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Physical and nutritional properties of eight types of potatoes
Aptitudes físicas y nutricionales de ocho tipos de patata

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ABSTRACT

In this research, measurements and analyses of different characteristics were carried out on eight types of potatoes. The vitamin C content was analysed by the Indophenol method, the dry matter content was determined by ash determination, the sizes were measured with ring ranges to determine their size and classified into medium and large sizes. In addition, the external appearance and colouring of the flesh was visually judged by differentiating between rounder or oval shapes and white or yellowish colours. A tactile analysis was also carried out to determine whether the samples had a firm and consistent texture. Among the results obtained, it was found that the Monalisa potato had the largest size of 67 mm, the Gallega potato was the only one with a white flesh colour and the Gallega and Agria potatoes were the only ones with large and deep eyes. The Valderredible potato excelled, as it had the highest values in terms of dry matter content, vitamin C and presented a firm and consistent texture, which makes it a favourable choice in terms of quality.

Palabras clave:
patatas, materia seca, almidón, vitamina C, calibre.

RESUMEN

En este estudio experimental, se realizaron mediciones y evaluaciones de diferentes parámetros en ocho tipos de patatas. Se analizó el contenido de vitamina C utilizando el método del Indofenol, se determinó el contenido de materia seca mediante la determinación de cenizas, se midieron los calibres utilizando rangos de anillas para determinar su tamaño y se clasificaron entre medianas y grandes. Además, se evaluó visualmente el aspecto exterior y la coloración de la carne diferenciando en formas más redondas u ovaladas y colores blancos o amarillentos. También se realizó un análisis táctil para determinar si las muestras tenían una textura firme y consistente. Entre los resultados obtenidos, se encontró que la patata Monalisa presentó el mayor calibre de 67 mm, la patata Gallega fue la única que con un color de pulpa blanco y las patatas Gallega y Agria fueron las únicas que presentaron ojos grandes y profundos. La patata Valderredible destaco, ya que tuvo los valores más altos en cuanto a contenido de materia seca, vitamina C y presento una textura firme y consistente, lo que la convierte en una opción favorable en términos de calidad.

Introduction

The potato Solanum tuberosum L. is a herbaceous plant that produces tubers for vegetative propagation. Tubers, commonly called potatoes, are protrusions of the subway stem, also called rhizome or subway stolon (1). It is one of the most important food crops for food security, with high levels of production and consumption worldwide, mainly in developing countries. Its importance is due to its high yield, high cost efficiency and good nutritional value containing an important source of essential nutrients (2). In addition, potatoes are very versatile, due to their multiple culinary uses. They can be cooked, fried, dehydrated or used as ingredients in processed foods. This made potatoes a staple food in many cultures, having a much higher production growth than other tubers (2). Its production is widely distributed in more than 160 countries and its cultivation area reaches 19 million hectares (3). In addition, it is estimated that it provides food for more than one billion people. It is one of the most important crops worldwide, with a production of more than 376 million tons (3).

1.1 Health Benefits of Potatoes

Potatoes provide significant amounts of various vitamins, minerals and phytochemicals. Potatoes are rich in calcium, potassium, magnesium, phosphorus, and several B vitamins. A cooked potato provides a significant amount of potassium and magnesium, which are important for cardiovascular and muscular health, providing 544 mg of potassium/100 g and 27 mg of magnesium/100 g, which represents 12% of the recommended adequate intake of potassium (4). Potatoes are an important source of vitamin C, containing an average of 20 mg per 100 g, accounting for about 20% of dietary intake in Europe (5). Vitamin C or chlorogenic acid is present in potato as carotenoids and phenolic compounds (PC) (6). The amount of carotenoids varies between 50 and 100 µg per 100 g fresh weight in white-fleshed potatoes and 2000 µg per 100 g fresh weight in orange to yellow-fleshed potatoes (6), these confer antioxidant capacity (7). Potatoes have been shown to scavenge 94% of hydroxyl radicals due to their flavonoid and flavone content, which have a high oxygen radical scavenging capacity (8). Potato skins are particularly rich in phenolic compounds and anthocyanins, especially in the outer 1 mm layer of the skin (9). These compounds are known for their beneficial health effects, including reducing the risk of chronic diseases such as cancer and cardiovascular disease (CVD) (10). FCs reduce CVD risk factors by reducing platelet activity, reducing anti-inflammatory effects and protecting against oxidation (10). Notably, the composition of phenolic acids and anthocyanins in potato was found to vary depending on the potato and the place of cultivation, suggesting that these compounds may be influenced by environmental factors (11). Therefore, it is important to consider the origin and type of potato.

