

CHEMICAL AND BIOCHEMICAL COMPONENTS IN FRUIT AND THEIR ROLE IN THE HUMAN HEALTH

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Abstract

The long-term investigation on the nutritive value of fruit expressed by their chemical composition came to prove the considerable amounts of soluble sugars easily assimilated by the human body, of organic acids and pectin, very benefic to digestion, of vitamin C which is benefic to the general metabolism and macroelements. The variability of the biochemical components in fruit and within the most fruit species is rather large because of the numerous varieties within each species, of the technology applied and not least because of the ecological conditions. The fruit species studied at the Research Institute Fruit Growing Pitești – Maracineni were: apple, pear, plum, sweet cherry, sour cherry, strawberry and some of the small fruits: black currant, red currant, blackberry, raspberry and blueberry. Simultaneously with the fruit biochemical analyses, the effects of these fruit on some consumers were investigated at the Public Health Institute. Bucharest. Positive results were obtained. The subjects had to consume daily 150-300g fruit for 30 days and the data were written down on individual records. The following parameters were noticed: age, sex, weight, and blood pressure, subjective and objective modification of the digestion (transit. appetite), general condition of subjects, miction, stress, previous diseases as well as food habits.

Key words: **fruits, chemical and biochemical composition, human health**

1. Introduction

The fruits of trees and small fruits species have a different content in biochemical and chemical components with nutritive value. Chemical composition differs between species, but also at the same species it is a difference between cultivars and their location. Therefore, variation of the limits at chemical and biochemical compounds is relatively large for all species (Gherghi et al., 2001; Beceanu, 1999; Leshem et al., 1998; Thomson, 1993)

The studies by far on the nutritional value of the fruits, express by their chemical composition, proved the presence at soluble sugars in easily assimilable quantities of the organisms, the presence of pectic substances with role in optimisation intestinal tractus, the vitamins, especially vitamin C with its beneficial effect on general metabolism of organic acids and with energetical effect, and a micro and microelements from enzymes compositions. Absence of the fruits in alimentation makes more disequilibrium in human metabolism (Alexan, et al., 1983, Bădescu, 1984)

2. Material and method

The studies about chemical and biochemical composition of trees and small fruit species were made at the Research Institute for Fruit Growing Pitești, having in view: dry weight by gravimetric method, mineral substances by calcination method at 450°C, total sugars by Fehling method, total acidity by titrimetric method, the phosphorus by spectrophotometric method and potassium by photometric method. At the same time, it was studied the alimentary consuming effect of fruits on the human health, at the Institute of Public Health - Bucharest, according to a standard medical sheet. The parameters pursued in this medical sheet are: age, sex, weight, and arterial blood pressure, subjective and objective modifications (symptoms) about modification of the digestive apparatus (transit, appetite), general status, miction, stress, pathologic antecedents and their alimentation practice (type and quantity of the bread, meat, fish and fruits consumed daily).

3. Results and discussions

The species studied in this paper are: apple, plum, sweet cherry, cherry, strawberry, black currant, blackberry, raspberry, gooseberry and bilberry.

The limits of variation in chemical and biochemical compounds of fruits are well known from the literature (see table 1).

The apples are the frequently consumed fruit in alimentation because they can be stored almost all year. The values of the studied fruits are in limits, but there is difference between fruit from different location, at the same species and same cultivars. Thus, according to table 2 at Florina cv. harvested from Colibași farm, the dry weight content and total sugar is more than the one harvested from RIFG Pitești surface with 25%, and 28% respectively. The explanation can be a better exposition because of their placement in the terrace. However this cultivation system affects the phosphorus and potassium content in fruits because of a difficult application compost, and soil leaching phenomenon (table 2). Thus, the fruit of Florina apple cultivars from RIFG Pitești have a big content in phosphorus and potassium than the one of the Colibași farm with 21.7% and 23.07%. At the same time the fruit from the same cultivars but, nearly (500m in this case) have a similar chemical composition (Idared cultivars, table 2). In this study it also was determined chemical composition for ten cultivars of apple stored about 160days at 4.5°C temperature (table 3).

