Journal homepage: www.fia.usv.ro/fiajournal
Journal of Faculty of Food Engineering,
Ştefan cel Mare University of Suceava, Romania
Volume XXIII, Issue 4- 2024, pag. 45 - 56

TECHNO-FUNCTIONAL CHARACTERIZATION OF TUBERS, FLOURS AND STARCHES FROM THREE CULTIVARS OF LIVINGSTONE POTATOES (*Plectranthus esculentus* N.E. Br)

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Received 24 July 2024, accepted 13 December 2024

Abstract: *Livingstone potato is a neglected and underutilized root crop that is indigenous to Africa, and there is a need to identify its potential for use in both food and non-food applications. The physical properties of tubers, proximate composition of flours, and physicochemical (starch yield, amylose content, water-binding ability, bulk density, starch size) and pasting properties of starches from three cultivars (Riyon, Laongat, and Bebort) of Livingstone potatoes were examined using standard laboratory procedures. All the cultivars had the same shape but showed different physical characteristics, in terms of colour, length and circumference. Laongat had the highest dry matter (1.70%,) and protein content (6.66%), while highest crude fat (0.03%) and carbohydrate content (78.29%) was recorded for Bebort cultivar. Significant (p<0.05) variation in starch yield and amylose content was recorded, with values of 8.49% - 11.40% and 26.09% - 31.21%, respectively. Laongat cultivar gave the highest values for both parameters. Values ranging from 1.74-1.95%, 10.47-12.95%, 0.72-0.87 g/mL were observed for swelling index, water absorption capacity, bulk density of the starches, respectively, while all the starches fall in the category of large granule size (130 - 200 nm). Laongat cultivar gave the highest peak viscosity (580.80 RVU) but lowest pasting temperature (74.03 °C) while Bebort cultivar had the highest values for trough (265.60 RVU), breakdown (99.96 RVU), and final (392.50 RVU) viscosities and the lowest peak time (4.80 min.). The pasting temperature ranged between 74.03 and 81.15 °C. Laongat cultivar had higher dry matter content, protein content, amylose content and starch yield than others. However, Bebort cultivar could find application in foods that require reduced cooking loss, slow retrogradation, higher digestibility, tolerance for high temperature heating and ability to cook faster due to its higher trough values, lower setback viscosity, higher breakdown viscosity and lowest peak time than other cultivars.*

Keywords*: Underutilized crop; Livingstone potato; Derivatives; Proximate composition; Techno-functional properties*

1. Introduction

Potato, sweet potato, and cassava are among the root and tuber crops that are widely consumed around the world [1]. After rice, wheat, maize, and potatoes are among the most significant vegetable crops on a global scale [2]. According to Okello [3], potato has increasingly contributed to the food supply in developing nations. It is a significant energy source because of its relatively high carbohydrate content and low fat, and it is also a rich source of dietary fiber, minerals, protein and antioxidants [4]. Livingstone potato (*Plectranthus esculentus* N.E. Br), with its characteristic finger-like tuber, is also called *rizga* in Nigeria. It is one of the minor crops that are extensively grown in Nigeria's northern areas, particularly in the states of Kaduna and Plateau [5]. The tuber is also commonly found within Southern Africa, Malawi, Zimbabwe, Congo, Zambia, South Africa, Angola, Swaziland, and Asia [5]. The tuber has the potential to grow well under hot

DOI: https://doi.org/10.4316/fens.2024.021

climatic conditions, in the wild, dry woodlands and rocky hillslopes, hence the reason for its wide distribution [6]. It is not a member of the *Solanaceae* family to which the common Irish potato (*Solanum tuberosum*) belongs [7]. According to Schippers [5], it is categorised as one of Africa's lesser-known and rarely used species of root crops, despite its nutritive potential. Although it has been reported to have low yields, however, some authors argued that it remained relevant as a food crop because of the harvestable yield obtained where some major food crops have failed [8]. When compared with other root and tubers (RTBs) crops such as cocoyam, yam, potato, and cassava, it has been reported to be highly nutritious; having better protein content than Irish potato and significant levels of starch, essential amino acids, calcium, iron, and vitamin A [5, 6].

