

ARONIA MELANOCARPA, A POTENTIAL THERAPEUTIC AGENT

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ABSTRACT. The positive effect of *Aronia melanocarpa* on human healthy is well known from over hundred years with a global and targeted action direct on certain organs and systems as cardiovascular system, age associated diseases, with prodigious results regarding cancer treatment, especially gastro-intestinal cancer (Slimestad, 2005/ Grajek, 2004). The absolute positive tendency of *Aronia* plant on humans is well known, however the variant originated from North America lies in attention of different researchers groups beginning 1990 years. Our clinical tests regarding the impact on the arterial hypertension and hypercholesterolemia, regulation of lipid equilibrium are encouraging. Our data establish the biggest microelements content of Chokeberry (*Aronia*) against other fruits as sour cherry (*Prunus cerasus*), wine grapes (*Vitis vinifera*), *Rubus caesius*, *Vaccinium myrtillus* and *Rosa canina*. Favorable action on blood glucose level is also reported as clinical result. Our findings imply a start point for future investigations in order to elaborate new drugs based on *Aronia* plant extracts.

Keywords: glycaemia, minerals, vitamins, cholesterol, Chokeberry, *Aronia*

INTRODUCTION

Aronia is a tree from Rosaceae family that can reach 4 m and originated from North America. *Aronia* exhibits nice summit leaves, with simple redish leaves in autumn, white flowers in mai. The fruits are comparable with those of *Vaccinium myrtillus* and represent one of the most rich vegetables in phenolic substances especially antociane (Ara, 2002), tannins, glycosides. The majority of remarkable actions on well-being of humans and experienced animals appears the antioxidant ability. The protecting capabilities on liver, gastric mucosa, anti-inflammatory effect after administration of alkaline fresh fruits or juice were registered. An antiviral action and against bacteria (Slimestad, 2005) as well on glucose metabolisms and developing of cancer cell on incipient steady were observed.

Aronia fruits are a little known. Because of their potential in regulation of human body functions, the berries are more and more used as food article. The frequency of stress caused diseases, like cardiovascular diseases, diabetes mellitus type 2, cancer (Valcheva-Kuzmanova, 2005) or allergies (Borrisova, 1994) are very high close linked with the pollution on environment. The natural products from plants, like fruits, leaves, roots are invaded simply the market and provides the most promising remedies.

This is also the case of *Aronia melanocarpa*. In Russia is one of the most recommended plants. The fruits and leaves are from years used successfully for the treatment of different sufferings (Valcheva, 2006 / Sieronov, 2006). The vitamins and minerals content of fruits is able to cover the correspondingly daily requirements of human body. The rich content in antocyanine ACs (Kay, 2004) and protoantocyanine PAs (He, 2006) is responsive from the biological response (Pilaczynska-Szczesniak, 2005). There are no studies regarding the action of PAs on humans, even if the pigments are an important part of

flavones from *Aronia*.

In addition to the little known ledges about PAs from *Aronia*, the positive action of plant on human healthy can be correlated with the presence of PAs. The antioxidant capability of plant is far higher compared to other fruits. Because of higher antioxidant content *Aronia* is used in therapy of diseases being able to function as “quencher” of free radicals (Kowalczyk, 2002).

One advantage of *Aronia* is that doesn't necessitate treatment with pesticides because of the high content in tannins. *Aronia* is very decorative plants in gardens. The fruits are used in manufacturing of marmalades, juices, ice creams.

Our studies are concentrated on clinical evaluation of human blood parameters after a diet containing extract of *Aronia*. The results showed a positive change on value of triglycerides, cholesterol, LDL-cholesterol, blood glucose content.

Simultaneous studies are performed related with the content in vitamins and minerals of different fruits. Our findings reveals the higher contents of Na, K, Ca, Mg compared with the other investigated fruits, while the most abundant vitamin A and C fruit was *Rosa canina*.

MATERIALS AND METHODS

Materials

A clinical experiment was realized with a patient 67 years old with hypercholesterolemia, arterial hypertension and deregulated protein metabolisms.

An alcoholic extract of crude *Aronia* (variant “Nero”) fruits (10%) was administered daily as dietary supplement, in quantity of 30 ml extract 40 days.

