STUDY OF THE CHEMICAL AND TECHNOLOGICAL PROPERTIES OF FRUITS FROM DIFFERENT APPLE VARIETIES

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Abstract

The nutritional value of the fruitsis given by the primaryandsecondary metabolites, as well by the balance ratiobetween these, what offers them a specific harmonyeasy accessible by the human organism.Alongside the nutritional and gustatory value, the apples have even therapeutic properties considering variousaffections of human organism(they increase the gastric secretion,they absorb the toxins at intestinal level, they have diuretic activity, they reduce the obesity).In România, the appleassortmentis rich and is made up of older varieties, traditional,as it'sfor examplethe variety Jonathan,called as well "the king of the apples" and which together withGoldenDelicious,StarkrimsonandIdaredformthe base of apple production.

Key words:technological properties,gustatory qualities,antioxidant activity , nutritional value,biologic potential

INTRODUCTION

The apple is one of the oldest and most widespread fruit-growing species.From thespecific species for thetemperate climate,the apple owns by far the first place,as well as surface, and in the same time as production.Its big "disponibility" in consumisdeterminedby many factors from which: the long storage life of the fruits, even in common conditions, next to the remarkablebiologicaldowrythat the speciesowns, respectivelythousands of varieties and hundreds ofparent stock, which allow various combinationsfor different varieties,as well as different systems of culture.

The fresh fruit containsimportant quantities ofsugars,organic acids, pectic substances,tanoide substances,proteic substances,vitaminsA,B,C,as well asmineral salts. This componentaccompanied bygustatory qualities,veryapreciatedanddifferent from a variety to another, ensures to a great extent the satisfactionof the tastes of various consumers,so, the apples are very required (Popescuet al,1974).

Alongside the nutritional and gustatory value,the apples have even therapeutical propertiesin various affections of human organism (increase the gastric secretion,absorbthetoxins at intestinal level,diuretic activity,reducethe colesterol,combat the obezity.

The existence of a big number of varieties, withstaggered ripening from June till October, ensures the consume of fresh fruits during a period of time of 5 months,without to be needed the storage. By storage during winter, it's ensured the necessary supply with vitamins for theorganism.Alongside with this,is added a series of attributes of the fruits:they bearthe transportmuch easier than other fruits, they can be stored fresh (raw) for long time, constitute high-rawmaterialinthe foodindustry.

The apples are used for the preparation of marmelade, compotes, juices, dried fruits, and even of the slightly alcoholic beverages as cider,very appreciated in France, Germany, Switzerland and United Kingdom. The apple vinegar has favorablesefectsin keeping theacid-basebalance of the humanorganism.(Ghenaet al.,1977).

The apple Syrup was foundvaluablefor mentainingthe quality and the humidity of white bread,of cigarettes and cigarillos(Childers,1976).

The use of apples in farmaceutic industry and cosmetics (creams, pasts, soaps) records a large widespread (Glăman et al., 1977).

Inmedium valuesthe apples contain98%pulpand2%refusals(peduncle,seeds and the walls of the lodges).

From a good variety of apples,in the current stage,is asked efficiency,precisely threedezideratum (goals):big productivity, genetic resistance to diseases andto pests,and gustatory and technological qualitiescorresponding to the market requirements(V.Cociu,1990)

At the level of the year 2003(Ghena,Braniște) theconveerulof varieties was established bycriteriawhich consider the adaptability level in a certain areea,where the biologic potentialis expressed quantitativeorqualitative(taste,flavor)of the varieties,and are satisfied the consumer's preferences for a determined period (summer,autumn,winter), the longest possible from a year.

In Romania, theassortment of applesis rich and is made upfrom older varieties, traditional,as is for examplethe varietyJonathan,called as well,,the king of the apples",which together with GoldenDelicious,StarkrimsonandIdaredform the base of appleproduction.

MATERIAL AND METHOD

The apple plantationis placedon one hectar,plantedat3/1mwith3333trees,with14 varieties, plantedliniarly(Table 1).On the row,the work is done manually, alaneof 1,0m, and theintervalis made with grass,because the

plantationisirrigated,andismaintainedthrough4-5 sews a year.

The plantationwascreatedîn the spring of the year2013,with graftedtreesonparent stockM 9, which hadpreformed crownfrom nurserywith5-7anticipated branches,with fruit buds).The crown systemisvertical cord.