Root and tuber crops are made into flours and starches for food manufacture and other industrial applications [9]. Apart from the nutritional benefits of flours and starches in the human diet, they are also used as texturizers, thickeners, binders, gelling agents, water retention agents, film formers for technological improvement and to impact the sensorial characteristics of different food types [10]. It was found that starches from potato work quite well as stabilizers and are superior to other cereal starches because of starch purity, chain lengths of the amylose, and amylopectin, and higher granular size [11]. Livingstone potato, like most other underutilized crops, has gained less attention due to lack of awareness among consumers and researchers. Baa-Poku [12] reported that underutilized crops are currently necessary to achieve sustainable agricultural production and to eliminate non-communicable diseases, hunger, and the triple burden of nutritional challenges. In order to diversify this crop and utilize its potential, there is a need to research its postharvest attributes, hence this work. The purpose of this study was to characterize the tuber, flour and starch of three cultivars of Livingstone potatoes identified in Nigeria.

2. Materials and methods

2.1. Materials

Three cultivars of the livingstone potato [Riyon (RYN), Laongat (LNG), and Bebort (BIB)] were collected from Jos station of National Root Crop Research Institute, Umudike, and used as experimental samples.

2.2. Methods

Flour sample preparation

The approach outlined by Sethuraman [13] was followed. Two kilogram (2 kg) of freshly harvested potato were washed with clean water to get rid of soil particles and debris. The cleaned tubers were washed, peeled, and cut into thin pieces with a stainless-steel knife and oven dried at 40 °C for 48 h. After being dehydrated, the chips were ground into a powder using a disc mill which after was passed through a mesh screen (250 μm) to achieve a finer flour consistency. The flour was kept at 4 °C in an airtight plastic bag till it was required for use.

Extraction of starch

A wet extraction technique outlined by Torres [14] was used to extract starch from the Livingstone potato, with some modifications. The samples were peeled manually after being sorted, cleaned and chopped into around 2-3 g sized bits. The chopped bits were blended in distilled water at ratio 1:2 w/v using Sonik Blender (Model:SB-566 220-240V 50/60Hz 800-120W China). The slurry obtained was agitated at 200 rpm for 90 min and sieved through 150 µm sieve. Until the washing water became clear, the starch was

Fig. 1: Images of the 3 cultivars of Livingstone potatoes

Fig. 2. Images of flour samples from cultivars of Livingstone potatoes

repeatedly washed. The supernatant was decanted after the starch in the filtrate was allowed to settle for 3 h. After re-suspending the starch in 500 mL distilled water, the sediment was decanted three times, and the starch's moisture content was reduced to less than 10% using an oven at 40 ºC. The dried starch was milled into powder and stored in air tight bags for further analysis.

2.3. Sample Analysis

Determination of fresh tuber physical properties

Vernier caliper, with 0.01 mm accuracy, was used for tubers' length and circumference measurement, while shape and color of the unpeeled tubers were done visually [15]. Twenty tubers were randomly selected from each variety for the measurement.

Determination of tuber dry matter

The potato tuber's percentage dry matter was determined as described by Mohammed [16]. Five (5) freshly harvested tubers were randomly taken and weighed immediately. The tubers were sliced and oven dried to a constant weight at 75 ºC. Percentage dry matter was determined as follows:

$$Dry\ matter\ (\%) = (Sample\ weight\ after\ drying\ (g))/(Sample\ initial\ weight\ (g)\ )\ X\ 100$$ (Eq. 1)

Flour samples proximate composition

The Association of Official Analytical Chemists [17] technique for nutrient analysis was followed in the proximate composition analysis of flour samples. The parameters that were analyzed were the moisture content, ash content, crude protein content, crude fat content and crude fibre content, respectively. Using the difference approach and the calculation below, the carbohydrate content was determined.

