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Journal of Agroalimentary Processes and Technologies 2009, *15* (4), 506-510

Journal of Agroalimentary Processes and Technologies

Researches regarding the antioxidant capacity of some fruits vinegar

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Received: 01 Octomber 2009; Accepted: 03 November 2009

Abstract

The purpose of this study is to point out antioxidant capacity of some kinds of fruits (apples, bilberry, blackberry, raspberry) from raw material to processed products (vinegar obtained from these kinds of fruits). Nutritional antioxidants gain lately a special attention from researchers for their potential effects on preventing or improving more than 100 chronicle degenerative diseases, as cancer, heart diseases, growing older phenomenon. Is well known the importance of fruits and vegetable antioxidant capacity through direct consuming or derivates foods. Antioxidant capacity was determined with FRAP method on fruits raw material and during the process of fermentation Antioxidant capacity of these products was determined on final product and on several steps during fermentation process. Antioxidant activity of fruit vinegar was determined on groups of fruits and fermentation periods (3 periods of fermentation) at 593nm absorbance. After this study we could conclude that antioxidant capacity of fruits vinegar decrease during the fermentation process (increasing the absorbance values of antioxidant capacity during fermentation),but unfortunately could not make a very good correlation between various kinds of fruits vinegar and corresponding values for antioxidant capacity.

Keywords: antioxidant capacity, fruit vinegar, fermentation

1. Introduction

It is well known the fact that increased fruit and vegetable consumption is associated with a decreased incidence of cardiovascular diseases, cancer, and other chronic diseases. Antioxidant substances are defined as those substances that are against oxidation or which stops the reactions of oxygen or peroxides, ones of these substances (as tocopheroles) are used as conserving in different products (fats, oils, food, soaps – to stop oxidation, petrol oil – to avoid gums formatting, rubs – to avoid growing older).

Nutritional antioxidants gain lately a special attention from researchers for their potential effects on preventing or improving more than 100 chronicle degenerative diseases, as cancer, heart diseases, growing older phenomenon. [5,6,20,26].

We stopped on a very common product obtained from fruits: vinegar.

Although this product is well know from ancient times and used as a food product as well as medicine because of his multiple qualities, the fruit vinegar put together the old and the new in the same time. Antioxidant capacity of these products was determined on final product and on several steps during fermentation process. It was used as raw material apples, blackberries, bilberries, raspberries. We tried to obtain fruit vinegar through a ancient, traditional recipe. Several methods were developed recently for measuring the total antioxidant capacity of food and beverages [20,24,26], between them the ferric reducing antioxidant power (FRAP) method.

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2. Material and methods

2.1. Obtaining process of fruit vinegar. The recipe was that following:- raw material (apples, blackberries, bilberries, raspberries) 800g; water (1l); 200g honey/ sugar; 10g yeast/ 20g black bread. This way it was made 24 kinds of fruit vinegar:

Me + Z – apple + sugar; Me + D + Z – apple + yeast + sugar; Me + P + Z – apple + black bread + sugar; Me + M – apple + honey; Me + D + M – apple + yeast + honey; Me + P + M – apple + black bread + honey; A + Z – bilberry + sugar; A + D + Z – bilberry + yeast + sugar; A + P + Z – bilberry + black bread + sugar; A + M – bilberry + honey; A + D + M – bilberry + yeast + honey; A + P + M – bilberry + black bread + honey; Z + Z – raspberry + sugar; Z + D + Z – raspberry + yeast + sugar; Z + P + Z – raspberry + black bread + sugar; Z + M – raspberry + honey; Z + D + M – raspberry + yeast + honey; Z + P + M – raspberry + black bread + honey; M + Z – blackberry + sugar; M + D + Z – blackberry + yeast + sugar; M + P + Z – blackberry + black bread + sugar; M + M – blackberry + honey; M + D + M – blackberry + yeast + honey; M + P + M - balckberry + balck bread + honey.

On these 24 kinds of fruit vinegar it were made several phisico- chemical analisys. These analasys were made on the final product (fruit vinegar) and on the processing product during fermentation period. We chose to monitorise 3 periods of fermentation watching sugar contain, pH, metal contant, antioxidant capacity. The most representative results were expose.