Table 1

Apple varieties studied

Nr. Crt.	Variety
1.	ELSTAR
2.	ROTERBOSKOOP
3.	JONAGOLD
4.	GRANNYSMITH
5.	RUBINFUJI
6.	IDARED
7.	TOPAZ
8.	REDKAN
9.	EVELINA
10.	GOLDENCLONB
11.	GOLDENSMOOTHEE
12.	REANDA
13.	SUMMERRED
14.	GALADECARLI

Chemical properties of the fruits

The soluble dry substance

It'sdeterminedwithrefractometerKarlZeisefrom which is calculated the content of sugar.The determination of the soluble dry substance implies:

a) Setting up the device

The prism is degreased with gauzeor cotton, and it's put a drop of distilled water,observing in the day lightthrough telescopethe demarcation line betweenthose two fields:dark and lighted field.As therefractometer isgraduated, for the temperature of20^{o}C,the demarcation line will be at0 only at this temperature.

b) Obtaining the juice:

Using the manualpress,are obtained a few dropsfrom the tissue of the apples.From this juice, with a wand,are applied a few drops on the prism of the device.Theprism is closed, and theocularulis led at the eyein front of a light source.The reading is done where the demarcation line between those two areas, lit andshaded, crossesthe graduated scale.

c) The expresssion of the reading:

The device beeing graduated at20^{O}C, is needed the correction,considering that for each ±1^{O}Cwe add or substractfrom the performed reading0,07.The content in sugar for the apples which reached maturity is calculated applying the formula:

$$Z = \frac{83 \cdot S.U.}{100}$$

Z=reprezents the sugar content

S.U.=the soluble dry substancedetermined with refractometer

The total or titratable acidity

To know the total acidity it is important,because it is connected with:the resistance to handling andtransport,the formation of the tasteand of the flavor, and it gives us information about the degree of maturationand thequalities for consumtion.

The principle of thetotal acidity determinationmethodis based on the extraction of organic acids from the raw material using boilt water,and thetitration of the extract, using a titrated solution of sodium or potassium hydroxide in theprezencephenolphthaleinasindicator.

The horticulturalraw material issolidand fresh.From the sample, it's taken an amount,for example100g,it's shredded fastin amortar, and it'spassed quantitatively in a Erleinmayervessel of500ml,it's added distilled wateraround 1/3 from the capacity of the vessel,and it's boilt onhot plates or on water bath.During boiling, the evaporatedwater will be replaced constantly, till the wholevegetable matter is dismantled completly.

We filter it in a rated balon of500ml, thefilter is washed with distilled waterrepeatedly,and after that,the content of the rated baloon is brought at the sighn with the distilled water.The obtained extractis stirred forhomogenization, and then istaken by pipette 5 mlor10ml,which are transfered in a conical glassof150-200 ml, are added2-3 drops ofde phenolphthaleină 1%, the walls of the glass are washed with distilled water, and we titrate with sodium or potassium hydroxiden/10till the indicator turns to pink.

The expression of the results is done conventionally asmlNaOH n/10, or ingramsof thepredominantacid(inthe case of the apples, inmalicacid)to100gvegetal material.The rezult ismultiplied with theequivalent of themalicacid,precisely1 mlNaOHn/10isequivalentwith0,0067gmalic acid.

The determination of the ascorbic acid

Inthiscategoryare includedeven thevitamins,which can be hydrosoluble,namelysolublein water,andliposoluble,namelysolubleinfat.

Theiodometric method

The raw materialissectioned in little pieces with astainless steel knife,on awatch glass, from which we weigh 5g.Using a solution of HCl2%,it's passed quantitatively in a mortar, washing the glass very well.

We add1-2g quartz sand orcrushedglass, and it is powdered10-15minutes, till we get a homogeneousmass. Thecontent of the mortaris passed quantitatively, using HCl solution, in a ratedballoonof100ml, is brought at the signwith HCl2%,is stirred well,and it's let to settle.

After sedimentation, it's filtered in a dry glassand from the filtrateis taken by pipette10or20 ml, which are put in another vessel, over which is added30mldistilled water,5mlKI1%and 2-3 dropsamidine0,5%.

The glass is stirred lightly and it's titrated with a solution ofKIO_3n/1000 till turns in blue.

The global determination of polyphenols

The total ofpolyphenolic compoundswere determined throughFolin-Ciocâlteu method.The apple juices,diluted 10times(100µl),weremixedwith1700µl ofdistilled waterand200µl reactiveFolin-Ciocâlteu (fresh dilluted1:10v/v).After around 3minutes,was added 1ml sodium carbonate15%.The samples were incubated thenat room'stemperature,in the dark for 2 hours,and then was measured the absorption at765nm,using thespectophotometerShimatzu miniUV-VIS.The calibration curve was performd versusthe gallicacid,in a domain between0,05-0,25mg/ml,and the result was expressed in milligramsgallic acidequivalents(AGE)/100 mljuice.

The determination of antioxidant activity

The FRAPmethod isspectrophotometric, it tests theantioxidant power of the samplesincluded in the study, and is based onreduction of theferriccomplextripyridyltriazinetoferrous tripyridyltriazinecomplexby areductantto acidpH.TheFRAP solution is prepared freshby mixing 50mltamponacetat300mMwith5mlsolution$Fe_2(SO4)_3$•H_2Oand5ml TRTZ.The sample of apples(100µl) was let to react with 500µlsoluțieFRAPand2mldistilled water, for 1 hour in the dark,and then the readings at spectophotometerwere doneat 595 nm. The calibration curve was performed with a solution of Trolex of knownconcentration(0-400µM).

RESULTS AND DISCUSSIONS

The varieties in pomiculturareimportantthrough theirfinalelement"thefruit”.Theedibile partsof thefruit have indispensabilecomponentesfor human nutrition,this beeing the main reasonfor which are cultivated the pomicole plants.

