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DETERMINATION OF THE NUTRITIONAL QUALITIES AND MINERALS CONTAINED IN DRIED PRODUCTS FROM DIFFERENT VARIETIES OF TRADITIONAL ROMANIAN APPLES

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Abstract
The aim of this work was to quantify the content of nutritional elements and minerals in dried products from traditional Romanian old apple varieties from Salaj county, with potential for production and introduction into population consumption, as well as establishing shelf life for dried apples without the addition of preservatives, on the technological flow. The apple varieties evaluated were "Jonathan", "Poinic", "Mustos - sample 2", "Summer- not nominally identified", "Winter- not nominally identified", "Mustos - sample 1", "Dulce", as well as 2 mixes with apples "Mix of dried apples (from the Poinic, Mustos, Dulce, Summer, Winter, Ionathan varieties)" and "Summer variety dried apple mixed with dried chokeberry and dried blackcurrant"(contains apples from the "Summer- not nominally identified"). The samples taken in the study continued the skin and pulp of the fruits. The minerals iron, manganese, magnesium, potassium, calcium and sodium were evaluated. The evaluated nutritional indicators were the content of available carbohydrates, energy (Kj/100g, kcal/100g), energy from fats, ash content, fat content, dietary fiber, protein, dry matter, moisture. The evaluated minerals showed significant differences depending on the variety. The variety 'Jonathan' was noted for its high content of iron 8.1 mg/kg. High manganese content was detected in "Jonathan" variety - 2.11 mg/kg and in "Dulce" variety - 3.11 mg/kg. The "Summer- not nominally identified" variety was noted for its high content of sodium 14.4 mg/kg and calcium 276 mg/kg. The "Poinic" variety stood out for its high potassium content 6380 mg/kg. The "Winter- not nominally identified"variety stood out for its high magnesium content of 377 mg/kg. The results indicated the high nutritional potential of apples from old traditional Romanian varieties.

Keywords: minerals, nutritional facts, old varieties, romanian apple fruits.

1. INTRODUCTION

The chemical and nutritional composition of fruits is influenced by factors such as the variety of trees, growing conditions, climatic conditions and the form of preservation. Apples (Malus domestica Borkh.) are fruits that can be eaten both raw and preserved in a variety of forms. Nowadays, we lead a life that mirrors the life of our ancestors, the Dacians and the Romans, who left us not only interesting architectural structures, living vocabulary, but also healthy culinary and eating habits, it being well known that they preserved food by drying. After more than 2000 years, we reproduce the drying process, in a controlled environment, maintaining a temperature below 58 degrees Celsius, without using preservatives, sulfites or dyes, with the aim of obtaining an authentic product, in Salaj County. The drying process removes the water content and preserves the natural nutrients and minerals. For this study we chose the varieties "JONATHAN", "POINIC",

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"MUSTOS" - Sample 2021, "Summer" not nominally identified, "Winter" not nominally identified, "MUSTOS" - Sample 2018, "DULCE". The samples taken in the study included the peel and pulp of the fruits approximately in proportions of 1:3. The mineral substances iron, manganese, magnesium, potassium, calcium and sodium were evaluated. The evaluated nutritional indicators were available carbohydrate content, energy content (Kj/100g, kcal/100g), fat energy, ash content, fat content, dietary fiber, protein, dry matter, moisture. To establish the shelf life of dried apples, two samples processed in different years from the same apple specimen were compared. The raw apples were picked from the organically certified orchard in the village of Jac, Salaj county, and from the orchard in the village of Brusturi. The trees are between 50 and 100 years old, they are of great vigor, still productive, some with tendencies towards the state of decline. Growing conditions were poor for many consecutive years, without any tree treatment or soil improvement. The trees show signs of disease and the fruits show signs of pests. (Figure 1)

Figure 1. "Winter- not nominally identified" old Romanian apple variety, fresh sample, with pests

Starting from these aspects, respectively the samples being of inferior quality, we processed them by drying to determine their nutritional qualities and minerals. In the case of improving the culture conditions of the studied apple specimens and improving the soil, the laboratory analyzes will be able to be repeated, to compare the results. When labeling products, it is necessary to apply the legal norms in force regarding the mention of the validity period. In order to determine the shelf life of dried apples, the amounts of nutrients and minerals contained in two distinct samples were analyzed in parallel in 2023, namely dried apples of the MUSTOS variety (sample processed in 2018) and dried apples of the MUSTOS variety (sample processed after 3 years, in 2021), both samples being collected from the same apple specimen. Both samples were analyzed in the laboratory in April 2023. All dried apple samples taken in the study contained the peel and pulp of the fruit.