% Carbohydrate content = 100 – (% moisture+ % crude protein + % total fat + % crude fibre + % total ash) (Eq. 2)

Determination of yield of starch

The percentage of starch recovered following extraction from a weighted kilogram of potato tuber was used to calculate the starch yield.

$$\%\ Starch = (Weight\ of\ dry\ starch)/(Weight\ of\ tuber)\ X\ 100/1$$ (Eq. 3)

Amylose content determination

Iodine colorimetric method was used to evaluate the amylose concentration of the starch samples, as outlined by Gerard [18]. After solubilizing approximately 0.1 g of the sample in 1 ml of 95% ethanol and 9 ml of 1 N NaOH, the mixture was heated for 10 min in a boiling water bath. One milliliter (1 mL) of the extract was then diluted with 10 mL distilled water. To get a dark blue hue, 0.5 mL of the diluted extract was mixed with 0.1 ml I N acetic acid and 0.2 mL iodine solution. To achieve full color development, the colored solution was diluted with distilled water to a volume of 10 mL and let to stand for 20 min. After vortexing the solution, a spectrophotometer was used to measure the absorbance at 620 nm. The amylose content was calculated using the absorbance of standard maize amylose with known amylose concentration.

Water-binding capacity determination

Water binding capability of the extracted starch samples was assessed using Addy [19] methodology. Two grams (2 g) of starch was dissolved in 40 mL distilled water to form an aqueous solution and centrifugation was applied for 10 min at 2200 rpm to stir the solution for 1 h. Available free water was removed from the centrifuged wet starch, allowed to drain for ten minutes and weighed.

Bulk density determination

The starch samples' bulk density (BD) was determined in accordance with Addy [19] method. After 100 taps, the volume of 5 g starch in a 10 mL measuring cylinder was determined. The ratio of the sample's weight to its occupied volume was used to compute the bulk densities.

Size and shape determination of the starch granules

For the starch granule's size and shape determination, a spatula was used to place a tiny quantity of starch powder on a clean micro-slide. A drop of distilled water was added, thinly spread across the slide, and covered with a slip.

Under a light microscope (LEICA CMEa Leica Microsystems) at x 400 magnification, the diameter of the starch granules was measured using an ocular micrometer that was attached to the microscope lens. The mean of 10 diameter readings per starch sample was multiplied by a factor of 2.47 µm to determine the actual sizes of the granules.

Pasting properties determination

A Rapid Visco Analyzer (TecmasterPerten N103802, Australia) was used to determine the pasting properties of the starch samples. A test canister was filled with 3.5 g of test samples with the addition of 25 mL distilled water.

The mixture was well mixed, and the canister was safely inserted into the RVA in accordance with the instructions.

The slurry was heated to 95 °C for two minutes, after which it was cooled to 50 °C for an additional two minutes of holding. After heating the slurry to 95 °C for two minutes, it was cooled to 50 °C for an additional two minutes of holding. A consistent pace of 11.25 °C per minute was maintained throughout the heating and cooling regime. The pasting profile was analyzed to derive a number of parameters, including peak viscosity, trough, breakdown, final viscosity, setback, peak time, and pasting temperature.

Data Analysis

Data generated were analyzed using an open-source R environment version 4.2.2. The general linear model approach (GLM) was used to calculate the mean separation and analysis of variance.

For each variable, differences ($p<0.05$) were analyzed using the least significant difference (LSD).

