Chapter

Nutritional Composition and Biochemical Properties of *Solanum tuberosum*

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Abstract

Solanum tuberosum is the most popular vegetable in people's diets all over the world, and it's considered a staple crop in many countries. It has immense potential to reduce food insecurity and prevent malnutrition in developing and developed countries because of its productivity, nutritional composition and unique biochemical features. However, a lack of information about the nutritional composition and biochemical properties of this tuber severely limits its use. Improved awareness of the biochemical and nutritional quality, utilization, and future economic importance of the crop has important implications for human food systems, nationally and internationally. This chapter presents a brief overview of key findings that led to our current knowledge of the biochemical and nutritional composition of the *Solanum tuberosum* tuber. The wide range of *Solanum tuberosum* varieties lays a great foundation for their industrial production and applications. The biochemical and nutritional composition of the *Solanum tuberosum* is summarized briefly.

Keywords: Antioxidants, Biochemical properties, Minerals, *Solanum tuberosum*, *Solanum tuberosum* nutrition

1. Introduction

Potato is in the 4th order with respect to production and area harvested after maize, wheat and rice, as a staple crop for human nutrition with a production of more than 368 million tonnes [1, 2]. This famous tuber is grown in 80 percent of the world's countries [3, 4]. This shows that *Solanum tuberosum* is one of the most productive crops in the world. Potato can produce more nutritious food on less land and in harsher climates than most other major crops. Furthermore, this tuber can be harvested after only 8 weeks [5]. There are numerous myths about the biochemical and nutritional value of *Solanum tuberosum*. *Solanum tuberosum* is a versatile, carbohydrate-rich food that is widely consumed and prepared in a variety of ways around the world. This tuber is typically regarded as a ritual food or a garnish for other major meal components, and it is consumed as a complementary vegetable with staple foods [6]. *Solanum tuberosum* is commonly thought to contribute insignificantly to the nutritive value of a meal. Even in areas where *Solanum tuberosum* is considered staple foods, they are typically viewed solely as a source of energy, with little awareness of their vitamin or protein content [6, 7].

Solanum tuberosum contains a variety of biochemical and nutritional properties, including starch, ascorbic acid, reducing sugars, non-reducing sugars, total sugars, phenolic content, flavonoids, polyamines, and carotenoids, all of which are highly desirable in the diet due to their beneficial effects on human health [8, 9]. The nutritional value of *Solanum tuberosum* tubers is primarily defined by the presence of essential amino acids, particularly lysine, as well as high levels of starch and dietary fiber and a low concentration of fats [10]. The chemical composition of *Solanum tuberosum* determines the quality of the processing and is influenced by a series of factors including the production area, crops, soil and the climate, farming practices, storage and marketing conditions [11]. *Solanum tuberosum* tubers with no or low-fat addition have high levels of bioactive compounds and antioxidants, such as phenolic acids, primarily chlorogenic acid, ascorbic acid, and flavonoids, which are phytochemicals [10]. Increased consumption of potato tubers may increase antioxidant levels in blood and tissues and protect against oxidative stress, which is responsible for lipid, protein, and enzyme damage [3]. One of the global health goals is to increase nutrient availability to a large portion of the world's population. A sensible approach to achieving this goal would be to boost the nutritional content of commonly consumed crops like *Solanum tuberosum* [5]. Furthermore, *Solanum tuberosum* have superior biochemical and nutritional properties and are amenable to development via breeding and biotechnology methods [5, 12]. However, a paucity of information regarding the biochemical and nutritional composition of the *Solanum tuberosum* greatly limits its exploitation. Improved awareness of the biochemical and nutritional quality, utilization, and future economic importance of the crop has important implications for human food systems, nationally and internationally.

2. Nutritional composition of *Solanum tuberosum*

Solanum tuberosum have been discovered to be an especially nutritious vegetable. Freshly harvested *Solanum tuberosum* tubers contain approximately 80% water and 20% dry matter. *Solanum tuberosum* is primarily composed of starch, but they also contain trace amounts of protein and alkaline salts. They are complex carbohydrate in the form of sugars that are virtually fat and cholesterol-free. Beta-carotene, vitamin C, A, B_1, B_2, B_6, and folic acid are among many vitamins found in *Solanum tuberosum*. It also contains trace amounts of protein, amino acids, and nicotinic acid [6]. However, there have been significant variations. Because many of the nutrients in *Solanum tuberosum* are found in their skin, eating them whole rather than peeled has been linked to more health benefits [12]. *Solanum tuberosum* is not only important food security crops, but they are also excellent candidates for commercial use [13]. Processing adds value to this tuber, extends their shelf life and convenience, reduces post-harvest losses and waste, and yields a diverse range of products for various applications. *Solanum tuberosum* tubers are eaten raw or processed into products such as French fries, crisps, and canned potatoes [14].

