Rector's Allocution

We have the special pleasure to let you know that the Review of our University, „Bulletin of Scientific Information", having ten years of consecutive issue, it achieved the recognition of the National Council for Scientific Research in Higher Education (NURC), being comprised in the category „National Reviews — C Category".

So, Bioterra University review „Bulletin of Scientific Information" works as a real platform for the information and exhibition of the most recent and valuable research in the agricultural field and connected sciences (food industry, agro-tourism, ecology, environment protection, agricultural economics etc).

This way, I express my gratitude to the contributors to our science magazine, to the authoritative academic and universitary personalities of whose studies are found in the selection done by the scientific board of our magazine with whom we have strong relations of partnerships in the development of jointed research projects.

I wish to our scientific science magazine many and consistent issues.

Prof. Floarea Nicolae, PhD

Rector of Bioterra University Bucharest

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EXPLORING THE VALORIZATION POTENTIAL OF BY-PRODUCTS GENERATED DURING DIETARY SUPPLEMENT PROCESSING AS FUNCTIONAL BIOACTIVE INGREDIENTS

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Abstract

Given the growing importance of functional food ingredients in promoting healthier dietary choices, food manufacturers face the challenge of identifying suitable and convenient components for improving the nutritional quality of bakery products.

In this study, partially defatted flaxseed, a by-product of cold-press oil extraction, and alfalfa concentrate, a by-product obtained during the processing of the dietary supplement Alfalfa Complex, were used as functional ingredients. These materials were incorporated to enrich wheat flour with bioactive carbohydrates (dietary fiber), bioactive proteins, unsaturated fatty acids, and minerals. Mixtures of wheat flour fortified with different levels of partially defatted flaxseed and alfalfa concentrate were analyzed to evaluate their functionality in bakery applications, particularly in products primarily based on wheat flour. The objective of this work was to investigate the physicochemical and technological properties of bread samples enriched with varying proportions of these ingredients: 5% alfalfa concentrate, 10% partially defatted flaxseed, and a combination of 7% partially defatted flaxseed with 3% alfalfa concentrate.

Keywords: *flaxseed*, *alfalfa, amino acids, mineral, dietary fiber.*

1. Introduction

The big challenges of the world, increasing the number pf people over 9 billion by 2050 and limited resources lead to an urgent need for finding renewable and biological resources for obtaining nutricious food products.

The bread and bakery products is one of the most important food for people, for this reason, nowadays, the nutritional values of these products could be enriched using different active principles as vitamins, enzymes, minerals, fiber, antioxidants. (L. Apostol et al.[2], Kianoush Khosravi-Darani et. al.[8]; Pîrvulescu P. et. al.[10]).

Flaxseed is the seed of the flax plant (*Linum usitatissimum* L.) (Yalçın Coşkuner et al.[12]). The production of flaxseed, all over the world, grew rapidly, over the past years. The request for flaxseed refers to oil content, with multiple destinations, including, edible oil with human health benefits. The increasing demand for the flaxseed oil leads to increased oil yield and the qualtity of byproducts obtained. (Alaa El-Din A.[1]; Bekhit & all. [3]). The extraction consists in pressing the flaxseed, without heating by getting the extraction of oil and a byproduct such as, defatted flaxseed. Many years - byproduct was not interesting for scientists or for the manufacturers so, it was used for feeding animals and fertilize the ground. After a tghouruogh analyzing it it has been noticed that it contains valuable nutrients, protein, minerals and dietary fiber. The composition of the flaxseed defatted is consisting in: 30–41% fat, 20–35% dietary fiber, 20–30% proteins, 3–4% ash, and 1% sugars, depending on the external variations from the flaxseed growth location (Carter [4]). Therefore, in 2013, Bekhit et al.[3], have highlighted the potential of improvement of nutritional and functional properties of food products.

Alfalfa (*Medicago sativa* L.) is primarily used in animal feed, however in recent years it started to be used more often for food, as it is a rich source of easily assimilated minerals (calcium, phosphorus, iron, magnesium, potassium, zinc, copper, selenium, manganese), vitamins (C, K, D, E, U, provitamin A, B1, B2, B6, B12, folic acid/B9, biotin, niacin) and eight essential amino acids (alanine, lysine, arginine, histidine, cysteine, proline, methionine, tyrosine).

