

Evaluation of the Sensory Quality of Extra Virgin Olive Oil in the Albanian Market

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Abstract:- Sensory analysis is an essential criteria for the official control of extra virgin olive oil (EVOO) quality. The purpose of this study was to assess the organoleptic quality of the olive oils declared as EVOO, in the Albanian market. The sensory analysis was performed by the official Albanian Panel Test, according to the method specified in the International Olive Council (IOC) and European Regulations, while physico-chemical indicators were analysed by the Oil Analytic Laboratory in the National Food Safety and Veterinary Institute. Samples were taken from the mills and in the market. Samples taken from the mills which resulted "EVOO" regarding the physico-chemical characteristics, in 50% of cases presented sensory quality non conform to standard for EVOO category. The EVOO samples presented an "well balanced" sensory profile with "medium" intensity of fruitiness and "light" intensity of bitterness and pungency. For clearly discrimination between different quality levels within the grade EVOO, were used additional sensory descriptors "Harmony" and "Persistency". Three from 5 samples taken from the domestic market, labelled as "Extra Virgin Olive Oil" resulted non conform to quality criteria and presented a sensory profile with defects.

Keywords:- extra virgin olive oil, grade, sensory quality, panel test, harmony, persistency, competition.

I. INTRODUCTION

Sensory analysis is an essential part of evaluating "Extra Virgin Olive Oil" quality and complements chemical analysis, both of which are requirements for determining the quality of olive oil according to IOC and EU standards. The Regulation 2568/91/CE amended, lays down the characteristics of the olive oil and relevant methods of analysis. This regulation defines as well the methodology to evaluate the sensory characteristics for classification and labelling of virgin olive oil, according to the intensity of defects and positive characteristic fruitiness, perceived by the selected, trained and monitored group, known as Panel Test (PT). The Albania has approximated the EU and IOC Legislations on characteristics of olive oils and relevant methods of analysis and has established the laboratory infrastructure on analysing the quality and purity criteria. Aiming at the official control of the sensory quality of olive oils in the domestic market, a group made up of the 10 persons have been trained for 5 years and selected as Panel Test by the IOC expert. In the year 2013 the Albanian Panel Test (APT) became functional and official as well. The APT conducted by an IOC expert, has evaluated the sensory quality of olive oils, in the framework of National Competitions of the domestic Extra Virgin Olive Oils, organized in the seasons 2011-2012-2013. The evaluation of sensory quality is performed according to Basic Profile Sheet (figure 1). Based on the detection of certain negative attributes as well as the measurement of the intensity of three positive attributes (fruitiness, bitterness and pungency) the PT leads to the classification of olive oil from organoleptic point of view. Three different quality levels can be distinguished:

- Oils that show a median of defects not above zero (=0) and a median of fruitiness above zero (>0) are categorized as Extra Virgin Olive Oil;
- Oils that show a median of defects up to 3.5 and a median of fruitiness above zero (>0) are categorized as Virgin Olive Oil;
- Oils that show a median of defects above 3.5 but no greater than 6, are categorized as Ordinary Virgin Olive Oil;

Aiming at the differentiation of the olive oils within the category "Extra Virgin Olive Oil" and to select the best EVOO's, the additional sensory characteristics like "Harmony", "Complexity" and "Persistency" were used (fig. 2).

"Harmony" is the degree of balance of all positive characteristics, which is evaluated quantitatively on a 10 cm scale. "Persistency" describes the length of time that retronasally perceived (positive) sensations persisting in the mouth and the senses. "Persistency" like "Harmony" is quantitatively evaluated on a 10 cm scale.

The aim of this study is to present the results of sensory evaluation for the first time in Albania in order to control the conformity of “Extra Virgin Olive Oil”, to the declared category, based on the standardized methodology and differentiation of the olive oils within the grade EVOO.

II. MATERIALS AND METHODS

2.1 Materials

The samples were collected during the 2012 and 2013 seasons. In the 2012 season, were taken 19 samples direct from the mills, from the major producers which were evaluated in the frame of the annual Albanian Competition of the Extra Virgin Olive Oil. In the 2013, were taken 5 samples in the market, labelled as “Extra Virgin Olive Oil”. The samples were stored in dark glass and transported refrigerated at 6°C. The physico – chemical indices were analysed in the Food Safety and Veterinary Institute, in Tirana.

The sensory analysis were performed by Albanian Panel Test which was recognized officially by the Ministry of Agriculture, Food and Consumer Protection in the year 2013 and is under the procedure to be recognized by COOI. The laboratory is well equipped and is located in Food Safety and Veterinary Institute in Tirana.