Methods

1. Blood analysis was performed including the routine parameters.

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Lipid parameters tested were the value of total cholesterol, triglycerides, HDL-cholesterol, LDL-cholesterol.

Hepatic parameters were also tested including: TGO (AST) aspartate-amino transferase, TGP (ALT) alanyl-amino transferase, GGT gamma glutamyl transferase.

Protein metabolism was investigated (Lowry, 1951), as parameters were tested: creatinine, urea, creatine, uric acid. From minerals was tested the Fe content of blood.

All the analysis were performed to a private clinic using a semiautomatic system from Company Futura System (Italia) with the correspondingly work methods.

2. Fruits from different plants considered having a therapeutic effect: Chokeberry (*Aronia*) sour cherry (*Prunus cerasus*), wine grapes (*Vitis vinifera*), *Rubus caesius* and *Rosa canina*, *Hippophae rhamnoides*, *Vaccinium myrtillus* were supposed to analysis of vitamin A, vitamin C total protein concentration, water content, lipid content, dry substance, pH value of fruits.

RESULTS AND DISCUSSIONS

Almost all information about Aronia benefits are the result of sporadic researches beginning with the time of ending of world war particularly from Russia.

The large spectrum of diseases possible to be

ameliorate or treated definitively with this miraculous plant, the few published results but assimilated in medicine, are a good recommendation to begin the systematic study of botanical presentation, fruit obtaining technology, obtaining the products with therapeutic application, in food industry as colorant or additive for taste, color, antioxidant supplement, textile industry as dyes.

Our researches started on experienced animals are continued on humans as clinical trial. The action of Aronia fruits as extract was followed before and after administering of Chokeberry extract of Aronia melanocarpa, "Nero" variant.

The fruit were procured from a private tree nursery located in Zalau, Romania.

The aim of experiment was on one side to test some biochemical blood parameters after administration of plant extract.

Investigation of Aronia Chokeberry on lipidic homeostasis

The followed tables (table 1 and table 2) represent the value of blood regarding lipid, protein and glucidic metabolism obtained before and respectively after ingestion of Aronia extract.

Table 1

Test of blood parameters before intake of Aronia extract

analyze	result	Unity measure	Biological reference
Urea	49,8	mg %	17-50
Uric acid	5,74	mg %	Women: 2,4-5,7; men: 3,4-7,0
creatinine	1,17	mg %	Women: 0,8-1,4; men: 0,7-1,2; children < 2 years: 0,3-0,6
TGO	25,3	U/L	Women: <38; men: <46;
TGP	23,7	U/L	Women: <44; men: <49;
GGT	22,67	U/L	Women: 7-32; men: 11-55
Lactic dehydrogenase	546,01	U/L	200-400
LDL cholesterol	143,80	mg %	<115
iron	117,20	mg / dl	Women: 37-145; men: 59-158
Glucose	102,88	mg %	70-110
Cholesterol	244,9	mg %	<200
Triglycerides	305,7	mg %	Women: 40-140; men: 60-165
HDL cholesterol	39,7	mg %	Women: >60; men: > 50

Table 2

Test of blood parameters after administration of Aronia extract

analyze	result	Unity measure	Biological reference
Urea	30,2	mg %	17-50
Uric acid	8,60	mg %	Women: 2,4-5,7; men: 3,4-7,0
creatinine	1,00	mg %	Women: 0,8-1,4; men: 0,7-1,2; children < 2 years: 0,3-0,6
TGO	31	U/L	Women: <38; men: <46;
TGP	21	U/L	Women: <44; men: <49;
GGT	17	U/L	Women: 7-32; men: 11-55
Lactic dehydrogenase	569,00	U/L	200-400
LDL cholesterol	111,00	mg %	<115
iron	66,00	mg / dl	Women: 37-145; men: 59-158
Glucose	83	mg %	70-110
Cholesterol	191	mg %	<200
Triglycerides	203,0	mg %	Women: 40-140; men: 60-165
HDL cholesterol	39,0	mg %	Women: >60; men: > 50

Significantly differences were registered regarding the at lipid values of the blood. The others parameters were from the beginning of experiment in normally limits.

Compared results are represented in the followed table (Table 3).

