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Comparación del perfil vitamínico en jugos ultrapasteurizados de manzana y su impacto térmico de degradación

Comparison of vitamin profile in ultrapasteurized apple juice and its thermal degradation impact

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RESUMEN

La manzana contiene azúcares provenientes principalmente de la fructosa y, en menor grado, de la glucosa y la sacarosa. Además, tiene acido málico y ácido ascórbico, este último agente nutrimental que por lo general se cuantifica. Aproximadamente hay 10 mg de ácido ascórbico en cada 100 g de manzana, aunque eso depende de la calidad y la clase de esta fruta.

El ácido ascórbico es un nutrimento esencial que se puede hallar en frutas y verduras; sin embargo, el hombre no puede almacenarlo en su organismo porque es hidrosoluble. Otra de sus funciones está en la fijación de oxígeno —cuando los alimentos se embotellan o se enlatan, el oxígeno es eliminado o fijado si se agrega ácido ascórbico.

Durante la elaboración de jugos concentrados se utilizan tratamientos que originan cambios sustanciales en su sabor y olor, y que disminuyen la calidad nutrimental.

Palabras clave: Ultrapasteurización, degradación, ácido ascórbico.

ABSTRACT

The apple has mainly given by nutritional properties containing sugars, mainly fructose and in smaller proportion glucose and sucrose. Besides having malic acid also contains ascorbic acid, which is considered as a quality attribute so it is generally quantified. The block registers contained approximately 10 mg of ascorbic acid per 100 g. this depends on the quality and type of the block.

Ascorbic acid is an essential nutrient for humans that is found in fruits and vegetables, which, being water soluble, the man does not store it. In addition to its nutritional value another of its important functions is the fixation of oxygen; when foods are canned or bottled this contain oxygen, when add ascorbic acid this are fixed or removes oxygen.

During the preparation of concentrated juices industry, treatments by which the juice is subjected are used, this promotes substantial changes in flavor, aroma loss besides eliminating nutritional factors.

Keywords: Ultrapasteurization, degradation, ascorbic acid.

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INTRODUCCIÓN

The main objective of this analysis by HPLC equipment, is to determine the ascorbic acid content of different commercial juices and juice of a processed at the Faculty of Chemistry. Treatments usually uses the juice industry, as pasteurization and clarification, make the product loses nutritional value, why the amount of ascorbic acid containing apple juice shelled the region was determined without treatment. That way you could compare their vitamin profile (vitamin C) with the juices that had been ultrapasteurised, and determine both the loss and the addition, if held, ascorbic acid in ultra pasteurized juices. Jumex, Del Valle, Confrutta, Smile and JUACH: For this purpose the procedures used to develop clarified pasteurized juices and nectars pasteurized juices in samples of various brands like analyzed.

Chromatographic analysis of the clarified juices showed that only one showing a fair amount to the nutritional tables was the juice Del Valle, with an average of 9.99mg / 100g. Also, nectars Del

Valle brand juice showed higher content of ascorbic acid together with JUACH, surpassing the nutritional values table.

The result of the content of ascorbic acid in apple juice shelled and treatment of the region was 14mg / 100g. NMX-F-045-1982 standard states that the maximum value of ascorbic acid may be added to the apple juice is 15 mg / 100g, so that according to the values obtained, no juice exceeded that amount, being on only limit Del Valle juice with 12.2 mg / 100 g of ascorbic acid.

The apple fruit tree is probably the most extensive global distribution. Apple varieties grown commercially today are mainly derived from Malus pumila. Among the varieties of higher global production of this important result we can mention the following: Golden Delicious, Red Delicious, Rome Beauty, Starking and Starkimson. (González, 2006)

One of the characteristic products of the region of the state of Chihuahua is the apple, whose varieties are Golden Delicious, Red Delicious, Royal Gala and Golden Supreme, mainly in the municipality of Cuauhtémoc.

Apple quality is measured according to a combination of attributes that cause consumer satisfaction, among which are its appearance and freshness. Consumers are beginning to see food not only for energy and nutrients, but also as a source of minor compounds that benefit the body by preventing or alleviating the effects of some chronic diseases. (Silveira, 2007)

The properties of apple make a good natural remedy for many health problems and diseases, for example, nerve disorders, liver disease, poor digestion, diarrhea, insomnia, and so on. Thanks to its antioxidant effects and its contribution of phytochemicals, is ideal to combat aging, purify the blood and replenish the brain, especially in the case of students and people with severe mental activity. (Rossi, 2011)

Ascorbic acid is an essential nutrient for humans, so its insufficient intake causes a disease called scurvy. This acid is naturally present in many fruits and vegetables, also rich in vitamins, antioxidants, phenolic compounds and carotenoids foods. (John, 2002)

