Original Scientific Paper

PHYTOCHEMICAL SCREENING AND SPECTROPHOTOMETRIC DETERMINATION OF TOTAL POLYPHENOLS IN POTATOES

Maja Sencheva Petrevska[1]*, Mirjana S. Jankulovska[2], Milena Jankulovska Petkovska[3], Igor Jordanov[1], Vesna Dimova[1]

[1]Ss. Cyril and Methodius University in Skopje, Faculty of Technology and Metallurgy, Skopje, North Macedonia
[2]Ss. Cyril and Methodius University in Skopje, Faculty of Agricultural Sciences and Food - Skopje, North Macedonia
[3]University St. Kliment Ohridski, Faculty of Veterinary Medicine, Bitola, North Macedonia
*Corresponding author: majasencevap@tmf.ukim.edu.mk

ABSTRACT
Potato (Solanum tuberosum L.) is an important food crop recognized not only for its nutritional value but also for its content of bioactive compounds with potential health benefits. This study aimed to evaluate the phytochemical composition and total polyphenolic content (TPC) in potato core and peel extracts. Samples were subjected to drying, followed by ultrasonic extraction using 80% methanol. Qualitative phytochemical screening was performed to identify major classes of bioactive compounds, while TPC was determined using the Folin-Ciocâlteu method. The results revealed variability in phytochemical composition depending on the sample type and drying conditions. Terpenoids, saponins, tannins, and glycosides were detected in most samples, while flavonoids and phenolic compounds were not identified using qualitative assays, likely due to low concentrations or degradation during processing. A strong linear relationship was obtained for the calibration curve (R^2 = 0.9994), confirming the reliability of the method. Quantitative analysis showed significantly higher TPC in potato peel (1.67 mg GAE/100 g) compared to the core (1.02 mg GAE/100 g), highlighting the peel as a richer source of phenolic compounds. These findings emphasize the potential of potato by-products as valuable sources of natural antioxidants for applications in functional foods and sustainable food systems.

Keywords: potatoes, *Solanum tuberosum L.*, total phenolic content (TPC), phytochemical screening.

INTRODUCTION

Potato (*Solanum tuberosum L.*) belongs to family Solanaceae and the genus Solanum. Globally is the fourth most widely cultivated and consumed crop, after rice, wheat and maize (corn), because of its great yield production and high nutritive value. The prise of wheat and rise in the world is continuous rising all the time. The reason of high price was the high cost of bio and fossil fuels. In production of potatoes are used almost half amount of fuel that in wheat production. That's very important for poor developing countries to produce a product as dietary source of energy (Sandilya et al., 2023). According to The Food and Agriculture Organization of the United Nations (FAO), the potato is a very significant crop because of high nutritional value of its tubers and the capacity to produce substantial dry matter per unit area. This crop is cultivated in over 160 countries, with widely varying yields and consumption patterns (Zarzecka et al., 2026). Over the past half century, the global potato industry has changed dramatically. The largest potato producer in the world is China, that processes around 15% of its total potato output, India such as second-largest producer processes only about 7%. Otherwise, developed countries such as Canada, the United States, France, Belgium, Germany and Netherlands are processing much more with automation and advanced technologies and very efficient quality-control systems (Hu et al., 2025). It is used as vegetables for manufacturing starch, alcoholic beverages and for some processed products such as chips, French fries. The basic nutrients of potato are carbohydrates, vitamins and minerals, dietary fiber and a little amount of protein. That's why potatoes have a better nutritional quality than cereals. Also, colored potatoes provide essential nutrient antioxidants, such as vitamins, β-carotene, polyphenols, and minerals. This type of potato plays an important role in the production of antioxidants for defense systems (Sandilya et al., 2023).

Widespread consumption of potato is attributed to its adaptability to diverse agroecological conditions, relatively low production cost, and high yield potential. Recent literature highlights that global demand for potatoes continues to increase due to population growth and changing dietary patterns. Nowadays, a growing trend in food and medical areas is to maximize the benefits of potato and discovery a new high-value products, avoiding unfavourable properties of the potato. Analysing the conditions that influence changes in the main functional components of potatoes it can be useful for developing fiber-rich products to supply dietary fiber intake, for preparing starchy foods for special groups of people, also for manufacturing specific design films/coatings in the packaging industry and extracting a different bioactive components such as antioxidants, proteins and potato protease inhibitors with high biological activity (Xu et al., 2023).