3. Results and discussion

Physical properties of tubers

Presented in Table 1 are the Livingstone potato tubers' physical properties. Bebort and Riyon tubers were observed to have creamy colour while Laongat tuber had a light brown colour, this is comparable to what was stated by Ukpabi [20]. Observed similarity could be attributed to the fact that samples for both studies were sourced from the same location. The tuber length for Bebort and Laongat samples were in the same range of 7-15 cm with mean values of 10.05 cm and 10.20 cm, respectively. Riyon sample however had smaller length (6.4 cm) compared with the other two tubers. For the circumference, Bebort was observed with the highest value (8.65 cm) while 5.80 cm and 4.95 cm were the values for Riyon and Laongat, respectively. All the three tubers were cylindrical in shape, also, similar to the observation by Ukpabi [20] for Livingstone potato (var. Riyom). For the best design of harvesting or processing equipment for improved sorting, cleaning, handling, processing and packaging practices, the knowledge of the physical characteristics of agricultural commodities are necessary [21]. According to Adegoke [22], for the purpose of achieving efficient root and tuber peeling and trimming operations, tuber shape and configuration are one of the most important determinant factors. Also, physical parameters such as length, width, and thickness have been opined to be key factors in determining the suitability of potato tubers production into either French fries or crisp. Nain [23] argued that French fries' production requires a long and oval shaped tuber while spherically shaped tuber is more suitable for crisp production.

Table 1.

Physical properties and dry matter content of fresh Livingstone potato tubers

Sample	Skin colour	Shape	Length (cm)		Circumference (cm)		Dry matter content (%)
			(range)	(mean)	(range)	(mean)	
Bebort	Cream	Cylindrical	7-15	10.05	7-10	8.65	1.6±80.15
Laongat	Light brown	Cylindrical	7-15	10.2	4-6	4.95	1.70±0.57
Riyon	Cream	Cylindrical	5-7	6.4	5-6	5.80	1.61±0.18

Proximate composition of flour samples

Table 2 displays proximate composition of Livingstone potato flour samples based on dry weight. The values for the dry matter, moisture, crude fat, crude fibre, ash, crude protein and carbohydrate contents ranged from 1.61 - 1.70%, 6.77 - 7.24%, 0.01 - 0.03%, 4.25 - 5.18%, 3.73 - 5.69%, 5.60 - 6.66% and 75.72 - 78.29%, respectively. Laongat cultivar gave the highest dry matter and protein content, highest values for crude fat and carbohydrate content were observed in Bebort cultivar, while Riyon tuber had highest values of crude fibre and ash content. Considerable variations (p<0.05) were noted in the amounts of crude fiber, protein, ash, and carbohydrates in the tubers. In crops with root and tuber, the dry matter portion is mostly carbohydrate [24]. It is a component of tuber and root crops that is determined by factors such as variety, soil, growing and storage environmental conditions, and also by the methods used for processing. The results found in this investigation are notably less than 18.06% reported by Ezeocha [24] for Livingstone potato (*Plectranthus esculentus*) while Abebe [25] reported higher dry matter content for different varieties of potatoes.

Values obtained for moisture content for the three cultivars are lower than values (8.26% and 8.06%) reported for Livingstone potato by Eleazu [26] and flour from sweet potato according to Olatunde [27], respectively, however, slightly higher than 6.50% cited by Ngoma [28] for Ndou sweet potato. Moisture content is an important quality characteristic of food material that determines storage stability, as high moisture content provides an ideal environment for spoilage and pathogenic microorganisms, and could also lead to chemical deterioration such as oxidation [29]. The low moisture content obtained in this study is ideal in extending the shelf life of the flour samples. Eleazu [26] reported higher protein content than the values obtained in the current study, despite the collection of experimental samples for the two studies from the same location, however, not at the same planting season. The variation in protein content could be because of changes in environmental factors like temperature, sunlight, rainfall, as well as soil composition. Difference in cultivation practices such as fertilizer application, irrigation management and pest control methods could be contributing factors as well.

Application of nitrogen fertilizers was reported to cause possible increase in protein content of potatoes by Anis [30]. Olatunde [27] and Ngoma [28], nevertheless, reported lower values for both untreated and chemically treated *Ndou* sweet potato flour, and sweet potato flour, respectively.

