

## ASSORTMENT OF VINEGAR OF SUPERMARKETS IN IAȘI: QUALITATIVE ASSESSMENT ACCORDING TO EU STANDARDS

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**ABSTRACT.** We studied a number of 14 samples representing common (regular) vinegars from different sources and aromatic vinegars produced by traditional companies: from wine, five assortments (one with pepper, two with herbs, one from fermentation and a common one), two assortments from cider (France), one assortment from apples, one assortment from alcohol, one assortment from rice (Japan) and three assortments of balsamic vinegar (from Modena, Colavita - Italy and Kalamata - Greece). They were analyzed in terms of density, total dry extract, ashes (mineral content), total acidity (expressed in acetic acid) and colour. In parallel, we effectuated complex qualitative determinations according to the existing standard norms. Vinegars analyzed can be grouped into three distinct categories, depending on the content in the extract, respectively ash (mineral) : products with low extract and high acetic ; products with acetic degree between 6 and 8, with significant content in extract and mineral in large quantity (balsamic and flavored) ; products with acetic lower grade, with

extracts and mineral relatively low content (apple vinegar / cider) or upper limit (Kalamata balsamic vinegar and rice vinegar). A low mineral content might be associated with a less credible natural quality.

**Keywords** : vinegar, qualitative assessment, EU standards

**REZUMAT. Sortimentul de oțet existent în magazinele din Iași: evaluare calitativă, conform standardelor UE.** S-au luat în studiu un număr de 14 probe (sortimente comerciale), reprezentând oțeturi comune (obișnuite), de diferite proveniențe, și oțeturi aromatizate, produse de firme tradiționale: din vin, cinci sortimente (unul cu piper, două cu plante aromate, unul de fermentație și unul comun), două sortimente din cidru (Franța), un sortiment din mere, un sortiment din alcool, un sortiment din orez (Japonia) și trei sortimente de oțet balsamic (de Modena, Colavita - Italia și Kalamata - Grecia). Acestea au fost analizate în privința densității, extractului sec total, cenușii

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(conținut mineral), acidității totale (exprimată în acid acetic) și a culorii. În paralel, s-au efectuat determinări calitative complexe, conform normelor standard existente. Oțeturile analizate pot fi grupate în trei categorii distincte, în funcție de conținutul în extract, respectiv în cenușă (minerale) : produse cu extract redus și conținut acetic ridicat; produse cu gradul acetic între 6 și 8, având extract semnificativ și minerale în cantitate mare (balsamice și aromatizate); produse cu grad acetic mai redus, având extracte și conținuturi minerale relativ mici (oțetul de mere/cidru) sau la limita superioară (oțetul balsamic Kalamata și oțetul din orez). Un conținut mineral redus ar putea fi asociat cu o calitate naturală mai puțin credibilă.

**Cuvinte cheie:** oțet, evaluare calitativă, standarde UE

## INTRODUCTION

Acetic fermentation and the acetified products have been known for more than six millennia, once with their alcoholic precursors. In older times, they were identified as the same product (reminiscence from the French term *vinaigre* – sour wine). Vinegar was used in ancient times, in the Near East as a nutriment/spice associated to food (Ruth, 2, 14). It was also an ingredient of the soft drinks from the oldest times.

*Posca* was the drink of the Roman legionaries seconded to the Orient (a vinegar diluted with water also mentioned in the New Testament – Mathew – 27, 48; Mark 15, 36; Luke 23, 36). This product is still used nowadays by the French peasants who drink it during the

summer agricultural works to quench their thirst.

*Sherbet/sharaab* were the vinegar acidulated refreshments consumed in the medieval Islam world (Andalusia) and modern world (Egypt, Turkey) (Beceanu, 2002, Beceanu, 2008, Beceanu, 2009).

The technology of alimentary vinegars is much diversified offering consumers natural but expensive products as well as industrial vinegars manufactured from cheap raw materials or imitations of the expensive products. Very fine vinegars do not come from fermentative processes but from acetic acid of synthesis or distillation, by dilution and bonification (Alais, Linden, 1997, Banu, 1999, Bârzoii, Apostiu, 2002, Clemansa, 2004, Dan, 2000).