2.1 Carbohydrate

Solanum tuberosum carbohydrates can be divided into four types: starch, non-starch, polysaccharides, and sugars. Starch is present in the form of granules, which are composed of amylopectin and amylose in a fairly constant 3:1 ratio. Amylopectin is a large, ramified molecule with approximately 10^5 glucose residues. The amylose molecule is smaller, with approximately 5000 glucose residues. There are trace amounts of phosphorus in the amylopectin fraction, which is chemically combined with starch [3]. Because of the high starch content, manufacturing *Solanum tuberosum* starch is now economically feasible in developed countries. *Solanum tuberosum* starch is used in the manufacture of adhesives, textiles, food, and the production of derived substances such as alcohol and glucose. Unlike cereal starches, these starch gels set quickly and have a high pot-paste viscosity. Non-starch polysaccharides account for only a small proportion of tuber dry matter. Because of their role as dietary fiber, non-starch polysaccharides contribute to the nutritional value of *Solanum tuberosum*. The major sugars found in white potato are sucrose, fructose, and glucose, with traces of other minor sugars [6].

2.2 Fat

Solanum tuberosum fat content is low, ranging from 0.08 to 0.13 percent fresh weight basis. This range is too low to be nutritionally significant, but it contributes to *Solanum tuberosum* flavor, tuber cellular integrity and bruising resistance, and helps to reduce enzymic darkening in tuber flesh [15]. The lipids are more important because they are susceptible to enzymatic degradation and non-enzymatic auto-oxidation, which cause off flavor and rancidity in dehydrated and instant *Solanum tuberosum* products. Polyunsaturated linoleic and linolenic acids account for 75% of total fatty acids in lipids. These factors contribute to the development of both desirable flavor characteristics in cooked tubers and undesirable off flavors in processed products. During tuber processing, lipid-degrading enzymes rapidly convert polyunsaturated acids to free fatty acids and other compounds, and they are also extremely susceptible to auto-oxidation [6].

2.3 Crude protein

Solanum tuberosum contains approximately 2 to 3% protein content on a fresh weight basis [8], and is comparable to most other root and tuber staples, except for cassava, which has half this amount. On a dry basis, it is comparable to cereals, and on a cooked basis, it is comparable to boiled rice [6]. One advantage that *Solanum tuberosum* have over cereal staples is their high lysine content. It does, however, have lower concentrations of sulfur-containing amino acids (such as methionine and cystine/cysteine) than cereals. *Solanum tuberosum*, when combined with other foods, can supplement diets that are low in lysine, such as rice accompanying *Solanum tuberosum*, which provides a higher quality protein. Meals in some developing countries are frequently served with a combination of boiled tubers of *Solanum tuberosum* and rice or pasta. However, consumers in developed countries frequently mistakenly believe that such mixtures provide nothing more than large amounts of carbohydrate energy [3]. It has been proposed that *Solanum tuberosum* comparative advantage as a food in the tropics, on a unit weight basis, stems from its ability to supply high-quality protein.

Using the most recent figures for energy and protein requirements, it can be calculated that 100 g (one small tuber) of *Solanum tuberosum* can supply 7%, 6%, and 5% of daily energy, and 12%, 11%, and 10% of daily protein needs of children aged 1–2, 2–3, and 3–5 years, respectively. Adults, depending on body weight and gender, can get from 3–6% of their daily protein needs from 100 g of tuber [15]. Bekele and Haile [16] reported that the protein contents of improved *Solanum tuberosum* varieties were 1.65% to 3.28%. The results show that these contents were variety dependent.