The nutritional composition of potatoes is mainly of water (around 75-80%) and carbohydrates, primarily starch, such as their main energy source. Although they are often considered carbohydrate-rich, potatoes also contain notable amounts of vitamins (vitamin C and B-complex vitamins), minerals (K, Mg, P) (Khalid et al., 2020). Moreover, although potatoes contain relatively small amounts of protein, these proteins have a high biological value due to their well-balanced amino acid composition. This enhances the nutritional importance of potatoes, particularly in plant-based diets. Recent studies also highlight that resistant starch in potatoes supports gut health by serving as a fermentable substrate for intestinal microbiota, leading to the production of beneficial short-chain fatty acids (Zaheer et al., 2016). It is worrying that the potatoes contain some antinutrients such as glycoalkaloids, phytic acid, protease inhibitors, lectins and calcium oxalate which can interfere with nutrient absorption and digestion. The amount of these anti-nutrients depends on environmental conditions, genetic factors, post-harvest handling of potatoes etc. High concentrations of anti-nutrients may pose health risks, especially for individuals affected by kidney disorders, gastrointestinal sensitivities, or nutrient deficiencies (Mredul et al., 2025).

The fleshes of all types of potatoes are a rich source of bioactive compounds, including phenolic acids, flavonoids, carotenoids and glycoalkaloids. The most extensively studied are the phenolic compounds due to their strong antioxidant properties. The predominant phenomenon in potatoes is Chlorogenic acid, which contains a large proportion of total phenolics. Other significant compounds are ferulic acid, caffeic acid and flavonoids such as quercetin and anthocyanins. Chlorogenic acid and anthocyanins are present in potato skin in the form of phenolic acids. These compounds promote a lot of health benefits, such as antimicrobial, anti-inflammatory and anticancer activities (Raigond et al., 2023).

The chemical composition and nutritional quality of potatoes are significantly affected by various factors, including genotype (variety), environmental conditions, the interaction between them, stage of maturity and agricultural practices. Post-harvest handling and processing methods significantly influence the retention of nutrients and bioactive compounds in potatoes. Thermal treatments, including boiling, frying, and baking, may result in the degradation or alteration of phenolic compounds and vitamins. Furthermore, peeling can remove a considerable proportion of bioactive compounds, as they are largely concentrated in the potato skin (Affleck et al., 2008). Because of increasing annual consumption of potatoes, the food industry is producing a variety of products, such as chips, French fries, frozen or mashed potatoes. As a result, substantial quantities of potato peel (PP) are generated, representing nearly 10% of total waste and between 15% and 40% of the tuber, depending on the peeling method used. In recent years, food waste and by-products, particularly peels, have been studied. Even though, potato peel is traditionally used for producing a low value of biogas, animal feed and fertilizer, the most important component-phenolic compounds and dietary fibres were wasted (Jimenez-Champi et al., 2023). Furthermore, the potential of potato by-products as a source of protein represents a promising opportunity to develop innovative methods and technologies for their extraction, enhancement, and incorporation into diverse food products (Dong et al., 2024).

Potato by-products are increasingly being explored as functional food ingredients and natural antioxidants and antimicrobial in the food industry. Potato peel (PP) extracts have been utilized across various sectors, including food, pharmaceuticals, healthcare, biotechnology, animal feed, and renewable energy. These industries aim to identify effective ways to exploit the bioactive compounds present in potato peels to generate products with significant economic and sustainability benefits. However, the development of industrial processes for the utilization of this waste remains time-consuming and requires considerable investment. Studies indicate that potato peels may contain higher concentrations of phenolic compounds than edible flesh, making them a valuable resource for developing nutraceuticals and functional foods (Jimenez-Champi et al., 2023). Besides the basic nutritional composition, the potato possesses various health-promoting properties. Bioactive compounds in potatoes have antihypertensive (high potassium and low sodium levels), anti-diabetic, anti-obesity, antioxidant, cytotoxic, anti-inflammatory and anti-tumor effects. As a result, potatoes are increasingly recognized as a functional food with promising applications in preventive nutrition and health promotion, as well as in the development of sustainable food systems (Kumar et al., 2024).