Special categories of vinegars are those characterized by high extract and important content of minerals. They also have special organoleptic qualities and sometimes distinct nutraceutical properties. They mention the **apple/cider vinegars** that are highly remineralizing, rich in enzymes and adjusting the flora from the gastro-intestinal tract and buffering the gastric acid. For these reasons, they are efficacious against flatulence (gases), spasms and stomach burns, the fight against food poisoning and stimulate digestion. The daily consumption prevents the risks of kidney infection and is efficacious against obesity (40 ml/day may ensure the loss of one kilo per month). Vinegars are a blood

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depurative balancing the blood pressure and pH as well as cholesterol. They are efficacious in the arthritic diseases dissolving and eliminating the lime deposits from the body. They are recommended in cases of arthrosis, gallstones and nephroliths etc. Though there is a literature exaggerating these effects, there is also the certitude of the nutraceutical action of this product (Lavédrine, 1999)\*.

**Aromatic vinegars** have been used from ancient times in medicine for their gastronomic, disinfectant and medicinal qualities. Primarily characteristic to the Mediterranean area but also the Germanic peoples, the most famous recipes used lemon, garlic, green walnuts, peanuts, onion and even wild berries. Among the herbs, they mention basil, tarragon and other aromatic plants.

Balsamic vinegars are produced in Italy (Modena) having a very specific and elaborated technology. Italian traditional products are obtained from certain species of grapes processed as musts. After a concentration  $\frac{1}{4}$  of volume, they are directly acetified in wooden barrels of difference types (oak tree, chestnut tree, cherry tree, ash tree, mulberry tree etc) by successive filing outs. Barrels are stored outside on the roofs of the houses and the thermal

difference between seasons favors maturation. The authentic qualities result from a slow (multiannual) process during which a complex of derived compounds of the acetic acid and primary components of musts forms. AOC product is taken into account after 12 years of evolution but extra vecchio quality (traditional) may be more than 25 years. Balsamic vinegars may not bear the name AOC and are produced not only in Italy but also in other countries (Greece) (Alessi, 1996).

The technology of food vinegars is highly diversified offering consumers natural but expensive products as well as industrial vinegars produced from cheap raw matters or imitations of the expensive products.

## MATERIALS AND METHODS

We analysed vinegars from different sources (from red/white wine, balsamic, from alcohol, from apples/cider or from rice, supplied as such or aromatized, non-matured or matured) (*table 1*). The Vinegretto product is a vinegar-based sauce containing spices and herbs, sugar etc. Most packages were from glass (11 assortments), only three assortments being packed in plastic material containers.

The ingredients and the recipe differ very much from one assortment to another and it is presented in short (*tab. 1*). At the same time, they mention the producing countries and distributors from Romania. The Romanian products are four in number, five from Italy, two from France, and one assortment from the Great Britain, Greece and Germany.