2.2. Determination of antioxidant capacity through FRAP method

Reagents

- acetate buffer solution, pH = 3.6
- HCl 40mM : 1.46mL HCl concentrate (11M) bringing at 1L with distilled water;
- solution TPTZ (2, 4, 6-tri [2-piridil]-s-triazyne); the solution is prepared each time;
- solution of $FeCl_3$ 20mM; solution is prepared fresh;
- stock solution of $FeSO_4$ 1mM. With this solution are prepared other standard solutions which has to contain 0.1 ÷ 1µM Fe^{+2}/ mL. In order to prepare standard solutions for calibration curve. We used the fallowing concentrations: 0.1; 0.2; 0.4; 0.6; 0.8; 1.0 1µM Fe^{+2}/ mL

Aparatus

- Analytic balance**;** Was 220/C/2 (e= ± 0.1 mg)
- Spectrophotometer UV/VIS; Jasco V- 670
- Samples and standards are read against blank simple at 593nm. Total antioxidant capacity is directly proporcional with concentration in ferric ions.

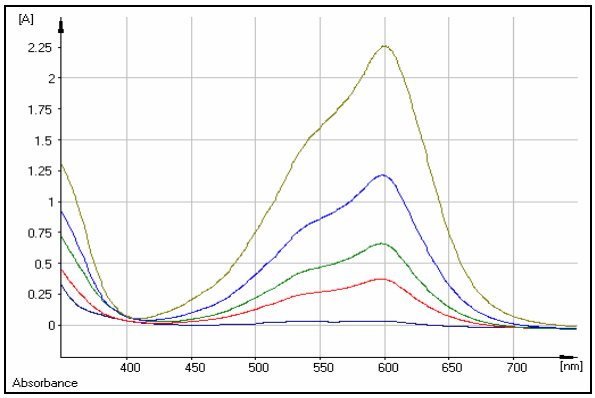

Figure 1. Specters of standards for determination of antioxidant capacity – FRAP method

$$Y= -0.02404+3.41362 \cdot X \; ; \; r^2=0.9991$$

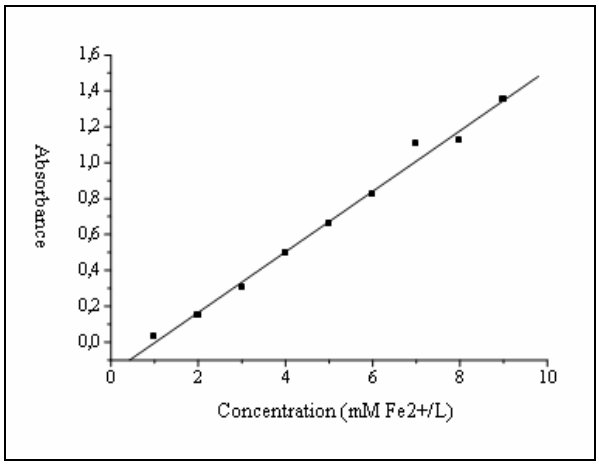

Figure 2. Standard curve used to determine total antioxidant capacity

3. Results and discussion

Frap evaluation of antioxidant capacity. The FRAP was assessed according to Benzie and Strain [1] using a spectrophotometer UV/VIS; Jasco V- 670. the method is based on the reduction of the Fe^{3+} TPTZ complex to the ferrous form at low pH. This reduction was monitored by measuring the absorption change at 593 nm. Antioxidant activity of fruit

vinegar was determined on groups of fruits and fermentation periods (3 periods of fermentation) at 593nm absorbance. We analyzed 24 kinds of fruit vinegar made from apples, blackberries, bilberries, raspberries at 593 nm for three periods of fermentation (I, II, III). From the figures above could be observed a different evolution of antioxidant capacity in the three periods of fermentation because of the initiation and stimulating factors for fermentation process. We used as stimulating and initialization factors black bread, yeasts, sugar and honey.

For bilberries vinegar the highest value for antioxidant capacity in the first period of fermentation has A+D+M and A+D+Z varieties (have the same value for absorbance), meaning varieties with yeasts, used to generate fermentation process.

The smallest value of absorbance for this period of fermentation had A+P+Z variety. Figure 3 shows that, with one exception (A+P+Z), antioxidant capacity decreases in second period of fermentation and then increases again in third period, riching aprox. the same values or a little bit higher.

