vitamin C functions as anti-oxidant and anti-allergic molecule and is a crucial factor in the eye's ability to deal with oxidative stress, and can delay the progression of advance age-related macula degeneration (AMD) and vision loss. It is also important in the stimulation of the immune system. Mineral elements do not furnish energy but their presence is necessary for the maintenance of certain physiochemical conditions, which are essential for life. Minerals are not destroyed in food preparation; however, they are soluble in water so that some loss will occur if cooking liquids are discarded (Fafunso and Bassir, 1977).

In an attempt to determine whether boiling or frying best retains nutrients since these two methods of food processing are the most common in preparing Nigerian delicacies, and coupled with the fact that there is paucity of information concerning how cooking methods affect minerals in food and also in view of the importance of these nutrients to human health, this work was initiated to evaluate the effect of boiling in water and frying in refined vegetable oil on total carbohydrate, vitamin C and mineral contents present in Irish and sweet potato tubers.

Materials and Methods

Collection and processing of tubers

Potato tubers were freshly purchased from Lusada market in Igbesa, Ogun State, Nigeria. The local varieties of Irish potato *(Solanum tuberosum)* and sweet potato *(Ipomea batatas)* freshly harvested were used and identified by a plant taxonomist in the Department of Biological Sciences, Crawford University, Igbesa, Ogun-State. The potato tubers were washed with clean water and allowed to dry at room temperature for 3 h, cooled and finally weighed using a triple beam balance. Boiling and frying were done using the Nigerian household methods. Ten grams of the raw Irish and sweet