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1. Dhan Prakash, Brahma N. Singh, Garima Upadhyay,
Antioxidant and free radical scavenging activities of phenols from onion (Allium cepa),
Food Chemistry, Volume 102, Issue 4, 2007, Pages 1389-1393,
ISSN 0308-8146, 10.1016/j.foodchem.2006.06.063.
(http://www.sciencedirect.com/science/article/pii/S0308814606006005)

Abstract: Summary

Four (red, violet, white and green) varieties of Allium cepa were studied for their total phenolic contents (TPC), antioxidant (AOA) and free radical scavenging activities (FRSA). The TPC varied from 4.6 to 74.1 mg/g GAE, AOA varied from 13.6% to 84.1% and FRSA showed wide range in terms of IC50 (inhibitory concentration) from 0.1 to 15.2 mg/ml, EC50 (efficient concentration) from 4.3 to 660.8 mg/mg and ARP (antiradical power) from 0.15 to 23.2. The outer dry layers of red and violet varieties showed better inhibition of lipid peroxidation assayed by ammonium thiocyanate than α-tocopherol. The non-site-specific inhibition of hydroxyl radical induced deoxyribose degradation was also higher in the outer dry layers of red and violet varieties than in their middle and inner layers. The outer layers were also potential inhibitors of nitroblue tetrazolium chloride (NBT) reduction caused by superoxide anions. On the other hand the ferrous ion chelating capacity of the red and violet varieties was highest in the inner layers. Specific phenolic composition performed through HPLC and LC–MS/MS showed the presence of gallic acid, ferulic acid, protocatechuic acid, quercetin, and kaempferol. The unutilised outer layers of the red variety were a rich source of quercetin (5110 μg/g) with high AOA, FRSA and also showed significant protection of DNA damage caused by free radicals.

Keywords: Allium cepa; Polyphenols; Antiradical power; Reducing power; Free radical; scavenging; activity; Chelating effect; DNA damage

2. Domenico Caridi, V. Craige Trenerry, Simone Rochfort, Samantha Duong, Dianne Laugher, Rod Jones
Profiling and quantifying quercetin glucosides in onion (Allium cepa L.) varieties using capillary zone electrophoresis and high performance liquid chromatography,
Food Chemistry, Volume 105, Issue 2, 2007, Pages 691-699,
ISSN 0308-8146, 10.1016/j.foodchem.2006.12.063.
(http://www.sciencedirect.com/science/article/pii/S0308814607000441)

Abstract: **Summary**

There is increasing evidence that flavonols demonstrate beneficial properties for human health. Quercetin is the major flavonol present in onion

(Allium cepa cv) and is present predominantly as quercetin 3,4′-diglucoside and quercetin 4′-monoglucoside. These compounds are known to be potent free radical scavengers and antioxidants, and are considered to be protective against cardiovascular disease. Analysis for the presence of these compounds has therefore become more important. Robust capillary zone electrophoresis and high performance liquid chromatography procedures were developed for profiling and quantifying the levels of quercetin 3,4′-diglucoside and quercetin 4′-monoglucoside in 70% methanol/water extracts of six different onion varieties available in Victoria, Australia. Quercetin 3,4′-diglucoside, which is not commercially available as a reference standard, was isolated from freeze-dried onion powder by preparative high performance liquid chromatography and used to quantify the levels in the onion extracts. Significant differences in the levels and ratios of the two compounds were seen between red, brown and white onion varieties (e.g. ‘Redwing’; quercetin 3,4′-diglucoside 191 mg/100 g DW, quercetin 4′-monoglucoside 85 mg/100 g DW; ‘Cream Gold’, quercetin 3,4′-diglucoside 153 mg/100 g DW, quercetin 4′-monoglucoside 58 mg/100 g DW, ‘Spanish white’; quercetin 3,4′-diglucoside <1 mg/100 g DW, quercetin 4′-monoglucoside <1 mg/100 g DW).