Regarding the alfalfa concentrate, it is another valuable by-product obtained during dietary supplement "Alfalfa complex" processing.

The aim of the present study is to mix the partially defatted flaxseed, by-product from obtained by cold pressing extraction oil, with an alfalfa concentrate, in different proportions, and add them to wheat flour in order to study the improvement of the nutritional and functional values of resulting bread.

2. Materials and Methods

2.1. Materials

Partially defatted flaxseed flour, a by-product obtained during processing the flaxseed oil extraction, alfalfa concentrate flour, a by-product resulted from the processing of the dietary supplement "Alfalfa Complex" and whole wheat flour provided by *Hofigal Export – Import SA* (Bucharest, Romania).

Fig. 1. Raw materials

2.2. Preparation of wheat flour enriched in bioactive compounds types

Three samples of mixtures from wheat flour, with different proportions of partially defatted flaxseed flour and alfalfa were obtained. The types of flour mixtures used in this study are presented in Table 1.

Table 1. Types of flours obtained by addition of partially defatted flaxseed flour

M	100% whole wheat flour
1	90% whole wheat flour +10% partially defatted flaxseed
II	95% whole wheat flour +5% alfalfa
III	90% whole wheat flour +7% partially defatted flaxseed+3% alfalfa

2.3. Chemical analysis

Moisture content was determined at 103^{0}C (±2 ^{0}C) (2 g test samples) until constant weight was attained (SR 90:2007). The ash content was determined by incineration at 525 ± 25^{0}C (SR 90:2007). Total fat content was determined by extracting 5 g of sample with petroleum ether at 40-65^{0}C, using a semi-automatic Soxhlet Foss Extraction System 2055 (Foss, Sweden). Total nitrogen (N) and crude protein content (N·6.25, conversion factor) was determined by the Kjeldahl Method (KjelMaster K-375, Buchi, Germany). The total carbohydrate content was calculated by difference: 100 - (ash content + protein content + fat content + moisture content). The crude fiber content of the samples was determined using a Fibretherm-Gerhardt apparatus. Crude fibers include cellulose, hemicellulose, and lignin. All experiments were performed in triplicate.

2.4. Mineral content analysis

Mineral content was determined using an atomic absorption spectrophotometer (ContrAA 700; Analitykjena)). Total ash was determined by incineration at 550 °C, in an oven. Analysis was performed using an external standard (Merck, multi element standard solution) and calibration curves for all minerals were obtained using 6 different concentrations. Dried samples were digested in a mixture of concentrated HCl.

2.5. Amino acid content analysis

For the analysis of amino acid content, samples were hydrolyzed at 100–120 ^{0}C in 6N hydrochloric acid for 22–24 hours under vaccuum.
After evaporation to dryness of hydrochloric acid, the dried residue was diluted using 4 mM stock solution of Norleucine.
The chemical score of alfalfa concentrate flour was calculated according to FAO/WHO (1985) as follows:

$$\text{Chemical Score} = \frac{mg/g \text{ of essential amino acid in test protein}}{mg/g \text{ of essential amino acid reference protein}} \times 100$$

2.6. Bread quality

2.6.1. Specific volume measurement

To determine the bread specific volume, each loaf was weighed and its volume was determined by the rapeseed displacement method (SR 91:2007). Data were reported as the mean of three measurements of fresh-made loaf bread. It is expressed in g/cm^3.

2.6.2. Porosity measurement content consists in determining the total hole's volume of a known volume of core bread, knowing its mass and density. It is expressed in %.

2.6.3. Elasticity content measurement consists in pressing a standardized piece of crumb bread, determined by measuring it at a given time and return to its original shape after removing the pressing force. Crumb elasticity is expressed in percent meaning the ratio between the height expressed in% by pressing and return, and the initial height of the cylinder crumb bread.