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2. MATERIALS AND METHODS

The raw material was harvested from Jac and Brusturi villages, located in Salaj county, all being organically grown.

The 6 ancient varieties of apples and the other 2 mixes with apples analyzed in this study were:

"POINIC", - sample harvested in 2021, from Jac village

"Summer- not nominally identified" - sample harvested in 2021, from Jac village

"Winter- not nominally identified"- sample harvested in 2021, from Jac village

"IONATHAN", -sample collected in 2021, from Brusturi village

"MUSTOS sample 1" - processed by drying in 2021, harvested from Jac village

"MUSTOS sample 2" - processed by drying in 2018, harvested from Jac village

"DULCE", - sample harvested in 2023, from Jac village

"Summer variety dried apple mixed with dried chokeberry and dried blackcurrant" - contains apples from "Summer- not nominally identified" - harvested in 2021, from Jac village.

"Mix of dried apples (from the Poinic, Mustos, Dulce, Summer, Winter, Ionathan varieties)"

We used a pilot recipe of dried apples, correlated with compliance with HACCP principles on the technological flow.

The samples were prepared by slicing with an electric machine and subjected to slow drying for 25 hours, the first 20 hours at a temperature of 48 degrees Celsius, followed by another 5 hours at a temperature of 58 degrees Celsius, in an electric food dryer. , without adding preservatives to the contents of the samples and preserving the skin and pulp. The dried apples were stored at room temperature in paper bags inside a 30 micron bulk plastic bag. At an interval of one month, the process of drying the apples was resumed (for 3 hours at a temperature of 48 degrees Celsius), in order to remove the accumulated moisture from the air, with a view to final packaging. Laboratory samples contained approximately 1:3 skin and pulp.

To determine the validity of the samples, we analyzed in parallel two samples collected from the same apple specimen, in different years. The laboratory analysis was carried out in March 2023, both for the sample processed in 2021 and for the sample processed in 2018.

3. RESULTS AND DISCUSSIONS

The evaluated minerals showed significant differences depending on the variety of apples.

Table 1. Determination of the mineral Iron content of dried apples varieties Poinic, "Summer- not nominally identified", "Winter- not nominally identified", Jonathan, Mustos, Dulce

Parameter	Meas. Unit	Sample identification: The year of drying processing / The date of the laboratory analysis						Legislation max. limits	Testing methods
		Determined value (from the lowest to the highest)							
		SUMMER	MUSTOS	POINIC	WINTER	JONATHAN	DULCE		
		2021	2021	2021	2021	2021	2023		
		March 2023	March 2023	March 2023	March 2023	March 2023	July 2023		
Iron	mg/kg	5	5.5	5.5	7.9	8.1	13.9	N/A	B-METAXDG2

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High iron content was detected in "Jonathan" variety - 8.1 mg/kg and in the "Dulce" variety - 13.9 mg/kg. (Figure 2), (Table 1).

Figure 2. Old apple variety JONATHAN, fresh sample

Table 2. Determination of the mineral Manganese content of dried apples varieties Poinic, "Summer- not nominally identified"apple, "Winter- not nominally identified", Jonathan, Mustos, Dulce

Parameter	Meas. Unit	Sample identification: The year of drying processing / The date of the laboratory analysis						Legislation max. limits	Testing methods
		Determined value (from the lowest to the highest)							
		SUMMER	WINTER	MUSTOS	POINIC	JONATHAN	DULCE		
		2021 March 2023	2021 March 2023	2021 March 2023	2021 March 2023	2021 March 2023	2023 July 2023		
Manganese	mg/kg	1.5	1.53	1.74	1.98	2.11	3.11	N/A	B-METAXDG2

High manganese content was detected in "Jonathan" variety - 2.11 mg/kg and in "Dulce" variety - 3.11 mg/kg. (Table 2). The results show that "Summer- not nominally identified" variety and the "Winter- not nominally identified" variety have a low manganese content, compared to the apple varieties Dulce, Poinic, Jonathan and also Mustos (Figure 3), (Table 2).

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Figure 3. Romanian old apple variety DULCE, fresh sample

Table 3. Determination of the mineral Magnesium content of dried apples varieties Poinic, "Summer- not nominally identified", "Winter- not nominally identified", Jonathan, Mustos, Dulce

Parameter	Meas. Unit	Sample identification: The year of drying processing / The date of the laboratory analysis						Legislation max. limits	Testing methods
		Determined value (from the lowest to the highest)							
		SUMMER	MUSTOS	POINIC	DULCE	JONATHAN	WINTER		
		2021	2021	2021	2023	2021	2021		
		March 2023	March 2023	March 2023	July 2023	March 2023	March 2023		
Magnesium	mg/kg	273	293	297	306	321	377	N/A	B-METAXDG2

High magnesium content was detected in "Winter- not nominally identified" variety - 377 mg/kg and in "Jonathan" variety - 321 mg/kg. (Figure 4, 5), (Table 3).