Keywords: Profiling; Quantification; Quercetin glucosides; Onion; Capillary electrophoresis; High performance;liquid; chromatography

3. Gemma A. Chope, Leon A. Terry, Philip J. White,
The effect of 1-methylcyclopropene (1-MCP) on the physical and biochemical characteristics of onion cv. SS1 bulbs during storage,
Postharvest Biology and Technology, Volume 44, Issue 2, May 2007, Pages 131-140,
ISSN 0925-5214, 10.1016/j.postharvbio.2006.11.012.
(http://www.sciencedirect.com/science/article/pii/S0925521406003255)

Abstract: Summary

There is a paucity of information on the role of ethylene in onion bulb dormancy, and the available literature is conflicting. Onion cv. SS1 bulbs were treated with 1 µl l−1 1-MCP for 24 h at 20 °C and then stored at 4, 12 or 20 °C. Sprout growth was reduced in onions treated with 1-MCP and stored at 4 or 12 °C, but not when stored at 20 °C. Greater concentrations of sucrose, glucose and fructose were measured in 1-MCP treated bulbs stored at 12 °C as compared with untreated bulbs. Dry weight was also maintained in onions treated with 1-MCP. Abscisic acid (ABA) concentration before storage has previously been shown to be correlated with storage life, but there were no differences in the ABA concentration between 1-MCP treated and untreated bulbs. It appeared that 1-MCP reduced the rate of carbon utilisation. The mechanism by which this occurred is unknown although it is unlikely to be mediated by ABA.

Keywords: Abscisic acid; Allium cepaL; Ethylene; Non-structural carbohydrates; Sprouting

2009

1. A.S. Rodrigues, M.R. Pérez-Gregorio, M.S. García-Falcón, J. Simal-Gándara, Effect of curing and cooking on flavonols and anthocyanins in traditional varieties of onion bulbs,

Food Research International, Volume 42, Issue 9, November 2009, Pages 1331-1336,
ISSN 0963-9969, 10.1016/j.foodres.2009.04.005.
(http://www.sciencedirect.com/science/article/pii/S0963996909001069)

Abstract: Summary

The stability of the major flavonol glucosides and anthocyanins was studied in two regional varieties of Portuguese onion (a white variety “branca da Póvoa” and a red variety “vermelha da Póvoa”). White and red onions from 2007 and 2008 harvests were subjected to field curing with and without light, but the red cultivar from 2008 was also subjected to typical domestic processing, including chopping and different cooking treatments. Field curing resulted in increases in quercetin content compared to levels at lifting, especially important for all white bulbs (33–40% increase). Flavonol and anthocyanin levels in onions cured in the dark were similar to those obtained in bulbs cured in the light. The treatments chopping followed by refrigerated storage, oven roasting and frying, did practically not contribute to modify the total levels of flavonols. Moderate microwave cooking did not affect to the flavonol content, but intense microwave treatment cause flavonol losses of 16% and 18% for quercetin 3,4′-diglucoside (QdG) and quercetin 4′-glucoside (QmG), respectively. Boiling onions for 30 min leaded losses of quercetin glycosides, which leached to the boiling water without being degraded at 37% and 29% for QdG and QmG, respectively. Boiling for 60 min had more severe effects, since it caused the degradation of quercetin derivatives at 53% and 44% for QdG and QmG, respectively. For anthocyanins, the severity of the cooking treatments was in the following order: frying > boiling > roasting (microwave roasting > oven roasting).

Keywords: ***Allium cepa ; Flavonols; Quercetin; Anthocyanins; Cyanidin; Curing; Cooking***

2. Eun Jin Lee, Kil Sun Yoo, John Jifon, Bhimanagouda S. Patil, Application of extra sulfur to high-sulfur soils does not increase pungency and related compounds in shortday onions,

Scientia Horticulturae, Volume 123, Issue 2, 15 December 2009, Pages 178-183,
ISSN 0304-4238, 10.1016/j.scienta.2009.09.009.
(http://www.sciencedirect.com/science/article/pii/S0304423809004312)

Abstract: Summary

Sulfur (S) nutrition has a strong influence on onion pungency, and the production of sweet onions in the high-sulfur soil of Texas is a challenge to growers. This study was performed to determine the effects of S applications to

fields already having sufficient levels of soil S on pungency and related compounds in four shortday onion cultivars. The onion cultivars ‘Cougar’, ‘Legend’, ‘Texas Early White’, and ‘Texas Grano 1015Y’ were grown in three commercial fields at Edinburg, Mercedes, and Weslaco of the Rio Grande Valley of South Texas with applications of sulfur at 0, 13, and 26 kg S/ha. Pyruvic acid, bulb weight, extractable S in soil and total S in bulb, soluble solids content (SSC), flavor precursor compounds [also called S-alk(en)yl-l-cysteine-sulfoxides (ACSOs)], and total sugars were measured. The pyruvic acid level of onions was not increased by the S applications and showed no significant correlation with soil S levels in any of the cultivars at locations having 30 or 235 ppm S. The SSC, total S in bulbs, total sugars, and total ACSO content also showed no correlation with the S applications and soil S levels. Onion pungency and content of flavor precursor compounds were significantly influenced by cultivar and cultivar × location interaction. We conclude that onion pungency is not increased by application of extra S fertilizer to commercial fields already containing sufficient levels of soil sulfur.

