



## Original Research Article

### Determination of nutritional value and antioxidant from bulbs of different onion (*Allium cepa*) variety: A comparative study

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#### A B S T R A C T

##### Keywords

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Onion (*Allium cepa*) is one of the most economically important vegetable crops consumed for their ability to enhance the added flavor and typical taste in other foods. It is a good source of antioxidants as well as some phytonutrients. So the experiment was conducted to study the nutritional quality along with various parameters contributing antioxidant activity from onion of different red and white type local varieties. The findings revealed from all the variety studied, shows 58.14 to 77.67 % DPPH value, comparable amount of flavanoids (0.422 to 1.232 mg.g<sup>-1</sup>) and anthocyanine content along with total phenol(8.96-18.23 mg.100 g<sup>-1</sup>), Pyruvic acid (1.09 to 1.33 mg.g<sup>-1</sup>), ascorbic acid (1.18 to 3.89 mg.100g<sup>-1</sup>), protein (0.79 to 1.27%) and titrable acidity (0.34–0.75%). These results reveal that JDRO-07-13 of Red variety and GWO-1 of white nutritionally found better due to its higher antioxidant property, proteins, carbohydrates, reducing sugar and should be include in diets to supplement our daily allowance needed by the body.

## Introduction

Onion (*Allium cepa*) is one of the important vegetable crops grown throughout the world including India. Onion bulb can be red, yellow or white however; the taste does not depend on the color. As a vegetable, it is a low in fat and calories, although, it primarily consumed for their ability to enhance the flavor of the other foods. It also contributes significantly to the human diet and has a therapeutic property. It is a good source of vitamins, minerals, polyphenols and a number of phytonutrients. These phytonutrients such as phenolics and

flavanoids present in onion have been found to act as antioxidants to lower blood pressure and prevent some kinds of cancer (Yang *et al.*, 2004; Slimestad *et al.*, 2007). Onions are a source of ascorbic acid and dietary fiber too. It also possesses a high content of flavonoid (mainly quercetin and its conjugates) and sulphur compounds (i.e. thiosulphinates), both of which have a high level of antioxidant activity (Griffiths *et al.*, 2002). Antioxidants can scavenge radicals by three major mechanisms: hydrogen atom transfer, electron transfer, and combination

of both these transfers (Prior *et al.*, 2005). Thus the experiment was planned to study the nutritional quality along with various parameters contributing antioxidant activity from various red and white type of local varieties of this region of Saurashtra.

## **Material and Method**

### **Source of Materials**

Seven varieties of onion viz., JWO-05-07, GWO-1, PWF-131 (White type) and AGFL-Red, Pillipati, JDRO-07-13, Talaja red (Red type) obtained from Vegetable research centre, Junagadh Agricultural University, Junagadh.

### **Sample Extraction**

From each variety, uniform size of onion were selected from three replication; dried outer layer of onions was removed, cleaned and cut into small pieces. Sample (0.5 gm) was weighed and homogenized until the tissue gets into a fine paste in a mortar and pestle in 5 ml of 80 % methanol, 2 N HCl, Water as per the assay. The samples were then centrifuged for 15 minutes at 5000 rpm at 4°C. The supernatant was separated and stored at -20°C for further studies.

### **Determination of reducing sugar, total soluble sugar, protein**

The amount of reducing, total sugar and true protein was estimated by Dinitrosalicylic acid (DNSA) reagent (Miller, 1959), Anthrone reagent (Hedge and Hofreiter, 1962) and Folin-Phenol reagent (Lowry *et al.*, 1951) respectively. Total acidity was determined by titration with a standard solution of NaOH as described by Rangana (1977). The content of pyruvic acid was estimated using dinitrophenyl hydrazine (DNPH) reagent (Anthon and Barrett, 2003)

### **Determination of Antioxidant related components**

The phenol content in was determined by method of Malik and Singh (1980) using methanolic extract. Total Ascorbic acid was quantified according to the colorimetric method described by Omaye *et al.*, (1979). Total flavonoid was estimated as described by the Chanda and Dave (2009). Quercetin was used as a standard and the results were expressed as mg of quercetin equivalents per gm of fresh weight sample. Total anthocyanins were analyzed by differential pH method (Cheng and Breen, 1991) and expressed as OD per g fresh weight.