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Figure 4. "Winter- not nominally identified" old Romanian apple variety, fresh sample

Figure 5. "Winter- not nominally identified" old Romanian apple variety, fresh sample

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Table 4. Determination of the mineral Potassium content of dried apples varieties Poinic, "Summer- not nominally identified", "Winter- not nominally identified", Jonathan, Mustos, Dulce

Parameter	Meas. Unit	Sample identification: The year of drying processing / The date of the laboratory analysis						Legislation max. limits	Testing methods
		Determined value (from the lowest to the highest)							
		SUMMER	JONATHAN	DULCE	MUSTOS	POINIC	WINTER		
		2021	2021	2023	2021	2021	2021		
		March 2023	March 2023	July 2023	March 2023	March 2023	March 2023		
Potassium	mg/kg	5240	5580	5600	5960	6380	8330	N/A	B-METAXDG2

High potassium content was detected in "Poinic" variety - 6380 mg/kg and in "Winter- not nominally identified" variety - 8330 mg/kg. (Figure 6, 7, 8), (Table 4).

Figure 6. Romanian old apple variety POINIC, fresh sample

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Figure 7. Romanian old apple variety POINIC, fresh sample

Figure 8. Romanian old apple variety POINIC, dried sample

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Table 5. Determination of the mineral Calcium content of dried apples varieties Poinic, "Summer- not nominally identified", "Winter- not nominally identified", Jonathan, Mustos, Dulce

Parameter	Meas. Unit	Sample identification: The year of drying processing / The date of the laboratory analysis		Legislation max. limits	Testing methods
		Determined value (from the lowest to the highest)			
		MUSTOS	**SUMMER**		
		2021	**2021**		
		March 2023	March 2023		
Calcium	mg/kg	272	276	N/A	B-METAXDG1

High calcium content was detected in "Summer- not nominally identified" variety - 276 mg/kg. (Figure 9, 10, 11), (Table 5).

Figure 9. "Summer- not nominally identified" old Romanian apple variety, fresh sample

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Figure 10. "Summer- not nominally identified" old Romanian apple variety, fresh sample

Figure 11. "Summer- not nominally identified" old Romanian apple variety, fresh sample

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Table 6. Determination of the mineral Sodium content of dried apples varieties Poinic, "Summer- not nominally identified", "Winter- not nominally identified", Jonathan, Mustos, Dulce

Parameter	Meas. Unit	Sample identification: The year of drying processing / The date of the laboratory analysis		Legislation max. limits	Testing methods
		Determined value (from the lowest to the highest)			
		MUSTOS	**SUMMER**		
		2021	**2021**		
		March 2023	March 2023		
Sodium	mg/kg	5.3	14.4	N/A	B-METAXDG1

High sodium content was detected in "Summer- not nominally identified" variety - 14.4 mg/kg. (Table 6).
The sodium content shows significant differences between Mustos apple variety and "Summer- not nominally identified" variety (Figure 12, 13, 14), (Table 6), as does the calcium content (Table 5).

Figure 12. Mustos old Romanian apple variety, fresh samples

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Figure 13. Mustos old Romanian apple variety, fresh samples

Figure 14. Mustos old Romanian apple variety, dried samples

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In a 100g portion of " Mix of dried apples (from Poinic, Mustos, Dulce, Summer, Winter, Jonathan varieties)", there are 64.9 grams of total carbohydrates, < 2.4 kcal as energy from fats, 15.8 grams of dietary fiber, 0.26 grams of fat content, protein 1.21 grams (Table 7).