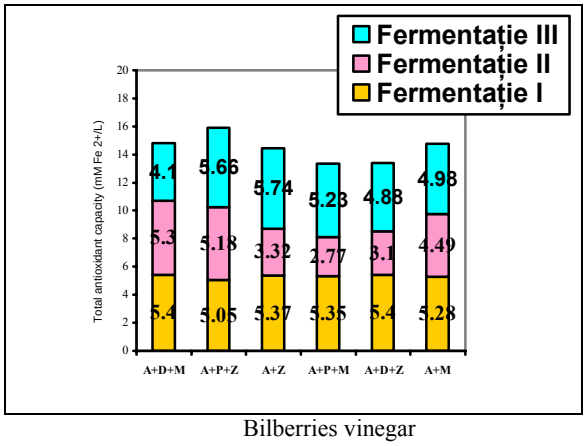

Figure 3. Antioxidant capacity of bilberries vinegar

For the apples vinegar in the first faze of acetic fermentation could be observed the highest values of antioxidant capacity, but different because of the acetic fermentation system used. Could be observed that in the second period of fermentation there is an decrease that could be explained through adsorbtion of antioxidant action substances on solid parts from liquid medium (figure 4).

Between faze II and III of fermentation the phenomenon is continue and reversible. For apples vinegar this adsorbtion is more evident because of the structure and texture of the fruits. These don`t depreciate so fast as blackberries or bilberries.

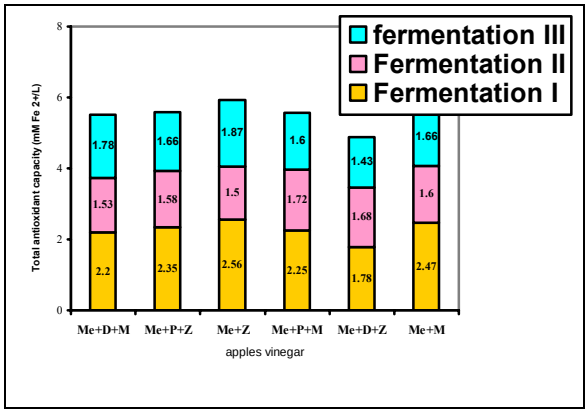

Figure 4. Apples vinegar antioxidant capacity

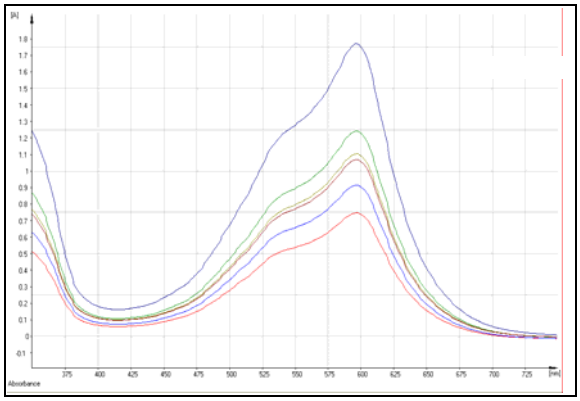

Figure 5. UV-VIS specters for blackberries vinegar, fermentation I

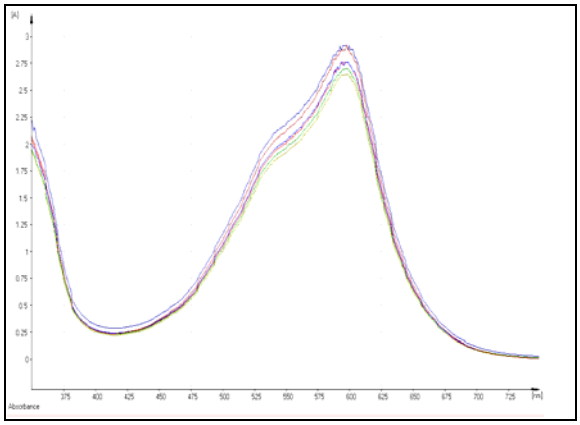

Figure 6. UV-VIS specters for blackberries vinegar, fermentation II

For blackberries vinegar the data showed that in the second period of fermentation the values for antioxidant capacity crows much, but decrease again in the third period, with two exceptions: M+Z and M+D+Z varietes, both with sugar as factor of fermentation. For these two varieties antioxidant capacity is increasing during the fermentative process.