The apple juice concentrate is the product that is produced due to the large demand which is used as a flavoring in various other products. However, during substantial changes are presented in their original taste, loss of smell and reduced various nutritional factors. (Lorenzen et al 2011;. Jung W, 2009)

There is currently a high demand for natural products or those minimally processed, which could have a positive impact on economic development in the region. In the market for this product is a

sector that requires receiving the flavor, aroma and natural nutritional benefits of this fruit fresh. (Lorenzen et al 2011;. Jun-Wu, et al. 2009)

In production at household juice pasteurization objecting to the change in taste is not customary, however, the Administration Food and Drug Administration (FDA for its acronym in English) US has protested contamination of Escherichia coli O157: H7 (E. coli), transmitted by unpasteurized apple juice (FDA, 2011). To prevent further outbreaks taking as a transmission medium apple juice, became mandatory pasteurization by federal regulation 21 CFR-120 Y-66-FR-6137 US. (Franklin, 1969)

Whichever method of food preservation is used, the purpose is to obtain a safe food with sufficient stability to be stored for long periods. So small scale has been using for apple juice pasteurization at low temperatures for long periods of time. However, for large production of apple juice pasteurization is recommended to high temperatures for short times (UHT). (Franklin, 1969)

The concentrated juice has a high demand to be considered a source of high amounts of nutrients; however, during processing and pasteurization lose flavor, aroma and nutritional intake, mainly vitamins. This situation makes the juices sold in supermarkets present a considerable variation in their vitamin content, especially vitamin C (ascorbic acid). That is the reason why this research aims to determine ascorbic acid to apple juices that are made with pasteurized ultra heat treatment (UHT) in trademarks and juices processed in the School of Chemical Sciences by HPLC system (liquid chromatography high resolution).

Is to show using a juice raw apple, ie unpasteurized and unclarified, there is a loss of quality in the ascorbic acid content of the commercial products, as well as juices prepared in the Faculty. In determining whether it was added ascorbic acid to commercial juices after being subjected to heat treatments, will be corroborated if products are being sold meet the standards the labels say.

MATERIALS AND METHODS

The methodology shown in Figure No.1.

raw material

The raw material used in the juices was the Golden Delicious apple, from the municipality of Cuauhtémoc, Chihuahua.

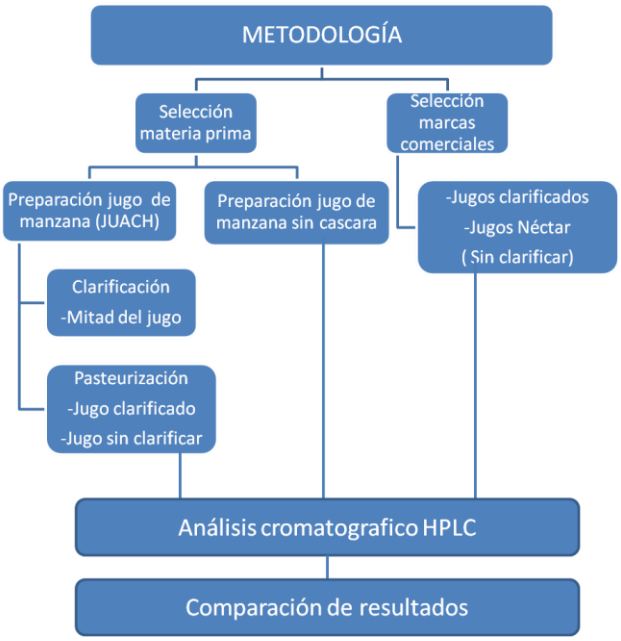

Figura 1. Methodology for making apple juice and chromatographic analysis.

Production of apple juice

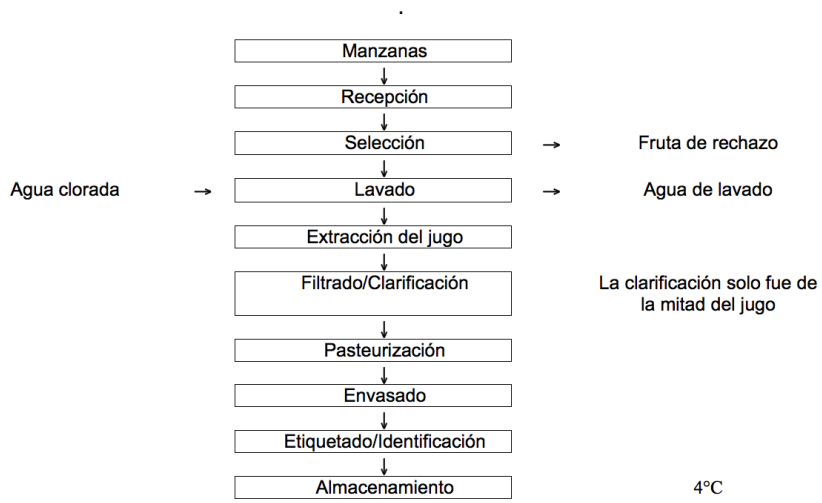

Figura 2. Flowchart of the methodology for the preparation of JUACH

Methodology

The methodology followed for the preparation of apple juice in the region shown in Figure No.2.

