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Hot air drying and quality powder of three, red-skinned, white-skinned and yellow-skinned, onion varieties (*Alium cepa* L.)

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Abstract

Food dehydration is one of the oldest unit operations used by the food processing industry. Onion (*Allium cepa*) have been widely reported to possess a significant antioxidant activity which has been ascribed to allicin, a known scavenger of peroxyl radicals. The onion contains a number of quercitin, isorhamnetin, and kaempferol conjugates and, indeed, is one of the major sources of flavonols in European diet.

The study aim was to evaluate the quality of onion powder obtained by dehydration of three different varieties (white, yellow and red onion) by evaluating the polyphenol content and antioxidant activity. The onion raw materials were purchased from the food market (local farmers from Cluj-Napoca).Three onions varieties were chosen (white, yellow and red). After preliminary cleaning, peeling, slicing and chopping, onions were dehydrated at 70–60 °C in a Hot Air Dryer Machine, the temperature being reduced as the moisture content decreases. Total phenolics content was assesed by Folin-Ciocalteu spectrophotometric method using a UV-VIS spectro photometer.The radical scaveging activity (RSA%) was assesed by DPPH spectophotometric methods.

The highest content of total polyphenols was recorded in the red onion powder extract 1086.71 (mg.GAE/100g sample), followed by the yellow onion powder extract 667.87(mg.GAE/100g sample) and then the white onion powder extract 353.18(mg.GAE/100g sample). Regarding the antioxidant activity, the scavenging efficiency of onion powder extracts against the DPPH radical was the strongest due to their high polyphenol content.

According to these results it is recommended to use red onion powder as a basic ingredient in the preparation of different spice mixtures or in the simple use in different culinary preparations.

Keywords*:*onion powder, dehydration, polyphenols, antioxidants

1. Introduction

Onion (*Allium cepa* L.) is one of the most cultivated vegetables in the world and is a good source of flavonoids. Flavonoids are bioactive components that possess a distinct flavor and aroma, and have potential health benefits [7, 6].

Onion (*Allium cepa* L.), which is one of the most consumed vegetables, is known for its flavonoid content, contributing considerably to its dietaryintake in many countries. [1, 8] Heating vegetables during the cooking process causes the loss of heat sensitive compounds and reduces the nutritional quality.

Depending on the morphology and nutritional properties of vegetables, positive and negative effects of heating have been reported [5].

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The onion powder belongs to a class of food powders that is highly hygroscopic by nature and that help in determination of package systems that maximize product protection. [1]

To obtain maximum health benefits, raw onion should be used or moderately cooked. In onion, quercetin aglycone accounts for up to 10% of the total flavonoids, and the remaining amount is in the form of glucosides. The compositional variations of quercetin and its glucosides exist in the yellow, white, and red onion varieties; and various other flavonoids, flavonols, anthocyanins, and dihydroflavonols exist in different cultivars Compared to red onions, yellow onions contain a high level of quercetin, and white onions have the lowest concentration. [4]

Some autors demonstrated that Quercetin and its glucoside contents increased up to 120°C and then decreased at 150°C, whereas the sugar content continuously decreased with heating total flavonoid levels registred a considerable change. On heating the onion samples at 120°C for 30 minutes, the red-skinned variety showed the highest level of total phenolic content [13712.67 ± 1034.85 mg of gallic acid equivalent/g dry weight (mg GAE/g DW)] and total flavonoids [3456.00 ± 185.82 mg of quercetin equivalents/g dry weight (mg Q/g DW)], whereas the content of total phenolics and total flavonoids were 13611.83 ± 341.61 mg GAE/gDWand 3482.87 ± 117.17 mg Q/g DW, respectively, for the yellow-skinned (Sunpower) variety. [6].

The objective of this study was to characterize three varieties of onion (white, yellow and red onion) grown in the central of Transilvania, and turning them into powder after drying by hot air drying powder, and caracterisation with a focus on their bioactive compounds and their antioxidant capacity.

2. Materials and Methods

2.1 Materials

Fresh, medium grade (60±70 mm diameter), fully matured red-skinned onion variety (RO), white-skinned onion varietiy (WO) and yellow-skinned onion varietiy (YO) were purchased from the food market (local farmers from Cluj-Napoca) he standard compounds (gallic acid) and reagents: 2,2-diphenyl 1-picrylhydrazyl, Folin-Ciocalteu, methanol, aluminium chloride, sodium carbonate, sodium nitrite and sodium hydroxidewere purchased from Sigma Aldrich or Merck (Darmstadt, Germany).

The products were made in the laboratory of vegetable products preservation and analysed in the Food Quality Control of Facultz of Food Science - UASMV, Cluj-Napoca.#

2.2 Sample preparation

To achieving the onion powder were used 10 healthy onion bulbs from each veriety red skinned variety, white-skinned varietiy and yellow-skinned varietiy. To prepare the onion powder, approximately 500 g of onions after preliminary cleaning, peeling, slicing and chopping, onions were dehydrated at 70–60 °C in a Hot Air Dryer Machine, the temperature being reduced as the moisture content decreases. The resulting dehydrated onions were then

ground into powder. The samples were stored in sealed plastic bottles at -20 °C until analysis. In order to obtain the onion powder extract, the following steps were followed: 1 g dried onion of each veriety + 20 ml methanol - soniaction 30 minutes - continuous agitation (1 h) - vaccum filtration - solvent evaporation - residues recovery in methanol, - storage at -20 C until analysis. The method used for the extraction of polyphenols from plant materials is important for the accurate quantification of antioxidant content and activity. This fact makes it difficult

to compare data from the literature reports which vary in extraction solvent and conditions.

