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NUTRITIONAL PROFILE ASSESSMENT OF RED ONION (ALLIUM CEPA L.) – PRELIMINARY RESULTS

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Abstract. *Onion (Allium cepa L.) is one of the most important vegetables cultivated and consumed worldwide, being appreciated both for its culinary role and for its health benefits. The specialized literature shows that onion has a high nutritional value, being a source of vitamins, minerals, dietary fiber, simple carbohydrates and bioactive compounds (flavonoids, polyphenols, sulfur compounds). The red variety is distinguished by a higher content of anthocyanin pigments and flavonoids, which give it superior antioxidant properties and a sweeter taste than white onion. The purpose of this work was to evaluate the basic nutritional composition (proximate composition) of a red onion variety available and sold on the local agri-food markets. Preliminary determinations included analysis of moisture, ash, protein, lipid, fiber and carbohydrate content. The results obtained: 10.37-10.89 % moisture, 3.54 - 4.06 % ash, 2.65 - 3.29 % protein, 1.38-1.98 % fat, 6.52 - 7.64 % fibers, and 71.63 - 74.93% carbohydrates, show the analyzed red onion samples contain principally minerals, carbohydrates, modest amounts of moisture and fibers and low amounts of protein and fats. These results confirm the role of red onion as a food with moderate energy value but with an important contribution to dietary fiber intake. These data support the nutritional potential of red onion and propose the use of red onion powder as a natural additive in food with added value or as an alternative source in animal feed ingredients. Thus, red onion is not just a variant of the regular onion, but a valuable food due to its contribution of bioactive compounds and sensory qualities, which recommends it as an important component of a balanced and healthy diet.*

Keywords*: red onion, proximate composition, nutritional parameters*

INTRODUCTION

Onion (*Allium cepa* L.) is one of the most important vegetables cultivated and consumed worldwide, being appreciated both for its culinary role and for its health benefits. It is a crop of great economic importance throughout the world, being a natural part of the daily diet for most of the population. Onion (Allium cepa L.) is a very important agricultural culture rich source of phytochemicals and antioxidants responsible for fighting free radicals in the body and preventing diseases. Onion is a bulbous vegetable and spicy plant, appreciated for its distinct flavor, health support, and active ingredients.

Onion (Allium cepa L.), one of the most cultivated and consumed vegetables worldwide, has been cultivated for over 5000 years in the ancient world due to its unique pharmacological, medicinal, and culinary qualities (AKINWOTU AND ADENIRAN, 2025; GUPTA ET AL., 2025). Specialized literature shows that onions have a high nutritional value, being a source of vitamins, minerals, dietary fiber, simple carbohydrates and bioactive compounds (flavonoids, polyphenols, sulfur compounds). The red variety is distinguished by a higher content of anthocyanin pigments and flavonoids, which gives it superior antioxidant properties and a sweeter taste than white onions (METRANI ET AL., 2020; JURGIEL- MALECKA ET AL., 2015; WAHYUNINGSIH ET AL., 2025). Onion can be consumed in raw, processed and stored

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state. As food, onions are used fresh, for salads as well as processed for pickles, chutneys, sauces and dehydrated powder for seasoning. Its medicinal uses are found in diuretic, digestive, heart, eye and joint conditions (SINGH AND KHAR, 2024; LAWAL AND MATAZU, 2015). Studies suggest that onions contribute to heart health by potentially lowering blood pressure and cholesterol levels, helping to reduce the risk of cardiovascular disease, and their consumption is associated with the prevention of liver, gastrointestinal, lung, stomach and colorectal cancer (DINKECHA ET AL., 2017; AKINWOTU & ADENIRAN, 2025; METRANI ET AL., 2020). Onions are a perfect blend of diverse nutritional compounds and phytochemicals such as allicin, quercetin, organosulfur compounds, antioxidants, phenolic compounds, flavonoids and fructo-oligosaccharides. Fresh onion bulbs contain approximately 89.11% water, 1.10% protein, 0.10% lipids, 0.35% ash, 0.34% carbohydrates, 1.70% dietary fiber, and 4.24% total sugar (0.99% sucrose, 1.97% dextrose, 1.29% fructose), as well as 0.21% minerals (potassium, phosphorus, calcium, magnesium, sodium, iron) and a significant amount of vitamins B, C, and E (GUPTA ET AL., 2025; SAMI ET AL., 2021).