Reception

Apple bars were weighed on scales clean and calibrated for the amount of kilograms that occurred with the juice. (Lama, et al 1997;. Paltrinieri, et al 1993;. FAO, 2006)

Selection

Ripe fruit is picked, discarding the green fruit, overripe or had bruises or rot. (Lama et al .; Paltrinieri, et al. FAO)

Wash

With a solution of 50 ppm of chlorine in water fruit was disinfected, thus remove surface bacteria, insecticide residues and dirt adhering to the fruit. (Lama, et al 1997;. Paltrinieri, et al 1993;. FAO, 2006)

Extraction of apple juice

The apple juice extraction was performed by a crusher / Vegetable Dicer, Duplex (See Figure No. 3), with which a paste consisting of juice and bagasse was obtained. Then the juice with a blanket to separate small amounts of solids are strained. The blanket was rinsed several times to keep it in good condition for filtering. At the end of this process, the juice was stored in the refrigerator at 4 ° C. (Lama, et al 1997;. Paltrinieri, et al 1993;. FAO, 2006)

Figura 3. Crusher / Vegetable Dicer, Duplex.

Filtration

First was cleaned with distilled water in the filter press INPASA (See Figure No. 4) of 9 plates, blankets 9 square 18 cm long and 1.3 cm thick plate reviewing each and every blanket and placing them so that each coincide with their respective holes. Once positioned in this manner, we proceeded to hold them together applying pressure as needed to ensure not to keep waste of any other substances and juice purity is affected. (Lama, et al 1997;. Paltrinieri, et al 1993;. FAO, 2006)

Once clean the filter, half pumping juice at a constant rate through a hose in which flowed constantly filtered recirculating for one hour to ensure that there are no remaining solid and could continue to the next step. (Lama, et al .; Paltrinieri, et al .; FAO)

Figura 4. Filtro Prensa INPASA

Figura 5. Unidad de Ultrafiltración/Ósmosis inversa RO/UF FT18 Armfield

Clarification

Subsequently the filtration system was used for ultrafiltration unit membranes / Reverse Osmosis RO / UF Armfield FT18 (see Figure No. 6). With a membrane of 100 kilodaltons, about 6 hours at high speed with a pressure of 10 bars, and for 4 hours at low speed at a pressure of 19 bar, in both cases at a temperature below 40 ° C. (Lama, et al .; Paltrinieri, et al .; FAO)

UHT pasteurization

First team HTST UHT-LAB-25-DH MicroThermics (See Figure No.6) was adjusted to ensure that the equipment worked properly with distilled water. Once done we proceeded to enter the apple juice clarified obtained with a flow rate of 0.8 to 3 L / min. Was taken into account that the equipment must operate at a pressure of 80 to 100 psi with an inlet temperature between 100 ° and 115 ° C and an outlet temperature of the juice between 80 and 95 ° C, passing the juice pasteurizer for about 5 seconds. At the end of unpasteurized juice not clarified juice was then introduced clarified to go through the same process of pasteurization. Finally, he turned to cleaning with distilled water.

(Lama, et al 1997;. Paltrinieri, et al 1993;. FAO, 2006)

Figura 6. UHT-HTST LAB-25-DH MicroThermics.

Packing

Once started dating juice pasteurizer, this was introduced in plastic bags leaving an empty space in the bag and sealing it immediately with a sealant to 110 ° C. This was done with the kinds of juices clarified and unclarified. Figure No.7 not clarified juice packed in plastic bag shown. (Lama, et al 1997;. Paltrinieri, et al 1993;. FAO, 2006)

Figura 7. Jugo de manzana no clarificado pasteurizado

Figura 8. Jugo clarificado de manzana pasteurizad

1

2

Labelling / ID

He then proceeded to identify each bag juices with name and date of

manufacture. This was done with both types of juices, clarified and unclarified. (See Figure No.8) (Lama, et al 1997;. Paltrinieri, et al 1993;. FAO, 2006)

Storage

Finally, the bags of the two kinds of juice, clarified and not clarified in the refrigerator at 4 ° C were saved. (Lama, et al 1997;. Paltrinieri, et al 1993;. FAO, 2006)

Chromatographic analysis

Below is shown in Figure No.9 the methodology followed in HPLC analysis of the chromatographic process