Analysis of total phenolics: The total phenolic content was assesed by Folin-Ciocalteu spectrophotometric method using a UV-VIS, JASCO V-530 spectrophotometer (International Co., Ltd., Japan).

The content of total phenolics was analyzed spectrophotometrically at 790 nm using the FolineCiocalteau colorimetric method described by Kavita *et al* [6], The standard curve was prepared from gallic acid, and the content of total phenolics were expressed as mg of gallic acid equivalents/g dry weight (mg GAE/g DW).

***Analysis of antioxidant activity*:** Antioxidant capacity: The radical scavenging activity (RSA%) was assessed by DPPH spectrophotometric methods. A 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay was performed using the method of Kavita et al [6]. but with some modifications. The DPPH solution was prepared by dissolving 24 mg DPPH with 100 mL of 75% methanol and stored at -20°C

until use. The working solution was prepared by diluting the DPPH solution with 75% methanol to obtain an absorbance in the range of 1.1 ± 0.02 units at 515 nm. The DPPH solution (950 mL) was mixed with sample extracts, and diluted with 1 mL of 75% mehanol. It was then incubated for 20 minutes. A control was prepared by adding 1050 mL of 75% of methanol to 950 mL of DPPH solution. The percentage of scavenging effect of different extracts against DPPH radicals, was calculated using the following equation:

$DPPH_{scavenging}effect(\%)= [(A0-AS)\times100]/A0$

where, A0 is absorbance of the blank, and AS is absorbance of the samples at 515 nm.The absorbance was measured against the blank using the Shimadzu UV-1700 spectrophotometer (Shimadzu)

Other Physicochemical analysis: The moisture content and ash and were determined according to AOAC method (2000) [4]. The total soluble solids content of the fresh onion sample from each veriety was measured with the help of hand refractometer from Hanna Instruments HI 96801.

3. Results and discussion

Physicochemical analysis: Our results are consistent with the researchers results [4] who found that total flavonoids increased after heating at a certain temperature and magnitude of time, whereas heating for 3 hours at 150°C decreased the content of total flavonoids [4]. The reason for the decrease in the total flavonoid at higher temperature could be because of the degradation of flavonoids. It also depends on the structure of particular flavonoids.

The highest content of total polyphenols was recorded in the red onion powder extract 1086.71 (mg.GAE/100g sample), followed by the yellow onion powder extract 667.87(mg.GAE/100g sample) and then the white onion powder extract 353.18(mg.GAE/100g sample). Regarding the antioxidant activity, the scavenging efficiency of onion powder extracts against the DPPH radical was the strongest due to their high polyphenol content. Researchers [6]. reported that the total antioxidant activity for all varieties of onions, was less at 150°C, compared to 120°C. After heating, the order of antioxidant activity measured with DPPH methods were (in decreasing order) red -skinned (Colossal), yellow-skinned (Sunpower), 110455, white-skinned (110444), Chairman.

Porosity is amplified by the thermal variations of the membrane components from the cell structure induced by the Hot Air Dryer Machine. This will lead to enhanced water diffusivity in the dried vegetal product. In this regard the temperature has been reduced from 70 °C to 60 °C as the moisture content decrease.

Table 1. Physico-chemical parameters evaluated on WO, YO and RO dehydrated experimental variants

	Dehydrated onion		
Drying temperature	70-60°C	70 -60°C	70 -60°C
Drying time	for 6 hours in a Hot Air Dryer Machine		
Experimental variants	WO	YO	RO
Total polyphenols (mg GAE/100g dw)	353.180 ±0.019	667.874 ±0.021	1089.71±0.057
Antioxidant activity (% RSA)	38.69± 0.028	49.94± 0.014	63.74± 0.007
Total Soluble solid content, ° Brix (on fresh	11.6± 0.002	12.5± 0.008	13± 0.009
pH	7.40± 0.006	7.40± 0.009	7.30± 0.005
Ash, %	3.52± 0.028	4.27± 0.014	4.59± 0.007
Moisture content, %	7.78± 0.007	6.98± 0.014	6.5± 0.008

Figure 1. Dehydrated white-skinned varietiy by the Hot Air Dryer Machine and powder transformation

All three fully matured red-skinned onion variety (RO), white-skinned onion varietiy (WO) and yellow skinned onion varietiy (YO) showed high Total Soluble solid content, (13± 0.009, 11.6±0.002, 12.5±0.008 °Brix), with similar results obtained on other onion slices [11]

4. Conclusions

In this work it is shown that one of the powder onion variety richest in phenolic compounds with antioxidant capacity is red-skinned variety (RO), followed by yellow-skinned varietiy (YO) and white-skinned varietiy (WO). The hot draying process dehydrated at 70–60 °C in a hot air Dryer machine for 6 hours, the temperature being reduced as the moisture content decreases has highlighted the quality of the powder.

Bsed on this study and others researchers results mansion in this paper work we recommend for obtaining maximum health benefits of bioactive compounds, the onion powder should be used in the preparation of prepared dishes or moderately cooked instead. More than that the recent research of Kavita Sharma, *et al*., 2015 suggests that to maintain the sweetness of the onion powder during the processing of onion, heating at high temperatures above 120°C should be completely prohibited.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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