Because the apples are consumed from autumn to spring and quite all year, it is initiated one study on the 16 people which eat 300g apple every day, for a period of 15 days.

At the end of the study we remarked a good general status of the people. The weight of all people was stabilizing, but a little part of the group recorded an easy weight and appetite losses. The best results were found recorded with digestion. Regular apple consumption is associated with a low risk of heart diseases, asthma, diabetes, neoplasm. Although the apples contain sugars as fructose which is slowly released in blood after the intestinal absorption, they do not raise glycaemia.

As regards the antioxidant action in fruit the apples hold the second place after the rowan tree because of high amounts of quercetin, phloridzin and chlorogenic acid concentrated especially in the skin.

The plum is a very frequently met species because it does not claim too many needs. The plums are really appreciated for their glucides, fibers and Mg, Na, K, Fe contents. Their total dry weight as reported in the literature is between 11-18%, total sugars between 7-14%, total acidity 0.55-2.66%, tannins between 0.01-0.27%, pectin 0.37-1.8%, minerals (ash) 0.3-0.77%, vitamin C 3-26mg%, P 13-25mg%, K 135-292mg%, Fe 0.2-1.6mg%.

The studies performed at RIFG showed the chemical and biochemical composition of them cultivars (table 4).

Among the plum cultivars studies there are emphasized Centenar cv., with a high content of K and Ca (248 mg %) and 6, 54%, respectively and Vână de Italia cv. with the high content minerals especially P 924.86mg%.

The plum consumption proved to be beneficial in all kinds of diseases such as: mictions, constipation, liver gall stomach affections, eliminating the toxin and increasing the human body resistance.

The sweet and sour cherry have a high content in antocyanins with as antioxidant roll and therefore increasing the body resistance against diseases and slowing down the ageing phenomenon. At RIFG there were studied 21 cherry cvs to better cherry cvs and 6 sources were for there chemical and biochemical composition (table 5).

For sweet cherry we can mention Kardia cv. with a high content (0.98mg% K, 193mg% Ca, 23.03 mg% P) and Kristin cv rich in organic acids (0.71% and total sugars 14.52%).

Amara cv. bitter cherry has higher content of chemical compounds than Amar rose de Costulesti cv. For sour cherry the highest content in organic acids was found with Vyfebertoi (1.65%) and minerals (0.88%), P 222mg%, total sugar 11,05%. HV 49/5 hybrid showed also a high content of total sugars 11.05% and P 25.43mg%.

The investigations done at the Institute of Public Health of Bucharest involving ten persons with consume daily 200g sweet cherry for 14 days improved visibly their health condition. The vitamins A and C in sweet and sour cherries had favourable action on the natural immunity of the persons.

The salicylic acid presently in sweet and sour cherries give positive results arthritis. Thanks to their beneficial proprieties, there prevent the cardiovascular diseases decreasing cholesterol and therefore preventing arteriosclerosis and infarct and brain accidents.

The sweet and sour cherry juices and syrups have an energizing action, hyposalted, alkaline, hypocaloric action. By their Fe and Cu content they are recommended in malnutrition. They have also tonic effect on the brain system and slow down the ageing process.

The strawberries are important for their antioxidant action because of the content in many phlavonoids preventing thus cronical and degenerative diseases.

The small fruits species are widely grown because the berries are a source and reservoir of active physiological substances (vitamins C and A), organic acids, phenols, and they can be consumed freshly or processed in the pharmaceutical or food industry. It should be mentioned that red currant berries overcome to 2-3 times the ascorbic acid content than that of citric. The blue berries are recommended against nutrition diseases, and seabuckthorn berries contain large amounts of A, C, PP vitamins, lipids and organic substances which play an important role in increasing the natural resistance to diseases and also having energizing effect.

We studied some raspberry, gooseberry, blackberry and blueberry cultivars (table 6). The gooseberry, white E38 selection showed the very rich content in biochemical compounds and minerals: 22.17% dry weight, 1.54% organic acids, 15.57% total sugars and 2.077% minerals.