The term "ash" describes the inorganic residue that is left over after all organic matter has burned completely during incineration process, which is an indication of the presence of minerals and trace elements in food [31]. The experimental tubers in this investigation had a greater ash content than Eleazu [26], Olatunde [27] and Ngoma [28] reports. The ash content variation may also be related to factors that were indicated for variance in the protein content of the current study and other investigations. According to Suksabye and Kaphueakngam [32] research, potatoes' ash content changed according to the stage of maturity at harvest.

This study's fat content readings are much lower compared with those published by Eleazu [26], however, quite similar to those reported by Olatunde [27] and Ngoma [28]. Storage conditions of tubers such as temperature, humidity and duration has been reported to impact constituents such as fat content [33]. Generally, compared to other root and tuber crops, potatoes have a relatively lower fat level. People seeking low-fat substitutes in their diet can benefit from the comparatively low-fat content of the Livingstone potato cultivars examined in this study.

Crude fibre refers to the resilient plant material present in food that human digestive enzymes are unable to break down. It mainly consists of cellulose, hemicellulose and lignin [34]. Few of the nutritional and health benefits of fibre include regular bowel movement, weight management, and delay in the breakdown and absorption of carbs with consequent slow release of glucose in the bloodstream [35]. Other authors [38 and 39] reported values higher than those obtained in this study.

Values obtained for carbohydrate content fall under the range of values stated by Eleazu [26] and Olatunde [27]. Carbohydrates are structures that serve as energy reserves for plants. Roots and tuber crops are known to be rich sources of carbohydrates used for human food, animal feed and for production of industrial products such as fermented beverages, alcohol and starch [36].

Table 2.

Proximate composition (%) of Livingstone potato flour samples

Sample	Moisture content	Crude fat	Crude fibre	Crude ash	Crude protein	CHO
Bebort	7.24±0.01^{a}	0.03±0.01^{a}	5.13±0.21^{b}	3.73±0.02^{a}	5.60±0.38^{a}	78.29±0.57^{b}
Laongat	6.77±0.62^{a}	0.01±0.00^{a}	4.25±0.11^{a}	4.22±0.16^{b}	6.66±0.30^{b}	78.10±0.65^{b}
Riyon	7.12±0.51^{a}	0.02±0.14^{a}	5.18±0.01^{b}	5.69±0.13^{c}	6.28±0.23^{ab}	75.72±0.90^{a}

CHO – Carbohydrate, Values represent means of duplicate determination ± standard deviation.
At the 5% level, mean values with different letters (superscripts) in the same column indicate significant differences

Starch yield and functional properties

The main component in the majority of plant storage systems, such as cereal grains, tubers, and legumes is starch. It is a vital source of calories in diets for both humans and animals [37]. Additionally, the food, fabric, beauty products, plastics, adhesive, paper, and pharmaceutical industries use it extensively as a biomaterial. Factors that contributed to its various utilization in either food or non-food industries include its inexpensive cost, rich energy value, natural physicochemical characteristics that has been proven to be exceptional, and the ease at which the starch can be modified to achieve better end products [38]. The starch yield (SY) from the three Livingstone potato tubers is presented in Table 3. The values varied between 8.49% (Bebort) and 11.40% (Laongat). The value reported by Ezeocha [24] for Livingstone potato is within that obtained in this study. Abebe [25] also reported significantly different SY values for twenty-five (25) potatoes varieties; the difference was attributed to varietal and environmental factors. Similarly, the observed significant variation in yield of starch for Livingstone cultivars in this study could be linked to varietal effect. A higher starch yield means a higher quantity of saleable starch, hence, leading to potential financial gains. According to Siddiqui [11], the excellent texture stabilizing and regulating properties of potato starch stands it out from starches from corn, wheat, rice, etc. in food production system. The Laongat variety appears more promising in this regard due to its higher starch yield than other cultivars. Percentage amylose content varied from 26.09% - 31.21%, with Laongat tuber having the highest value. Assefa [39] reported similar value (28.8%) for Ethiopian potato (*Plectranthus Edulis*). The two main starch components are amylose and amylopectin. Functional characteristics like swelling, water solubility, and water-binding capacities have been reported to be influenced by these two starch components. Nutritionally, amylose is known to be a slowly digestible starch, i.e., it can provide a sustained release of glucose into the bloodstream, hence giving a slower glycemic index compared to rapidly digestive starches [40]. Additionally, it can affect textural properties of cooked and processed food products: higher amylose content has the potential to contribute to firmer texture and improved shape retention in products such as French fries and chips.