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Table 1 - Material used

No.	Products	Package	Weight	Ingredients	Producer/Distributor
1	Aceto di vino aromatizzato al pepe nero	Glass Bottle	250 mL	- wine vinegar, natural flavors, antioxidant: sulfur dioxide.	CARREFOUR România
2	Aceto di vino bianco aromatizzato alle erbe fini	Glass Bottle	250 mL	- white wine vinegar, natural flavors of sage, rosemary.	CARREFOUR România
3	Aceto Balsamico di Modena	Glass Bottle	1000 mL	- concentrated grape must, wine vinegar, coloring: caramel E 150 d, E 224 (contains sulphites).	Acetificio M. de Nigris Afragola - Italia/
4	Colavita Condimento Balsamico Bianco	Glass Bottle	500 mL	- white wine vinegar, concentrated grape, antioxidant E 224.	DARINNE DISTRIBUTION S.R.L.
5	Balsamic vinegar Kalamata	Glass Bottle	250 mL	- is a natural product produced from dried grapes from vineyards only peloponesiene.	C.C.PAPADIMITROIU S.A România
6	Vinegar Kräuter	Glass Bottle	500 mL	- wine vinegar, apple vinegar, salt, acidity regulator, sodium acetate, hardener carrageen, herbs, natural extracts of herbs.	MATRA INTERNATIONAL
7	Vinegar Fermentation	Plastic Bottle	1000 mL	- obtained exclusively from natural acetic fermentation	S.C. PRODALCOOL
8	Alcohol vinegar	Plastic Bottle	1000 mL	- vinegar fermentation of ethyl alcohol, coloring: caramel food, E 150 c.	S.C. SIENANA S.R.L.
9	Apple vinegar	Plastic Bottle	500 mL	- apple vinegar obtained by the classical method of natural fermentation.	VINCON VRANCEA
10	Japanese rice vinegar	Glass Bottle	150 mL	- distilled vinegar (made from wheat, cooking sake, rice and corn), water, salt.	ROCON DISTRIBUTION 2000
11	Vinaigre de cidre au cidre de Normandie	Glass Bottle	750 mL	- apple vinegar, E 223.	CARREFOUR România
12	Vinaigre de cidre aux pommes du verger	Glass Bottle	750 mL	- apple vinegar, E 224.	CARREFOUR România
13	Vinigretto	Glass Bottle	500 mL	- wine vinegar, sugar, natural extract of garlic, pepper, coriander, chives, bay leaves, mustard seeds	S.C. CRAMELE HALEWOOD S.A.
14	Wine Vinegar	Glass Bottle	750 mL	- wine vinegar, preservative sulfur dioxide.	CIRIO - Roma Italia

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The balsamic vinegars from Italy and Greece drew our attention since they are obtained from concentrated grapes must. Most assortments contain SO<sub>2</sub> as preservative.

To evaluate the samples, we used the existing European norms and standards. The appreciation of colour was made according to CIE-Lab norms.

On this occasion, we noticed that in some members states of the EU there are national provisions that have not been adopted at the level of the European Community (Ciani, 1998, Hurduc, 2001, Moțoc, 1962, Moțoc, 1964, Oancea, 2000).

### RESULTS AND DISCUSSION

From chemical analysis and physical determinations were obtained the following results:

There is not always an obvious correlation between density and refraction index (*table 2*). Density (specific mass) of the vinegars under study ranged between 1.109 and 1.007

g/cm<sup>3</sup>. We noticed that five assortments had a density close to that of water, namely between 1.010 g/cm<sup>3</sup> and 1.007 g/cm<sup>3</sup>. Six samples had a relatively higher density (between 1.022 g/cm<sup>3</sup> and 1.013 g/cm<sup>3</sup>). Only three samples of balsamic vinegars had a more important density between 1.109 g/cm<sup>3</sup> and 1.075 g/cm<sup>3</sup>.

In most cases, the refraction index registered the value of 1.34, except the two samples of balsamic vinegar of Italian origin.

For the total dry extract (*table 3*), we noticed a situation similar to that for density meaning that the highest values were registered by the balsamic vinegars (between 16.3 and 26.4 g/L). There is an intermediate segment with an extract higher than 1 g/L (between about 3.1 and 1.3 g/L) registered by seven samples. A number of four samples registered an extract smaller than 1 g/L.

**Table 2 - Density and refraction index**

No.	Products	Density g/cm <sup>3</sup>	Refractionindex
1	Aceto di vino aromatizzato al pepe nero	1,013	1,341
2	Aceto di vino bianco aromatizzato alle erbe fini	1,013	1,340
3	Aceto Balsamico di Modena	1,075	1,362
4	Colavita Condimento Balsamico Bianco	1,100	<b>1,372</b>
5	Balsamic vinegar Kalamata	<b>1,109</b>	<b>1,337</b>
6	Vinegar Kräuter	1,022	1,341
7	Vinegar Fermentation	1,013	1,341
8	Alcohol vinegar	1,010	1,339
9	Apple vinegar	<b>1,007</b>	1,338
10	Japanese rice vinegar	1,016	1,339
11	Vinaigre de cidre au cidre de Normandie	1,010	1,339
12	Vinaigre de cidre aux pommes du verger	1,010	1,339
13	Vinigretto	1,020	1,343
14	Wine Vinegar	1,010	1,338