### **Determination of Antioxidant Activity by DPPH**

Methanolic extract (100 µL) of sample was mixed with 900 µL of Tris HCl buffer (50 mM, pH 7.4) and 2 ml of DPPH (0.1 mM in methanol). The solution was incubated at room temperature for 30 minutes and the absorbance was read at 517 nm. The percentage of DPPH scavenging activity was determined as follows,

$$\text{DPPH Radical Scavenging Activity (\%)} = [(A_0 - A_1) / A_0]$$

where A<sub>0</sub> is the absorbance of control and A<sub>1</sub> is the absorbance of sample (Gyamfi *et al.*, 1999).

### **Statistical analysis of results**

For interpretation, data was statistically analyzed as per CRD design as out lined by Snedecor and Cochran, (1967).

### **Results and Discussion**

The results of various nutritional components as well as antioxidant

contributing factors like total phenol, flavonoids, total anthocyanins, ascorbic acid content and radical scavenging assays in both the onion varieties are given in Table.1 and Figure.1 to 4. The results were reported as mean values from three replications on fresh weight basis only.

The moisture content in bulb of variety varied from 89.04 to 91.94%. There were no statistical significant differences found among the varieties. The lower value for most of the parameters was observed in present study was due to the higher moisture content in the bulb. Total soluble sugar content varied significantly in the onion varieties were ranged between 8.2 to 12.2 mg g<sup>-1</sup> on fresh weight basis (Table.1). In general total soluble sugar remains higher in red type of onion. The highest amount was noted in case of JDRO-07-13 in case of red type onion whereas from white variety, the higher content was recorded in JWO-05-07 (10.4 mg g<sup>-1</sup>) compared to other white varieties. The reducing sugars also follow the same trend ranges from 2.21 to 3.62 mg.g<sup>-1</sup> fresh tissues. The total carbohydrate content on fresh weight basis also follows the same trends. These high amounts of carbohydrates and its sugar components in varieties investigated confer on them, significant roles to human health. This is because, apart from the supply of energy, carbohydrates are also needed in numerous biochemical reactions not directly concerned with energy metabolism. In addition, these carbohydrates may serve as substrates for the production of aromatic amino acids and phenolic compounds through the Shikimic acid pathway and this may confer high phenolic and antioxidant potentials on both varieties. Thus the carbohydrate levels of the studied samples suggest its usefulness as alternative source of glucose. Protein present in the onion is responsible for its nutritional value. It varied from 0.79 % to

1.27%. There was a no distinct difference in the protein content of both the types of varieties. However the highest protein was recorded in GWO-1 (1.27%) followed by JWO-05-07 (1.19%) in white and red varieties respectively. The higher protein contents of GWO-1 and JWO-05-07, indicates that its intake can contribute to the formation of hormones which controls a variety of body functions such as growth, repair and maintenance (replacement of wear and tear of tissues) of body. The titrable acidity ranges from 0.34-0.75%. It found low in JWO-05-07 and Talaja red.

The pungent flavor of onions is produced by hydrolysis of the flavor precursor compounds, like, S-alk(en)yl-L-cysteine sulfoxides, when the cells are mechanically ruptured, such as by cutting or macerating. The hydrolysis reaction is catalyzed by allinase and is completed within 6 min (Schwimmer and Weston, 1961). This reaction produces thiopropanol S-oxide (lacrymator), pyruvic acid, ammonia and many sulfur volatiles (Whitaker, 1976). The determination of pyruvate as an indicator of pungency is perhaps the most established method for pungency assessment in vegetable like onion. In present study, the pyruvic acid content varied from 1.09 to 1.33 mg.g<sup>-1</sup>. The lowest content was found in GWO-1 and highest content recorded in AGFL-Red. However, highly pungent onions are popular in India, less pungent ones are preferred in other countries.