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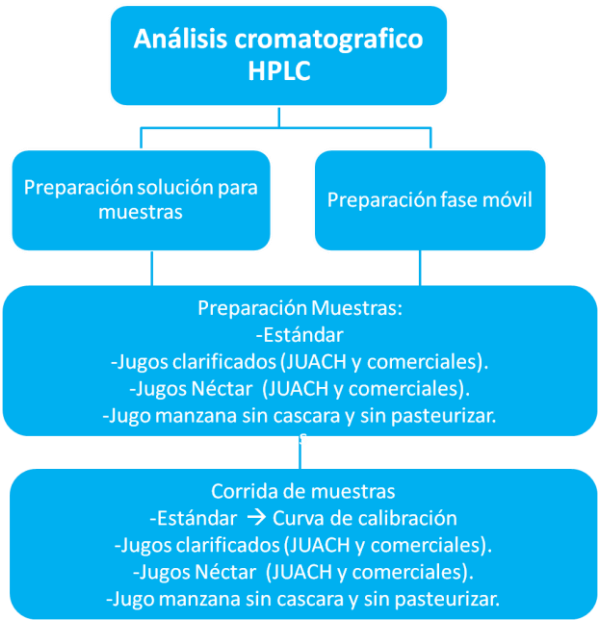

Figura 10. Metodología análisis cromatográfico HPLC.

Run samples

Terms of HPLC equipment

The HPLC equipment was adjusted (see Figure No.11) to the following conditions:

Equipment: Model UltiMateTM 3000, Thermo Scientific.

Column: AcclaimTM 5uM 120A, C-18, 4.6x150mm.

Mobile phase: NaH2PO4, 1%, pH 2.9.

Temperature: 15 ° C.

Flow rate: 5 ul.

Pressure: 3500psi.

Wavelength: 255nm.

(Gutierrez et al. 2007)

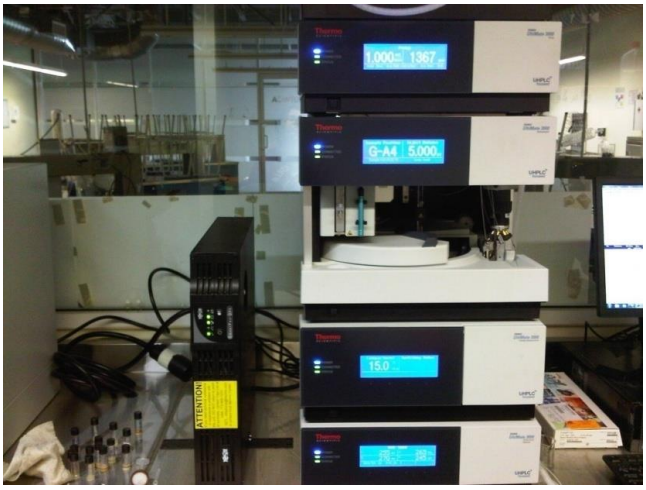

Figura 11. HPLC UltiMate^{TM} 3000, ThermoScientific

Standards

7 having different concentrations of ascorbic acid standards, the samples were run on the computer to obtain an HPLC calibration curve. Each sample was run in duplicate and analyzed by a time of 15 minutes. (Gutierrez et al. 2007)

Clarified juices, nectar juice and apple juice without clarifying and unpasteurized
Once the samples prepared in vials, samples of clarified juice, juices, apple juice clarification and shelled were run and unpasteurized. In total there were 11 samples, and each was analyzed in duplicate for 12 minutes. (Gutiérrez et al, 2007).

Statistical Analysis

The ANOVA (for its acronym in English) single with 2 replicates (n = 2) was used for data interpretation. And the Tukey method for the analysis of means was used. All this through Minitab 16 Statistical Software Statistical System.

RESULTS AND DISCUSSIONS

Chromatographic analysis results
Calibration curve
The results of absorption areas, and parts per million milligrams of ascorbic acid standards obtained from the chromatographic analysis are shown in Table No.1.
Table 1. Results of the chromatographic analysis of samples of ascorbic acid standard.

Estándar	PPM	Área	Promedio	mg/100g
1	0.78125	0.1399	0.13645	7.8125
1	0.78125	0.1333		
2	1.5625	0.2942	0.28755	15.625
2	1.5625	0.2809		
3	3.125	0.5908	0.5805	31.25
3	3.125	0.5702		
4	6.25	1.1747	1.1595	62.5
4	6.25	1.1443		
5	12.5	2.4249	2.38265	125
5	12.5	2.3404		
6	25	4.7156	4.6843	250
6	25	4.6580		
7	50	9.4239	9.28185	500
7	50	9.1398		

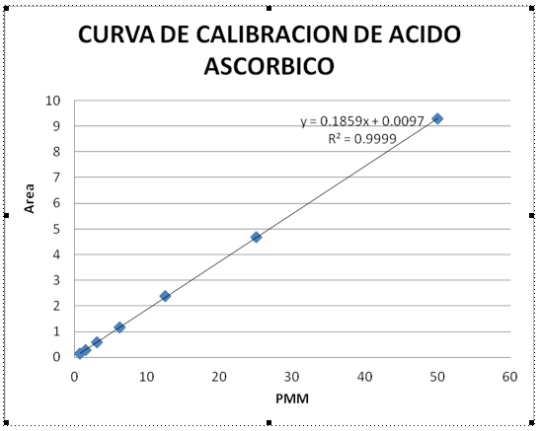

Figura 13. Calibration curve graph of ascorbic acid.