Table 3 - Total dry extract

No.	Products	Total dry extract	
		g/L	%
1	Aceto di vino aromatizzato al pepe nero	1,39	0,137
2	Aceto di vino bianco aromatizzato alle erbe fini	1,31	0,129
3	Aceto Balsamico di Modena	16,26	1,513
4	Colavita Condimento Balsamico Bianco	26,01	2,365
5	Balsamic vinegar Kalamata	26,39	<b>2,380</b>
6	Vinegar Kräuter	2,36	0,231
7	Vinegar Fermentation	0,75	0,074
8	Alcohol vinegar	0,07	<b>0,007</b>
9	Apple vinegar	0,91	0,091
10	Japanese rice vinegar	2,37	0,233
11	Vinaigre de cidre au cidre de Normandie	1,64	0,163
12	Vinaigre de cidre aux pommes du verger	1,61	0,159
13	Vinigretto	3,06	0,300
14	Wine Vinegar	0,89	0,088

The mineral content (*table 4*) of the samples under study registered fewer extreme values. Thus, Kräuter vinegar and rice vinegar's content was above 10g/L. Most samples' content ranged between 2 and 6 g/L (seven assortments). At the same time, five assortments registered values below 2 g/L, among which one smaller than 1 g/L (vinegar from alcohol). Not always did we notice a correspondence between the quantity of ashes g/L and its alkalinity expressed in gK<sub>2</sub>CO<sub>3</sub>/L.

According to Favier J.C. et al. (1995), the vinegars for current consumption contain the following mineral elements (mg/100g): sodium 20, magnesium 20, phosphor 25, potassium 90, calcium 15 and iron 0.5, the total reaching about 170 mg/100 g (an equivalent of the product Vinegar from white wine aromatized with fine herbs).

Total acidity (*table 5*) expressed in g/100mL acetic acid oscillated within very large limits (from about 10 to 4.5). We may group samples in several classes of acetic content:

1. Prodalcool Vaslui fermentation vinegar and Seini alcohol vinegar's content in acetic acid was above 9%.

2. The acetic acid content of six samples was between 6 and 8% acetic acid (four Italian vinegars, the German vinegar and Vinegretto – vinegar-based product).

3. A content smaller than 6% acetic acid was registered by six samples, two of them having a content even below 5 % acetic acid (Kalamata balsamic vinegar and the rice vinegar). We also noticed that all vinegars from apples/cider had a quite similar content of acetic acid (5.2-5.3% acetic acid).

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Table 4 - Determination of ash and ash alkalinity

No.	Products	Ashes g/L	Ash alkalinity	
			meq/L	g/L K <sub>2</sub> CO <sub>3</sub>
1	Aceto di vino aromatizzato al pepe nero	2,15	28,0	1,93
2	Aceto di vino bianco aromatizzato alle erbe fini	1,79	29,0	2,00
3	Aceto Balsamico di Modena	4,28	24,5	<b>1,79</b>
4	Colavita Condimento Balsamico Bianco	1,35	30,5	2,10
5	Balsamic vinegar Kalamata	6,36	38,0	2,62
6	Vinegar Kräuter	<b>17,4</b>	42,5	<b>2,93</b>
7	Vinegar Fermentation	2,36	33,0	2,28
8	Alcohol vinegar	<b>0,32</b>	26,0	1,69
9	Apple vinegar	1,29	32,5	2,24
10	Japanese rice vinegar	10,9	26,0	1,79
11	Vinaigre de cidre au cidre de Normandie	2,89	40,0	2,76
12	Vinaigre de cidre aux pommes du verger	5,48	32,5	2,24
13	Vinigretto	3,36	32,5	2,24
14	Wine Vinegar	1,54	29,5	2,04