2.4 Nitrogen

Solanum tuberosum is rarely eaten as the sole source of nitrogen and mixing potatoes with other foods has supplementary or synergistic effects. *Solanum tuberosum* is not a high-energy food, providing only about 80 kilocalories per 100 g, but it does provide high-quality protein. This is especially important in developing countries, where energy is more readily available than protein [3]. When compared to many other vegetable crops, the nitrogenous content of the *Solanum tuberosum* tuber has a high nutritional value. The distribution of nitrogen within the tuber is not uniform, with the skin having the highest concentration, followed by the cortex, and then rising again toward the pith. *Solanum tuberosum* tubers' total nitrogen content consists of the following elements: (a) soluble, coagulable (true) protein; (b) insoluble protein; and (c) soluble non-protein nitrogen, which is composed of free amino acids, the amides asparagine and glutamine, and small amounts of nitrate nitrogen and basic nitrogen compounds including nucleic acids and alkaloids [6]. The insoluble protein fraction is mostly found in the peel. It accounts for only about 4% of total nitrogen [15].

2.5 Fiber

The dietary fiber content of raw *Solanum tuberosum* ranges between one and two g per 100 g of fresh weight. Furthermore, some of the dietary fiber may be starch that is resistant to hydrolysis by the enzymes used to remove starch before determining dietary fiber [15]. This resistant starch is created by subjecting foods to heat or dehydration, which gives the starch molecules a more ordered structure and makes them less susceptible to enzymatic digestion. In comparison to other raw items, the fresh *Solanum tuberosum* has dietary fiber content similar to sweet potatoes, but slightly lower than other roots and tubers and much lower than most cereals and dried phaseolus beans, though potatoes and cereals are similar on a dry basis [3]. Dietary fiber determinations have primarily been done on raw foods rather than cooked foods. Boiled potato flesh has fiber content comparable to cooked white rice but significantly lower than boiled green plantains or boiled phaseolus beans. Consuming the entire tuber rather than just the flesh may increase dietary fiber intake [3].

2.6 Mineral

Minerals are an important part of a healthy diet. Because of its relatively high content of certain macro and trace minerals, *Solanum tuberosum*, as a major staple food crop, could play an important role in combating mineral deficiencies. Boiling thinly sliced *Solanum tuberosum* will result in a large reduction in mineral levels while boiling whole *Solanum tuberosum* or that have been cut into large pieces increases [17].

The presence of magnesium, potassium, iron, and zinc is notable in *Solanum tuberosum* [7]. Potassium is the most abundant mineral (320 mg/100 g raw), with a higher concentration in the skin and, as a result, a lower concentration in peeled *Solanum tuberosum* products [6]. *Solanum tuberosum* is a good source of a variety of dietary minerals. *Solanum tuberosum* is listed as providing 18% of the RDA for potassium, 6% for iron, phosphorus, and magnesium, and 2% for calcium and zinc. Most minerals are well retained in boiled *Solanum tuberosum* cooked with the skin. Baking *Solanum tuberosum* with the skin on is a good way to retain minerals. There are significant differences in major and trace mineral contents between *Solanum tuberosum* genotypes. Potassium levels varied the most, while manganese levels varied the least [6].

2.6.1 Potassium

Solanum tuberosum is a valuable source of potassium in the human diet. It contains a source of dietary potassium (42.73 dried matter), which plays an important role in acid–base regulation and fluid balance and is required for optimal functioning of the heart, kidneys, muscles, nerves, and digestive systems [17, 18]. Potassium levels in *Solanum tuberosum* are comparable to those found in most fruits and vegetables per unit weight, and because potatoes are typically consumed in larger quantities, they are an important and dependable food source of this nutrient [15].

2.6.2 Phosphorus

Aside from potassium, phosphorus is the most abundant mineral in *Solanum tuberosum* (3.54 g/kg dried matter) [18]. It plays numerous roles in the human body and is essential for healthy cells, teeth, and bones. Inadequate phosphorus intake results in abnormally low serum phosphate levels, which affect appetite loss, anemia, muscle weakness, bone pain, rickets osteomalacia, susceptibility to infection, numbness and tingling of the extremities, and difficulty walking [15].

2.6.3 Calcium

Solanum tuberosum is a good source of calcium, with a wide range being reported. Two studies found calcium levels as high as 130 mg/100 dry weight and 455 mg/kg. Resistance to pathogens is linked to high levels of tuber calcium. Calcium is important for bone and tooth structure, blood clotting, and nerve transmission [6].