2.6.4. Determination of organoleptic characteristics

It was determined the "Bread score" based on the quantification of a set of organoleptic characteristics, reported to a standard volume of 400 cm^3/100g and 85 % porosity, method validated by IBA Bucharest.

Table 2. Organoleptic characteristics and theirs scores for Calculating the bread marks.

Indicator	Scores
Volume	24
Marginal crack height	7
Crust color	7
Crumb appearance	10
Porosity	20
Elasticity	20
Aroma	12
Total	100

2.6.5. Moisture content measurement

Moisture content of the bread crumb was determined at 103 ^{0}C (±2 ^{0}C) until constant weight for each measurement. Approximately 5 g of crumb were taken from central slices of the loaf. Data are reported as the mean of three measurements, each one performed on a freshmade loaf.

2.6.6. Acidity content measurement consists of aqueous extract of bread titration with 0.1 N NaOH solutions in the presence of phenolphthalein as indicator. The acidity was expressed in degree of acidity.

2.7. Statistical Analysis

All analyses were performed in triplicate and the mean values with the standard deviations were reported. Microsoft Excel 2003 Program was used for statistical analysis of the data with a level of significance set at 95%. Analysis of variance (ANOVA) followed by Tukey's test was used to assess statistical differences between samples. Differences were considered significant for a value of $P < 0.05$.

3. Results and discussion

3.1. Chemical analysis of the wheat flour and partially defatted flexseed mixture

Partially defatted flaxseed flour enriched with alfalfa concentrate, for the obtaining of a value-added wheat flour is an interesting source of enrich the nutritional composition of bread, compared with those obtained from the simple wheat flour. In addition, flaxseed is a rich source of oil: 38-45% (Daun et al. [5]), of α-linolenic acid, lignans and phenolic compounds, providing beneficial effects on human's health.(Hall et al [6])

The chemical composition of wheat flour and mixtures wheat flour with partially defatted flaxseed flour and alfalfa concentrate flour are shown in Table 3. The ratios of the different flours incorporated in, are shown in Table 1.

Table 3. Chemical composition of wheat flour and mixtures wheat flour with partially defatted flaxseed and alfalfa concentrate flours

Sample	g/100 g, based on dry weight				
	Total proteins	Ash	Total lipids	Crude fibers	Total carbohydrates
M	11.60 ± 0.11	0.95 ± 0.08	1.16 ± 0.11	2.48 ± 0.11	86.29 ± 0.16
I	13.92 ± 0.16	1.46 ± 0.09	2.81 ± 0.14	3.32 ± 0.16	81.81 ± 0.11
II	12.07 ± 0.13	1.47 ± 0.09	1.18 ± 0.11	3.19 ± 0.14	85.28 ± 0.15
III	13.50 ± 0.15	1.62 ± 0.10	2.32 ± 0.12	3.50± 0.18	82.55 ± 0.12

* Results given as: M ± SD (mean ± standard deviation) of triplicate trials.

As the data from the previous table shows, the enrichment of wheat flour with partially defatted flaxseed flour and alfalfa concentrate enhances the nutritional values of bakery products, especially in crude fibers. Therefore, all three mixtures of flours contain more than 3 grams of crude fibers per 100 g total.

In this study, the content of some minerals were analysed: calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), iron (Fe) and manganese (Mn), as well as an additional two essential traces of zinc (Zn) and copper (Cu).

Table 4. Mineral content of wheat flour and mixtures wheat flour with partially defatted flaxseed flour and alfalfa concentrate flour

Sample	Constitutes (mg/100g):							
	Ca	**Mg**	**Na**	**K**	**Fe**	**Mn**	**Zn**	**Cu**
M	41.50±0.65	87.20±0.70	19.50±1.35	305.30±1.07	4,78±0.41	2.52±0.45	2.10±0.52	0.45±0.09
I	45.78±0.68	99.68±0.78	26.85±1.70	335,27±1.11	13,73±0.61	2.66±0.48	2.41±0.54	0.95±0.14
II	145.43±0.79	122.69±0.80	18.95±1.15	405,54±1.54	5,38±0.47	2.59±0.45	2.13±0.53	0.43±0.08
III	106.85±0.90	117.23±0.90	24.32±1.55	386.42±1.18	11.40±0.56	2.66±0.48	2.34±0.48	0.78±0.11

Thereby, samples I and III fit into the category of iron source raw materials. (The recommended daily iron dose according to FDA, 2011is 18 mg/100 g product). The calcium content of samples II and III increased more than the double from 41.2 mg/100 g to 145.43 mg/100 g, respectively 106.85 mg and the magnesium content increased considerably, compare to flour of wheat.