Keywords: style Allium cepa; Flavor; Pungency; Pyruvic acid; Quality; Soil sulfur

3. Eduvigis Roldán-Marín, Concepción Sánchez-Moreno, Rosana Lloría, Begoña de Ancos, M. Pilar Cano,

Onion high-pressure processing: Flavonol content and antioxidant activity, LWT **Food Science and Technology**, Volume 42, Issue 4, May 2009, Pages 835-841,

ISSN 0023-6438, 10.1016/j.lwt.2008.11.013.
(http://www.sciencedirect.com/science/article/pii/S0023643808002867)

Abstract: **Summary**

Onion flavonol content and antioxidant activity have been related to human health promoting effects. Quercetin and quercetin glucosides (quercetin-4′-glucoside and quercetin-3,4′-diglucoside) have been reported the main onion flavonols in recent literature. Impact of combined treatments of high-pressure processing (HPP) and temperature on onion nutritional attributes has been scarcely studied.

Our study aimed to investigate the impact of HPP technology combined with temperature on onion (Allium cepa L. var. cepa, ‘Grano de Oro’) total phenol content, flavonol content, and antioxidant capacity. The experimental design comprised a response surface methodology according to a central composite face-centred design. The variable ranges were 100–400 MPa (pressure) and 5–50 °C (temperature), time was set up constant to 5 min. Response surfaces of onion total quercetin, quercetin-4′-glucoside, and quercetin-3,4′-diglucoside content showed a similar pattern. The application of low temperature (5 °C) combined with pressures of 100 and 400 MPa triggered to a better extraction of these flavonols among the treatments analysed. Response surface of the EC50 antioxidant parameter as a function of pressure and temperature showed a clear trend towards an increase in onion antioxidant activity when applying pressures from 100 to

400 MPa. Four hundred megapascals/5 °C-processed onion showed an approximately 33% higher quercetin-4′-glucoside content compared with the untreated onion, and maintained the antioxidant activity of the untreated onion.

Keywords: Onion; High-pressure processing; Flavonols; Quercetin glucosides; Antioxidant activity

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1. Nina Beesk, Henrike Perner, Dietmar Schwarz, Eckhard George, Lothar W. Kroh, Sascha Rohn,

Distribution of quercetin-3,4′-O-diglucoside, quercetin-4′-O-monoglucoside, and quercetin in different parts of the onion bulb (Allium cepa L.) influenced by genotype,

Food Chemistry, Volume 122, Issue 3, 1 October 2010, Pages 566-571, ISSN 0308-8146, 10.1016/j.foodchem.2010.03.011.
(http://www.sciencedirect.com/science/article/pii/S0308814610002712)

Abstract: Summary

Flavonoids have gained much attention because of their proposed positive effects for human health. Onions are a rich source of flavonoids, consisting mainly of the major flavonols quercetin-3,4′-O-diglucoside (QDG) and quercetin-4′-O-monoglucoside (QMG) in the bulb and the aglycone quercetin in the outer scales. In this study, distribution of these three flavonoids was determined in 16 onion cultivars (Allium cepa) using HPLC–DAD. Three different parts of the onion bulb, the inner layers, the middle layers and the outer scales were analysed. The analysis showed varietal differences in the selected onion cultivars. The cultivars with the highest total flavonoid content were the red skinned ‘Red Baron’ and the yellow skinned cultivars ‘Ailsa Craig’ and ‘Prilep’. The distribution of the total flavonoid content in the different parts of the onion bulb showed the following order: middle layers > outer scales > inner layers. In the inner layers QDG was the major flavonoid, while in the middle layers QDG and QMG were in equal amounts. In the outer scales quercetin was the major flavonoid prior to QMG.