Was observed in the chromatograms which ascorbic acid had a retention time

2.7 minutes, allowing the realization of the calibration curve of ascorbic acid.

It is noteworthy that the samples were prepared and immediately analyzed by the HPLC equipment for the lower percentage of ascorbic acid degradation due to weather.

Figure 13 shows the calibration curve obtained. As shown in the graph, the equation of the line (R2) was very positive with a value of 0.9999, indicating that the margin of error of the curve to be used is very low because the standard of ascorbic acid was 99% purity, allowing to make further comparisons with confidence.

Samples clarified juices

For samples clarified juices results obtained in the chromatographic analysis are presented in Table No. 2. The quantities of ascorbic acid found in samples and JUACH Jumex juice were very similar, being within the same range of mg / 100g ; however, presented a very low amount of ascorbic acid, being below the smallest of the calibration curve (0.78125 ppm) concentration. On the other hand, proved to have vitamin C, while samples of juices Confrutta Smile and brought no amount of vitamin C, demonstrating that do not meet 100% of the nutritional quality required. However, only one of the samples analyzed -Juice Del Valle presented a very high amount relative to the other four samples, showing a big difference.

The juices of the Smile and Confrutta brands have demonstrated no ascorbic acid, JUACH juice had the lowest content of vitamin C, and Del Valle, by far, was the juice with higher content of ascorbic acid.

Table 2. Results of chromatographic analysis clarified juices.

Muestra	PPM	PPM	Área	Área	mg/100g	mg /100g
Jumex	0.0619	0.0505	0.0212	0.0191	0.6186	0.50565
	0.0393		0.017		0.3927	
Sonrisa	0	0	0.0008	0.00065	0	0
	0		0.0005		0	
Confrutta	0	0	0.002	0.0019	0	0
	0		0.0018		0.4250	
Del Valle	1.0538	0.9992	0.2056	0.19545	10.5379	9.9919
	0.9446		0.1853		9.4459	
JUACH	0.0414	0.03765	0.0174	0.0167	0.4142	0.37655
	0.0339		0.016		0.3389	

Figura 14. Loss of ascorbic acid in different clarified juice samples.

On average, the loss of ascorbic acid in the samples analyzed was 96.9289%. Meanwhile, the brand Del Valle differed greatly from the other samples, so we can say that yes it is added with vitamin C, as indicated in its official website, although not specified on the label. It is noteworthy that was based on the amount of ascorbic acid found in apple juice without any treatment (see Table No.2).

The percentages of each mark shown in Figure No. 14.

Samples of nectar juices

Table No.3 can observe the results obtained from the chromatographic analysis. The quantities of ascorbic acid in 5 different samples, compared with clarified juices tend to not be within a single range or pattern as the results were varied, being placed at various points on the calibration curve, unlike the clarified juices of which only one was placed inside the curve.

The Jumex juice and smile were the only yielded very similar data, while the juice Confrutta demonstrated a minimal amount of vitamin C. Moreover, Del Valle juices and JUACH have a considerable amount of this vitamin, can be observed that Del Valle juice is very similar to the clarified presentation.

The only juice that followed presented almost no vitamin C was the brand Confrutta, where none of the types of juices analyzed showed more than 1 mg / 100g. On the contrary, the Jumex juice, smiling and Del Valle had high marks for its vitamin C in their presentations of nectar, with an increasing trend between 4 and 5 mg / 100g.

Finally, the biggest difference could be seen in the juice JUACH, the amount found was very high compared to the clarified juice. Increased ascorbic acid content was 27 times relative to its original value (10.379mg / 100g).

Table 3. Results of chromatographic analysis nectar juices.