2.2 Analytical methods

The physico- chemical characteristics: free acidity, peroxide value, UV absorption etc, were determined following the analytical methods described in Regulation EEC/2568/91, amended.

The sensory analysis, for categorization of olive oils, were performed according to the method described in the Regulation EEC/2568/91, amended. The sensory assessment to control the conformity with the declared category EVOO, was carried out based on the Basic Profile Sheet (figure. 1).

The oil is graded by comparing the median value of the defects and the median for “fruitiness” with the reference ranges given above.

In the Regulation EEC/2568/91, there is a lack of objective measurement relating the sensory differences within the category of Extra Virgin Olive Oil. Aiming to differentiate the quality levels within the grade EVOO, were used the additional sensory attributes ‘Harmony’, ‘Persistence’ and ‘Complexity’. The sensory evaluation for ranging the best EVOO was performed based on Advanced Profile Sheet (figure 2).

Profile sheet for virgin olive oil

INTENSITY OF PERCEPTION OF DEFECTS

Fusty/muddy sediment | _____ →

Musty-humid-earthly | _____ →

Winey-vinegary — acid-sour | _____ →

Metallic | _____ →

Rancid | _____ →

Other (specify) | _____ →

INTENSITY OF PERCEPTION OF POSITIVE ATTRIBUTES

Fruity | _____ →
greenly ripely

Bitter | _____ →

Pungent | _____ →

Name of taster: _____

Sample code: _____

Date: _____

Comments: _____

Figure1. Basic Profile Sheet for sensory evaluation of the extra virgin olive oil.

**NATIONAL EXTRA VIRGIN OLIVE OILS CONTEST
2011-2012 SEASON
JUNE 25 – 29.2012**

Sample code: A 13
Taster identification no.:
Date:06/29/2012

Olfactory sensations (maximum 35 points)

Olive fruitiness (0–7) 5,9
Other fruits (0–3) 1,8
Green (grass/leaves) (0–2) 1,8
Other positive sensations (0–3) 1,8
Harmony ⁽¹⁾ (0–20) 16,8
Partial score 28,1

Gustatory-retronasal sensations (maximum 45 points)

Olive fruitiness (0–10) 5,9
Sweet (0–4) 1,5
Bitter (0–3) 2,9
Pungent (0–3) 2,7
Green (grass/leaves) (0–2) 1,7
Other positive sensations (0–3) 1,9
Harmony ⁽¹⁾ (0–20) 16,5
Partial score 33,8

Final olfactory-gustatory sensation (maximum 20 points)

Complexity ⁽²⁾ (0–10) 8,1
Persistence (0–10) 8,3
Partial score 16,4

Category of fruitiness:

GREEN (0 – 10) 7
RIPE (0 – 10) 3

Total score 78,2

Tirana, june 29, 2012

Figure 2. Advanced Profile Sheet for sensory evaluation.

III. RESULTS AND DISCUSSION

3.1. Sensory evaluation of “Extra Virgin Olive Oil” taken from the mills.

The sensory evaluation of the samples taken from the mills was performed in the framework of the National Competition of Extra Virgin Olive Oil for season 2011-2012, organized to select three best sensory quality “Extra Virgin Olive Oils”. This evaluation was performed by the Albanian Panel Test headed by a COOI expert.

The evaluation was performed in following steps:

First step: Analysis of physical chemical characteristics for all samples declared as “Extra Virgin Olive Oil”. From the results obtained and the classification of oil grade according to the standards, only 12 samples resulted conform to the grade declared “Extra Virgin Olive Oil” (Table 1).

Table 1. Physical chemical analysis results for samples from mills.

Samples	Acidity %	Peroxide (mEq O ₂ /kg)	K ₂₃₂	K ₂₇₀	ΔK	Oil Grade
1	0.4	9.2	-	0.197	0.0044	Extra virgin
2	0.54	13.2	1.996	0.168	0.0087	Extra virgin
3	0.27	8.07	1.457	0.087	0.0044	Extra virgin
4	1.28	10.8	1.551	0.14	0.0072	Virgin
5	0.54	10.8	1.725	0.144	0.0027	Extra virgin
6	1.1	16.1	1.908	0.141	0.0055	Virgin
7	2.2	16.2	1.772	0.199	0.0084	Ordinary virgin olive oil
8	0.3	12.2	-	0.172	0.0040	Extra virgin
9	0.52	10.76	1.754	0.140	0.0012	Extra virgin
10	0.62	13.18	1.721	0.159	0.0089	Extra virgin
11	1.8	20.06	-	0.152	0.0070	Inedible
12	0.25	12.9	1.866	0.104	0.0099	Extra virgin