Keywords: Onions; Allium cepa; Flavonoids; Quercetin glucosides; Cultivars; Profiling

2. Rosa María Pérez-Gregorio, Mercedes Sonia García-Falcón, Jesús Simal-Gándara, Ana Sofia Rodrigues, Domingos P.F. Almeida

Identification and quantification of flavonoids in traditional cultivars of red and white onions at harvest

Journal of Food Composition and Analysis, Volume 23, Issue 6, September 2010, Pages 592-598,

ISSN 0889-1575, 10.1016/j.jfca.2009.08.013.
(http://www.sciencedirect.com/science/article/pii/S0889157509002634)
Abstract: Summary

Onions are rich in different types of phenolics, mainly flavonols, and in red varieties anthocyanins are also present. This is significant because these classes of phenolics are antioxidants and hence may impart important functional properties to onions. The aim of the present work was to simultaneously determine flavonol and anthocyanin concentrations in different onion varieties, two white (Branca da Póvoa and the hybrid SK409) and three red (landrace Vermelha da Póvoa, a selected line of Vermelha da Póvoa and Red Creole). Flavonols (quercetin 7,4-diglucoside, quercetin 3,4-diglucoside, isorhamnetin 3,4-diglucoside, quercetin 3-glucoside, quercetin 4-glucoside and isorhamnetin 4-glucoside) were the predominant polyphenolic compounds. White cultivars had the lowest total flavonol content, with values of 89.3 ± 38.5 and 101.0 ± 18.9 mg quercetin/kg fresh weight for Branca da Póvoa and the hybrid SK409, respectively. The red onions had the highest levels of flavonols, especially the selected population of Vermelha da Póvoa and Red Creole, with values of 280.2 ± 41.5 and 304.3 ± 81.2 mg quercetin/kg fresh weight, respectively. Red onions are not only richer in flavonols, but also contain anthocyanins. Four anthocyanins (cyanidin 3-glucoside, cyanidin 3-laminaribioside, cyanidin 3-(6″-malonylglucoside), and cyanidin 3-malonylaminaribioside) were quantified in all red onions, with Red Creole presenting the highest concentration (28.6 ± 8 mg cyanidin/kg fresh weight). Red onions may be recommended for their major potential functional properties. A distinct gradient in total flavonoid content was found between the outer, central and inner edible scales and along the longitudinal axis of the bulb. Differences in flavonol levels between small- and large-sized onions were also found. All of these factors are of paramount importance for sampling and characterizing onions with regard to flavonoids.
Keywords: Onion; Onion bulbs; Allium cepa: Polyphenols; Flavonoids; Anthocyanins; Flavonols; Food analysis; Food composition

3. Ana Sofia Rodrigues, María Rosa Pérez-Gregorio, Mercedes Sonia García-Falcón, Jesús Simal-Gándara, Domingos P.F. Almeida

Effect of post-harvest practices on flavonoid content of red and white onion cultivars

Food Control, Volume 21, Issue 6, June 2010, Pages 878-884,
ISSN 0956-7135, 10.1016/j.foodcont.2009.12.003.
(http://www.sciencedirect.com/science/article/pii/S0956713509003284)
Abstract: Summary

Onions are major sources of flavonoids in the human diet. However, little information is available regarding the effects of long-storage or exposure to specific stress conditions on flavonoids content of onions. The aim of this work was to assess the effect of different post-harvest treatments on the flavonoid

composition of two Portuguese landrace varieties of onions (‘Branca da Póvoa’ and ‘Vermelha da Póvoa’). The evolution of the content of some major flavonols and anthocyanins was measured in red and white onion bulbs (from 2005 and 2006 harvests) during 7 months of storage, under refrigerated and under traditional bulk storage in the field. Total flavonols increased up to 64% after 6 or 7 months of storage. This increase was especially important during the first 3 months of storage (58% increase). In red onions, with the largest concentrations in flavonols, bulbs stored in the field reached higher levels of flavonoids (64% maximum) than refrigerated onions (40% maximum). For red onions, the increase after 6-months storage usually has place when the flavonol post-harvest levels are low (40–64% increase), whereas for white onions the increase after 6-months storage is important for onions with higher levels after harvest (44–60% increase). These results suggest that storage at fluctuating ambient temperatures can positively affect flavonol metabolism, while keeping the flavonols profile. There were no significant modifications of the total levels of anthocyanin pigments after 6 months of storage of red bulbs, but after 7 months total anthocyanin content was reduced between 40% and 60%. Post-harvest UV (40 kJ/m2, 1 week storage) and ethylene (100 µL/L for 24 h, 2 months storage) treatments did only affect the flavonol content of the edible portion of onions with a profitable increase.