Muestra	PPM	P PPM	Área	P Área	mg/100g	mg /100g
Jumex	0.4804	0.464	0.0990	0.0848	4.804	4.0398
	0.3276		0.0706		3.276	
Sonrisa	0.5858	0.5624	0.1186	0.1142	5.858	5.6239
	0.5390		0.1099		5.390	
Confrutta	0.0909	0.0865	0.0266	0.0257	0.909	0.8633
	0.0818		0.0249		0.818	
Del Valle	1.4707	1.4355	0.2831	0.2773	14.707	14.3948
	1.4083		0.2715		14.083	
JUACH	1.0861	1.0756	0.2116	0.2096	10.861	10.7530
	1.0646		0.2076		10.646	

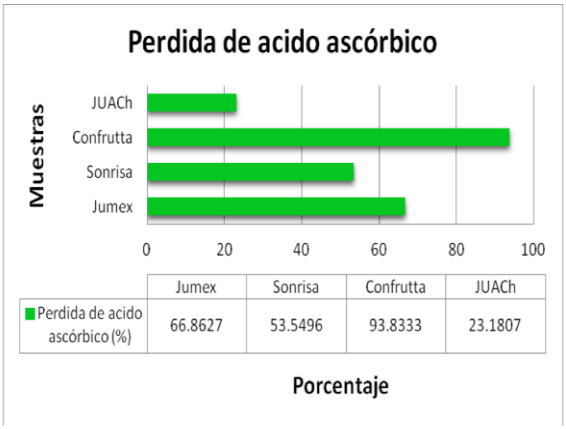

Figura 15. Loss of ascorbic acid in juice nectars different samples.

As in the clarified juice, the average loss of ascorbic acid in the samples analyzed was 59.3565%, disregarding the value of the brand Del Valle, because its content was greater than the reference value taken, so states that itself was supplemented with vitamin C, as indicated by its official website, although this is not specified on the label of juice. For this was taken as reference the amount of ascorbic acid found in apple juice without any treatment (see Table No.3).

The percentages of each sample are taught in Figure No.15.

Statistical Analysis

Results from statistical analysis where the clarified samples were analyzed globally and nectars were: P 0.000 was obtained, which indicates a significant difference between the clarified juices and nectars juices. The results obtained from the mean of all samples of both types of juices indicated that Jumex juice Smiling and do not present any statistical difference between them, so they contain the same concentration of ascorbic acid while juices Del Valle, JUACH and Confrutta do show a statistical difference (See Figure No. 16).

As shown in Figure No.16, the JUACH, Del Valle and Confrutta juices (of both types of juices) did not present the same average, which means they do not share the same range of concentration of ascorbic acid.

Del Valle juice juice turned out to be the largest media on average between the two types of juice, clarified and nectar, which means it contains the greatest amount of ascorbic acid among all samples.

The juice that had the lowest content of ascorbic acid was Confrutta with 0.4 mg / 100g, while Del Valle proved to contain a quantity of acid with 12.2mg / 100g.

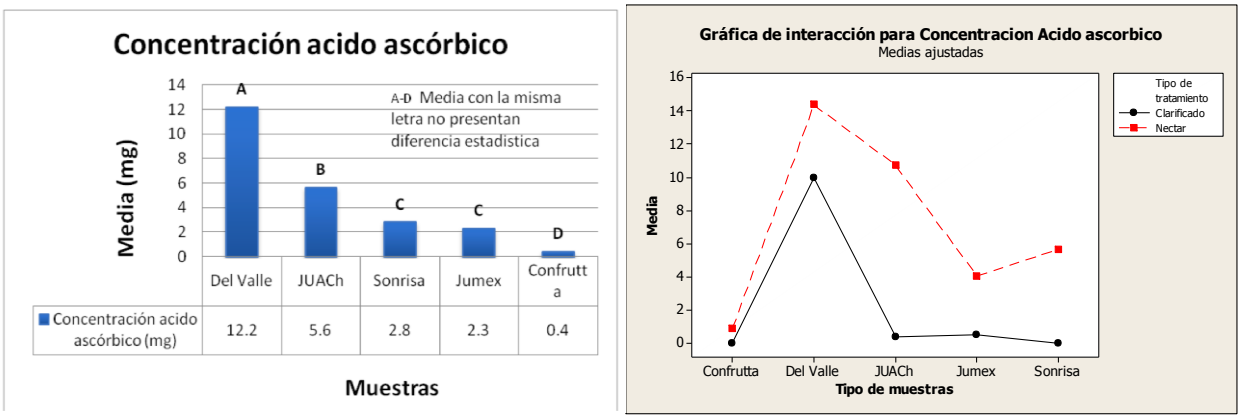

Figure 16. Graph of overall ANOVA / Tukey ascorbic acid concentration of all samples in both types of juices.

Figure 17. Graph of interaction for ascorbic acid concentration in samples of clarified juices and nectars (ANOVA / Tukey).

In contrast to the above results, then the results of a more disaggregated analysis are shown in Figure No.17, differentiating the types of juice, clarified and nectars.

-The Juice nectar Del Valle contains the highest concentration of ascorbic acid.

-The Juice nectar and Del Valle JUACH clarified share the same media, therefore, considered that the concentration of ascorbic acid is the same.

-The Smile and Jumex juice nectars were with the same mean, noting that the amount of ascorbic acid is significantly containing the same.