There are more than 4,000 varieties worldwide that have significant differences in the contents of macronutrients and micronutrients, so attention must be paid to biodiversity (12)therefore, it is important to pay attention to biodiversity. The 4,000 varieties are the result of thousands of years of evolution, where multiple hybridizations have taken place between different species of plants of the Solanaceae family. The first potatoes were cultivated some 6,000 - 10,000 years ago in the Andes mountain range (13). Subsequently, they spread throughout Latin America and after the arrival of

Columbus in 1492, they spread to Europe and finally to the rest of the world. Over the past 150 years, farmers have tried to develop potato cultivars that are earlier maturing, smoother tubers, more disease resistant, and of better quality from a processing point of view by hybridizing between different varieties, resulting in many varieties (14).

1.2 Main characteristics of potatoes

In the composition of the potato, the carbohydrate content stands out, being one of the vegetables with the highest caloric content (88 kcal/100 g of potatoes), mostly in the form of starch and a small proportion as glucose, fructose and sucrose (15). A medium potato (148 g) contains 4 g of high quality protein, having a particularly good amino acid balance, as it contains recommended amounts of 4 of the 9 essential amino acids, and is the only staple food that meets the recommended level of lysine (16).

Variety, size, color, texture, dry matter and vitamin C content are the main quality parameters in potatoes, conditioning their use and acceptability in the market (17)and their acceptability in the market. Harvest time and post-harvest storage are critical as they have a direct impact on quality (18). The dry matter content of potatoes represents a criterion of nutritional or energetic value, mainly because the dry matter content corresponds to between 60% and 80% of the starch content (19). 80% of the weight of the potato is water, while the rest (20%) is dry matter, of which starch makes up 60-70% (20). Dry matter content is a key quality determinant in potatoes because it influences the flavor, aroma, texture, shelf life and cookability of potatoes (21).

1.3 Potato quality parameters

Potatoes are classified by size or caliber, which will be given by the length in millimeters of the side of the grid of a square mesh. Depending on the size range, potatoes are considered small if they have a diameter of less than 30, medium if they have a diameter of 30 to 60 mm and large if they are larger than 60 mm. Texture is the resistance of the tuber to an applied force and varies according to the cellular structure of the potato (22). The texture will depend on the interaction of several factors such as the structure and composition of the cell wall, whether the potato is raw or cooked, the starch content, and the shape and size of the starch granules (22). Texture is a quality determinant as firmness is an important textural attribute in potatoes because firmness is used to assess quality and freshness during storage and marketing (23). The hardness and firmness of raw potatoes decrease progressively with post-harvest storage as the starch is converted to reducing sugars, over time the reducing sugars accumulate and the starch is depleted (24).

The color of the skin can vary from white to violet red, this is due to the type of pigments present in the cells of the periderm (25). In general, except in the case of certain varieties, most of the varieties destined for the market are grouped into white, yellow and red skinned tubers. The texture of the skin, the shape and the presence of eyes can be distinctive features that may or may not attract consumers, however it is known that consumers tend to associate a skin of bright and uniform color and shape, without spots or discolorations, with greater freshness, indicating an optimal state of maturity and quality (26). As for the color of the internal matter (medullary tissue and reserve vascular parenchyma), generically known by the term "flesh," they are usually grouped into two blocks: white and yellow flesh (27). In each case, it can be accompanied by a second term

referring to the shade (creamy, light or dark). The color of the tuber peridermis does not determine the intrinsic quality of each variety, but it does influence consumer preference for quality (28). According to different studies, the culinary quality of potatoes is often associated with the color of the peridermis (29). Potatoes with uncolored peridermis generally have low dry matter contents. On the contrary, potatoes with yellow peridermis would be recommended for processing, due to their high dry matter content and low concentrations of reducing sugars (30).