4. Conclusions

- The chemical and biochemical composition of fruit differs from one species to another, and within the species from one cultivar to another.
- The fruit coming from different places showed change in the chemical composition, even for the same cultivar.
- The nutritive value of fruit is represented in their content by easily assimilable soluble sugars, of pectins, very important in adjusting intestinal tracts of vitamins as antioxidants and of macro- and microelements.
- Consumption of this kind of fruits by several individuals for a certain period of time improved their health condition thanks to the beneficial substances from these fruits.

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Table 1. Variation limits of chemical and biochemical compounds of fruit trees, small fruits and strawberry

Fruit species	Water (%)	Total sugars (%)	Total acidity (%)	Tannins (%)	Minerals (ash) (%)	Proteins (%)	Vitamin C (mg %)	Anthocyanins (mg%)	P (mg%)	K (mg%)	Fe (mg%)
Apple	77-93	7-15	0,17-1,35	0,04-0,30	0,14-0,45	0,15-0,54	2-35	-	4-18	80-326	-
Pear	79-87	8-11	0,07-0,40	0,02-0,13	0,19-0,36	0,17-0,31	3-12	-	10-22	80-180	0,1-0,4
Plum	72-89	7-14	0,55-2,66	0,01-0,27	0,30-0,77	0,42-0,92	3-26	-	13-25	135-292	0,2-1,6
Sour cherry	80-90	6-11	0,60-2,45	0,11-0,30	0,35-0,62	0,90-1,70	4-26	3-161	13-24	150-260	0,2-4,5
Sweet cherry	76-90	6-15	0,20-0,80	0,03-0,28	0,25-0,68	0,40-1,17	3-39	1,8-74,3	11,8-30	155-348	0,3-2,8
Black currant	77-85	5-8	3,0-4,8	0,57-0,87	0,6-0,96	-	114-264	-	42,5-66	308-447	-
Red currant	81-89	6-8	1,70-2,68	0,26-0,52	-	-	-	-	-	-	-
Bilberry	79-88	7-9	0,80-1,20	0,30-0,47	-	0,80-1,12	10-18	-	-	-	-
Strawberry	86-93	4-9	0,6-1,09	0,14-0,27	0,31-0,66	-	44-92	7-37	11-29	108-273	-

Table 2. Variation of chemical and biochemical compounds of 2 apple cvs.related to location

nr. crt	Apple cv/location	DW (%)	Total acidity (%)	Total sugars %	P (mg%)	K(mg%)
1	Florina /Farm 1 (RIFG)	12,34	0,34	8,33	11,94	128
2	Florina / Farm 3 (Colibași)	15,42	0,31	10,67	9,81	104
3	Idared / Farm 1 (RIFG)	11,67	0,57	8,72	8,06	95
4	Idared/ Farm 7 (RIFG)	11,69	0,56	8,48	9,38	83

Table 3. The biochemical composition of ten apples cvs and selections after 160 days storage at 4.5 °C

nr. crt.	Apple cvs. and selections	DW(%)	Total acidity (%)	Total sugars (%)
1	Hillwell	11,71	0,46	12,34
2	Champion	11,17	0,25	13,16
3	DL 35	13,12	0,48	11,79
4	Prima	8,72	0,31	8,8
5	Rebra	10,02	0,16	9,83
6	Ariva	12,47	0,21	13,97
7	Rustic	11,19	0,19	12,73
8	Sir Prize	7,9	0,31	9,67
9	Baujade	10,44	0,61	11,64
10	Liberty	11,39	0,34	13,85

Table 4 . Chemical and biochemical composition of 11 plum cvs.