-Both Types of juices and juice clarified Confrutta Jumex, Smile and presented JUACH same average, indicating that these significantly containing the same concentration of ascorbic acid.

Figure No.18 interactions concentration of ascorbic acid in the 2 different types of treatment to which they were subjected juices analyzed, where, as mentioned above, the difference is observed between the clarified juice and nectar are shown Del Valle with respect to the other samples. Can be interpreted to start from the same point in the clarification treatment and take different values without clarification treatment.

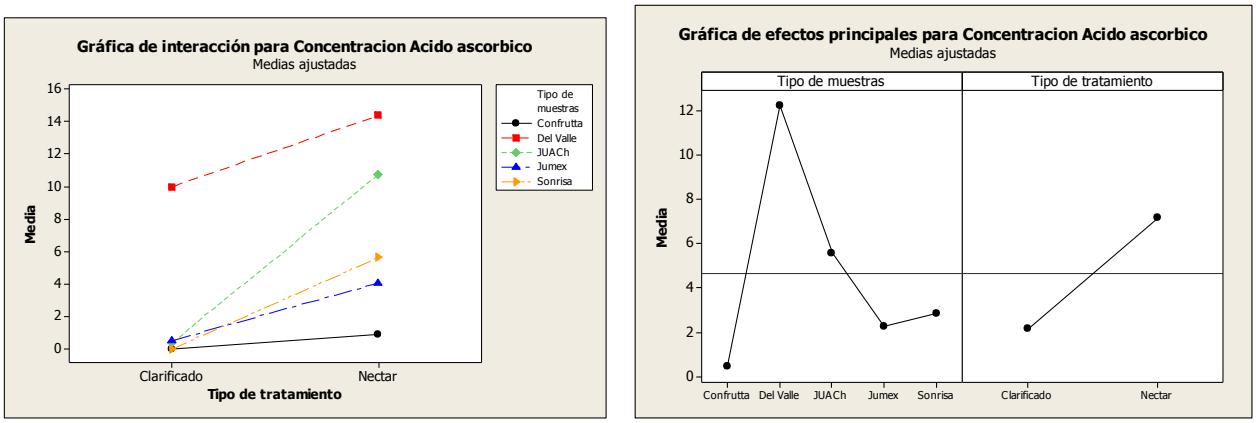

Figure 18. Graph of interaction for ascorbic acid concentration in type of treatment; clarified and nectar brands that were analyzed (ANOVA / Tukey).

Figure 19. Graph of comparative samples juice clarified juice and nectar.

It encompassing in a single graph (Figure No.19) the amount of ascorbic acid found in clarified juices and nectars, it was determined that the difference between juices and nectars clarified is more than three times (3.22 times), since according to the data obtained should be 2.22 times of adding ascorbic acid (4.9mg) to the clarified juice to obtain the same amount of vitamin C in nectars. This showed that not only the heat treatment they undergo pasteurization juices affects the amount of ascorbic acid, but also pretreatments as clarification through membranes. The size of the molecules of vitamins is very small, so that during the clarification process by ultrafiltration and / or microfiltration membranes are trapped, resulting in ascorbic acid and vitamins are deleted in a large percentage.

Now, given apple juice shelled and unpasteurized (JUACH untreated) and comparing it with JUACH juices clarified and JUACH nectar (unclarified), a difference of 91.14% was found

between JUACH clarified juice and juice JUACH untreated, showing a significant loss of 13.6 mg vitamin and 21.42% difference between juice and nectar JUACH JUACH untreated juice with a loss of 3.2 mg. This can be seen in Figures 20 and 21.