Keywords: Allium cepa; Flavonols; Quercetin; Anthocyanins; Storage; UV-C; Ethylene

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SCIENCEDIRECT 2011

1. Domínguez, J.M. Tarjuelo, J.A. de Juan, E. López-Mata, J. Breidy, F. Karam, Deficit irrigation under water stress and salinity conditions: The MOPECO-Salt Model,

Agricultural Water Management, Volume 98, Issue 9, July 2011, Pages 1451-1461,
ISSN 0378-3774, 10.1016/j.agwat.2011.04.015.
(http://www.sciencedirect.com/science/article/pii/S0378377411001041)

Abstract: Summary

In both arid and semi-arid areas the use of saline water for irrigation is a common practice, even though it may cause a drop in crop yield and progressive soil salinization. In order to determine the most suitable irrigation strategy for higher yield, profitability, and soil salinity management of certain crops, the MOPECO-Salt Model has been developed. This model was first validated in the Eastern Mancha Agricultural System in Albacete (Spain) through a test carried out on onion crop in April–September 2009, where the simulated yield was 2% lower than the observed one. The model was then tested at Tal Amara Research

Station in the Central Bekaa Valley Agricultural System (Lebanon) using data from a 5-year experiment on the effects of deficit irrigation on two cultivars of potato (Spunta: July–October 2001, and June–September 2002; and Agria: March–August 2004, 2005, and 2007). Furthermore, these results were compared with those obtained through AquaCrop, which does not currently assess crop response to salinity. Differences between observed and simulated yields were lower than 3% for MOPECO-Salt and up to 12% for AquaCrop. According to findings from simulations, the irrigation strategies without leaching fraction employed in both areas are remediable since the off-season rainfall is sufficient to wash out soluble salts supplied with irrigation water. Results showed that as much as 14.4% water could be saved when this strategy was adopted for onion crops.

Keywords: Salinization; Leaching fraction; Water stress; AquaCrop; Solanum tuberosumL.; Allium cepaL.

2. Zill-e-Huma, Maryline Abert Vian, Anne-Sylvie Fabiano-Tixier, Mohamed Elmaataoui, Olivier Dangles, Farid Chemat,

A remarkable influence of microwave extraction: Enhancement of antioxidant activity of extracted onion varieties,

Food Chemistry, Volume 127, Issue 4, 15 August 2011, Pages 1472-1480, ISSN 0308-8146, 10.1016/j.foodchem.2011.01.112.
(http://www.sciencedirect.com/science/article/pii/S0308814611002196)

Abstract: Summary

Four (red, yellow, white and grelot onion) varieties of Allium cepa, a rich source of quercetin (flavonol) glycosides, were studied for their total content of reducing compounds (TCRC), flavonol content and antioxidant activity evaluation. Extracts obtained by solvent free microwave hydrodiffusion and gravity (MHG) technique and conventional solvent extraction (CSE) were analysed with high performance liquid chromatography (HPLC) for quantification of flavonoids. Three different methods were selected for evaluating the antioxidant capacity of the different onion varieties (after the determination of their phenolic content by the Folin–Ciocalteu method): the reduction of the stable DPPH (2,2-diphenyl-1-picrylhydrazyl) radical, the ORAC (oxygen radical absorbance capacity) method, and the inhibition of the AAPH-induced peroxidation of linoleic acid in SDS micelles. The highest antioxidant capacity was observed for red onion, followed by yellow, white and grelot onion. In spite of the low recovery of extractable flavonoids (quercetin 3,4′-diglucoside, 4′-glucoside and 3-glucoside), MHG remained the preferred extraction method in comparison to the conventional method, as all the samples obtained under microwave-assisted extraction (MAE) exhibited the highest antioxidant activities in all the tests. Also the microscopic observations of extracted tissues showed that at cellular level, microwaves induced disruptions of vacuoles and cell walls thus promoting the effectiveness of this method.

Keywords: Microwave extraction; Solvent free; Onions; Flavonoids; Antioxidant activity