2.6.4 Iron, zinc and copper

Iron is found in small amounts in potatoes. A study of cultivated varieties revealed 0.3–2.3 mg of Fe per 100 g. The iron content ranges between 6 and 158 μg/g dry weight [6]. Some *Solanum tuberosum* contain iron levels comparable to those found in some cereals (rice, maize, and wheat). *Solanum tuberosum* iron should be bioavailable because, unlike cereals, it contains very little phytic acid. *Solanum tuberosum* have significant differences in zinc content [19]. The zinc content varies between 1.8 and 10.2 ug/g fresh weight. *Solanum tuberosum* from different cultivars contain zinc in 0.5–4.6 ug/g fresh weight. Zinc is required for the proper functioning of the body's immune system and is involved in cell division, growth, and wound healing. The copper content of *Solanum tuberosum* ranges from 0.23 to 11.9 mg/kg fresh weight. Copper, like zinc, is abundant in yellow-fleshed *Solanum tuberosum* [19]. Copper is required for hemoglobin synthesis, iron metabolism, and blood vessel maintenance [6].

3. Biochemical properties of *Solanum tuberosum*

In addition to supplying energy, *Solanum tuberosum* contains biochemical ingredients such as phenolics, flavonoids, anthocyanins, carotenoids, folates, ascorbic acid and sugar [3, 12, 20]. Phenolics, anthocyanins, flavonoids and carotenoids are the major antioxidants found in *Solanum tuberosum* that are beneficial for human health [8].

3.1 Phenol content

Solanum tuberosum is an excellent source of these compounds. After apples and oranges, *Solanum tuberosum* was thought to be the third having the most important source of phenols [20]. Both the skin and flesh of *Solanum tuberosum* contain phenolic compounds, whereas, the concentration is greater in the skin than in the flesh. Purple and red-skinned tubers had twice the phenolic acid concentration as white-skinned tubers. The most important phenolic acids have been identified as chlorogenic acid, protocatechuic acid, vanillic acid, and p-coumaric acid. Even though, the peels of *Solanum tuberosum* tubers contain the most phenols they discarded as waste during potato processing [12]. Fresh *Solanum tuberosum* pulp and skin contain 30 to 900 mg/kg and 1000 to 4000 mg/kg, respectively. It was also reported that the concentration of phenolic acids in purple or red-fleshed cultivars was three to four times higher than in white-fleshed cultivars. White fleshed *Solanum tuberosum* varieties were found to have fewer phenolics (less than 4 mg/g dry weight) than purple-fleshed wild species (more than 5 to 6 mg/g dry weight) [3].

The total phenolics in eleven Indian *Solanum tuberosum* varieties were evaluated after 0, 30, 60 and 90 days of storage at room temperature, 15°C and 4°C. All 11 showed a variation among the varieties and were different with storage temperature; their levels fluctuated during storage but remained above the initial level until the last day of observation [21]. Cooking significantly affects the retention and availability of phenolic compounds [22]. The effect of three domestic methods of cooking (boiling, steaming, and microwaving) on total phenols, antioxidant and anticholinesterase activities were studied. All three modes of cooking cause a decrease in the total polyphenol contents, antioxidant and anticholinesterase activities [23]. Their results show that the polyphenols are lost to different degrees according to the method of cooking, the classification of the polyphenol contents places the microwave in the first position then comes the steam cooking and lastly the cooking in the water. Similar observations have been reported in which frying causes the greatest loss of total phenolic compounds, followed by baking, steaming, boiling, and microwaving [23]. Twelve *Solanum tuberosum* landrace clones collected from established cultivations on Chiloe Island and Valdivia were selected and the total phenolic content was evaluated. The total phenolic content varied in the peeled *Solanum tuberosum* samples from 191 to 1864 mg/100 g dry matter meanwhile these parameters varied from 345 to 2852 mg/100 g dry matter in unpeeled samples [24].

3.2 Flavonols and Anthocyanins

Although *Solanum tuberosum* contains flavonols such as rutin, they are not thought to be significant sources of dietary flavonols. Flavonol concentrations increased in fresh-cut tubers, reaching up to 14 mg/100 g, implying that because of the large number of potatoes consumed, they could be a valuable dietary source. Numerous studies have suggested that flavonols have a variety of health benefits, including a lower risk of heart disease and a lower risk of certain respiratory diseases such as asthma, bronchitis, and emphysema as well as a lower risk of certain cancers such as prostate and lung cancer [3, 7, 25].