Table 3

Comparison between blood values before and after ingestion of Aronia fruits as extract 40 days, 30 ml/ day

parameters	Before ingestion	After ingestion
Cholesterol	244 mg%	191 mg%
HDL cholesterol	39,7 mg %	39 mg%
triglycerides	305,7 mg%	203 mg%
LDL cholesterol	143,80 mg%	111 mg%
TGP	23,7 U/L	21 U/L
GGT	22,67 U/L	17 U/L
urea	49,8 mg%	30,2 mg%
Uric acid	5,74 mg%	8,6 mg%

Cholesterol: there are a decrease of serum value after ingestion of Aronia fruits, so that the obtained parameters has a value normally (decrease from 244 mg% before ingestion to 191 mg% after ingestion).

HDL-cholesterol: the value is approximately the same, a little decrease, nonsignificant can be observed (from 39,7 to 39 mg%).

LDL-cholesterol: showed a deep decrease from 143 mg% to 111 mg%. The result suggests a positive action of Aronia extract on lipid metabolisms.

Triglycerides: decreased value from 305, 7 mg % before administration of Aronia extract to 203 mg% that means that plants was effectively in regulation of triglycerides. Is is to observe that the patient was before the plant treatment under medication for cholesterol adjusting, but unfortunately without well observed results.

TGP (ALT, alanin amino trasferase) a little decrease from 23,7 to 21 U/L. However in this case it cannot be made an appreciation because the TGP value was in normally limits before the intake of Chokeberry.

GGT (gamma glutamyl transferase): similarly to TGP, there are a slightly decrease from 22,6 to 17 U/L. In this case an assertion on the role of Aronia Chokeberry on hepatic function cannot be made because of the normally value before treatment.

Investigation of Chokeberry (Aronia) in glucose homeostasis

The experiment as clinical trial was performed on a patient non- diabetic. The glucose blood concentration was measured before and after intake of Chokeberry extract. As before, the administration was 30 ml daily 40 days.

Table 4

Comparison between glucose serum level before and after Chokeberry treatment

Glucose level in blut before treatment with Chokeberry aronia	Glucose level in blut after treatment with Chokeberry aronia
102,88 mg%	83 mg %
Reference value	70-110

Diabetes is a risk factor in developing of cardiovascular diseases. Since 2002 it is known that after administering of Aronia juice the value of glucose in serum by patients with diabetes mellitus type 2 decreases. In literature the value of glycated hemoglobin HbA1c was measured 60 minutes after intake of Glucose level in blood before treatment with Chokeberry Aronia juice.

In this experimental case even if there is a non diabetic patient a discrete decrease of glucose in normally limits, can be observed.

Investigation of bioactive substances from Glucose level in blut before treatment with Chokeberry Aronia

Plants were the first therapeutic agent from ancient time.

In our experiments we try to quantify some of bioactive compounds from Glucose level in blut before treatment with Chokeberries. Vitamin C, vitamin A, as well known, have an important significance for humans. These vitamins were quantified from different fruits as Chokeberry (*Aronia*) sour cherry (*Prunus cerasus*), wine grapes (*Vitis vinifera*), *Rubus caesius* and *Rosa canina*, *Vaccinium myrtillus* , *Hippophae rhamnoides*.

Total protein concentration, dry substance, humidity, as well as pH , total lipid concentration, and minerals: Na, K, Ca, Mg, Fe were examined.

Table 5

Analysis of chemical composition of some fruits

Fruits from	Dry substance %	Total Protein / 100 g fresh fruit	Vitamin A mg / 100 g fruit	Vitamina C/ mg100 g fruit	H ₂ O to 100 g fruit comestible
Aronia Melanocarpa	15,7	0,7g/100 g fruct uscat	0,77	13,7	84,3 %
<i>Rosa canina</i>	16	1,2 g	0,27	17	84 %
<i>Vitis vinifera</i>	20	0,7 g	3	0,03	80 %
<i>Hippophae rhamnoides</i>	18	14	1500	450	82
<i>Rubus caesius</i>	14,2	0,6	0,130	20	84,8
<i>Rosa canina</i>	52	-	600-10000	500-1000	48 %
<i>Prunus cerasus</i>	14	0,9	0,03	12	84%

Table 6

Parameters some fruits (pH, total lipids)

