

Argentinian consumers' extra virgin olive oil preference

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Olive oil has been introduced in many regions with Mediterranean climate around the world. However, many of these areas have not yet implemented an adequate olive oil culture. In this work, the preferences of Argentinian consumers have been studied with respect to extra virgin olive oil, to evaluate consumers' behaviour in regions with a different olive oil culture. With this purpose, three extra virgin olive oils with different purity and quality were purchased. Tasting sessions with 100 consumer judges took place in two Argentinian provinces with a different olive cultivation tradition (Buenos Aires and Mendoza). The oils were subjected to sensory evaluation by consumers (test for measuring the degree of satisfaction by using verbal hedonic scale). The results differed depending on the province. In Mendoza, with greater olive oil tradition, the olive oil of highest quality was the best valued, while in Buenos Aires, the preferred olive oil was the one with the lowest quality and probably mixed with other seed oils.

Keywords: Argentina, consumer, olive oil, quality, sensory.

1. INTRODUCTION

There is a widespread wrong idea that food analysis should be carried out in a chemical or microbiological laboratory, underestimating the sensory analysis. However, sensory evaluation techniques are as scientific as other laboratory analysis as they are based on several science branches like statistics, physiology, or psychology [1]. Sensory evaluation is defined as the analysis of food or other materials through the senses.

Food sensory analysis may be carried out by three main types of tests: affective, discriminatory, and descriptive. In the affective tests, the judge expresses his subjective reaction to the product [1]. Discriminatory tests are designed to establish differences between two or more samples and, in some cases, the magnitude or importance of that difference [2]. On the other hand, descriptive tests are carried out to define the properties of the food and measure them as objectively as possible [3].

The affective tests present high levels of variability in the results, which make them difficult to interpret because they deal with personal appreciations [3, 4]. The measurement of the satisfaction degree with verbal scales is one of the main tests among the affective ones. These are used when more than one sample must be evaluated at the same time, or when more information on a product is necessary. These tests attempt to manage subjective data such as the answers of the judges on how much they like or dislike a foodstuff more objectively. At least thirty judges are needed for this type of tests and they must be habitual or potential consumers of the specific food. [1, 5].

The consumption of virgin olive oil in Argentina has increased during the

last years (from 0.03 to 0.45 l/inhabitant per year), although it is still very low compared to the consumption of other seeds' oil (12 l/inhabitant per year). This increase has been especially important in restaurants, where the consumers who prefer it for raw salads has increased, although the corn oil is still the preferred oil for this purpose. The low consumption of olive oil is the result of a discredit advertising campaign that took place in the 1970s of which the consequences are still present.

Fifteen per cent of the olive oil consumed in Argentina comes from abroad (Spain and Italy). However, the actual trend is to increase the consumption of national olive oil due to the high price of European oils because of the compensatory charges on the European Union products.

This increased consumption of virgin olive oil in Argentina could be accelerated by being aware of the type of olive oil the consumers like. Thus, the first aim in this work is to know the preferences of Argentinian consumers towards their virgin olive oil, analysing several olive oil samples with different characteristics of purity and quality by sensory methods.

2. MATERIALS AND METHODS

2.1 SAMPLES SELECTION

Fifteen half litre bottles with different trademarks labelled as extra virgin olive oil were purchased in different supermarkets from the city of Buenos Aires (Argentina). All of them were analysed and three samples were chosen according to their quality characteristics to evaluate the consumers' preferences. Several parameters were analysed to determine the regulated quality and the purity of the samples.

2.2. ANALYSIS OF THE REGULATED QUALITY, PURITY, AND SENSORY CLASSIFICATION OF OIL SAMPLES

To evaluate the regulated quality and the purity of the oil samples, the following parameters were determined:

- Purity: Wax content, ECN 42 R – ECN 42 T, C18:1T trans isomers, C18:2T + C18:3T trans isomers, 3,5 stigmastadienes, Δ K, linolenic content, campesterol, apparent β -sitosterol and Δ 7-stigmastenol.

- Regulated quality: Free acidity, peroxide value, ultraviolet absorbance (K_{270} and K_{232}), median of defects, median of fruity and panel classification test.