The determination of total phenolic content (TPC) in potato (*Solanum tuberosum* L.) has received significant attention due to the well-established role of phenolic compounds in antioxidant activity and human health. Phenolic compounds, particularly chlorogenic acid and its derivatives, constitute the predominant class of bioactive substances in potatoes and are closely linked to their antioxidant capacity and functional food properties. The most widely applied method for the quantification of total phenolics in potatoes is the Folin-Ciocâlteu spectrophotometric assay. Recent studies indicate that extraction conditions (solvent composition, temperature, and time) significantly influence the measured TPC in potatoes (expressed as gallic acid equivalents (GAE) (Saini et al., 2023).

The main objective of this study was to investigate the phytochemical profile and determine the total polyphenolic content in potato (*Solanum tuberosum* L.) core and peel extracts, with particular emphasis on the influence of sample preparation and drying conditions. Additionally, the study aimed to evaluate the effectiveness of ultrasonic extraction and the Folin-Ciocâlteu method for reliable quantification of polyphenols, as well as to assess the potential of potato peel as a low-cost and sustainable source of bioactive compounds with antioxidant properties for future applications in food, nutraceutical, and industrial sectors.

MATERIALS AND METHODS

Preparation of Raw Material

The potatoes (*Solanum tuberosum* L.) were purchased from a local market in Skopje (Fig. 1a). First all visible mechanical impurities were removed from the surface of the potatoes.

The samples were thoroughly washed with distilled water and allowed to dry at room temperature. After drying, the potatoes were weighed for yield determination and manually peeled (Fig. 1b). The peels and the inner edible portion (core) were weighed separately. The potato core was cut into thin layers and dried together with the peels in a laboratory oven at 60 °C to constant weight. After drying, the samples were weighed and grounded to obtain a fine powder.

Figure 1. a) Fresh potato (*Solanum tuberosum* L.) and b) peeled potato: core and peel

Ultrasonic Extraction

Extraction of bioactive compounds from the potato samples (core and peel) was performed using 80% methanol. 5 g core/peel and 100 mL solvent were placed in flask, and the extraction process was carried out in an ultrasonic bath (28 KHz) at room temperature for 30 minutes. The extraction procedure was performed in triplicate to ensure the reliability and reproducibility of the results. After extraction, the samples were filtered at ambient condition for removal of peel particles. The obtained extracts were used for further phytochemical analysis and total polyphenols determination.

Phytochemical Screening

Due to the presence of various phytochemicals in potatoes, which contribute to their defense against microbial infections, specific qualitative tests were performed to identify major classes of bioactive compounds. The phytochemical screening included identification of flavonoids, steroids, terpenoids, saponins, phenolic compounds, tannins, alkaloids and glycosides (Sbhatu et al., 2020).

Identification of Flavonoids: An aliquot (1 mL) of the extract was transferred into a test tube. A few drops of 20% NaOH solution were added, resulting in the formation of a yellow coloration. Subsequently, a few drops of 1% HCl were added. Disappearance of the yellow color indicated the presence of flavonoids.

Identification of Steroids: An aliquot (0.5 mL) of the extract was mixed with 5 mL of chloroform. Carefully, 5 mL of concentrated $H_2SO_4$was added along the side of the test tube to form a separate layer. The appearance of a red coloration in the upper layer and yellow coloration with green fluorescence in the acid layer indicated the presence of steroids.

Identification of Terpenoids: One milliliter extract was mixed with chloroform, followed by careful addition of concentrated H_2SO_4 to form a layer. A reddish-brown coloration at the interface indicated the presence of terpenoids.

Identification of Saponins: One milliliter of extract was diluted with 4 mL of distilled water and vigorously shaken. A few drops of olive oil were added, and the mixture was shaken again. The formation of stable foam indicated the presence of saponins.

Identification of Phenolic Compounds: One milliliter of extract was diluted with 5 mL of distilled water, followed by the addition of a few drops of 5% $FeCl_3$ solution. The formation of blue coloration indicated the presence of phenolic compounds.

Identification of Tannins: One milliliter of extract was treated with a few drops of 1% $FeCl_3$ solution. The appearance of a green coloration confirmed the presence of tannins.

Identification of Alkaloids: One milliliter extract was acidified with a few drops of 1% HCl, followed by the addition of Wagner's reagent. The formation of a reddish-brown precipitate indicated the presence of alkaloids.

Identification of Glycosides: An aliquot (0.5 mL) of extract was mixed with 2 mL of glacial acetic acid containing a trace of $FeCl_3$. The mixture was cooled, and 1 mL of concentrated H_2SO_4 was carefully added. The formation of a brown ring at the interface, along with a bluish-green coloration in the upper layer, indicated the presence of glycosides.

