



Postharvest Handling of Potato (*Solanum Tuberosum*) in Indonesia: A Review

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Abstract. Potato (*Solanum tuberosum*) is a horticulture product containing a carbohydrate complex. This review aims to understand the potatoes characteristics, quality measurement, postharvest handling, and extended shelf life Potatoes contain carbohydrate content that reaches about 18%, 2.4% protein, and 0.1% fat. The total energy gained from 100 g of potatoes is about 80 kcal. Potatoes have characteristics such as very easy experiencing damage during harvesting, storage, and distribution. Damage in potatoes relates to temperature, lighting, and microbiological breakdown. This study aims to deliver a better knowledge of potato's quality characteristics and how to measure its quality by observing the skin color, shape, and skin condition, as well as weighing the skin to know the level of potato maturation. Potatoes handling is well explained to extend the shelf life by using heating and cooling treatment before processing it into potato flour. In addition, this potato flour retains its carbohydrates, B vitamins, vitamin C and a little vitamin A, as well as a source of minerals (phosphorus, iron, and potassium) that has a further potential utilization as thickener, binder, former, and non-stick agent.

Keywords: Postharvest handling · Potatoes · Solanine

1 Introduction

Potato (*Solanum tuberosum*) is one of the most popular vegetables planted in Indonesia. Food composition complements the consumption of potatoes as vegetables for plant food. In general, the number of potatoes in the industrial world increases yearly. Based on the survey conducted on Pangalengan farmers, the needs of Pangalengan and Garut potato supply potatoes to the processing industry as much as 1000 tons per month, while national consumption is as much as 1400 tons per year [1]. The potato very quickly experienced damage during harvesting, storage, and distribution. Storage handling is affected by environmental conditions, especially temperature, which is the most common condition to experience damage. According to [2], damage in potatoes relates to temperature and lighting. In addition, chemical damage effect the drop composition chemical, while microbiological damage affects the attack-related pests and diseases by physics and chemistry of tuber potato. The changes in potato nutrition at room temperature storage

Table 1. Classification of potatoes by weight

Class	Requirement
AL	>200 g/tuber
A	120–200 g/tuber
B	80–120 g/tuber
C	50–80 g/tuber

could experience more drop of starch content than sugar content due to the experience of respiration remodel from potato starch. This review aims to understand the potatoes characteristics, quality measurement, postharvest handling, and extended shelf life. Good potato handling will result in good quality of the derivative product.

2 Potatoes Characteristics

Potatoes have more starch low from sweet potatoes and cassava. The amylopectin ratio in potato flour is higher than in other tubers [3]. The amylopectin caused the flour could not to swell due to the low water absorption ability. This characteristic gives potato flour good stability [2]. Potato crops can be harvested after 3–4 months of age depending on the variety [4]. Based on [5], potato tubers harvested at the mature stage will have a higher nutrition content. Potato Granola varieties harvested at 100 days have more starch content than tubers Potatoes harvested at 90 days. Based on the dry weight, potato protein content is similar to cereals and very high compared with roots and tubers. The physical measurement of potatoes could represent potatoes' shape, width, length, and moisture content. The chemical quality of potatoes covers the starch content, protein, and mineral elements [6]. Furthermore, the qualitative parameters of potatoes were the skin color, pulp, tubers shape, color, and depth of eyes [7]. Potato is categorized as mature if there is no peeling off the skin and the proportion of potato skin is no more than 5% of the total potato's weight. Based on the Indonesian National Standard (SNI 01–3175-1992 of fresh potatoes), the uniformity of skin potato is yellow or red, meat white, yellow, white, brass or yellow whitish. The shape of a potato is round, oval, round oval or oval round. The definition of potato tubers according to their shape is divided into small tubers that are between 2–70 g in size. Tubers that weigh above 71 g belong to large tubers. Judging from the size of the tubers, they are classified according to their diameter (small < 40mm, medium 41-60mm, large > 61mm). Qualitative parameters including skin color, pulp color, tuber shape, color and eye depth are also noted [8]. Potatoes divides the grading/classification tubers potato based on its weight [9].

Specifically, potato tuber also has solanine compounds due to secondary metabolism. Solanine is the glycoalkaloid group that acts as an inhibitor of acetylcholinesterase enzyme (as neutralizer received stimuli) and butyrylcholinesterase, which works to operate by maximum muscles, glands, and nerves in humans. According to [10], solanine is generally found in potatoes with species *Solanum dulcamara* L, *Solanum nigrum* L, and *Solanum tuberosum* L. Solanine in potatoes is known as much as 3–6 mg/100g.

The effect of solanine compound, if consumed in considerable amounts, could result in nerve stop as a consequence of choline enzyme inhibition, so that could not catalyze neurotransmitter acetylcholine hydrolysis reaction at synapses in the system nerve center. Solanine in potatoes could cause nausea, vomiting, vertigo, cramps, dyspnea, gastroenteritis, tachycardia, and diarrhea. However, the solanine compound in potato plants is a poisonous substance as a defense mechanism against insects and diseases. Solanine in potatoes can be found in leaves, stems, tubers, and shoots. However, the highest solanine on the skin tubers of potatoes is about 30% to 80%, with high activity metabolism. In order to increase the product development potency of potatoes, solanine needs to be removed before processing. Solanine in potatoes could be removed if potato tubers expose to sunlight. Potatoes containing green solanine, where the skin color is green, will experience ingredients change and change into yellow through the drying process. Furthermore, storing potatoes in a cold or moist place reduces solanine content.