Wax content was carried out following the analytical method described by Regulation EEC/183/1993 Appendix IV [6]. Determination of ECN 42 R – ECN 42 T was carried out following the analytical method described by Regulation EEC/2472/1997 Appendix XVIII [7]. Determination of C18:1T trans isomers and

C18:2T + C18:3T trans isomers were carried out following the analytical method described by Regulation EEC 2568/1991 Appendix X [8], EEC/1429/1992 [9] and EEC/796/2002 [10]. Determination of 3,5 stigmastadienes was carried out following the analytical method described by Regulation EEC/656/1995 Appendix XVII [11].

Determination of free acidity, peroxide value, ultraviolet absorbance (K_{270} and K_{232}), was carried out following the analytical methods described by Regulation EEC 2568/1991 [8]. Determination of median of defects, median of fruity and panel classification test was carried out following the analytical methods described by Regulation EEC 792/2002 [10].

Sensory classification of oils was established by the accredited olive oil tasting panel of the Catholic University of Cuyo (San Juan, Argentina)

2.3. PREFERENCE DETERMINATION TEST FOR ARGENTINIAN CONSUMERS

After the quality and purity parameters analysis, three samples of extra virgin olive oil were selected to perform the sensory study, with clear differences according to their purity and quality characteristics:

- Sample n. 1: Good sensory quality, high median of fruity, high physical-chemical quality, no mixed with other oils.

- Sample n. 2: Bad sensory quality, bad physical-chemical quality, mixed with other low-quality oils. Although it was written on the label, it was not an extra virgin olive oil. It was a sample of a clearly false oil.

- Sample n. 3: Good sensory quality, low median of fruity, median physical-chemical quality, no mixed with other oils.

A satisfaction degree measurement test with a verbal hedonic scale (Table I) was used to assess the extra virgin olive oil preferences of Argentinian con-

Table I - Tasting sheet used in the test for measuring the degree of satisfaction by using verbal hedonic scale samples of extra virgin olive oil evaluated

Name:	Date:		
Product: EXTRA VIRGIN OLIVE OIL	Attribute: SMELL		
Smell the samples of extra virgin olive oil that are presented and indicate your level of satisfaction. Look carefully at the sample numbers.			
Mark with an X the line that matches the rating for each sample			
Scale	Samples		
	219	674	348
I like a lot (+3)	-	-	-
I like (+2)	-	-	-
I like slightly (+1)	-	-	-
Nor I like or dislike (0)	-	-	-
I dislike slightly (-1)	-	-	-
I dislike (-2)	-	-	-
I dislike a lot (-3)	-	-	-

sumers. Two consumer judges' panels were set up in two different Argentinian cities (Buenos Aires and Mendoza), which have different olive oil traditions. At least one hundred consumers participated in each panel to evaluate the parameters of smell and taste. Consumer judges were selected with the only prerequisite of being usual consumers of extra virgin olive oil. The judges were selected randomly and they were of different ages (18-75 years) and living standards (householders, students, retired persons, professionals, etc).

For each evaluation, a verbal hedonic scale of seven points between -3 standing for an extreme dislike and +3 for an extreme like were used, with a median that indicated 'neither like nor dislike' [12].

To evaluate the smell preferences, samples of the three different oils used for this study were presented to each consumer judge in official blue glass cups. They were told to take a note of the sensation caused by the smell of each oil sample (-3 to +3). Between each sampling, consumer judges were asked to smell their clothes to clean their nostrils of possible remaining olfactory substances.

To evaluate the taste of the oils, the three samples were presented in plates, and the consumer judges used a small piece of bread to taste the oils, indicating the sensation it had on them (-3 to +3). Between samples, consumer judges were told to take a small piece of apple and a drink of mineral water to eliminate the sensations produced by the previous sample.

Samples were marked with a key (different according to the evaluated parameter) to avoid that the fact of knowing the origin of the oil could influence the evaluation by the consumers.

2.4. STATISTICAL ANALYSIS

Data were analysed with the SPSS 11.5 software for Windows. Important differences between samples were established by ANOVA, using the Duncan test.

3. RESULTS AND DISCUSSION

3.1. PURITY ANALYSIS

Argentine consumers do not have an in-depth knowledge of olive oil, so sometimes oils labelled as extra virgin may be subject to adulterations for which the content of the bottles does not correspond to that classification [13].