Figure 1 presents the influence of the addition of partially defatted flaxseed flour and alfalfa concentrate on wheat flour mineral content in regards to iron, potassium, magnesium and calcium.

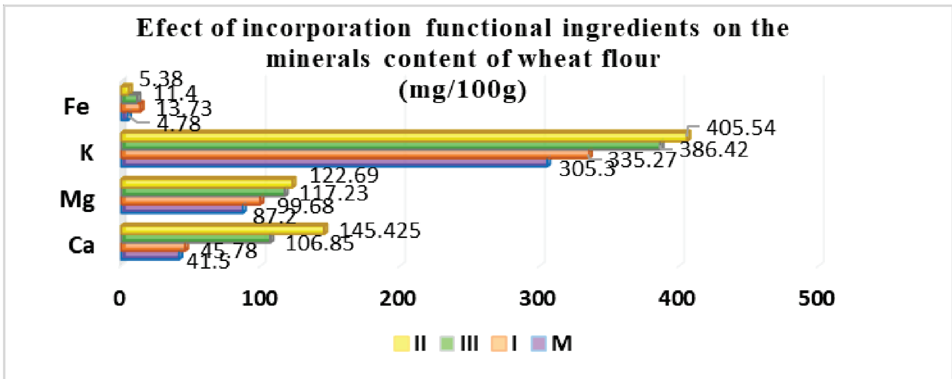

Fig. 2. Influence of addition of partially defatted flax seeds flour and alfalfa concentrate on mineral content of wheat flour

The calcium, magnesium and potassium content of the partially defatted flaxseed flour is lower than that of the alfalfa concentrate and the sample consisting of the mixture of these 2 ingredients has not a high mineral content. However, the mineral content increases considerably in the three variant of flour mixtures by addition of these ingredients.

The contents of the essential amino acids of the experimental variants studied are presented in table 5 below.

Table 5. The essential amino acids content of the experimental variants studied

Sample	Lysine	Isoleucine	Leucine	Phenylalanine	Histidine	Valine	Threonine	Methionine
	mg/100 g							
M	2.58	3.16	6.71	4.65	2.42	4.48	2.75	1.67
I	2.56	3.31	6.76	4.75	2.38	4.63	2.89	1.72
II	2.62	3.16	6.69	4.62	2.37	4.47	2.79	1.67
III	2.59	3.27	6.74	4.71	2.37	4.58	2.87	1.71

In the case of sample I consisting of a mixture of wheat flour with partially defatted flaxseed flour, the content of some essentila amino acids such as isoleucine, leucine, phenylalanine, valine, threonine and methionine is higher than that of the wheat flour. In contrast, a decrease in lysine and histidine content can be noticed.

Sample II consisting of 5% alfalfa flour and 95% whole wheat flour the content in essential amino acids is equal to or higher than that of pure wheat flour.

Sample III is more valuable in terms of the content of essential amino acids, in addition to histidine content, than that of wheat flour.