In a comparative study on the nutritional composition of white and red onions, it was found that red onion with a moisture content of 88.48% contained 3.17% DM ash, 6.50 % DM crude lipid, 3.02% DM crude protein, 2.83% DM crude fibre and 84.48 % DM available carbohydrate (LAVAL AND MATAZU, 2015). In a study regarding nutrients and antioxidant properties of red, yellow and white onions (Allium cepa L.) in Ibadan, Oyo State, Nigeria, the nutritional parameters of red onions present the following values: 84.60 % moisture, 1.30% protein, 1.10% crude fiber, 0.60% ash, 12.20% carbohydrate and 0.16% fat. (ANI ET AL., 2021). The study authors confirmed that red onions are a good source of macronutrients.

Valuable information on the nutritional composition of red onions is also provided by international databases. According to FoodData Central, the nutritional composition of red raw onions, presents the following value limits: 87.3-91.3 g/100g water, 0.84 0.72-1.15g/100g protein, 0 - 0.2 g/100g total lipid (fat), 0.37 - 0.49 g/100g ash, 9.93g/100g carbohydrate (by difference), 2.1-2.4g/100g total dietary fiber and 2.35- 4.93 g/100g total dietary fiber. From what is presented, it can be observed that the nutritional parameters: moisture, minerals (ash), protein, fat, fiber and carbohydrate have values that vary within wide concentration limits, depending on the variety, cultivation techniques, pedoclimatic conditions, methods used to analyze them, etc. The nutritional quality of the red onion can be evaluated by its content of proteins, carbohydrates, fats, minerals (ash), vitamins, etc. The objectives of this study was to evaluate the proximate composition: moisture, minerals (ash), proteins, fats, crude fibers and carbohydrates of red onions sold in local agri-food markets.

MATERIAL AND METHODS

The plant material used in this study consisted of red onion bulbs samples (Allium cepa) commercialized in local agri-food markets. From red onions randomly collected from three local vegetable producers were formed three distinct batches of about 1kg each. These were labelled in the text with L1, L2 and L3 and constituting the basis of the analyzed material. The red onion bulbs remaining after removing those with physical and biological defects were cleaned of the dry skin (the tunic that protects the edible part), root residues and other adhering impurities. The nutritional parameters of red onion were performed on dried material.

For this purpose the red onion bulbs were sliced and dried in an oven at 55ºC until constant mass. After drying, when the onion slices became crispy, the dried material was ground using a kitchen grinder. Until the time of analysis, the dry powder was stored in a sealed plastic bottle, protected from moisture, light, and heat. The determination of the

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nutritional composition of red onion (Allium cepa L.) was performed according to the AOAC Official Methods of Analysis, 2000 (AOAC, 2000) and following the recommendations of VELCIOV ET AL., 2024. Mineral substances (ash) were determined by the calcination method at 550 ºC. Protein content was determined by the Kjeldahl method, using a nitrogen conversion factor of 6.25. Crude fat was determined using the Soxhlet method with hexane as solvent. Crude fiber was determined using the acid–base digestion method. Carbohydrate content was obtained by difference.

Figure 1. Fresh and dried red onion slices

The objectives of our study was to evaluate the proximate composition: moisture, minerals (ash), proteins, fats, crude fibers and carbohydrates of red onions sold in local agri-food markets.

RESULTS AND DISCUSSIONS

The results obtained for the determination of the nutritional parameters of the red onion batches taken in the experiment are shown in table 1 and graphically represented in figures 2 and 3.

Table 1

The nutritional parameters of annalized red onion

Provider	Nutritional values, % (DM)					
	Moisture	Ash	Protein	Fat	Fiber	CHO
Sample L1	10.37±0.32	3.54±0.34	2.65±0.22	1.38±0.12	6.52±0.23	74.93±1.63
Sample L2	10.89±0.50	4.06±0.26	3.29±0.33	1.98±0.19	7.64±0.38	71.63±1.47
Sample L3	10.64±0.37	3.74±0.29	3.11±0.24	1.46±0.15	7.24±0.20	72.93±1.63
Mean value	10.64 ± 0.21	3.78 ± 0.21	3.02 ± 0.27	1.68 ± 0.25	7.13 ± 0.46	73.16 ± 1.35

As can be seen from the data presented in table 1, the determined nutritional parameters show different values that vary depending on the origin of the red onion bulbs and the analyzed parameter.