Preparation of standard solutions

A known amount of gallic acid (99.15%) was measured for the preparation of the stock solution. This solution was prepared in a 10 mL volumetric flask in pure methanol (CH_3OH, 99.8%) as a solvent and mixed with an ultrasonic bath for 15 minutes. The mass concentration of gallic acid in the stock solution was 0.9122 mg/mL. Standard working solutions were prepared with dilution from the stock solution. These solutions were prepared in 10 mL measuring flasks with 80% methanol. In each of the flasks a certain volume of the stock solution was placed (50, 100, 150, 200, 250, 300, 400, 500, 600, 700 and 800 µm). All standard solutions were stored in the refrigerator (4 °C). They were stable during the period of analysis.

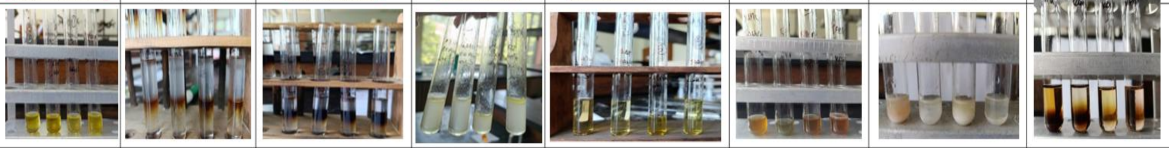
Folin-Ciocâlteu method for TPC determination

The Folin-Ciocâlteu method is based on a colorimetric reaction of the Folin-Ciocâlteu reagent with certain polyphenolic compounds **(**Stojchevska et al., 2022). To determine the content of total polyphenols, a diluted Folin-Ciocâlteu reagent was used at 1:10 (*V*/*V*), and a solution of Na_2CO_3 (7.5%). The reaction of polyphenols with the Folin-Ciocâlteu reagent is a redox reaction. Gallic acid is used as the reference standard. 1 mL of each potato extract was transfer to a beaker and 5 mL of freshly prepared Folin-Ciocâlteu reagent was added. After 5 minutes, 5 mL of sodium carbonate (7.5%) was added. The mixture was kept for 45 minutes in a dark place at room temperature to complete the redox reaction. The absorbance of each solution was measured at 760 nm with UV-Vis spectrophotometer. On the same conditions as the samples, a blank sample was prepared. In the blank, distilled water was added instead of 1 mL of the sample. The mean value of the absorbances was calculated from the individual values of the three measurements. The TPC in the potato samples was expressed as mg gallic acid equivalents per 100 g sample (mg GAE/100 g).

3. RESULTS AND DISCUSSION

The moisture content of potato samples plays a critical role in their chemical, physical, enzymatic, and microbiological stability, and may significantly interfere with the analytical determination of bioactive compounds. Therefore, a drying process was applied to reduce water content and stabilize the samples prior to further analyses. During the drying process, notable differences were observed depending on the applied conditions. First group samples initially dried in an oven and subsequently left inside the closed oven for an additional two days. These samples exhibited a darker coloration, a more intense odor, and slight development of yeast and mold. Such changes can be attributed to the retention of evaporated moisture within the closed system, which likely created favorable conditions for microbial growth and promoted chemical changes such as enzymatic browning. In contrast, second group samples dried under similar thermal conditions, but the oven was left open after drying. These samples retained a lighter color, showed no pronounced odor, and exhibited no visible signs of fungal growth. This indicates that proper ventilation during and after drying is essential to prevent moisture accumulation and preserve sample quality. For subsequent analyses, including extraction, phytochemical screening and TPC, second type of samples were taken. Average yield for potato core was 71.77%, and for peel 10.53%.

Qualitative phytochemical screening of potato extracts revealed variability in the presence of bioactive compounds depending on the sample type, extraction solvent, and drying conditions (Fig. 2).



flavonoids	*steroids*	*terpenoids*	*saponins*	*phenolic comp.*	*tannins*	*alkaloids*	*glycosides*
-	+	+	+	+ / -	+	+	+
No presence of flavonoids	red ring on the surface.	red-brown coloration in the middle	creation of a stable foam	Low concentration	non-intense green coloring	white precipitate	green ring on the surface and a brown layer

Figure 2. Results from phytochemical screening

The analysis indicated the absence of flavonoids in all tested samples, as no decolorization occurred after the addition of HCl following NaOH treatment. Similarly, phenolic compounds were not detected using the $FeCl_3$ test, as no characteristic blue-black coloration was observed. These findings may be attributed to the low concentration of phenolics or to their degradation during drying, particularly in samples exposed to prolonged moisture and oxidative conditions. Additionally, the limited specificity of the applied qualitative methods may have contributed to false-negative results.