The objective of this study is to analyze and describe "Monalisa", "Gallega", "Valderredible", "Agria", "Spunta", "Baraka", "Jaerla" and "Kelly" potatoes, measuring size, flesh color, external appearance, dry matter and vitamin C content.

Method

2.1 Evaluation of physical and nutritional aptitudes

From November 2021 to February 2022, 8 types of potatoes were evaluated, taking 30 samples of each type. The potatoes evaluated were: "Monalisa" 30 units, "Gallega" 30 units, "Valderredible" 30 units, "Agria" 20 units, "Spunta" 20 units, "Baraka" 20 units, "Jaerla" 20 units and "Kelly" 20 units.

To determine size square rings of the diameter corresponding to the potato to be measured were used, with a range of diameters from 20 mm to 80 mm, with 5 mm intervals. To characterize the physical aptitudes began with an evaluation of flesh coloration, which was carried out by 4 trained evaluators by 4 trained evaluators, who used a reference color scale with the following options: whitish, yellow, and intense yellow. The same panel of assessors made a description of the external appearance of the potatoes, distinguishing whether the samples were round to oval, elongated oval or rounded. Finally, they made a discriminative classification, differentiating the samples that presented deep and large eyes, and the samples that had a firm and consistent texture.

To characterize the nutritional properties, the vitamin C content was analyzed using the Indophenol method (31). This titration method based on the redox reaction between ascorbic acid and 2,6-dichlorophenolindophenol gave the amount of vitamin C present in potatoes. Dry matter was measured using a gravimetric method for ash determination (32). The procedure consisted of subjecting the samples to drying by heating, reaching a temperature of between 103 and 105 °C for one hour, and then calcining the sample in a muffle at a temperature of 550 °C until grayish ashes were obtained, thus obtaining the dry matter.

2.2 Vitamin C analysis by the 2,6-dichlorophenolindophenol titration method

The process began by extracting ascorbic acid from the potato sample using an oxalic acid solution. Vitamin C oxidizes very easily, so to prevent oxidation of the before titration add metaphosphoric acid to the sample (33). Then, titration was performed with 2,6-dichlorophenolindophenol solution, the reagent was added dropwise with a burette until a very pale pink color persisted in the sample added (33). The amount of reagent consumed was recorded during the titration. The use of 2,6-dichlorophenolindophenol as a reagent allowed an accurate and sensitive measurement of ascorbic acid concentration,

since in the presence of ascorbic acid an observable color change is generated which facilitates quantitative determination (33). This method is suitable for the determination of vitamin C due to its ability to measure the amount of ascorbic acid present in a sample. Ascorbic acid is an active form of vitamin C and has reducing properties that allow its detection and quantification using redox reactions (34). Ascorbic acid (C6H8O6) is oxidized to dehydroascorbic acid (C6H6O6), while DCPIP or iodide is reduced to DCPIPH2 or iodide, respectively (35). This method uses standard solutions and standard curve, which allows the precise quantification of the ascorbic acid concentration.