13	0.7	13.03	1.849	0.165	0.0092	Extra virgin
14	0.36	15.06	1.527	0.102	0.0068	Extra virgin
15	0.4	14.5	1.645	0.177	0.0071	Extra virgin
16	1.2	12.9	1.877	0.176	0.0041	Virgin
17	2.7	22.1	-	0.213	0.0099	Inedible
18	0.52	17.1	1.776	0.189	0.0085	Extra virgin
19	1.22	7.8	1.488	0.122	0.0059	Virgin

Second Step: These 12 samples were evaluated from sensory point of view by the Panel Test, determining qualitatively and quantitatively the positive and negative characteristics according to the Basic Profile Sheet (Fig. 1). Each panellist assessed the samples marking the intensity of negative and positive characteristics perception. After sensory assessment of the 12 samples, the statistical processing was done according to the statistical program

as required by Regulation EEC No 2568/91. The median of each negative and positive characteristics, Standard Deviation for each characteristic was calculated, as well as robust variation coefficient as indicator for data quality, which must be < 20% (Table 2).

After the statistical calculation of the results for 12 tested samples, 6 samples resulted conform to the minimal standard (Md = 0, Mf > 0) for the “EVOO” grade, 4 other samples resulted with Md ≤ 3.5 and Mf > 0 grading as “Virgin Olive Oil” and two other samples “ Ordinary Virgin Olive Oil” grade (6>Md ≥3.5) (Table 3). The “EVOO” samples presented sensory profile with “medium” fruitiness <6 and “light” bitterness and pungency” < 3.

Third step: As 6 samples belonged to the same “EVOO” grade, their sensory quality differentiation was performed based on two parameters “fruitiness” and “well balanced”. The characteristic “well balanced” is used where the oil does not display a lack of balance, which is defined as the smell, taste and feel that oil has when the median of the “bitter and/or pungent” attributes is two points higher than the median of its “fruitiness”. Based on these characteristics were selected three best samples (samples 3, 8 and 10, table 3).

ALBANIAN OLIVE OIL PANEL TEST										
Sample code										
Date										
Example EVOO										
TASTER		Attributes	Musty	Winey	Metallc	Rancid	Othe	Fruity	Bitter	Pungent
1								3.8	2.0	3.0
2								3.0	2.5	3.5
3								3.5	1.5	4.5
4								4.0	1.5	3.0
5								2.0	2.0	4.0
6								3.5	3.8	3.9
7								3.0	3.0	4.0
8								3.5	2.9	3.5
9								3.2	2.0	2.2
10								2.5	2.0	1.8
N° Tasters		10								
		Attributes	Musty	Winey	Metallc	Rancid	Othe	Fruity	Bitter	Pungent
MEDIAN	Me							3.350	2.000	3.500
P 75	p 75							3.50	2.80	3.98
P 25	p 25							3.00	2.00	3.00
interquartile intervale	IQR							0.50	0.80	0.98
Robust standard Dev.	S							0.13	0.21	0.26
Rel. Robust std. dev %	RSD							3.99	10.69	7.45
Upper C.I	IC sup							3.61	2.42	4.01
Lower C.I	IC inf							3.09	1.58	2.99
RSD < 20%										

Table 2. Example of a result table of EVOO sample from mills.

Table 3. Grade evaluation based on the sensory analysis.

Sample	Fruitiness median (Mf)	Defects Median (Md)	Oil grade
1	Mf = 3.5 >0	Md=0	Extra virgin
2	Mf = 3.0 >0	Md=0	Extra virgin
3	Mf = 4.2 >0	Md=0	Extra virgin
4	Mf = 2.5 >0	Md = 2.0 ≤3.5	Virgin
5	Mf = 3.2 >0	Md = 2.2 ≤3.5	Virgin
6	Mf = 2.0 >0	Md = 3.0 ≤3.5	Virgin
7	-	6>.Md = 3.6 ≥3.5	Ordinary virgin olive oil
8	Mf = 5.0 >0	Md=0	Extra virgin
9	Mf = 2.5 >0	Md=0	Extra virgin
10	Mf = 4.5 >0	Md=0	Extra virgin
11	-	6>Md = 3.8 ≥3.5	Ordinary virgin olive oil
12	Mf = 2.8 >0	Md = 2.0 ≤3.5	Virgin

As it is shown in the Figure 3, Basic Sensory Profiles of positive characteristics, are very similar for the three best samples.