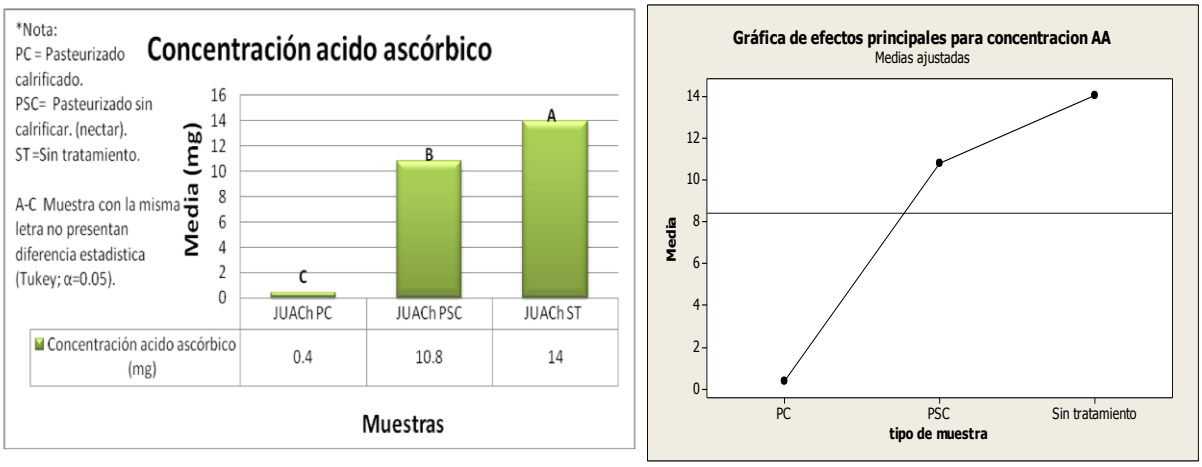

Figure 20. Graph of comparative concentration of ascorbic acid in JUACH clarified juices, nectar and JUACh JUACH without treatment.

Figure 21. Graph of main effects of ascorbic acid (AA) in juices processed in the laboratory; JUACH clarified, without clarifying JUACH (nectar) and JUACH untreated (apple juice without treatment).

An average of the average loss of ascorbic acid in the samples analyzed, which was 66.7142% regardless of the treatment that was submitted was calculated juice. Please note that it was based on the average amount of ascorbic acid JUACH untreated juice.

Comparison with Mexican Official Standards and nutritional tables

Nutritional tables

With reference to the nutritional apple tables, the amount of vitamin C it contains varies between 10 and 12 mg / 100g, depending on their characteristics.

Returning chromatographic analysis data, ascorbic acid concentrations of 5 different samples were analyzed show:

● Clarified Juices

-The Smile and Confrutta juices do not contain vitamin C and JUACH juices Jumex and have very little, not covering the minimum marked on the nutritional tables. However, it should be

noted that the nutritional data tables are not valid in the juices because these apple has undergone several changes resulting from processing; although the amounts of ascorbic acid should not vary significantly, as in this case. Because of this, it can be said that none of these marks added this vitamin juices, juice except Del Valle, whose website mentions. In JUACH juice is added ascorbic acid pretended not to observe precisely the loss of this acid during treatments to which he was subjected.

-The Juice Del Valle was the only one present in an amount equal to that of the nutritional tables.

● Juice Nectar

- The Jumex, Smile and Confrutta juices showed the same case clarified in their presentations: do not comply with the values specified in the nutritional tables, although they have higher amounts of ascorbic acid clarified their submissions, indicating that their products are not the expected quality.

- Juices Del Valle and JUACH exceeded the values specified in the nutritional tables, hence its quality is quite good.

Mexican Official Standards (NOM and NMX)

The rules applicable to this study are:

● NOM-051-SCFI / SSA1-2010. General specifications for labeling of food and non-alcoholic beverages prepackaged commercial and health information.

● NMX-F-045-1982. Foods. Fruits and Derivatives. Apple Juice.

These rules do not indicate the specific amount of vitamin C apple juices should contain, but other parameters that are worth mentioning.

In the case of the NOM-051-SCFI / SSA1-2010 (see Table No.2), the DRIs for the Mexican population, which states that consume the recommended daily amount of vitamin C is 60mg are indicated / 100g. Taking this as a base, the only juice that would

provide a considerable percentage of the daily intake of this vitamin is Del Valle in two presentations and juice JUACH nectar.

At 045-1982 F-NMX-indicated is the maximum value of ascorbic acid that can be added to the apple juice, which is 150mg / 1 kg (15mg / 100g), therefore, as the values obtained, no juice exceeds this amount, being over the limit juices Del Valle with an average of 12.2 mg ascorbic acid / 100g.

CONCLUSIONS

The content of vitamins in commercial apple juice is very important as they are an essential if the product is of good quality, both safety and nutritional part. Were studied and analyzed the nutritional properties -clarificados (ascorbic acid) in juices ultra pasteurized apple, both commercial and developed in the School of Chemical Sciences, determining the amounts of ascorbic acid of different commercial samples and juice prepared in the laboratory in two presentations and néctares- to yield unfavorable results in most of the samples analyzed. Fulfilling expectations expected, only two of the samples, the juice Del Valle, in his two presentations, and JUACH juice (juice produced in the School of Chemical Sciences) in his presentation of nectar. It is concluded that not only the heat conservation process used is a factor in obtaining a greater or lesser amount of vitamin C in the juice, but the filtration / clarification of juices, in industrial scale and in the laboratory.

Importantly, only one brand (Del Valle) demonstrated the expected quality in all samples and your product itself is supplemented with the nutrients of the original apple but because of the processes to which it is subjected during production they are They are losing up to be a minimum amount or total loss, as was in the case of other commercial samples.

Finally, all samples showed meet the standards set by the Mexican Official Standards (NOM-051-SCFI / SSA1-2010 and NMX-F-045-1982).

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