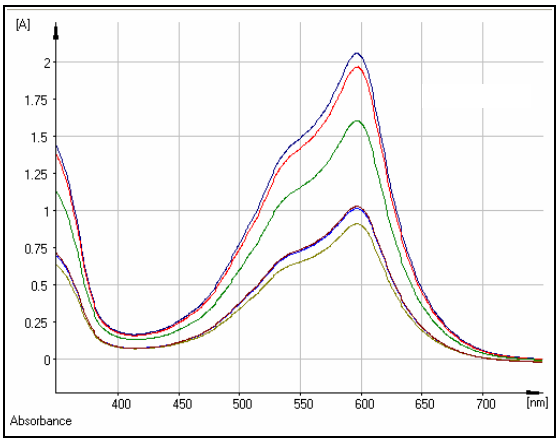

Figure 7. UV-VIS specters for blackberries vinegar, fermentation III

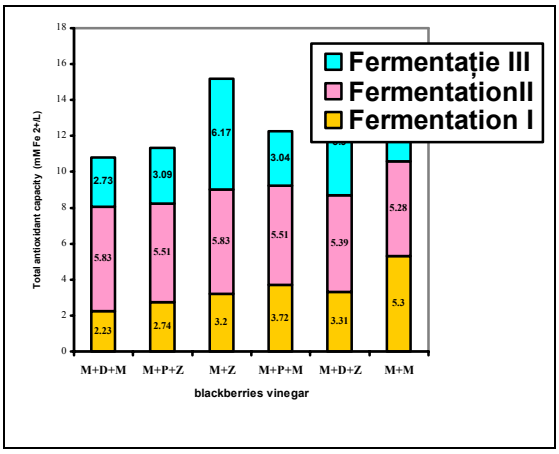

Figure 8. Antioxidant capacity of blackberries vinegar

The last analyzed vinegar was the raspberries one. Figure 9 shows antioxidant capacity modification for this kind of vinegar. The smallest values of antioxidant capacity in fermentation II and III were for Z+D+Z and Z+P+Z varieties, both varieties with sugar.

The second period of fermentation brings an decreasing in antioxidant capacity values, but it grows in the third period of fermentation.

This phenomenon could be explained through a temporary fixation on solid parts and then,because of the solubilisation of the structure, the antioxidant substances are released in liquid medium. The quantity of acetic acid developed in medium contribute to a better extraction of substances with antioxidant capacity. [2,16]

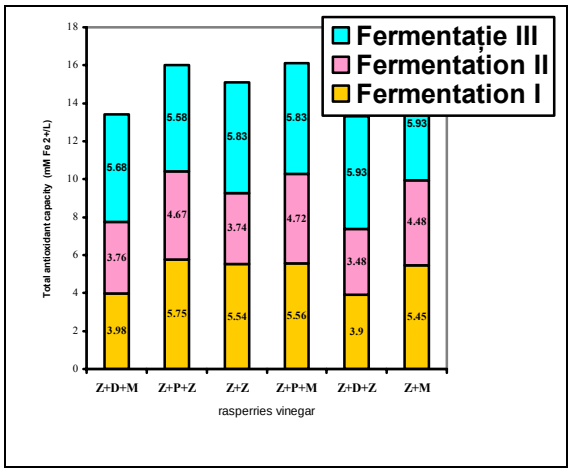

Figure 9. Antioxidant capacity of rasperries vinegar

Final values of antioxidant capacity for rasperries vinegar varieties are very close and the highest ones. This fact respect the literature that says that highest antioxidant capacity is ahown at blueberries and then at cultivated fruits (apples).[8,21]

1 – M+Z
2 – M+Z+D
3 – M+M
4 – M+P+M
5 – M+D+M
6 – M+P+Z

4. Conclusions

The results of this study indicates that:

- the highest antioxidant capacity from the four samples is that of raspberry, than blackberry, bilberry and finally apples. The results obtained confirm literature;[9,10,11,14]
- for apples, blackberry and bilberry vinegar spectrum UV-VIS absorbance values were very close;
- it could be observed that absorbance values rise as long as fermentation process is growing, so the antioxidant capacity of fruit vinegar decrease during the process;
- couldn't make a real correlation between varieties of fruit vinegar and antioxidant capacity values.

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