nr. crt.	Plum cvs.	DW (%)	Total sugars (%)	Total acidity (%)	Minerals ash (%)	K (mg%)	P (mg%)	Ca (mg%)
1	Strejești	13,73	8,33	1,07	17,22	165	17,22	4,1
2	Geoagiu	17,48	10,63	0,5	16,3	183	16,3	3,4
3	Centenar	14,63	8,47	0,97	13,82	248	13,82	6,54
4	Stanley	15,16	12,19	0,8	22,91	170	22,91	5,06
5	Anna Spath	17,85	10,63	0,81	23,02	163	23,02	5,51
6	Vânăț de Italia	18,56	10,86	1,05	24,86	172	24,86	4,69
7	Tuleu gras	15,91	10,2	0,71	18,74	165	18,74	3,49
8	Carpatin	15,6	10,2	0,79	15,35	153	15,35	3,26
9	Silvia	13,82	7,69	1,24	15,42	171	15,42	3,8
10	Piteștean	15,1	9,25	1,02	15,82	160	15,82	1,73
11	Minerva	10,01	9,25	0,99	13,98	196	13,98	2,98

Table 5. Chemical and biochemical composition of some sweet bitter cherry and sour cherry cvs. and selections

Nr. crt.	Sweet cherry cvs or selection	DW (%)	Total acidity (%)	Total sugar (%)	Minerals (%)	K (mg%)	P (mg%)
1	2D-28-31	14,29	0,63	12,5	0,61	161	19,08
2	NY-146	15,51	0,7	11,25	0,47	147	17,24
3	Viscount	13,51	0,67	11,69	0,56	183	18,55
4	Italia 1	11,64	0,68	11,54	0,72	168	14,38
5	Summit	13,86	0,75	13,24	0,61	157	13,92
6	Salnia	13,96	0,63	0,63	4,06	0,42	141
7	Kordia	16,62	0,5	12,86	0,98	193	23,03
8	Kristin	15,46	0,71	14,52	0,45	193	21,19
9	Izverna	15,95	0,56	13,64	0,43	164	15,81
10	HC 32/55	15,95	0,43	12,86	0,45	188	16,9
11	Rivan	11,44	0,54	7,54	0,37	103	11,11
12	Big burlat	13,09	0,29	8,72	0,49	145	10,39
13	HC 44/30	13,38	0,38	9,69	0,3	117	11,62
14	HC 58/53	12,84	0,33	12,18	0,29	110	9,99
15	Durana nero	18,05	0,44	11,45	0,46	186	16,95
16	Ponoare	11,04	0,46	8,19	0,66	152	14,26
17	Daria	13,03	0,48	8,72	0,36	146	11,52
18	HC 51/40	13,83	0,46	8,80	0,4	175	14,22
19	Sam	15,58	0,64	990	0,39	148	16,57
20	Vogue	14,81	0,55	10	0,39	163	16,94
21	Altenburgen	16,57	0,57	11,59	0,46	176	15,7
	Bitter cherry cvs.						
1	Amara	16,28	0,42	10,67	0,52	172	17,4
2	Amar roz de Costuleni	13,78	0,48	8,41	0,39	157	15,66
	Sour cherry cvs and selection						
1	Erdu nogy	12,33	0,81	8,33	0,45	165	15,01
2	Rival	13,5	0,91	8,48	0,74	145	14,05
3	HV 43/32	13,29	0,9	8,12	0,53	187	21,73
4	HV 45/40	15,04	0,82	10,33	0,41	166	23,89
5	Vyfebertoi	9,95	1,65	5,52	0,88	222	21,77
6	HV 49/5	16,16	1,43	11,05	0,46	193	25,43

Table 6. Biochemical composition of some raspberry, gooseberry, blackberry and blueberry cvs.

Nr. crt.	Species	DW (%)	Total acidity (%)	Total sugars (%)	Minerals (%)
1	Raspberry (Veten)	15,15	0,62	6,25	0,57
2	Raspberry (Willamentle)	16,27	0,79	7,98	0,769
3	Red gooseberry (E48)	15,81	2,23	8,64	0,584
4	White gooseberry (E38)	22,17	1,54	15,57	2,077
5	White gooseberry (E48)	20,58	1,42	13,57	1,007
6	Blackberry (Darow)	12,92	1,17	6,09	0,693
7	Blackberry (Arapako)	17,44	0,67	10,33	0,488
8	Bilberry(Simultan)	15,44	0,63	9,5	0,235
9	Bilberry (Lax)	14,91	0,72	8,8	0,243
10	Bilberry(Azur)	15,02	0,65	10,33	0,231