Anthocyanins are a type of pigmented flavonoids. The composition of anthocyanins in pigmented *Solanum tuberosum* is complicated by acylation in the glycoside ring. The purple and red colors of *Solanum tuberosum* varieties are due to anthocyanin pigment [26]. *Solanum tuberosum* anthocyanins have recently been recognized for their health benefits, as they have been shown to have strong antioxidative activity, anti-influenza virus activity, and anti-stomach cancer activity [27]. Flavonoids such as anthocyanins were found in high concentrations in pigmented flesh *Solanum tuberosum*, ranging from 5.5 to 35 mg/100 g fresh weight in tubers. Purple or red-fleshed *Solanum tuberosum* varieties had two times the flavonoid concentration than that of white-fleshed varieties and their concentration was significantly higher in the skin, impending 900 mg in purple-fleshed and 500 mg in red-fleshed types per 100 g fresh weight [12]. Anthocyanin pigments are found in the periderm of the tuber and impart various colors to their skin, with purple being the most common. As pigmented *Solanum tuberosum* is low-cost crops that are also a good source of antioxidant micronutrients, it could be a good source of natural anthocyanin pigments. Purple fleshed *Solanum tuberosum* had higher levels of anthocyanins than red-fleshed potatoes [28]. The extracts of flavonoids and flavones had high scavenging activities against oxygen free radicals. *Solanum tuberosum* exhibited 94 percent hydroxyl radical scavenging activity and nearly complete inhibition of superoxide radicals in the presence of anions [28]. Various biotechnological and transgenic approaches have demonstrated that it is possible to significantly increase the phenolic, anthocyanin, and flavonoid content of *Solanum tuberosum* tubers [28].

3.3 Carotenoids

Carotenoids are useful as food ingredients because they can replace synthetic pigments while also benefiting human health due to their provitamin content [29]. Carotenoids and other lipophilic compounds found in *Solanum tuberosum* tuber are also beneficial to one's diet. Carotenoids are synthesized in plastids from isoprenoids, and one of their functions is to protect against photo and oxidative stress [30]. Carotenoid concentrations in *Solanum tuberosum* germplasm have been reported to vary over a 20-fold range, with much of the variation controlled at the transcriptional level [27]. The major carotenoids found in *Solanum tuberosum* are lutein, violaxanthin, zeaxanthin, and neoxanthin, with trace amounts of -carotene. Zeaxanthin and lutein are responsible for the orange and yellow flesh colors of the tuber. White fleshed *Solanum tuberosum* varieties contained fewer carotenoids than yellow or orange-fleshed ones. Total carotenoids content in white and yellow-fleshed *Solanum tuberosum* varieties was reported to be in the range of 50–350 g/100 g fresh weight and 800–2000 g/100 g fresh weight, respectively [31]. Carotenoid levels in potato tubers vary greatly, with levels in yellow-fleshed cultivars being 20 times higher than levels in white-fleshed varieties [32]. Valcarcel *et al.* [33] reported that higher levels of total carotenoids in the skin of *Solanum tuberosum* tubers, with variety 'Burren' showing maxima values of 28 and 9 mg kg/dry weight in skin and flesh, respectively. They observed that yellow-skinned or fleshed varieties had higher contents than those with paler or white tissues, with no relationship found for other colors.

Solanum tuberosum have low basal carotenoid levels when compared to most fruits and vegetables [34]. For example, the maximum total carotenoid content of a *Solanum tuberosum* tuber is 20 mg/kg fresh weight, whereas the maximum carotenoid content of brussel sprouts is 1100 mg/kg fresh weight and carrots is 14000 mg/kg fresh weight. Despite the relatively low level of carotenoids in *Solanum tuberosum* tubers, the content of carotenoids in potato tubers is of dietary significance because *Solanum tuberosum* is a staple part of the diet.

3.4 Glycoalkaloids

Solanum tuberosum produce glycoalkaloids during germination, which protect the tuber from pathogens, insects, parasites, and predators [35]. The primary glycoalkaloids found in domestic *Solanum tuberosum* are -chaconine and -solanine, which is concentrated in the outer layers of the *Solanum tuberosum* skins (i.e., the periderm, cortex, and outer phloem). Glycoalkaloid levels in different *Solanum tuberosum* varieties can vary greatly and may be influenced postharvest by environmental factors such as light mechanical injury and storage [35]. Small *Solanum tuberosum* also have higher glycoalkaloids levels (per unit weight) than larger ones.