3 Postharvest Handling of Potatoes

According to [11], postharvest handling of potatoes consists of harvesting, sorting, cleaning/washing, grading, packaging, storage, transportation, and marketing. In order to prevent the potato during storage from mechanical damage, potatoes were packed into wooden boxes equipped with waring and efficiently organized in neat with humidity the air around 65–76%. The sorting process in potato handling with used to eliminate the physical impurities. Sorting is conducted by separating good tubers and healthy potatoes in good shape, with no defects, and disease free. Washing with water works as *pre-cooling*, resolving product heat release during harvesting and making the potatoes free from dirt, pests, and diseases. Grading is done to get potatoes with excellent and uniform quality in the same grade under a quality standard that has been set or consumers' needs. The transportation carried out through the field must use a pedestal like straw, palm leaves, and cardboard. While transportation carried out through water uses a plastic mat more formerly [12].

According to [4], the best time for harvesting potatoes is bright weather in the morning with harvesting procedures, namely dismantling the mounds using a hoe, dismantling from the side of the mounds, collecting and separating the rotten tubers and putting the good ones in a good container. Potato tubers can be stored safely for 12 weeks at 18 °C without sprouting if dipped in hot water (57.5 °C) for 20–30 min. Vacuum packaging with low-temperature modified atmosphere packaging has proven to increase potato shelf life, defend firmness tubers, and reduce sugar content and color. The hot water pretreatment shows less decay and shrinkage than untreated tubers [13]. According to [12], storage of low-temperature or cold potatoes could extend their shelf life, maintain their quality, and minimize shrinkage. Rice husk charcoal, sawdust, banana leaves, and fresh gamal leaves are unharmed media from extending the potato's shelf life during storage. Rice husk charcoal and sawdust can maintain the moisture level in storage because they have many pores and can hinder the high respiration rate. Banana leaves have lignin content, polysaccharides, and protein wall cell that are hard to penetrate and digested by pests and diseases. Gamal leaf is a suitable medium for the growth of endophyte mold that increases the resistance to attack by yellow cyst nematode (*Globodera rostochiensis*)

[15]. Physical damage to potatoes may relate to temperature and lighting. The increased levels of solanine and chaconine also occurred in tubers exposed to the light. According to [10], technology for hindering damage to potato tubers by controlling the storage environment, such as temperature, humidity, intensity irradiation, and irradiation.

During storage metabolic processes continue to run. One of the metabolic processes that occur in potato tubers during storage is the process of respiration. Respiration is the process of breaking down plant food reserves to produce energy. Product respiration rate is influenced by several factors, one of which is external factors. External factors that affect the rate of respiration include temperature, ethylene, O₂, and CO₂ gas.

The presence of O₂ during storage must be considered, this is because it can affect the rate of respiration. Storage in open containers will take longer to interact with the air than storage in closed containers. The higher the respiration rate of the storage product, the lower the quality of potato tubers along with the length of storage [17].

4 Potato Utilization

The utilization of potato flour has become something new that is used as a raw ingredient in cookie making. Cookies are a typical food that almost all age groups like it. The average consumption of cookies in Indonesia is 0.40 kg/capita/year. Using flour potato as cookies' raw ingredient aims to create snack products to substitute wheat flour. Potatoes flour is also used in yeast filtering and as additives in cosmetics and industrial pharmacies. Potato flour may contain carbohydrates, vitamin B, vitamin C, and a small amount of vitamin A, as well as a source of minerals (phosphorus, iron, and potassium) that are useful for the body. Potatoes flour helps reduce pain in heart health guard, launch defecate, overcome inflammation and eyes fatigue, and relieve pain in joints and bones [13].

Potato (*Solanum tuberosum*) is one type of horticultural plant that can be consumed by its tubers. Currently, the utilization of potatoes has become more widespread. Apart from being used as food, potatoes are also used as industrial raw materials, feed and potentially for biopharmaceuticals. Therefore, potato plants have good prospects if they are developed in Indonesia. The high nutritional value contained in potatoes causes potatoes to be consumed a lot so that they are widely cultivated and the planting area is wider. Potatoes are one of the foodstuffs that contain complex carbohydrates, so they are often used as a substitute for rice [6].

5 Conclusion

Potatoes have characteristics easy experience damage physically and chemically affected by environmental conditions, chemical composition, and microbiology that can reduce potato nutrition. Test potatoes' quality could be measured by observing the skin color, shape, and skin condition as well as skin weighing to know the potato age. The heating and cooling method with the moist condition is a proper harvest for producing tubers potato with low solanine content. The potato storage is conducted by controlling the temperature, humidity, irradiation intensity, and irradiation. Besides that, the potato could be processed into flour to extend its shelf life.

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