Thus, the first step was to establish the purity parameters of the samples used to ensure the proper classification of the samples. Table II shows the results of the purity analysis carried out on the three selected oil samples labelled as extra virgin olive oil, used for the sensory analysis (wax content, ECN 42 R – ECN 42 T, C18:1T trans isomers, C18:2T + C18:3T trans

isomers, 3,5 stigmastadienes, Δ K, linolenic content, campesterol, apparent β -sitosterol and Δ 7-stigmasterol).

Sample 1 was not considered fraudulent since all its values were within the range required by the European Regulation for extra virgin olive oil. In sample 3, the campesterol content is above the highest limit allowed, although this is the only parameter that did not fit the values established by the regulations for extra virgin olive oil. All the other parameters fall within the allowed limits for extra virgin olive oil. Previous works [14, 15] shown a similar pattern when Argentinian oils were analysed, with campesterol values exceeding the limits allowed by regulations. Thus, this sample was not considered fraudulent, and was labelled as extra virgin olive oil. The same characteristic has been found in different oils from *Cornicabra* variety cultivated in some areas of Spain [16-18]. On the other hand, sample number 2 was clearly fraudulent, probably mixed with cheap and poor-quality oils, as the parameters ECN42 R - ECN42 T, C18:2T + C18:3T trans isomers, 3,5 stigmastadienes, Δ K, apparent β -sitosterol and Δ 7-stigmasterol, showed values exceeding the maximum limits allowed by the European Regulation [19].

3.2. REGULATED QUALITY ANALYSIS

Table III shows the results obtained for regulated quality parameters in the 3 extra virgin olive oil samples selected for the sensory test (free acidity, peroxide value, uv absorbance K_{270} and K_{232}), and the sensory parameters evaluated by a panel composed of trained judges (median of defects, median of fruity and panel classification).

With respect to physical-chemical parameters, samples number 1 and 3 showed values below the maximum established by Regulation EEC/1989/2003 [19] for virgin olive oil (free acidity: $\leq 0,8$ g/100 g; peroxide value ≤ 20 meq/kg; $K_{270} \leq 0,22$; $K_{232} \leq 2,50$). According to these results, both samples were classified as extra virgin olive oils. However, some quality parameters from sample number 3 were near those limits, thus, physical-chemical quality from this sample was considered lower than sample 1. On the other hand, sample 2 exceeded the allowed limits for free acidity and K_{232} and was considered lampante regarding physical-chemical quality. Sensory classification was determined by trained judges in an accredited tasting panel. Samples 1 and 3 showed good results again, better in sample 1 (high values in the fruity median), whereas sample 2 was classified as lampante virgin olive oil, with clear defects of fusty/muddy sediment.

3.3. CONSUMERS' PREFERENCE

Two tasting sessions were performed, one in the city of Buenos Aires and the other in the city of Mendoza,

Table II - Purity parameters of the olive oil samples evaluated for the acceptance analysis

Sample	Wax Content (mg/kg of oil)	ECN42 R ECN42 T (%)	C18:1T Trans Isomers (% of total fatty acids)	C18:2T + C18:3T Trans Isomers (% of total fatty acids)	3,5 stigmastadienes (mg/kg of oil)	ΔK	Linolenic acid (% of total fatty acids)	Campesterol (% of total sterols)	Apparent β -sitosterol (% of total sterols)	$\Delta 7$ -Stigmastenol (% of total sterols)
*	≤ 250	$\leq 0,2$	$\leq 0,05$	$\leq 0,05$	$\leq 0,15$	$\leq 0,01$	$\leq 1,0$	$\leq 4,0$	$\geq 93,0$	$\leq 0,5$
**	≤ 300	$\leq 0,3$	$\leq 0,10$	$\leq 0,10$	$\leq 0,50$	-	$\leq 1,0$	$\leq 4,0$	$\geq 93,0$	$\leq 0,5$
1	194	0,1	0,02	0,02	0,03	$<0,01$	0,8	3,5	94,5	0,2
2	86	1,3	0,01	0,12	1,62	0,08	0,9	5,4	91,2	0,9
3	218	0,2	0,01	0,03	0,01	$<0,01$	0,8	4,2	93,5	0,2

* Values for extra virgin and virgin olive oil (CE, 2003). ** Values for lampante oil (CE, 2003).

each with 100 consumer judges. The average values for the parameters smell and taste obtained in the satisfaction degree measurement test are shown in Figure 1.