Steroid detection showed variable results among samples. Positive reactions (red coloration) in samples subjected to more controlled drying conditions, suggesting better preservation of steroidal compounds. In contrast, weaker or negative responses in other samples may indicate degradation due to oxidation or prolonged exposure to residual moisture. Terpenoids were detected in all tested extracts, as evidenced by the formation of a reddish-brown coloration. The increased intensity of color upon standing suggests ongoing oxidation processes, which are consistent with the chemical nature of terpenoids.

Saponins were present in all samples but varied in intensity. This difference may be related to the protective role of saponins in plant tissues, especially in the peel, as well as to their degradation under unfavorable drying conditions.

Tannins were detected in several samples. Despite the absence of phenolics in earlier tests, the detection of tannins (which are polyphenolic compounds) indicates that phenolic constituents are indeed present, highlighting the limitations and selectivity differences of qualitative assays.

The presence of alkaloids was inconclusive. Instead of the expected reddish-brown precipitate with Wagner's reagent, a white precipitate was observed in all samples. This deviation may be due to inappropriate pH conditions, reagent instability, or interference from other compounds. Nevertheless, the relative amount of precipitates suggests a higher concentration of alkaloids in the peel compared to the core, which is consistent with their known protective biological role.

Glycosides were detected in all samples, although with varying intensity. This may indicate that glycosides are more stable under certain drying conditions or that their concentration is influenced by oxidative processes.

Spectroscopic determination of total polyphenolic contents by Folin-Ciocâlteu method. Polyphenols have become an intense focus of research interest because of their diverse and beneficial health effects. The scavenging ability of phenols is mainly due to the phenolic structure of hydroxyl substituent on the aromatic ring (Bahorun et al., 2004).

In this research total polyphenolic content was determined in potato peel and core using gallic acid as a reference standard. This method is based on the reduction of a yellow phosphotungstate-phosphomolybdate complex by antioxidants (reductants) to a blue chromogen by phenolic compounds under alkaline conditions, resulting in a blue complex measurable at wavelengths typically between 750-765 nm (Munteanu et al., 2021). The reducing ability of key dietary phenolic compounds can be inferred from their molecular structure, as structural characteristics play a critical role in determining their antioxidant activity. Consequently, the results obtained from the Folin-Ciocâlteu assay are dependent on both the composition, and the relative abundance of individual (poly)phenolic compounds present in the sample. Due to its simplicity, sensitivity, and cost-effectiveness, the Folin-Ciocâlteu method remains the standard approach for TPC determination in plant-based matrices, including potato samples (Pérez et al., 2023; Domínguez-López et al., 2024).

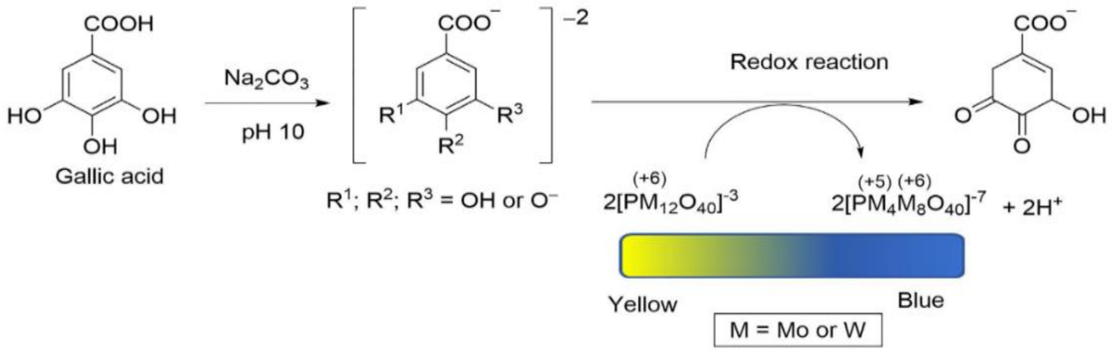


Figure 3. Redox reaction and color change of the Folin-Ciocâlteu reagent

The dependence between absorbance values and concentration of standard working solution was linear with coefficient of determination 0.9994 (Figure 3).