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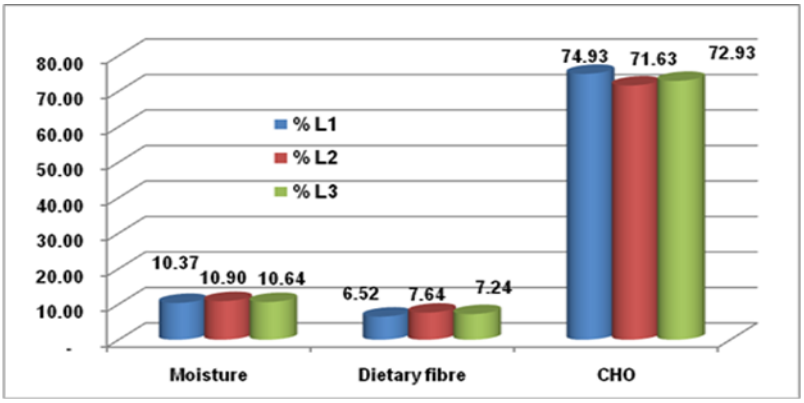

Figure 2. The moisture, dietary fibre and carbohydrate (CHO) concentration in three batches (L1, L2, and L3) of red onion samples

Moisture content is a parameter that provides information on the amount of water contained in a certain product, respectively the amount of dry matter of that product. In addition, this parameter provides indications related to the storage and processing of food. Foods with low moisture content**,** particularly less than 10%**,** tend to have longer shelf lives because microbial activity is significantly limited in such environments; while foods with moisture content major than 10% cannot be stored for long periods of time (VELCIOV ET AL., 2022). Considering the high value of raw red onion reported: 84.60, respectively 88.57%, it can be notice that this vegetable has a limited shelf life (ANI ET AL., 2021 ; CZECH ET AL., 2022). In contrast, the powder obtained from the red onion taken in the experiment, with a moisture content between 10.37 - 10.89 g/100g DM, has a higher content of nutritional compounds and can be stored for a longer period of time.

The ash content is an indicator of the total concentrations of mineral elements present in the analyzed samples (COZMA ET AL., 2023). The values obtained for the determination of the ash content of the red onion samples show values ranging from 3.54 - 4.06 g/100g DM. It can be observed that the highest ash concentrations were determined in the L2 group (4.06±0.26%) and the small ones in the L1 group (3.65±0.34%). It was reported that the ash content of the red onion samples contains the following mineral elements: calcium, iron, copper, manganese, zinc, sodium, phosphorus and potassium (BHATTACHARJEE ET AL., 2013; NIELSEN & MARSHALL, 2010). Numerous studies have shown that dried onions used in powder form can improve the nutritional quality of foods through their mineral content. These values, as well as the average value of the ash content (3.78 g/100g DM) reveal that red onion bulbs annalized can be considered as a potential source of mineral elements in the form of essential macro and micro elements.

Proteins are essential component of the diet needed for the survival of animals and human being important biomolecules for the body's homeostasis (COZMA ET AL., 2024). Protein deficiency is closely related to a number of diseases such as Kwashiorkor, Marasmus (energy deficiency), mental disorders, insufficiency of different organs, edema and immune system weakness. Additionally, proteins play a key role in the immune system by forming antibodies that help defend against pathogens (KHAN ET AL., 2017). Unlike carbohydrates and fats, which can be used interchangeably for energy, the body requires a continuous supply of dietary protein to meet its structural and functional needs. As such, an adequate intake of high-

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quality protein is essential to maintain health, support development, and ensure proper physiological function throughout life. The concentration of these essential macronutrients determined in the analyzed red onions shows values ranging between 2.65 - 3.29 g/100g DM. These limits, and also the average concentration (3.02 ± 0.27) show that the analyzed samples contain moderate amounts of protein, these having a relatively low protein intake. However, these values show that dried red onions cannot be considered an important source of protein.