For the preparation of the sample, 100 g of potato were peeled and cut into pieces, which were crushed to obtain a homogeneous sample. 1 g of potato was weighed and placed in a beaker, into which 10 mL of metaphosphoric acid was added and allowed to stand in the dark for 10 minutes to allow extraction of the ascorbic acid. After this time, a Kitasate flask and a vacuum pump were used to filter the sample, thus obtaining a clean extract. This filtered extract was then transferred to a 100 mL volumetric flask and volumetrized to a final volume of 100 mL using distilled water. For the ascorbic acid stock solution, 2 mg of ascorbic acid was dissolved in 100 mL of water, creating a concentration of 2 mg/100 mL. From this stock solution, different standard solutions were prepared, e.g., for solution I, 50 mL of the ascorbic acid stock solution, 10 mL of metaphosphoroacetic acid, and made up to 100 mL with distilled water were added to a final volume of 100 mL. Similar processes were followed for solutions II, III, IV and V.
In the Titration of the standard solutions, a burette was filled with the titrating solution of 2-6-dichlorophenolindophenol. Then, titration was performed for each standard solution, slowly adding the DCPIP titrating solution until the sample acquired a very pale persistent pink color. The volume of DCPIP consumed in each titration was recorded for each standard solution, using these data to construct the standard curve, representing the volume of reagent consumed versus ascorbic acid concentration. In the Titration with 2,6-dichlorophenolindophenol, a burette was used to titrate the potato sample, adding the DCPIP solution dropwise until the sample turned a very pale persistent pink color. The volume of DCPIP solution used was recorded, and this data was used to calculate the concentration of vitamin C in the potato sample.

2.3 Determination of ashes by gravimetric method

Total ash analysis was used as the basis for determining the dry matter content of foods (36). The total ash method consisted of incinerating a precise and weighed sample of the food in a crucible resistant to high temperatures, using a muffle at temperatures between 500 and 600°C (58). During incineration, the organic matter decomposed and was transformed into carbon dioxide (CO2) and water vapor, while the constituent minerals remained in the form of oxides, sulfates, phosphates, silicates and chlorides. The amount of ash obtained after incineration is related to the content of inorganic minerals present in the sample. By subtracting the weight of ash from the initial weight of the sample, the weight of organic matter in the potato can be obtained. By dividing this weight by the initial weight of the sample and multiplying by 100, the percentage of dry matter in the potato can be calculated (36).

For moisture percentage determination, the empty crucible was preheated in an oven at 103 °C for 1 hour and cooled in a desiccator. The empty crucible was weighed on an analytical balance (m0). The potato was peeled and cut into pieces to be mashed to have a homogeneous sample (100 g). 5 g of potato sample (m1) was weighed and placed

in the crucible. The crucible with the sample was placed in an oven at a temperature of 100-105 °C for 1 hour. After cooling in a desiccator, the crucible with the residue was weighed. For the determination of the ash percentage, the crucible with the sample was calcined in a muffle at a temperature of 550 °C until white or grayish ashes were obtained. The crucible was cooled in a desiccator and weighed (m2). The percentage of ash was calculated using the formula: % ash = [(m2 - m0) / m1] × 100, where m0 is the mass of the empty crucible and m1 is the mass of the sample.

Results

The mean values obtained from the size analysis of each type of potato are shown in Table 1. The results showed that all the potatoes were of different and varied sizes, with a difference of 13 mm between the largest and the smallest. Monalisa presented the maximum size with an average of (67 mm), followed by Baraka (63 mm) and Gallega (62 mm). These three are of large category since they have a caliber greater than 60 mm. The rest of the potatoes are considered medium, with sizes between 52 and 59 mm. None of the potatoes measured were less than 30 mm in size, so none of them are small potatoes. Once the results of the samples were available, the mean dispersion was calculated to see if the value obtained was representative for the type of potatoes evaluated. Kelly, Jaerla and Baraka potatoes showed the lowest dispersion around the mean with a value very close to 1. Galician and Valderredible potatoes are of moderate dispersion with 1.5 to 1.8. Finally, Monalisa and Spunta showed a high dispersion around the mean with values of 2.5 and 2.8. Indicating that, with the exception of the last case, the results of the average size for each type of potato that were obtained from this study are representative of the size of each type of potato.