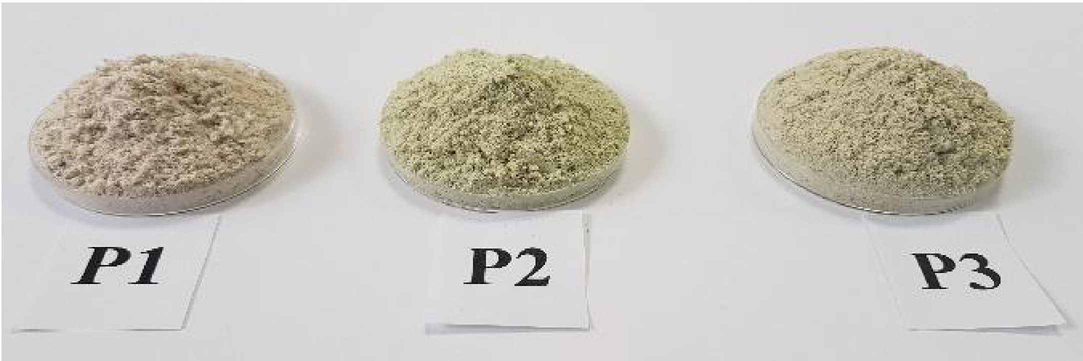

Fig. 3. Samples mixtures

Table 6 shows the content of non-essential amino acids that can be synthesized by the human body, but an intake of these amino acids is welcome in the case of deficiencies of these amino acids produced by various diseases or by a protein-poor diet, for the synthesis of the body's proteins, essential and non-essential amino acids are needed in certain ratios.

Table 6. The non-essential amino acid content of the experimental variants studied

Sample	Glutamic ac.	Glycine	Serine	Proline	Aspartic ac.	Alanine	Tyrosine	Cysteine	Arginine
	mg/100g								
M	26.25	4.26	4.67	10.52	3.35	3.37	1.61	2.36	4.34
I	25.88	4.53	4.54	9.90	3.97	3.57	1.73	2.32	4.91
II	25.31	4.26	4.61	10.23	3.47	3.44	1.64	2.27	4.32
III	25.42	4.45	4.54	9.91	3.85	3.56	1.72	2.28	4.73

Whitaker & Tannenbaum [11] have developed the chemical score procedure to evaluate the ability of a protein source to cover human amino acid needs. The procedure consists in calculating the percent that each amino acid in the tested protein represents out of the amount of the respective amino acid in the standard protein, egg protein beeing initially set as standard for evaluation of food proteins.

A strong correlation was reported between chemical scores determined in this manner and values obtained through biological assays for protein quality (Hegsted [7]).

Below, in table 7 presents the chemical scores of selected amino acids from sample I (90% wheat flour + 10% partially flaxseed flour), compared to the standard protein content of FAO / WHO / UNU (1985).

Data from table 7 indicates that the sample protein I is a rich source of valine with a chemical score of 132.31, histidine with 124.74, isoleucine with 118.25 and leucine with 102.41. There are also considerable scores for threonine (85.06) and methionine (78.36). However, it can be seen that lysine is the most limited amino acid (44.07).

Data from table 7 indicates that the mixture (90% whole wheat flour +10% partially defatted flaxseed) is a rich source of valine, histidine and isoleucine, whereas phenylalanine and methionine have the lowest scores.

Table 7. Chemical scores of amino acids in the sample I

Amino acids	Sample I	FAO	Chemical scores
Leucine	6.76	6.6	102.41
Threonine	2.89	3.4	85.06
Valine	4.63	3.5	132.31
Phenylalanine	4.75	6.3	75.44
Isoleucine	3.31	2.8	118.25
Lysine	2.56	5.8	44.07
Methionine	1.72	2.2	78.36
Histidine	2.37	1.9	124.74

Table 8 shows the chemical score of amino acids contained in protein II (whole wheat flour and alfalfa concentrate).

Table 8 Chemical scores of amino acids in the sample II

Amino acids	Sample II	FAO	Chemical scores
Leucine	6.69	6.60	101.43
Threonine	2.79	3.40	82.09
Valine	4.47	3.50	127.64
Phenylalanine	4.62	6.30	73.40
Isoleucine	3.16	2.80	112.95
Lysine	2.65	5.80	45.21
Methionine	1.67	2.20	75.80
Histidine	2.45	1.90	128.95

Data in table 8 indicates that the sample protein II is a rich source of histidine with a chemical score of 128.95, valine with 127.64, isoleucine with 112.95 and leucine with a score of 101.43. Lysine is the most limited amino acid, followed by methionine and phenylalanine.