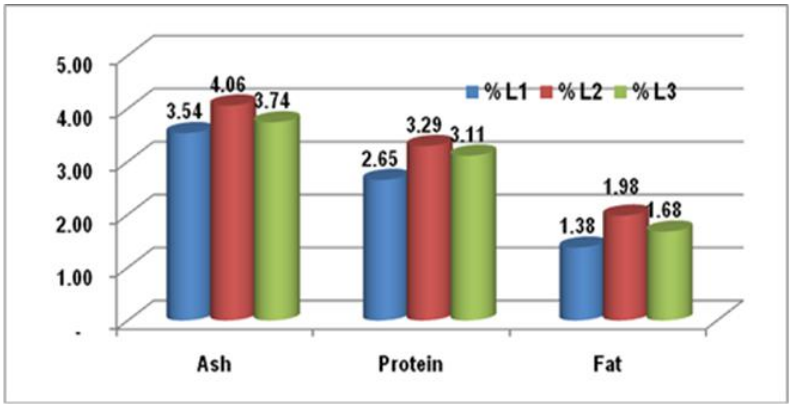

Figure 3. The ash, protein and fat concentration in three batches (L1, L2, and L3) of red onion samples

Fats are essential macronutrients that play an important physiological and biochemical role in the functioning of the human body and can also be used as ingredients to improve the texture, taste and aroma of foods. Being a good source of energy, they help absorb and transport fat-soluble vitamins (A, D, E and K), supporting essential cellular functions, such as membrane structure and hormone production (VELCIOV ET AL., 2022). The fat concentration in the analyzed red onion samples shows values between 1.38 - 1.98 g/100g. The average value of the fat concentration (1.68 ± 0.25) shows that, analyzed red onion powder has low value of the fat intake. These values show that the analyzed red onion bulbs are a poor source of calories.

The term ***crude fibre*** refers to the insoluble dietary fibre fractions and comprises the constituents of the cell walls found in plant tissues, including lignin, cellulose and hemicellulose. The crude fiber content of the analyzed red onion samples shows values ranging between 6.52 - 7.64 g/100g DM. These results and furthermore the average value of dietary fiber content (7.13 ± 0.46) show that the analyzed red onion contains modest amounts of crude fiber. Since crude fiber represents only a part of the total fiber, it can be seen that the analyzed red onion samples cannot be considered as potential sources of dietary fiber.

Carbohydrates are the body's main source of energy, being necessary for the normal functioning of muscles and the brain and helping to use fats, protecting cells against external harmful effects. The major metabolic role of carbohydrates in diets is energy production. Although there are different types of carbohydrates, only total carbohydrates are taken into consideration in food and remains when the protein, fat, moisture and ash of the food have been removed (COZMA et al., 2024). Carbohydrates are one of the three macronutrients in the human diet, along with protein and fat. As can be seen from Table 1 and Figure 2, the analyzed red onion samples contain high amounts of carbohydrates, their concentration being between 71.63 - 74.93 g/100g DM. These values show that the analyzed red onion samples are rich in

carbohydrates, and can be considered as beneficial sources of carbohydrates. From those presented it can be stated that the analyzed red onion bulbs contain high amounts of carbohydrates and minerals (ash), moderate amounts of moisture and fiber and low amounts of protein and fats.

CONCLUSIONS

The analysis of the nutritional profile of the three batches of red onion (Allium cepa L.) reveals a balanced composition and high nutritional value. The moisture content, ranging between 10.37% and 10.89%, indicates a significant concentration of dry matter, which contributes to the product's stability during storage.

The average values of the main chemical components are the following: ash 3.78%, protein 3.02%, fat 1.68%, fiber 7.13%, and carbohydrates 73.16%. These data confirm that red onion is a modest source of plant-based proteins, with a low lipid content and an appreciable amount of dietary fiber-important for maintaining normal intestinal transit.

The high ash percentage indicates a considerable presence of essential minerals (potassium, calcium, phosphorus, magnesium) while the predominant carbohydrate concentration explains the slightly sweet taste characteristic of this variety. In line with the specialized literature, the results confirm that red onion is an important source of vitamins, minerals, fiber, simple sugars, and bioactive compounds (flavonoids, polyphenols, sulfur compounds). Due to its high anthocyanin pigment content, this variety stands out for its superior antioxidant properties and remarkable functional value.

In conclusion, the analyzed red onion presents a complex and beneficial nutritional profile, recommending it as a valuable food both in terms of nutritional contribution and antioxidant potential, supporting health maintenance and dietary diversification.

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