Fruits	pH	Total lipids % to 100 g fruits
Aronia Melanocarpa	3,3-3,7	0,14
<i>Rubus caesius</i>	3,5-4,9	1
<i>Vitis vinifera</i>	2,5-4,4	0,5
<i>Hippophae rhamnoides</i>	2,0-2,5	7
<i>Vaccinium myrtillus</i>	2-3,8	0,6
<i>Rosa canina</i>	2,5-3,1	-
<i>Prunus cerasus</i>	2,6-3,7	0,5

Table 7

Minerals content some fruits. Comparison with Aronia

fruits	Ca mg %	Fe mg %	K mg %	Mg mg %	Na %	P %
Aronia Melanocarpa	32,2	0,93	218	16,2	2,6	
<i>Rubus caesius</i>	29	0,9	190	-	3	30
<i>Vitis vinifera</i>	22	0,5	180	15	0,7	26
<i>Vaccinium myrtillus</i>	10	0,7	65	2,4	1	9,1
<i>Rosa canina</i>	-	-	-	-	-	-
<i>Prunus cerasus</i>	8	0,6	120	8	2	7

It is easy to follow that *Aronia melanocarpa* is the most abundant fruit in minerals like: Ca, Fe, K, Mg, Na and also also in phosphorus. In addition, the most abundant in vitamin C and A are *Rosa canina*, from the group of investigated fruits. Without discussion the achievement and contribution of minerals on well being the body is well known taking in account their implication in enzyme activity.

The relative alkaline pH of Chokeberry (*Aronia*) fruits can be observed, and represent an argument on ability to protect gastro-intestinal mucosa (Table 6). The same observation can be made on vitamins that are precursors of coenzymes. The results shows a high content in vitamin C compared with *Rosa canina* can justify the antioxidant effects on age related diseases. *Aronia* fruits content is 15

timer higher as of *Vaccinium myrtillus* (<http://www.ars.usda.gov/Services/docs.htm?docid=15866>). The fresh fruits of *Aronia* contain a high quantity of inulin, so that are a rich source of glucide other as glucose for patients with diabetes tip 2 (<http://www.ncbi.nlm.nih.gov/pubmed/12580526>).

From the literature data it will be shown one comparison regarding the antociane content of different fruits originated from cultivar/ hybrids of *Aronia* (Jeppson, 2000). Because it is believed that antociuane are important in therapeutic effect of Chokeberry the future studies will be concentrated on this subject, investigation of more variant of plants and molecular and clinical trials to establish the well-being of humans.

Table 8

Medium values of weight and antociane contenst of fruits from different cultivar/ hybrids of Aronia (Jeppson, 2000)

Variety/Hybrids aronia	Fruits weight mg	Antociane content mg/l
Aron	93,8	1530
Nero	91	1590
Viking	95,5	1490
Var. elata	98,1	1970
Bar 2 12 30	95,9	1450
Bar 2 13 09	98	1290
Bar 2 13 19	95,7	1500
BarC 11 28	91,1	1260
Stewart	40,2	720
Appelberry	47,5	1440
Burka	59,6	170
Titan	99,2	120

CONCLUSIONS

Aronia melanocarpa is the most abundant fruit in minerals like: Ca, Fe, K, Mg, Na, while *Rosa canina* is the most abundant in vitamin C and A.

Aronia "Nero" has a positive action regarding the equilibrium of cholesterol values: total cholesterol, HDL or LDL-cholesterol. The level of triglycerides rich the normal limit only after 40 days of treatment.

In opposite with the drug medication against cholesterol and triglycerides, the plant extract of *Aronia* was able to bring the total cholesterol, LDL cholesterol and triglycerides at normally accepted values. The most impressed result was registered on concentration triglycerides, were a change from 305 mg% to 200 mg% represent a real achievement.

Our results refers to human lipid balance, the argument is that only the biochemical values of lipid serum were deviated from the reference biological intervals, while others were inside.

Future researches are planed in order to study the lipid metabolism on a larger clinical trial including more patients.

A former investigation refers to fruit chemical composition (lipid, protein, dry substances, water, vitamins, minerals) was performed, based on affirmation that the therapeutic benefits of plants reflect their chemical features. Following studies will be made on discrete chemical structure of Chokeberry (*Aronia melanocarpa*) including flavones, antociane, carotenoid pigments and their antioxidant capabilities.

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