So far as antioxidative property contributing parameters was concerned, the ascorbic acid concentration found in the range of 1.18 to 3.89 mg per 100g fresh weight. Ascorbic acid concentration was slightly less in all the cultures. Normally ascorbic acid content in the wild onion varieties was in the range from 5.0 to 10.0 mg/100g fresh weight (Lawande, 2001). However, lower content

recorded in present study was due to relatively higher moisture content found in bulb.

In general, higher phenol content was associated with higher antioxidant capacity (Santas *et al.*, 2008) and this was also validated in the case of onion (Rice-Evans *et al.*, 1996). Several studies have also reported a good correlation between the total phenol content of plant extracts and antioxidant activity (Bahorun *et al.*, 2004). However in present study, the variety JWO-05-07 having highest phenol content (18.23 mg g<sup>-1</sup>) has comparatively lowers antioxidant activity (Fig.1 and 4). The anthocyanine content was varied between 0.146 and 2.41 OD.g<sup>-1</sup>. All the white variety showed lower value (0.146-0.234) as compared to the red varieties. The highest vale was recorded for the variety JDRO-07-13 (2.41 OD.g<sup>-1</sup>). The flavanoid content also follows the same trend, ranges from 0.422 to 1.232 mg.g<sup>-1</sup>. The highest value was also observed in same variety JDRO-07-13.

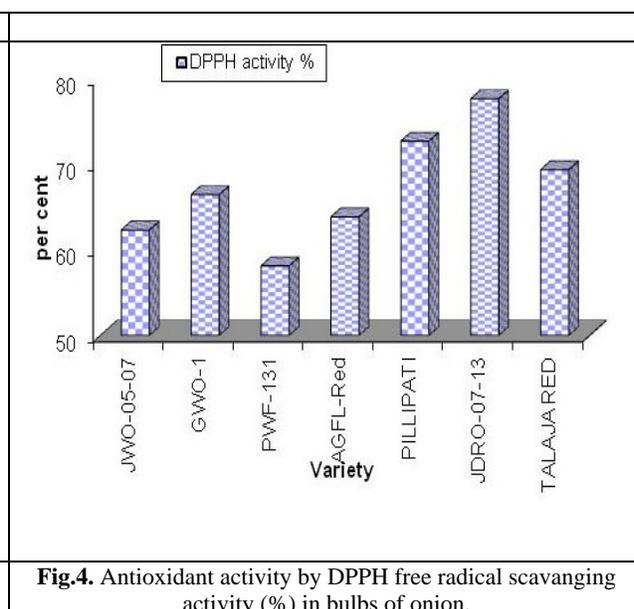
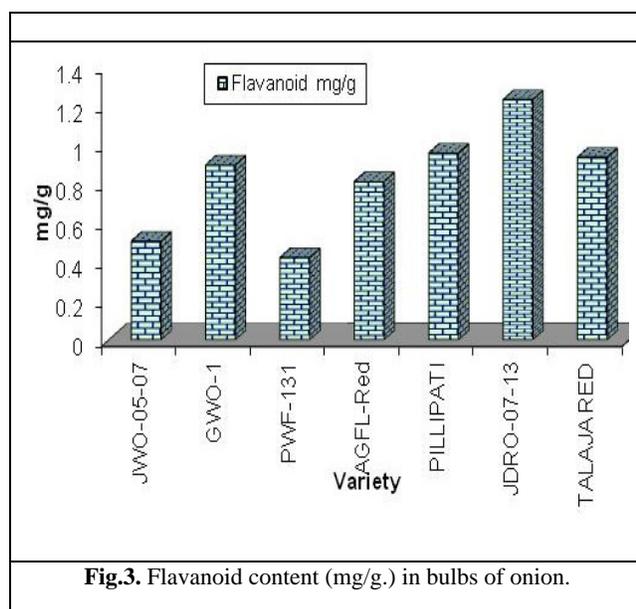
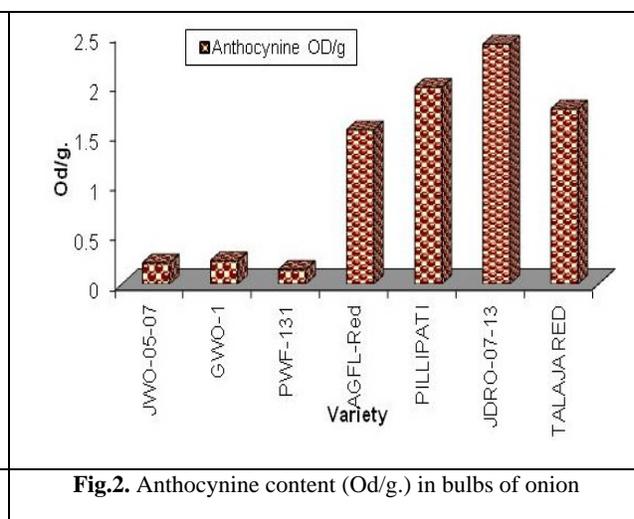
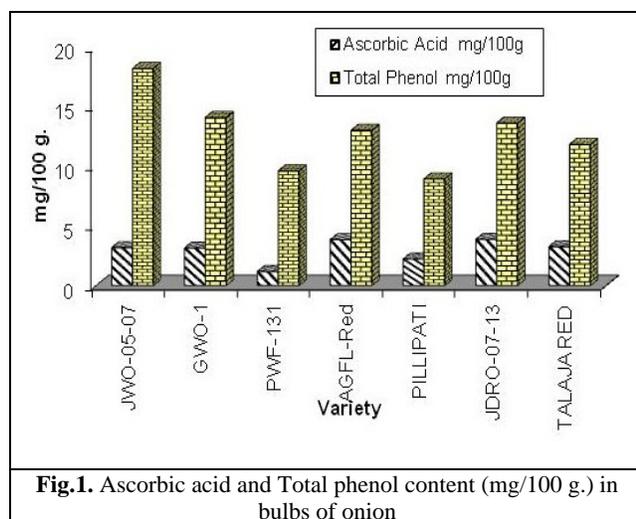
So far as antioxidant activity is concerned,