Table 7. Determination of nutritional information for " Mix of dried apples (from Poinic, Mustos, Dulce, Summer, Winter, Jonathan varieties)"

Sample identification				
Parameter	Meas. unit	Determined value	Legislation max. limits	Testing methods/Guide/SOP /
Mix of dried apples (from Poinic, Mustos, Dulce, Summer, Winter, Jonathan varieties)				
Available carbohydrates	g/100g	64.9	-	B-ENE2-CC
Energy (kj/100g)	kj/100g	1260	-	
Energy (kcal/100g)	kcal/100g	301	-	
Energy from fats (kj/100g)	kj/100g	<10	-	
Energy from fats (kcal/100g)	kcal/100g	<2.4	-	
Ash content	g/100g	2.04	-	B-ASH-GR
Fat content	g/100g	0.26	-	B-FATT-NMR
Dietary fiber	g/100g	15.8	-	B-DF-ENZ
Protein	g/100g	1.21	-	B-PROT-DUM
Dry substance	g/100g	84.3	-	B-DRY-GR B-DRY-GR

In a 100g portion of "Summer variety dried apple mixed with dried chokeberry and dried blackcurrant", there are 53.8 grams of total carbohydrates, 294 kcal as energy from fats, 28.1 grams of dietary fiber, 1.53 grams of fat content, protein 2.07 grams (Table 8).

Table 8. Determination of nutritional information for dried "Summer variety dried apple mixed with dried chokeberry and dried blackcurrant"

Sample identification				
Parameter	Meas. unit	Determined value	Legislation max. limits	Testing methods/Guide/SOP /
Summer variety dried apple mixed with dried chokeberry and dried blackcurrant				
Available carbohydrates	g/100g	53.8	N/A	B-ENE2-CC
Energy (kj/100g)	kj/100g	1230	N/A	
Energy (kcal/100g)	kcal/100g	294	N/A	
Energy from fats (kj/100g)	kj/100g	57	N/A	
Energy from fats (kcal/100g)	kcal/100g	13.6	N/A	
Ash content	g/100g	2.33	N/A	B-ASH-GR
Fat content	g/100g	1.53	N/A	B-FATT-NMR
Dietary fiber	g/100g	28.1	N/A	B-DF-ENZ
Protein	g/100g	2.07	N/A	B-PROT-DUM
Dry substance	g/100g	87.8	N/A	B-DRY-GR

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Some losses of nutritional qualities and the amount of minerals were observed in the time frame 2018-2021.

Table 9. Determination of nutritional information for dried apples of the Mustos variety, processed in different years

Sample identification					
Parameter	Meas. unit	Determined value		Legislation max. limits	Testing methods/Guide/SOP /
		MUSTOS 2021	**MUSTOS 2018**		
Available carbohydrates	g/100g	70.5	69.6	N/A	B-ENE2-CC
Energy (kj/100g)	kj/100g	1360	1350	N/A	
Energy (kcal/100g)	kcal/100g	326	322	N/A	
Energy from fats (kj/100g)	kj/100g	24	16	N/A	
Energy from fats (kcal/100g)	kcal/100g	5.6	3.7	N/A	
Ash content	g/100g	1.74	1.4	N/A	B-ASH-GR
Fat content	g/100g	0.64	0.42	N/A	B-FATT-NMR
Dietary fiber	g/100g	15.6	16.8	N/A	B-DF-ENZ
Protein	g/100g	1.1	0.686	N/A	B-PROT-DUM
Dry substance	g/100g	89.5	89	N/A	B-DRY-GR

The difference between the results of the two comparative laboratory analyzes, of the two dried products (one processed in 2018 and one processed in 2021), shows a decrease in the analyzed parameters, respectively the decrease of the protein by almost 38%, the decrease of the amount of fat with almost 35%, the decrease of fat energy by almost 34% and the decrease of ash content by almost 20%. This result indicates that the apples in the dry form maintain their nutritional qualities over 50% from year to year, for a long time, respectively they can have a long shelf life. (Table 10)

Table 10. Determination of nutritional information for dried apples of the Mustos variety, processed in different years

		Sample identification		
Parameter	Meas. unit	Determined value		percentage loss %
		MUSTOS 2021	**MUSTOS 2018**	
Available carbohydrates	g/100g	70.5	69.6	1,28
Energy (kj/100g)	kj/100g	1360	1350	0,74
Energy (kcal/100g)	kcal/100g	326	322	1,23
Energy from fats (kj/100g)	kj/100g	24	16	33,33
Energy from fats (kcal/100g)	kcal/100g	5.6	3.7	33,93
Ash content	g/100g	1.74	1.4	19,54
Fat content	g/100g	0.64	0.42	34,38
Dietary fiber	g/100g	15.6	16.8	
Protein	g/100g	1.1	0.686	37,64
Dry substance	g/100g	89.5	89	0,56

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4. CONCLUSIONS

The process of drying apples preserves many of the natural nutrients and minerals of the variety, a fact that can be taken into account in terms of healthy food for the romanian population.
Dried apples from the old traditional varieties that were grown on Romanian soils can be kept safe for consumption for a long time, through natural preservation, without the addition of preservatives.

5. ACKNOWLEDGEMENTS

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