Table 1 *Mean values of size, dry matter and vitamin C of each potato sample*

Potato	Caliber (mm)	Dry Matter (%)	Vitamin C (mg/100g)
Galician	62 (+/-8,26)	19,09 (+/-2,64)	20,54 (+/-1,05)
Monalisa	67 (+/-8,06)	14,88 (+/-2)	15,81(+/-1,09)
Valderredible	59 (+/-8,2)	22,48 (2,69)	24,91 (+/-2,23)
Sour	56 (+/-6,04)	21,58 (+/-1,16)	29,62 (+/-3,33)
Spunta	52 (+/-5,72)	20,11 (+/-2,14)	21,82 (+/-1,63)
Baraka	63 (+/-3,17)	21,81 (+/-1,82)	17,92 (+/-1,63)
Jaerla	53 (+/-5,15)	19,7 (+/-2,56)	20,26 (+/-1,16)
Kelly	58 (+/-4,97)	17,02 (+/-2,09)	20,35 (+/-1,16)

The potatoes with a predominance of yellow color were Monalisa, Baraka and Kelly, since all the samples evaluated showed a yellow color in the flesh. Spunta presented 45% of samples with a yellow color in the flesh. The potatoes with a predominance of intense yellow color were Agria, Valderredible and Jaerla, with 100%, 94% and 65% of samples with intense yellow color, respectively. The Galician potato was the only one with a predominance of whitish color, with 89% of the samples having this color. Spunta and

Jaerla potatoes obtained less definitive values of 45% and 65%, respectively, which means that there may be variation in flesh color in these varieties.

The rounded shape is the most common, representing between 40% and 60% of the samples. Elongated oval and round to oval are also present in different proportions, ranging from 20% to 50% in most of the potatoes evaluated. It was observed that Agria, Baraka, Jaerla and Monalisa potatoes had a higher proportion of potatoes with rounded shape. Valderredible and Spunta potatoes showed an equal distribution between round and elongated oval shapes. Kelly potatoes were distinguished by having more potatoes with an elongated oval shape. Finally, the Galician potato showed a balanced distribution between round and rounded shapes. After taking all the measurements and analyzing whether there was any relationship, they determined that there is a strong relationship between volume and diameter. Monalisa, Valderredible and Kelly potatoes have a majority of elongated oval potatoes, which were considered the largest in diameter. These same potatoes occupied the first, second and fourth largest sizes among the potatoes evaluated. The same could be said for Jaerla and Agria potatoes, which have a majority of round potatoes, which were considered to be the smallest in diameter. These occupy the second and fourth smallest sizes according to their caliber in mm. In this case, this study also found a moderate relationship between diameter and volume.

Gallega and Agria potatoes were the only ones with deep, large eyes. The Galician potato, of the 30 potato samples, 5 samples or 16.67% of the potatoes were found to have deep and large eyes, while 25 samples or 83.33% of the potatoes did not have these characteristics. The Sour potato was an interesting case since, in the study of the 20 samples, it was found that 50% of the potatoes had deep and large eyes, while the other 50% of the potatoes did not. This indicates that there is some variability in the characteristic of deep and large eyes within this potato. Monalisa, Spunta, Baraka, Jaerla, Kelly and Valderredible potatoes did not have any samples with deep, large eyes, these results indicate that these potatoes tend to have a smoother, more uniform appearance.

It was determined that Monalisa and Baraka potatoes do not tend to have a firm and consistent texture. While Valderredible, Spunta and Kelly potatoes had a high proportion of samples with firm and consistent texture. Finally, Gallega, Agria and Jaerla potatoes showed an equal distribution between firm and consistent and non-firm and consistent samples, indicating that these potatoes may have different textures.