the DPPH method is frequently used to determine the antioxidant activity. The red onion extracts showed good antioxidant activity varying from 63.87 to 77.67%, and better than in the white variety ranging from 58.14 to 66.47 (Fig.4). The results showed that the antioxidant activity remarkably decreased white type of variety compared to red ones which is consistent with flavonoid contents as well as ascorbic acid content in present study. Prakash *et al.* (1999) also reported that the DPPH antioxidant activity for onion varied from 13.6% to 84.1%. Other studies showed that the radical scavenging activities in onion were 20% - 90% (Nuutila *et al.*, 2003).

On the basis of the comparative assessment, it can be disclosed from this work that in a red type, JDRO-07-13 variety and GWO-1 from white variety of *Allium cepa* L. is better due to its higher antioxidant property, proteins, carbohydrates, reducing sugar with an adequate quantity of ascorbic acid with potentials to meet the nutritional requirements of human health.

**Table.1** Nutritional composition of some onion varieties of Gujarat region

Sr. No.	Onion Sample Name	Moisture %	Total Carbo hydrate (mg.g <sup>-1</sup> )	Total Soluble Sugar (mg.g <sup>-1</sup> )	Total Reducing Sugar (mg.g <sup>-1</sup> )	Total Protein %	Acidity %	Piruvic acid (mg.g <sup>-1</sup> )
1	JWO-05-07	90.73	79.7	10.4	2.42	1.19	0.37	1.29
2	GWO-1	89.04	73.9	9.9	2.36	1.27	0.42	1.09
3	PWF-131	91.05	69.8	8.2	2.21	0.79	0.53	1.12
4	AGFL-Red	89.94	64.0	9.4	3.43	1.04	0.75	1.33
5	PILLIPATI	91.94	68.5	10.4	3.26	1.01	0.56	1.17
6	JDRO-07-13	89.44	93.0	12.2	3.62	1.16	0.34	1.22
7	TALAJA RED	88.76	86.4	11.1	2.54	1.07	0.34	1.32
	S.Em +	1.32	0.71	0.33	0.16	0.06	0.024	0.06
	CD at 5%	NS	2.18	1.01	0.49	0.19	0.073	1.37
	C.V.%	2.54	1.61	5.56	9.82	9.97	8.68	6.37



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