Water-binding capacity refers to the ability of ingredients or food product to retain or hold water. It is an important property that influences the texture, juiciness, and overall quality of food. A higher water-binding capacity often results in a moist and tender texture. For the three Livingstone potato cultivars used in this study, the results showed significant ($p<0.05$) difference in values, Laongat gave highest value. Values recorded for the starches' bulk density showed significant ($p<0.05$) differences. Result in the order Bebort > Laongat > Riyon was obtained. Bulk density is a measurement that tells how heavy a starch or flour is, and also determines the amount of space occupied by the material during a manufacturing process. It also depicts the suitability of any starch or flour for food preparation. Low bulky density flour/starch has been reported to be suitable for complementary food formulation [41]. Ngoma [28] reported value (0.80 g/ml) within the range of what was found in this investigation for untreated *Ndou* sweet potato flour. However, lower values were reported by Khalid [35] for modified starches from Livingstone potato. Assefa [39] and Bayor [42] also observed lower levels for Ethiopian potato and sweet potato genotypes from CIP, Kumasi, respectively. The three starch samples were not significantly different from one another for swelling index. Swelling index represents the extent of swelling relative to the original size or dimension of a material.

Table 3.

Starch yield and functional properties of Livingstone potato starch samples

Sample	Starch Yield (%)	Amylose (%)	Water binding capacity	Bulk density (g/ml)	Swelling index
Bebort	8.49±0.10^{c}	26.09±0.17^{c}	10.47±0.31^{a}	0.87±0.00^{b}	1.74±0.26^{a}
Laongat	11.40±0.04^{a}	30.78±0.82^{b}	12.95±0.10^{c}	0.85±0.03^{ab}	1.90±0.04^{a}
Riyon	9.49±0.03^{b}	31.21±1.15^{a}	12.29±0.09^{b}	0.72±0.07^{a}	1.95±0.01^{a}

Values represent means of duplicate determination ± standard deviation. At the 5% level, mean values with different letters (superscripts) in the same column indicate significant differences

Particle size distribution

Particle size distribution of starches or flours plays an important role in food processing, especially in baking processes. Lindeboom [41] states that granules of starch can be categorized as very small (< 5 µm), small (5 - 10 µm), medium (10 - 25 µm) and large (> 25 µm). Based on results (Table 4) obtained in this study, the starches from the three cultivars are in the large granule size category, and are also higher than the values published by Bayor [9] and Molenda [43] for potato.

Table 4.

Particle size distribution of Livingstone potato starch granules

Sample	Size range (nm)	Mode (nm)	Mean (nm)
Bebort	150-200	200.00	180.65
Laongat	130-200	190.00	170.35
Riyon	130-160	130.00	130.86

Pasting properties

Pasting properties are rheological properties displayed by starches when heated moist with substantial amount of water [44]. As presented in Table 5, values for peak viscosity are 580.80, 421.67 and

