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# Antioxidant content of carrots with different pigments grown in Ontario, Canada.

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## INTRODUCTION

Vegetable crops, including carrots, are rich in phytochemicals and always an important part of a healthy diet. Epidemiological studies have consistently shown a strong link between antioxidant-rich diets and incidence of chronic diseases such as cancer and cardiovascular diseases. Anthocyanins, one of the major groups of flavonoids, are responsible for the blue, purple, red and pink colors in vegetables and fruits. Some health beneficial effects associated with anthocyanins include prevention of cancers [1] and lowering the risk of cardiovascular disease [2]. Different from the well known small berry fruits, anthocyanin rich vegetables have not been extensively studied. Carrots with different pigments and colours are have been commercially available for a few years (Fig. 1), and sometimes are available as an assortment of colours, such as the “Heirloom Collection” from Carron Farms in Ontario, Canada (Fig. 2).

In this study, total phenolic content and antioxidant capacity of five carrot cultivars and five breeding lines from the USDA/ARS carrot breeding program at the Univ. of Wisconsin were evaluated as a step in the selection and development of antioxidant-rich cultivars with enhanced human health and nutritional benefits. The antioxidant levels were compared to those in potatoes and published data on blueberries (Table 1).

## MATERIALS & METHODS

Carrot cultivars were: Purple Rain (purple, Bejo), Atomic Red ( red, Johnny’s Select Seeds), Envy (orange, Seminis) Mello Yello ( yellow, Bejo) and Crème de Lite ( white Nunhems). These were compared to breeding lines from the USDA/ARS carrot breeding program of Dr. Phil Simon.

Carrots were grown on muck soils in the Holland/Bradford Marsh ( pH 6.7, 48% organic matter), harvested 7 Nov., 2008 and placed in cold storage ( 2$^{o}$ C, 95% rh) for 20 weeks prior to assessment.

*Total Phenolic Content (TPC).* A modified Folin-Ciocalteu (FC) Reagent Method [3] was used for the analysis of total phenolic content in extracts. Results were expressed as microgram of gallic acid equivalent (GAE) per gram of dry weight.

*Antioxidant capacity.* Ferric reducing/antioxidant power (FRAP) Assay [4] *was* used to determine the antioxidant potential in selected vegetable cultivars. The FRAP values were expressed as micromole ascorbic acid equivalent (AAE) per gram of dry weight.

## REFERENCES

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Fig. 1. Carrots with different pigments
From the left, in 3’s, Atomic Red, Envy, Crème de Lite, Purple Haze, Cellobunch, Purple Rain, Indian red, White Satin, Alpha, Mello Yello, Cosmic Purple ,Yaya


Fig. 2. Heirloom Collection from Carron Farms, Bradford, Ontario, Canada

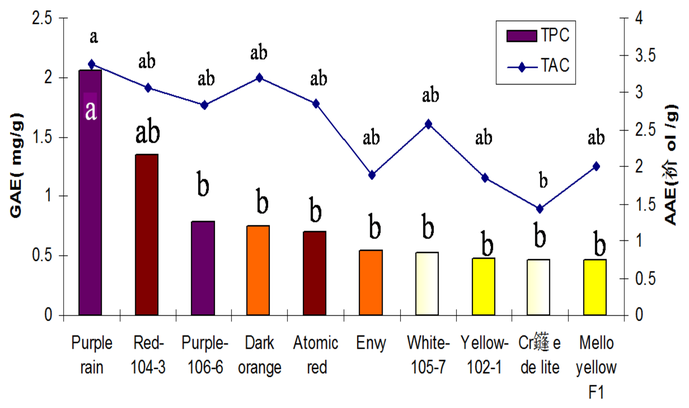
## RESULTS & DISCUSSION

❖Differences in the total phenolics and antioxidant capacity of the carrot extracts were identified. These ranged from 0.46 to 2.06 mg GAE/g carrot dry weight (Fig.3).

❖The cultivar Purple Rain had significantly higher total phenolic content and total antioxidant content than all other coloured carrots, except the breeding line Red-104-3.

❖Differences were found for TPC and TAC when the carrots were grouped according to colour. (Fig.4.). A positive linear correlation was found between TPC and TAC values ($R^2$= 0.9017). The anthocyanin pigments in the purple carrots may be responsible for the higher TPC and FRAP values.

**Fig. 3 Total Phenolic Content and Total Antioxidant Activity of Colored Carrot**




GAE: total phenolic content expressed as mg gallic acid equivalent (GAE) per gram dry weight.
AAE: total antioxidant capacity expressed as μmol ascorbic acid equivalent (AAE) per gram dry weight in FRAP assay
Numbers followed by the same letter were not significant different at p=0.05,Fisher’s Protected LSD Test.

## CONCLUSIONS

❖**There were greater differences in total phenol content than antioxidant content among carrots with different pigments.**
❖**Purple coloured carrots, rich in anthocyanins, are a good source of antioxidants, and can potentially be developed as functional foods.**
❖**Purple carrots are an economical source of antioxidants in the diet.**

**Total Phenolic & Total Antioxidant Activity of Color Carrots**

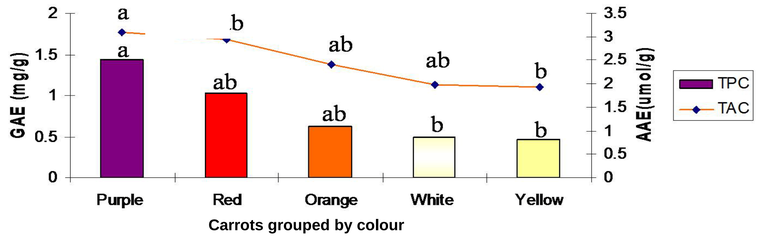



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Table 1. **Cost comparison of total phenol content and total antioxidant content of purple carrots, potatoes and blueberries**

| | Purple carrot | Purple potato | Blueberry |
|---|---|---|---|
| **Serving size (1 Cup )** | 128 g | 112 g | 145 g |
| **Moisture** | 87% | 79% | 85% |
| **Total Phenolic Compounds** | 35 mg | 85 mg | 435 mg |
| **Total Antioxidant Capacity** | 56 umol | 1505 umol | 1486 umol |
| **Price** | $0.14* | $ 0.4* | $ 2.5 |

Total phenolic content expressed as mg gallic acid equivalent (GAE)
Total antioxidant capacity expressed as μmol ascorbic acid equivalent (AAE)
Data source: University of Kentucky/ Sciencedirect/Metro
*regular carrot and potato mixes including purple carrots or potatoes

Purple potatoes and blueberries have a similar antioxidant capacity per serving. Purple carrots have fewer antioxidants but are a good source and are the most economical.

## ACKNOWLEDGMENT

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