Table 5 - Total acidity

No.	Products	Total acidity, g/100mLacetic a.
1	Aceto di vino aromatizzato al pepe nero	7,516
2	Aceto di vino bianco aromatizzato alle erbe fini	7,543
3	Aceto Balsamico di Modena	6,842
4	Colavita Condimento Balsamico Bianco	5,657
5	Balsamic vinegar Kalamata	4,665
6	Vinegar Kräuter	6,142
7	Vinegar Fermentation	<b>9,967</b>
8	Alcohol vinegar	9,482
9	Apple vinegar	5,388
10	Japanese rice vinegar	<b>4,472</b>
11	Vinaigre de cidre au cidre de Normandie	5,226
12	Vinaigre de cidre aux pommes du verger	5,307
13	Vinigretto	6,627
14	Wine Vinegar	6,088

Most assortments analyzed (*table 6*) were clear (nine samples), three samples were opalescent and Modena balsamic vinegar was practically opaque to sunlight. As for the coordinate of complementary colour **a**, six samples may be classified under the predominant red colour, among

which the cider vinegar, the vinegar from orchard fruits and especially the aromatic vinegar with black pepper had the most significant values; the rest of eight samples may be classified under the predominant green colour without having a more important value.

As for the coordinate of complementary colour **b**, all variants were predominantly yellow and few assortments even had an intense yellow colour: the cider vinegar and the aromatic vinegar with black pepper.

Consequently, we may affirm that the vinegars under study were mostly yellow with a greenish hue, very less obvious. There were also samples having an obvious reddish hue (two assortments).

**Table 6 - Determination of chromatic parameters**

No.	Products	L	a	b
1	Aceto di vino aromatizzato al pepe nero	57,91	31,3	47,68
2	Aceto di vino bianco aromatizzato alle erbe fini	96,98	-1,62	15,85
3	Aceto Balsamico di Modena	2,05	1,50	3,53
4	Colavita Condimento Balsamico Bianco	94,78	-0,32	19,69
5	Balsamic vinegar Kalamata	6,87	3,69	1,19
6	Vinegar Kräuter	96,06	-0,77	8,16
7	Vinegar Fermentation	96,95	-1,57	15,45
8	Alcohol vinegar	98,97	-0,65	4,96
9	Apple vinegar	97,11	0,58	9,68
10	Japanese rice vinegar	96,72	-1,19	13,80
11	Vinaigre de cidre au cidre de Normandie	95,21	-0,51	21,70
12	Vinaigre de cidre aux pommes du verger	65,24	19,3	64,12
13	Vinigretto	79,38	6,76	28,90
14	Wine Vinegar	97,43	-0,70	10,12

L- brightness; a - coordinate complementary color red (+) and green (-)  
 b - coordinate complementary colors yellow (+) and blue (-)

## CONCLUSIONS

The vinegar samples under study presented highly differentiated characteristics in terms of origin and processing technology. We may group these products in several commercial categorie:

- Strong vinegars with reduced extract (Prodalcool Vaslui vinegar and Seini alcohol vinegar)
- Vinegars with an acetic content between 6 and 8% g acetic acid (most

of them from Italy and Germany), among which the balsamic ones had a high extract quantity and the aromatic ones had a more reduced extract.

- Vinegars with a lower acetic acid content (vinegars from apples and cider as well as the Greek balsamic vinegar – Kalamata and the rice vinegar). The vinegars from apples and cider registered relatively reduced extract content whereas the rice vinegar and especially the



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Kalamata balsamic vinegar had high/very high content of extract.

The mineral content (ashes g%) is not always correlated with the appreciation criteria used. Thus, the aromatic vinegar (Kräuter) registered the maximum value followed by the rice vinegar. We may distinguish two following groups in terms of mineral content: between 6 and 2 g% (seven assortments, Kalamata balsamic vinegar, two cider vinegars, Modena balsamic vinegar, Prodalcool Vaslui fermentation vinegar, aromatic wine with black pepper and Vinegretto). Less than 2 g% of mineral content was registered by five samples (white wine aromatic vinegar, Wine Vinegar, Colavita balsamic vinegar, Vrancea apple vinegar and Seini alcohol vinegar. The reduced mineral content may lead to the suspicion of counterfeit.

The colour of the samples under analysis was mostly yellow with a slight greenish hue. Only two samples were yellow with a significant red hue.

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