

QUANTITATION OF POLYPHENOLS IN DIFFERENT APPLE VARIETIES CULTIVATED IN AOSTA VALLEY

Valentini S., Sado A., Chasseur M., Thedy L., Lale Murix H., Barrel I., Chatel A.
Institut Agricole Régional, Aosta, Italy



7th International
Congress on
Pigments
in food



Institut Agricole Régional

INTRODUCTION

Eleven traditional and more recent apple varieties (Renetta Canada (Fig. 1), Golden Delicious (Fig. 2), Gala, Jonagold, Red Delicious, Fuji, Pinova, Falstaff, Mairac, Topaz, Goldrush) were picked, between August and October, over four consecutive years, in orchards situated in different areas of Aosta Valley, a little region in the northwest of Italy.

The aim of this study was to compare the polyphenol content in different apple varieties, cultivated in Aosta Valley, at harvest time and after controlled atmosphere (CA) storage. The polyphenol content in Renetta Canada apples was investigated at harvest time, during the pre-storage period and after CA storage.



Fig. 1: Renetta Canada cultivated in Aosta Valley



Fig. 2: Golden Delicious cultivated in Aosta Valley

	Renetta	Jonagold	Red Delicious	Topaz	Falstaff	Mairac	Golden Delicious	Pinova	Goldrush	Gala	Fuji
N° of samples	48	16	24	4	4	4	40	4	4	40	16
Total Polyphenols mg/100g	156,63	111,22	99,06	85,03	83,06	82,05	76,41	74,37	72,78	69,49	65,40
sd	21.7	23.5	20.4	21.3	29.7	8.9	12.3	12.4	15.4	2.2	4.1

Table 1: Average content of total polyphenols (mg per 100g of fresh fruit), over four years, in eleven apple varieties cultivated in Aosta Valley, at harvest time.

	Renetta	Jonagold	Red Delicious	Topaz	Falstaff	Mairac	Golden Delicious	Pinova	Goldrush	Gala	Fuji
N° of samples	48	16	24	4	4	4	40	4	4	40	16
Total Polyphenols mg/100g	143.22	120.96	102.34	90.44	95.66	101.28	92.03	87.24	92.54	70.5	83.43
sd	17.5	21.9	23.6	14.1	32.8	14.6	16.9	25.7	22.7	6.6	17.8

Table 2: Average content of total polyphenols (mg per 100g of fresh fruit), over four years, in eleven apple varieties cultivated in Aosta Valley, after storage.

MATERIALS AND METHODS

Harvest time was decided according to commonly used ripening indices: flesh firmness, sugar content by refractometry, titrable acidity and starch, evaluated by colorimetry (ordinal scale from 1 to 5). Firmness, sugar content, titrable acidity tests were also performed during pre-storage on Renetta Canada and after CA storage in all the varieties investigated in this study. The Thiault quality index was calculated at harvest time, during pre-storage in Renetta Canada and after CA storage. The CA storage condition for Renetta Canada was 2% O₂, 3% CO₂, humidity 80-85% at 4°C; for the other apple varieties was 2% O₂, 3% CO₂, humidity > 90% at 1°C.

Samples were taken from fresh fruit, following the method of Mattivi et al. [2], using a mixture of acetone/water to obtain optimal polyphenol extraction. The total amount of polyphenols was measured with an optimized Folin-Ciocalteu (FC) assay [3], according to which interfering compounds, such as sugars, amino acids, and ascorbic acid were removed by cleanup on a C18 cartridge (0.5g, Sep pak, Waters). Extraction and analysis were performed at harvest time, during pre-storage in Renetta Canada and after CA storage. Quantitation of ascorbic acid was also performed using an HPLC method on all the varieties involved in this study (data not shown).

RESULTS

The average content of total polyphenols in the apple evaluated by the FC assay, over four years, at harvest time, was 88.7 mg/ 100g of fresh fruit, with significant differences depending on the apple variety (table 1).

Renetta Canada has a significant ($p < 0.01$) much higher content of total polyphenols than any other variety studied. Over four years, the average content of total polyphenols detected in the apple at harvest time was between 65.40 and 156.63 mg/100g of fresh fruit (fig. 3), according to the variety in the following increasing order: Fuji, Gala, Goldrush, Pinova, Golden Delicious, Mairac, Falstaff, Topaz, Red Delicious, Jonagold and Renetta Canada.

After storage the average content of total polyphenols in the apple, over four years, was greater than that found at harvest time (98.2 mg/ 100g of fresh fruit), always with significant differences depending on the apple variety (table 2).

In some of the apple varieties collected, no significant change in polyphenol content was observed over all the years considered; however some varieties such as Fuji and Golden showed a significant increase ($p < 0.05$) in polyphenol content after storage (Fig. 4), according to other authors.

CONCLUSIONS

For the first time, the present study has reported the differences in the composition of polyphenols in eleven apple varieties cultivated in Aosta Valley and has shown how CA storage does not significantly affect the total amount of polyphenols, indeed, in some of the apple varieties studied, seems to lead to an increase of these compounds.

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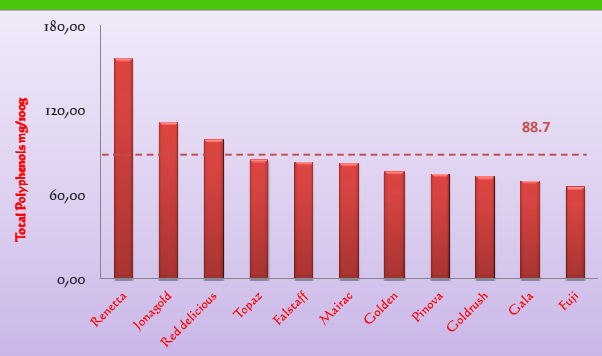


Fig. 3: Average content of total polyphenols (mg per 100g of fresh fruit), over four years, in different apple varieties cultivated in Aosta Valley, at harvest time.

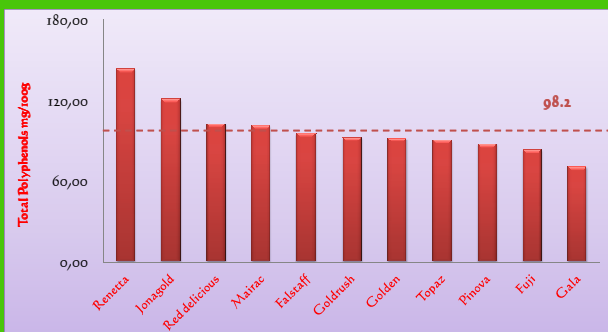


Fig. 4: Average content of total polyphenols (mg per 100g of fresh fruit), over four years, in different apple varieties cultivated in Aosta Valley, after storage.

ACKNOWLEDGEMENTS

Special thanks to Assessorato all'Agricoltura della Regione Valle d'Aosta and apple producers for providing many of the samples analysed in this study.