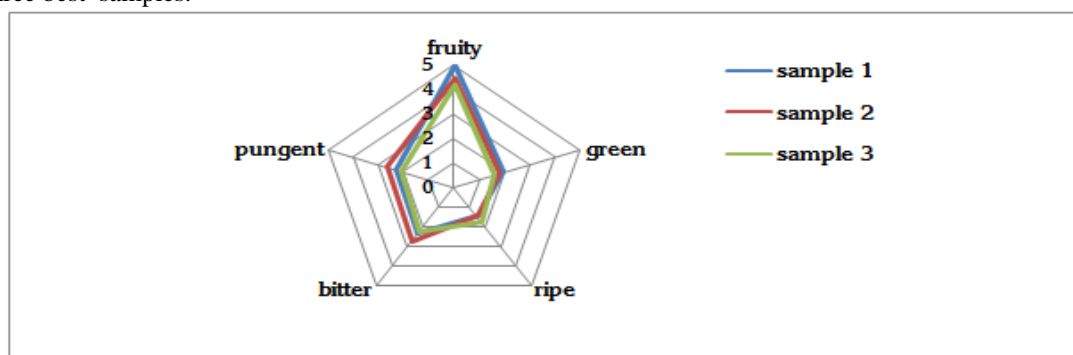


Figure 3. Sensory profiles for three best samples based on the Basic Profile Sheet.

Aiming at the further differentiation of the three best samples, the Panel Test performed the sensory evaluation according to an Advanced Profile Sheet (Fig.2). The data obtained for one of these best samples are presented in the Table 4.

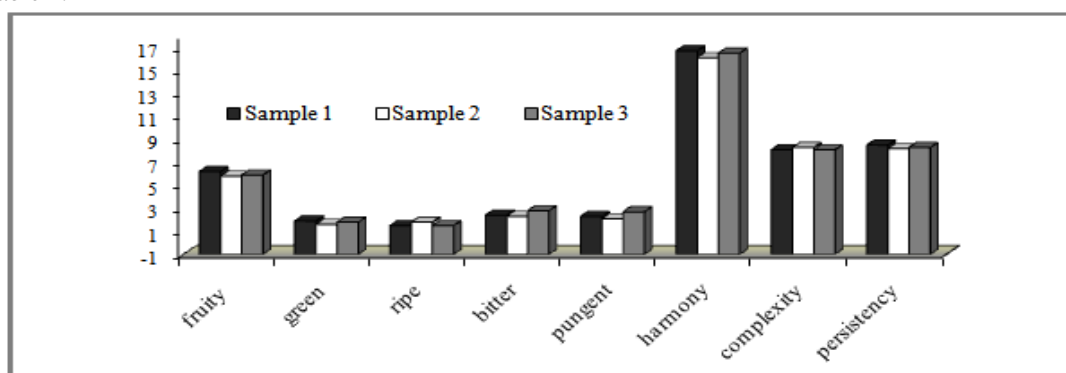


Figure 4. Sensory profiles of three best samples based on Advanced Profile Sheet.

In the Figure 4 is presented the sensory evaluation by scores based on Advanced Profile Sheet for three best samples. As is shown, the characteristics which makes difference between three “EVOO” samples are “Harmony” and “Persistency”. The sample nr.1 shows higher values of these characteristics and is qualified as the best quality Extra Virgin Olive Oil, followed by the samples nr. 2 and 3.

Table 4. Example: Summary table of sensory evaluation by scores, according to the Advanced Profile Sheet.