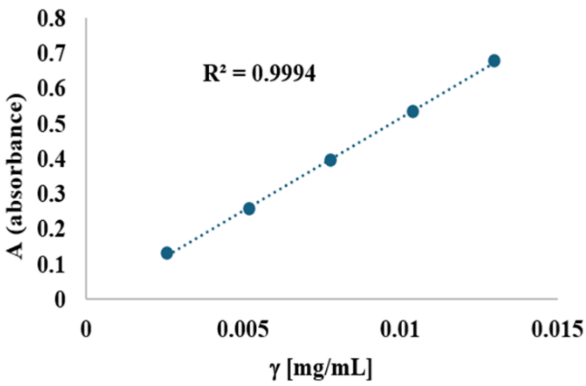


Figure 4. Calibration curve of gallic acid (absorbance vs. concentration), measured after 45 min

Using the calibration equation $y = 52.827x - 0.0143$ total polyphenols were determined in potato sample extracts immediately after extraction. The obtained results are presented as mg GAE/100 g sample (Table 1).

Table 1. Average TPC (core) and TPC (peel) presented as mg GAE/100 g sample

	TPC (core)	**TPC (peel)**
AVERAGE	1.0197	1.6705
SD	0.0657	0.5092

From the obtained results shown in Table 1 it can be seen that there is significant difference in the content of total polyphenols determined in potato core (TPC average = 1.02) and potato peel (TPC average = 1.67). The prevailing results of the total phenolic contents were consistent with previous findings, confirming that potato peels contain higher amounts of phenolic than flesh (Dramićanin et al., 2025). According to the literature, about 50% of phenolic compound concentration usually occurs in the peel and neighboring tissues and gradually decreases toward the tuber center (Gins et al., 2022). This fact makes potato peels an attractive source of antioxidants for nutrition and industrial applications. Also, potato peels, as a food processing waste, are a low-cost raw material for obtaining extracts with antioxidant activity. Past findings suggested that potato peel extracts can become a natural additive to prevent lipid and protein oxidation.

The findings of this study suggest that potato peels are a promising source of antioxidants, which can be used as a food additive or for other industrial applications. On the other hand, potato peels (obtained in large quantities as a waste from food processing), represent a cheap raw material for further processing and application. Furthermore, potato peel extracts can be a natural supplement to prevent lipid and protein oxidation (Polivanova et al., 2024).

CONCLUSIONS

Potatoes (*Solanum tuberosum* L.) contain a wide range of bioactive compounds with recognized health-promoting properties, including antihypertensive, antioxidant, antidiabetic, and anti-inflammatory effects. They are therefore considered a functional food with an important role in preventive nutrition and sustainable food systems. In this context, the present study aimed to perform phytochemical analysis and determine the total phenolic content (TPC) in potato extracts obtained via ultrasound-assisted extraction. Phytochemical screening included the identification of flavonoids, steroids, terpenoids, saponins, phenolic compounds, tannins, alkaloids, and glycosides. The qualitative analysis revealed variability in the presence of bioactive compounds, largely influenced by drying and storage conditions. The TPC was determined using the Folin-Ciocâlteu method, based on a colorimetric reaction between the reagent and polyphenolic compounds. A strong linear relationship between absorbance and standard solution concentration was observed (R^2 = 0.9994), confirming the reliability of the applied method. The results showed a significantly higher total polyphenol content in potato peel compared to the core, indicating that phenolic compounds are predominantly concentrated in the outer layers. Overall, potato peel represents a valuable by-product and a promising natural source of antioxidants with potential applications in the food and related industries.

REFERENCES

Affleck, I., Sullivan, J. A., Tarn, R., & Falk, D. E. (2008). Genotype by environment interaction effect on yield and quality of potatoes. *Canadian Journal of Plant Science, 88*(5), 1099–1107.

Dong, G., Naibaho, J., Hannon, S., & Sun, D.-W. (2024). Valorization of potato by-products as a source of plant proteins: Novel extraction techniques and potential applications. *Critical Reviews in Food Science and Nutrition*, 5666–5682.

Dramićanin, A., Horvacki, N., Gašić, U., & Milojković-Opsenica, D. (2025). Optimization of extraction conditions for phenolic compounds from potato tubers: LC-MS phenolic profile as a powerful tool to assess the genotypes, vegetation period, and production systems of potato. *Processes, 13*, 396.