420.00 RVU for Laongat, Bebort and Riyon cultivars, respectively, with significant (p< 0.05) variation. Hossen [9] reported values within the range reported here, while Eke-Ejiofor [66] reported higher values, both studies for sweet potato starch. Peak viscosity, which is the highest viscosity formed during or shortly after heating, is a measure of the paste's strength that results from gelatinization during food preparation [47]. Bebort sample has the highest values for trough, breakdown and final viscosity while lowest values were reported for Riyon starch sample. Trough viscosity refers to the measurement of the resistance of starches to flow at a specific temperature and concentration. High trough values might be an indication of reduced cooking losses [48]. Babu [49] reported a lesser value, while Hossen [9] stated levels within those found in this study. The degree to which starch granules disintegrate or the paste remains stable when heated is measured by breakdown viscosity [50]. A lower breakdown viscosity, as recorded for Riyon starch sample, might indicate the product's ability to withstand higher cooking temperatures. Final viscosity is a measurement of cooked paste's resistance to shear force while stirring and shows how stable a paste is [51]. Higher breakdown viscosity obtained for Bebort than other starch samples show its ability to tolerate high temperature heating and shear stress. A low setback viscosity signifies a reduced likelihood of a starch to reverse or experience syneresis throughout the freeze-thaw cycles [52]. According to Iwe [53], lower paste digestibility is correlated with higher setback values, hence, Bebort's lowest value is an indication of reduced possibility to retrograde and hence, a higher digestibility. Peak time is commonly understood to be a measure of the overall amount of time required for each sample to reach its own peak viscosity. Due to the lowest time reported for Bebort starch sample, it could have the potential to cook faster than the other two starches with higher peak times [50]. Pasting temperature on the other hand gives an estimate of how long food materials will take to cook, which translates to how much energy is used during production process [54].

Despite the lowest peak viscosity recorded for Riyon sample, it had the highest values both for peak time and temperature, which is an indication that the sample might take longer time and much energy for its starch to cook. Lowest pasting temperature was recorded for Laongat starch sample, although no significant difference existed between the samples. Oladebeye [45] together with Babu [49] presented results that are comparable.

Table 5.

Pasting properties of Livingstone potato starch samples

Sample	Peak Viscosity (RVU)	Trough (RVU)	Breakdown viscosity (RVU)	Final viscosity (RVU)	Setback viscosity (RVU)	Peak Time (min)	Pasting Temp (°C)
Bebort	421.67±0.06^{b}	265.60±0.02^{a}	99.96±0.07^{a}	392.50±0.33^{a}	126.80±0.07^{c}	4.80±0.04^{c}	75.13±0.18^{b}
Laongat	580.80±0.03^{a}	231.70±0.21^{b}	77.90±0.09^{b}	369.00±0.58^{b}	137.30±0.51^{a}	5.90±0.62^{b}	74.03±0.25^{c}
Riyon	420.00±0.11^{b}	227.70±0.14^{c}	71.50±0.13^{b}	360.90±0.17^{b}	133.20±0.47^{b}	6.07±0.03^{a}	81.15±0.89^{a}

Values represent means of duplicate determination ± standard deviation. At the 5% level, mean values with different letters (superscripts) in the same column indicate significant differences

4. Conclusion

The established variation in the physical properties of the studied Livingstone potato cultivars, especially the tubers' length and circumference should be put into consideration for the design of processing equipment intended for sorting, trimming and peeling operations.

None of the cultivars was found to be superior than the other in terms of the assessed proximate composition parameters, however, Laongat cultivar gave the highest dry matter content, starch yield and amylose content. This makes it appear more promising than others in terms of quantity of saleable starch for potential financial gain. Also, from health point of view, the high amylose will ensure slow starch digestion and consequently give a lower glycemic index.

Differences in the functional and pasting properties of the starches position them for various application in the food and non-food sector, depending on intended use. However, Bebort cultivar could find application in foods that require reduced cooking loss, slow retrogradation, higher digestibility, tolerance for high temperature heating and ability to cook faster due to its higher trough values, lower setback viscosity, higher breakdown viscosity and lowest peak time than other cultivars.

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