	A13										
Tasters	1	2	3	4	5	6	7	8	9	10	
Olive fruitiness	6.50	5.80	7.00	5.50	6.00	6.00	7.00	6.00	6.00	7.00	6.28
Other fruits	2.00	2.00	2.00	2.00	2.00	3.00	2.00	2.00	2.00	2.00	2.10
Green	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Other positive sensation	2.50	3.00	2.00	1.00	1.50	2.00	3.00	2.00	2.00	2.00	2.10
Harmony	18.0	18.0	19.0	16.0	16.0	18.0	17.0	17.0	18.0	16.0	17.3
	0	0	0	0	0	0	0	0	0	0	0
	31.0	30.8	32.0	26.5	27.5	31.0	31.0	29.0	30.0	29.0	29.7
	0	0	0	0	0	0	0	0	0	0	8
Olive fruitiness	8.00	9.00	9.00	7.00	6.00	7.60	9.00	9.00	9.00	10.0	8.36
Sweet	3.00	2.00	0.00	1.00	1.50	3.00	2.00	0.00	2.00	2.00	1.65
Bitter	2.00	2.00	2.00	3.00	2.80	3.00	3.00	2.00	2.00	3.00	2.48
Pungent	2.00	2.50	2.00	2.50	3.00	3.00	3.00	2.00	2.00	2.00	2.40
Green	2.00	1.00	2.00	2.00	1.80	2.00	2.00	2.00	1.00	1.00	1.68
Other positive sensation	2.00	2.00	1.00	1.00	2.50	3.00	2.00	3.00	2.00	2.00	2.05
Harmony	18.0	18.0	18.0	16.5	16.0	17.4	17.0	15.0	18.0	16.0	16.9
	0	0	0	0	0	0	0	0	0	0	9
	37.0	36.5	34.0	33.0	33.6	39.0	38.0	33.0	36.0	36.0	35.6
	0	0	0	0	0	0	0	0	0	0	1
Complexity	8.00	8.00	8.00	7.20	8.00	8.00	8.00	8.00	9.00	10.0	8.22
Persistence	8.00	8.00	9.00	8.50	8.00	8.50	10.0	8.00	9.00	10.0	8.70
	16.0	16.0	17.0	15.7	16.0	16.5	18.0	16.0	18.0	20.0	16.9
	0	0	0	0	0	0	0	0	0	0	2
	84.0	83.3	83.0	75.2	77.1	86.5	87.0	78.0	84.0	85.0	82.3
	0	0	0	0	0	0	0	0	0	0	1

3.2. Sensory evaluation of domestic market samples labelled as “Extra Vergin Olive Oil”.

According to the procedure, first the physical chemical analysis were performed and based on the standard, the grade of olive oils was determined. Three samples resulted “Extra Virgin Olive Oil”, one sample “Virgin Olive Oil” and another sample resulted blended and can not be graded as “Olive Oil” (Table 5). 4 samples resulting “Virgin Olive Oil” were submitted to sensory examination from the Panel Test. As this analysis was made in order to control the conformity of the declared grade, the sensory evaluation was performed based on the Basic Profile Sheet (Fig.1). The data obtained from each tester were processed in computer programme calculating the median value of the defects and the median for “fruitiness” and were compared to the standard values for grading the oils (Table 6).

Table 5. Physical chemical analysis tests for domestic market samples

Sample	Acidity (%)	Peroxides (mEq O ₂ /Kg)	K ₂₃₂	K ₂₇₀	ΔK	Grade
1	0,73	7.26	1.837	0.141	0.0058	Extra virgin
2	1,85	11.53	2.458	0.265	0.0069	Virgin
3	0,11	6.72	2.075	0.154	0.0081	Extra virgin
4	0,4	11.1	2.218	0.167	0.0085	Extra virgin
5	0,42	10.88	2.985	1.052	0.512	Blended

So, from 5 domestic market olive oils samples labelled as “Extra Virgin Olive Oils“, after the analysis of the quality criteria, only two samples resulted as “Extra Virgin Olive Oil”. Relating to fruitiness, both samples showed medium fruitiness. Sample nr. 1 showed balanced profile (bitterness, pungency) < fruitiness, while the sample nr.3 showed disbalanced profile (bitterness > fruitiness). Sample nr. 2 was graded as “Virgin Olive Oil” based on physical chemical analysis, while after sensory evaluation resulted with defects (rancid and winey) with intensity $3.5 < M_{d_{\text{rancid}}} = 3.6 < 6$, so it was graded as “Ordinary Olive Oil”.

Table 6. Samples classification based on sensory evaluation

Sample	Fruitiness median (Mf)	Defects median (Md)	Grade
1	Mf = 4.2 >0	Md=0	Extra virgin live oil
2	-	6.>Md=3.6≤3.5	Ordinary virgin live oil
3	Mf = 3.5 >0	Md=0	Extra virgin live oil
4	Mf = 2.5 >0	Md = 2.0 ≤3.5	Virgin live oil

IV. CONCLUSIONS AND RECOMMENDATIONS

- Results of this study show that sensory assessment, is an essential criteria for evaluation and classification of olive oil quality, for official control as well as for quality differentiation of “Extra Virgin Olive Oil” grade.
- The samples taken in the mills which resulted EVOO regarding the physical chemical analysis, after sensory evaluation resulted in 50% as Extra Virgin Olive Oil. The EVOO samples presented a sensory profile with “medium” intensity of fruitiness and “light” “bitterness and pungency”.
- Three from 5 samples taken from the domestic market, labelled as “Extra Virgin Olive Oil” resulted non conform to quality criteria and presented a weak sensory profile.
- The value of “Harmony” characteristic is an objective sensory characteristic in discriminating different quality levels within the grade of EVOO.
- We recommend the Advanced Profile Sheet (Fig.2) for our National Olive Oils Competitions.

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