From the calculation of the chemical score of sample III, consisting of the wheat flour mixture with both ingredients, it can be seen that the protein of this sample is an important source of valine with a score of 130.81, followed by histidine, isoleucine and leucine. The sample is deficient in lysine (Table 9).

Table 9. Chemical scores of aminoacids in the sample III

Amino acids	Sample III	FAO	Chemical scores
Leucine	6.74	6.60	102.05
Threonine	2.87	3.40	84.53
Valine	4.58	3.50	130.81
Phenylalanine	4.71	6.30	74.71
Isoleucine	3.27	2.80	116.69
Lysine	2.59	5.80	44.63
Methionine	1.71	2.20	77.56
Histidine	2.37	1.90	124.55

3.2. Bread properties

Table 10 presents the results of experimental bread samples analysis.

Table 10. Physicochemical results for the experimental bread samples

Sample	Mass (kg)	Volume (cm3)	Porosity (%)	Elasticity (%)	Humidity (%)	Acidity (grades)
M	0.512	299	78.44	95	44.11	1.2
I (10% flax)	0.518	245	71.6	92	43.59	1.6
II (5% alfalfa)	0.517	268	76.3	92	45.61	1.2
III(7% flax + 3% alfalfa)	0.532	233	68.1	85	45.69	1.4

The porosity values of the bread samples obtained from the three variants of mixtures are within limits of SR 878/1996 (minimum 66%) (Fig. 7).

The elasticity of bread samples I and II is also according standard (minimum 92).

The acidity of the bread samples, does not exceed 1.6 degrees of acidity which is a value within the normal limits for wheat bread (max. 3.3%, SR 878-1996).

According to Table 10 the three experimental bread samples obtained from wheat flour mixtures with the two functional ingredients are acceptable from the point of view of the physic-chemical indicators analyzed.

Fig. 4. Experimental variant of bread with addition of flaxseed flour

Fig 5. Experimental variat of bread with addition of *alfalafa* concentrated flour

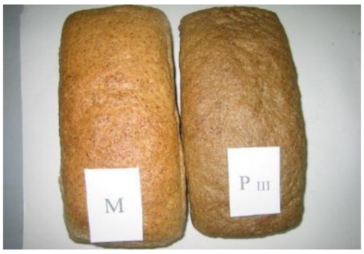

Fig. 6. Experimental variant of bread with
addition of flaxseed flour and *alfalfa* concentrated flour

Fig. 7. Experimental variants of bread in the section

Sensory analysis is a technique for determining the characteristics and quality of food that integrates knowledge accumulated in science such as neurophysiology and human physiology, sociology, statistics, psychology, etc. (Lawless Harry T. and Heymann H., [7]). The sensory attributes of food are one of the most important decision makers in their buying and consumption.

”The method of assessing sensory characteristics through "Bread score" is a method used on this study developed by IBA Bucharest..

In the experiments carried out, the sheets were based on the quantification of a set of sensory characteristics, compared to a standard volume of 400 cm3/100 g and 85% porosity.
Table 6 shows the sensory characteristics for determining the bread score.

Table 6. Scores obtained by the organoleptic evaluation of bread samples with the "Bread Score"

Sample/ Score	Volume	Marginal crack height	Crust color	Crumb appearance	Porosity	Elasticity	Aroma	Total
M	18	5	7	10	18	18	12	88
I	15	4	5	7	15	15	10	71
II	16	5	6	8	16	16	8	75
III	14	4	5	6	14	14	7	64

Based on the experimental results obtained by the "Bread Score" sensory method, it confirms the results obtained from the evaluation of the physic-chemical indicators of the bread samples. Thus, all bread samples obtained from wheat flour mixed with the two ingredients obtained an acceptable score from the sensory evaluation.

Samples of bread were subjected to sensory analyzes by the "Score Bread" method two hours after processing and cooling.

Conclusion

Alfalfa and flaxseed, as natural ingredients, due to well-balanced nutritional proteins, amino acids, lipids, vitamins, minerals and carbohydrates have been used as a dietary supplement.

In this study the effect of adding these ingredients to the quality of the bread was studied.