Plant secondary metabolites known as glycoalkaloids are toxic to microorganisms, viruses, insects, animals, and humans. The saccharide moiety of these compounds differs structurally in that solanine contains the trisaccharide solatriose, whereas chaconine has the aglycone attached to chacotriose [36]. The glycoalkaloid content of *Solanum tuberosum* tubers varies greatly and is influenced by post-harvest factors such as light exposure, irradiation, mechanical injury, and storage conditions. *Solanum tuberosum* peels are a rich source of steroidal alkaloids, which are well known for their toxicity in high concentrations for human consumption (>1 mg/g dry weight sample).

3.5 Folates

Potato is a well-known significant source of folates in the diet due to its high consumption level rather than its endogenous content. The folate concentrations in mature raw *Solanum tuberosum* range from 12 to 37 g/l00 g fresh weight [37].

3.6 Ascorbic acid

Ascorbic acid is a strong reducing agent in plant metabolism, it improves the absorption and internal transport of dietary iron and zinc from other plant sources. *Solanum tuberosum* tubers have been reported to contain up to 46 mg of ascorbic acid per 100 g tuber on a fresh weight basis, and their availability is dependent on the variety, maturity status, and environmental conditions under which the crop is grown [12]. The concentration of ascorbic acid in freshly harvested peeled raw tubers ranged from 22.2 to 121.4 mg/100 g on a dry weight basis and from 6.5 to 36.9 mg/100 g on a fresh weight basis and decreased with storage period in tubers of all varieties [12]. A British study measured vitamin C levels in 33 varieties grown in three different locations across Europe [38]. The vitamin C content ranged from 13 to 30.8 mg per 100 g fresh weight. Numerous studies have shown that vitamin C levels in potatoes decrease rapidly during cold storage, with losses approaching 60% [12, 38].

Valcarcel *et al.* [33] measured the L-ascorbic acid content in 60 varieties of *Solanum tuberosum* grown in Ireland and reported the highest content of 800 mg/kg on a dry basis. They observed significant differences in L-ascorbic acid content across years and sites. The vitamin C content of eleven Indian *Solanum tuberosum* varieties was observed to be in the range from 0.0828 to 0.2416 mg/g fresh weight and these concentrations were variety and storage temperature dependent [21].

3.7 Sugars

The sugar level in *Solanum tuberosum* during suberization and harvest is heavily influenced by the variety. Low sugar content is a desirable trait for processing. Sucrose content at harvest is an indicator of the tuber's chemical maturity [12]. The higher sucrose levels in *Solanum tuberosum* tubers at harvest indicate immaturity. The sucrose content at harvest is critical because invertase hydrolysis results in the accumulation of reducing sugars, rendering *Solanum tuberosum* unfit for processing [12]. An increase in total sugars or a specific sugar and dry matter is a heritable trait, but it is also influenced by a variety of environmental factors. The sugar content of *Solanum tuberosum* during tuberization and harvest is heavily influenced by the variety. The quantity and type of sugars in a specific cultivar are inherited characteristics [12]. Since *Solanum tuberosum* increased its ability to produce sucrose as the storage period increased, more than 65 percent of the maximum sucrose accumulation occurred within 5 days of storage. According to Zhitian [39], the sucrose concentration in

Solanum tuberosum increased early in storage and then remained constant. At relatively higher temperatures (25-30°C), *Solanum tuberosum* storage in ordinary rooms, traditional heaps, and so on showed very little increase in reducing sugars. Freshly harvested mature tubers of a few Indian *Solanum tuberosum* varieties have a low level of reducing sugars. The concentration of glucose increased early in storage and then remained constant [39].

4. Conclusion

Solanum tuberosum is a staple food crop providing basic nutrition to millions of people globally. It provides numerous compounds of high nutritional value including protein, carbohydrates, minerals, carotenoids, dietary fiber, vitamins, very little fat, and sodium and other bioactive compounds. The nutrient composition of potato tubers varies greatly according to genetic and environmental factors. As a result, the nutrient content of *Solanum tuberosum* should be considered during variety screening, demonstration, and growing *Solanum tuberosum* with the climate. Phenolics, anthocyanins, flavonoids and carotenoids are the major antioxidants found in *Solanum tuberosum* that are beneficial for human health.

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Conflict of interest

The authors declare no conflict of interest.

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