The potatoes with the highest dry matter percentage according to their mean were Valderredible potatoes with 22.50%, Baraka with 21.81% and Agria with 21.77%. On the other hand, the potatoes with the lowest percentages were Monalisa with 14.88 and Kelly with 17. To check whether the mean value of dry matter percentage of each type of potato is representative, a mean deviation analysis was performed. Gallega and Monalisa potatoes showed the greatest variability and dispersion of dry matter percentages with values of 2.86 and 4.1 respectively, although this is considered a moderate mean deviation. Agria, Spunta and Kelly potatoes presented a low mean deviation, showing the highest consistency in the data with 1.25, 1.79 and 1.80 respectively. This indicates that the mean values obtained can be considered representative of the dry matter content of the potato types analyzed. A lower starch content (16-18%) results in waxy potatoes; whereas floury potatoes have a higher starch content (20-22%). Under this criterion, of the 8 types of potatoes analyzed in this study, Monalisa and Kelly would be considered waxy and the rest floury.

Agria, Valderredible and Spunta potatoes showed values of 29.62 and 24.91, 21.82 mg/100 g of sample respectively, having high vitamin C contents. While Monalisa and Kelly have very low vitamin C values, with 5 and 3 mg/100g less than the average of 20 mg/100g, having 14.88 and 17.02 respectively. with an average value of 20% Vitamin C per potato. This study confirms this data as an average value for different potato cultivars, highlighting Agria, Valderredible and Spunta potatoes that exceed the average. Monalisa and Kelly's potato, potato below average. Taking into account how much the average vitamin C content varies according to potato type, it is important to analyze whether the results of this study are representative for each type of potato. For this reason, a mean deviation analysis was performed, in which it was found that Spunta, Baraka and Jaerla potatoes presented a low dispersion, with values very close to 1 indicating that these potatoes had the same amount of vitamin C mg/100 g fresh weight consistently. The rest of the results obtained for the other types did not deviate much from the mean, having moderate values of less than 2, so they can be taken as representative data of the percentage of vitamin C for each potato.

Discussion and conclusions

The results obtained are used to classify the potatoes evaluated within the quality ranges established above (37)being: small: <=30 mm, median: 30 - 60 mm and large: >60 mm. An effort was made to find studies or databases that had information on the sizes in millimeters for the types of potatoes evaluated, in order to compare results, but none could be found, since they did not give specific values in mm. For this reason, this study is useful to have a measurement in mm of the potatoes evaluated. This is determined by genotype, harvest conditions, post-harvest and ripening time. Leading to the thought that a variety of other genetic, environmental and agricultural factors, including genotype, seed size, plant density in a crop and number of stems per plant affect the growth and yield of different potatoes.

The potatoes with predominant yellow color were Monalisa, Baraka and Kelly, since all the samples evaluated showed a yellow color in the flesh. Spunta presented 45% of samples with a yellow color in the flesh. The potatoes with a predominance of intense yellow color were Agria, Valderredible and Jaerla, with 100%, 94% and 65% of samples with intense yellow color, respectively. According to these results it can be seen that the color of the flesh of each potato changes according to its type. This is determined by genotype, harvest conditions, post-harvest and ripening time. It is important to note that the higher the color intensity, the higher the amount of carotenoids present. This could explain, for example, why Agria and Valderredible potatoes, which have predominantly deep yellow flesh, have the highest vitamin C values. Similarly, Gallega, which is usually white in color, is the third potato with the lowest vitamin C content. This could explain, for example, why Agria and Valderredible potatoes, which have predominantly intense yellow flesh, have the highest vitamin C values. Similarly, the Gallega, which is usually white in color, is the third potato with the lowest vitamin C content. However, more rigorous and specific tests on each sample would be needed to establish a direct relationship.

This study confirms this data as an average value for different potato cultivars, highlighting Agria, Valderredible and Spunta potatoes, which exceed the average vitamin C value of potatoes, which is 20%, according to a group of researchers in Spain in 2002 (38). The study consisted of analyzing the loss of Vitamin C in 5 different types of potatoes, changing factors such as access to different gases or changing temperatures. Although before subjecting the potatoes to the different changes, they noticed that their potatoes had an average of 19.7 mg/100g of vitamin C per potato.