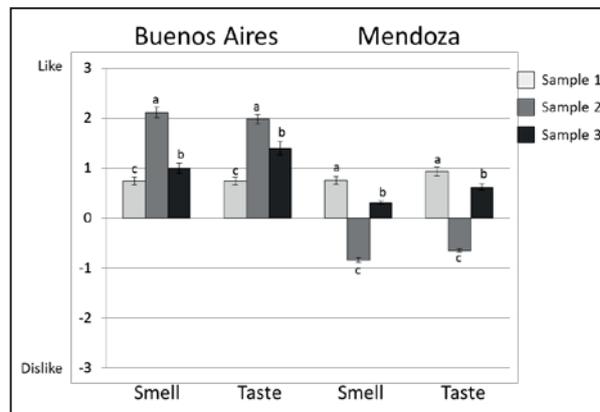


Figure 1 - Average values for parameters smell and taste from the acceptance test performed in Buenos Aires and Mendoza.

The results were different according to each province. Buenos Aires, the country's capital, is a region without any oil tradition where there is no olive cultivation or oil production at all. On the other hand, Mendoza is the largest olive oil producing region in the country.

When the tasting session took place in Buenos Aires, the best valued oil for both parameters evaluated (smell and taste) was sample 2, which is the sample with the lowest physical-chemical and sensory quality (classified as lampante) and probably fraudulent, mixed with other oils according to purity analysis. The sample with the highest physical-chemical and sensory quality (sample 1), was the worst valued. However, all the samples were evaluated positively, with values over 0, with sample 2 reaching values around 2 (I like). In the Buenos Aires region, consumers use other types of oils for cooking, and attributes of the olive oil like pungent or bitter may be considered undesirable. When the oil is mixed with other seed oils, the intensity of these attributes decreases and, consequently, the oil is valued better.

In Mendoza, with a traditional culture of olive oil, the best valued sample for both attributes was sample 1. In this case, the worst valued oil was sample 2, with negative values for both parameters (dislike). Thus, in this region, the results are consistent with the real quality of the samples measured by physical-chemical analysis and sensory classification by an accredited panel.

4. CONCLUSIONS

Olive oil is a typical product of the Mediterranean basin although olive cultivation has been exported to

Table III - Regulated quality and sensory parameters from the 3 oil samples used for the acceptance analysis

Quality parameters				
Sample	Acidity (g/100 g)	Peroxide index (meq/kg)	K ₂₇₀	K ₂₃₂
*	≤ 0,8	≤ 20	≤ 0,22	≤ 2,50
**	≤ 2	≤ 20	≤ 0,25	≤ 2,60
1	0,3	12,1	0,11	2,31
2	1,6	14,8	0,17	3,12
3	0,7	15,5	0,14	2,48

Sensory parameters				
Sample	Median of defects	Median of fruity	Classification panel-Test	Defects
	M _d = 0	M _f > 0	Extra Virgin	
	M _d ≤ 2,5	M _f > 0	Virgin	
	M _d ≥ 2,5		Lampante	
1	0	5,5	Extra virgin	-
2	4,7	1,2	Lampante	Fusty/muddy
3	0	1,7	Extra virgin	-

* Values for extra virgin and virgin olive oil (CE, 2003). ** Values for lampante olive oil (CE, 2003).

many other areas with similar climates in the world. One of these areas is Argentina, where there is an important cultivation area in the region of Mendoza. People of this region have a greater olive oil culture than in other areas of the country. Thus, the evaluations obtained in the samples that have been tested match the real quality of the oils estimated by physical-chemical and sensory analysis, as the highest quality oils were valued better. On the other hand, in the city of Buenos Aires, where there is no olive oil tradition and consumers use other types of oil, the best valued samples were those that were defective and that were considered lampante according to the sensory classification of the accredited panel. In these areas, positive attributes in olive oil, like spicy or bitter, are undesirable by consumers.

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