The nutritional value of the fruits is given by theprimary andthe

secondarymetabolites, as well asthe balance ratio between these, what offers them a specific harmony,easy accesible to the human organism.

From the primary metabolites, the sugars constitute the main componentof thefruits. From these, the glucose andthefructoseareasimilateddirectly by thehuman organism.

The average of the total sugar of the fruits of those 14 varietiestaken in account is11,30g/100g,with values thatosciliates from8,83/100gforGalaDecarlito14,54g/100g forRoterBoskoop.Big values of the total sugarare even to Elstar12,51g/100g,RubinFuji12,06/100gand Topaz 14,28g/100g.

The acidity is very important to be known, because it's very close related tothe resistance to handling andtransport, the formation of the taste and flavor,the degree of maturation,and the qualities for consumption.

The average acidity for the fruits of those 14soiuriis 0,46%,withvariability from0,24%forGoldenClonBto1,08%forRoterBoskoop.

The vitamins are usually ofvegetal origin and are found in the fruits as such,or as combinations called provitamines(Table 2).

Their absence causesthe appearance of certain disorderscalled hypovitaminosis,followed by true diseasesknown as avitaminosis.

From chemical point of view, theascorbic acidis thelactona of ahexonic acid, beeing related genericlywithhexoses.Inthe living cells, it's the maincomponent of the complex wich regulates the oxido-reductionpotential.The average of Cvitaminefor those14varietiesis5,83mg/100gwith variabilevaluesfrom 4,52mg/100g forEvelinato 9,61mg/100gforGoldenClonB.

Technologicalproperties of the fruits

AtpHover4,they can appear unwanted changes in the processed vegetal material.

The average pH for those 14varietiesis3,51,with values from 3,08forRoterBoskoopto3,96forGrannySmith.

The polyphenols, through the reactions they give in contact with the atmospheric air and with the active parts from the processing machines,can cauze many shortcomingslike: browning, blackened, loss of the characteristic flavours.

Table 2

Chemical and technological properties of apple varieties

Nr. crt.	Variety	CHEMICAL			TECHNOLOGICAL			
		Sugar total (g/100g)	**Acidity (%)**	**Vitamin C (mg/100g)**	**pH**	**Polyphenols (mgGAE/l)**	**Activity antioxidant(molTE/l)**	**ml juice/kg fruits**
1.	**GOLDENCLONB**	9.05	0.24	9.61	3.76	463.04	1.28	584.87
2.	**GOLDENSMOOTHEE**	11.73	0.30	5.63	3.73	199.05	0.81	492.87
3.	**REDKAN**	10.15	0.66	4.99	3.10	434.07	2.55	672.00
4.	**GRANNYSMITH**	10.93	0.26	4.99	3.96	392.61	0.98	474.83
5.	**IDARED**	11.73	0.63	4.84	3.30	306.19	1.20	594.23
6.	**EVELINA**	10.11	0.33	4.52	3.51	343.41	1.80	682.26
7.	**GALADECARLI**	8.83	0.25	4.68	3.72	261.74	1.42	674.24
8.	**ELSTAR**	12.51	0.56	4.68	3.38	678.32	2.49	540.72
9.	**JONAGOLD**	11.55	0.45	5.63	3.30	817.93	3.45	672.38
10.	**RUBINFUJI**	12.06	0.28	6.59	3.88	393.36	1.79	686.26
11.	**ROTERBOSKOOP**	14.54	1.08	5.63	3.08	1891.36	4.20	579.31
12.	**SUMMERRED**	9.02	0.44	6.11	3.73	459.29	0.58	622.44
13.	**TOPAZ**	14.28	0.39	6.27	3.45	1416.58	5.97	650.79
14.	**REANDA**	11.74	0.55	7.38	3.28	554.45	1.66	597.57
MEDIATEVARIETIES		11,30	0.46	5.83	3.51	615.53	2.16	608.91

The average of polyphenolsfor those14varietiesis 615,53ml GAE/l,withvalues between261,74mlGAE/lforGalaDecarliand1891,36mlGAE/lforRoterBoskoop.(Table2)

The antioxidant activity,responsibleforlinking the freeradicalsand the detoxification of theorganism,has an average value for those 14varietiesof2,16molTE/l,withvariablesfrom0,58molTE/lforSummerred,to5,97molTE/lforTopaz.(Table 2)

From one kg of fruits can be obtained608,91mljuice, the for those 14varietieswith values from474,83mlfor GrannySmithto686,26mlforRubinFuji.

CONCLUSIONS

The nutritional value of the fruits is given by the primary andsecondary metabolites, as well by the balance ratiobetween these, what offers them a specific harmonyeasy accessible by the human organism. Alongside the nutritional and gustatory value, the apples have even therapeutic properties considering variousaffections of human

organism(they increase the gastric secretion,they absorb the toxins at intestinal level, they have diuretic activity, they reduce the obesity).

Through the chemical and technological analyzes carried out we have brought data that will be used both by the fruit growers who will plant these apple varieties and those who want to process the fruits of these varieties

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