Gins, E. M., Egorova, A. S., Sivolapova, A. B., Apshev, K. K., Meleshin, A. A., Moskalev, E. A., Polivanova, O. B., Belov, G. L., & Goryunova, S. V. (2022). Pollen fertility assessment through acetocarmine staining and in vitro germination in *Solanum tuberosum* L. *SABRAO Journal of Breeding and Genetics, 54*(5), 1037–1048.

Hu, X., Jiang, H., Liu, Z., Gao, M., Liu, G., Tian, S., & Zeng, F. (2025). The global potato-processing industry: A review of production, products, quality and sustainability. *Foods, 14*, 1758.

Jimenez-Champi, D., Romero-Orejon, F. L., Moran-Reyes, A., Muñoz, A. M., & Ramos-Escudero, F. (2023). Bioactive compounds in potato peels, extraction methods, and their applications in the food industry: A review. *CyTA - Journal of Food, 21*(1), 418–432.

Khalid, W., Khalid, M. Z., Aziz, A., Tariq, A., Ikram, A., Rehan, M., Younas, S., Bashir, A., & Fatima, A. (2020). Nutritional composition and health benefits of potato. *Advances in Food and Nutrition Science, 5*, 7–16.

Kumar, L., Chaudhary, P., Anjali, Asif, M., & Chandra, S. (2024). Potatoes and their role in human nutrients. *International Journal of Advance Research in Multidisciplinary, 2*(4), 7–9.

Mredul, A. R., Mahin, M. I., Rashid, H.-A., Hossain, B., & Rahim, A. (2025). Anti-nutrient properties of different potato (*Solanum tuberosum* L.) and physicochemical properties of their extracted starches. *Journal of Central European Agriculture, 26*(3), 656–666.

Munteanu, I. G., & Apetrei, C. (2021). Analytical methods used in determining antioxidant activity: A review. *International Journal of Molecular Sciences, 22*(7), 3380.

Pérez, M., Domínguez-López, I., & Lamuela-Raventós, R. M. (2023). The chemistry behind the Folin–Ciocalteu method for the estimation of (poly)phenol content in food. *Journal of Agricultural and Food Chemistry*.

Polivanova, O. B., Goryunova, S. V., Simakov, E. A., Sivolapova, A. B., Zhevora, S. V., Gins, E. M., & Mityushkin, A. V. (2024). Total phenolic, flavonoid, and anthocyanin content in Russian potato. *SABRAO Journal of Breeding and Genetics, 56*(2), 728–738.

Raigond, P., Jayanty, S. S., Parmar, V., Dutt, S., Changan, S. S., Luthra, S. K., & Singh, B. (2023). Health-promoting compounds in potatoes: Tuber exhibiting great potential for human health. *Food Chemistry, 424*, 136368.

Saini, R., Kaur, S., Aggarwal, P., & Dhiman, A. (2023). The influence of conventional and novel blanching methods on potato granules, phytochemicals, and thermal properties of colored varieties. *Frontiers in Nutrition, 10*, 1178797.

Sandilya, V. K., Rangare, N. R., Rangare, S. B., Kumar, V., Rohit, Singh, T., Dehari, B., & Sahu, P. (2023). Potato production, usages and nutrition: A review. *The Pharma Innovation Journal, 12*(7), 1357–1365.

Sbhatu, D. B., & Abraha, H. B. (2020). Preliminary antimicrobial profile of *Solanum incanum* L.: A common medicinal plant. *Evidence-Based Complementary and Alternative Medicine*, 2020, 3647065.

Stojchevska, S., Jankulovska, M. S., Velkoska-Markovska, L., & Bogevska, Z. (2022). Spectrophotometric determination of total polyphenolic and flavonoid content in tomato. *Journal of Agricultural, Food and Environmental Sciences, 76*(1), 1–8.

Xu, J., Li, Y., Kaur, L., & Singh, J. (2023). Functional food based on potato. *Foods, 12*(11), 2145.

Zaheer, K., & Akhtar, M. H. (2016). Potato production, usage, and nutrition-A review. *Critical Reviews in Food Science and Nutrition*.

Zarzecka, K., Gugała, M., & Mystkowska, I. (2026). Yield potential of potatoes with colored flesh in central-eastern Poland. *Agronomy Science, 81*(1).