It was observed that Agria, Baraka, Jaerla and Monalisa potatoes had a higher proportion of round potatoes had a higher proportion of potatoes with rounded shape. Valderredible and Spunta have an equal distribution between round and elongated oval shapes. Kelly potatoes are distinguished by having more potatoes with an elongated oval shape. Finally, the Galician potato shows a balanced distribution between round and rounded shapes.

There are few studies on eyes in potatoes, but a study in the American Journal of Potato Research in 2022 reports that they facilitate the exchange of gases between the atmosphere and the interior of the potato (39). Research is presented that demonstrates interactions between the presence of eyes and certain diseases, although it is not very clear. The European Potato Journal, for example, published a study in 1965 announcing that no obvious relationship was found between eye structure and susceptibility to infection in relation to skin and eye structure, since in the nine potatoes examined, no significant differences in susceptibility to disease were shown (40). This would indicate that the presence of deep-set and large eyes is more related to consumer preferences at the time of purchase. This explained the 2008 U.S. study, which said that a product with good appearance, uniform size and shape will be preferred by most consumers and will have a greater sales appeal (41).

Valderredible, Baraka and Agria potatoes showed above average dry matter content, making them favorable choices for culinary and industrial uses. A high dry matter content is one of the most important values when choosing a potato. One of the first studies to determine the cooking quality of potatoes, conducted in 1937 by the official American potato magazine, states that the quality of potatoes is directly associated with the dry matter content, so that a high dry matter content of 25% is associated with "good quality" and a low dry matter content of 15% is associated with "poor quality" (42). Other studies of the time found similar results, noting that after chemical and cooking tests they concluded that good cooking quality is closely associated with high starch and dry matter content and low nitrogen content (43). However, nowadays, this issue is no longer so widespread, since a potato with a low dry matter content may have other nutritional or culinary qualities and can be used and exploited in a different way. For example, good quality can be given by high vitamin C contents, as is the case of Agria, Valderredible and Spunta potatoes have high vitamin C values, with values of 29,62mg/100g and 24.9mg/100g, 21.82mg/100g, respectively.

Gallega, Agria and Jaerla potatoes showed an equal distribution between firm and consistent and non-firm and consistent samples, indicating that these potatoes may have different textures, which may be explained by post-harvest storage and storage during marketing, which has a considerable effect on the texture of a potato (44). The longer the time and the extreme temperatures the starch is converted into reducing sugars, resulting in loss of texture and therefore quality.

In conclusion, this study analyzed eight types of potatoes and described their physical and nutritional characteristics. It was found that potato size is not related to the number of planting days, but rather to genetic, environmental and agricultural factors, such as genotype, environment or soil type.

Valderredible, Baraka and Agria potatoes showed above average dry matter content, making them favorable choices for culinary and industrial uses. Agria, Valderredible and Spunta potatoes presented high levels of vitamin C, which is important considering that its content is reduced after cooking or processing. As for potato flesh color, it was observed that potatoes with an intense yellow color, such as Agria and Valderredible, showed the highest vitamin C values. However, flesh color is not a reliable indicator of dry matter content or antioxidant capacity. In terms of shape and size, a possible relationship between potato diameter and size was found. Elongated oval potatoes, such as Monalisa, Valderredible and Kelly, were the largest. Gallega and Agria potatoes were the only ones with large and deep eyes. However, this did not affect their appearances negatively. Finally, the Valderredible potato stood out in terms of dry matter content, vitamin C and firm and consistent texture, making it a favorable choice in terms of quality.

See further research should be further research should be conducted in order to validate the present findings in larger settings and by including a larger number of samples. In addition, the implementation of controlled studies is recommended to examine the representativeness of the characteristics obtained for each variety. Additional studies on each quality parameter should also be carried out individually. It is noteworthy that the lack of studies on the characteristics of the different potato varieties has been identified, so it is important to carry out studies such as the present one with the aim of updating potato catalogs in the European context. It should be noted that recent potato research has been predominantly conducted in the Americas and Asia, highlighting the relevance of extending these studies to the European region to gain a more global perspective.

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