The chemical characterization performed in this study proved that the alfalfa concentrate and partially defatted flaxseed is a valuable source of nutritional components, mainly brute fiber content, amino-acids and minerals content.

The experimental bread samples obtained from wheat flour mixtures with the two functional ingredients are acceptable from the point of view of the physic-chemical indicators analyzed. So it can be concluded that bread can be healthy and very attractive when it's enriched with these two ingredients with a functional potential.

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References

- ALAA EL-DIN A. BEKHIT & ALL., *Flaxseed: Composition, detoxification, utilization, and opportunities*, Biocatalysis and Agricultural Biotechnology, 13 (2018) 129-152.
- APOSTOL LIVIA., MOȘOIU CLAUDIA, IORGA SORIN, SANMARTIN ÁNGEL MARTÍNEZ, , *Effect of the addition of pumpkin powder on the physicochemical qualities and rheological properties of wheat flour.* Romanian Biotechnological Letters, (2017) *DOI: 10.26327/RBL2017.80.*
- APOSTOL A., IORGA S., MOȘOIU C., RACOVIȚĂ R.C., NICULAE O.M., VLĂSCEANU G.A., *Alfalfa concentrate – a rich source of nutrients for use in food products*, Agriculture & Food ISSN 1314-8591, Volume 5, pg. 66- 73. - Journal of International Scientific Publications, *www.scientific-publications.net* (2017)
- BEKHIT, A.E.D., TIAN, X., CARNE, A., HA, M., *Effect of Kiwifruit and flaxseed flours on the texture of salami*. In: Proceedings of the International Congress of Meat Science and Technology, Izmir, Turkey (2013),18-23rd August.
- BELC N., APOSTOL L., VLĂSCEANU G.A., MOȘOIU C., VLĂDUȚ V., MARTINEZ SANMARTIN A., *Valorisation as functional ingredients of some subproducts from dietary supplement processing*, Romanian Biotechnological Letters, ISBN 1224-5984, In Conf. ISB-INMA-TEH (2018)
- CARTER, J.F., *Potential of flaxseed and flaxseed oil in Baked goods and other products in human nutrition*, Cereal Foods World 38 (1993) 753–759.
- DAUN, J.K., BARTHET, J.V., CHORNICK, T.L. AND DUGUID, S., Structure, composition, and variety development of flaxseed. In „Flaxseed in Human Nutrition", (S.C. Cunnane and L.U. Thompson, cds), 2ne Ed. AOCS Press, Champaign, (2003) 1-40, IL
- HALL, C. TULBEK, M.C.XU, T.Y., Advances in food and nutrition research. Flaxseed (2006) 10.1016/S1043-4526(06)51001-0

- HEGSTED, D.M., Assessment of protein quality, in *Improvement of protein nutriture*. National Academy of Sciences, Washington DC (1974) 64–88.
- KIANOUSH KHOSRAVI-DARANI, GHOLAMI ZAHRA, GOUVEIA LUISA, *Effect of Arthrospira platensis on the shelf life, sensorial andrheological properties of strudel*. Romanian Biotechnological Letters, Vol. 22, No. 1, (2017) 12250-12258.
- LAWLESS, H.T., HEYMANN, H., *Sensory Evaluation of Food. Principles and Practices*, *2nd ed*. Springer, New York, NY (2010).
- PÎRVULESCU PANFIL, BOTĂU DORICA, CIULCA SORIN, MADOŞĂ EMILIAN, ALEXA ERSILIA, GERGEN IOSIF, *Biochemical characterization of flour obtained from germinated cereals (wheat, barley and oat)*, Romanian Biotechnological Letters, Vol. 19, No. 5, (2014) 9772-9777.
- VLĂSCEANU G.A., APOSTOL L., MULŢESCU M., MANEA S, New recipes for food by adding functional ingredients coming from food supplement processing, Agriculture & Food ISSN 1314-8591, Volume 5, pg. 542 – 550 - Journal of International Scientific Publications www.scientific-publications.net (2017)
- WHITAKER JR, TANNEBAUM S.R. *Food proteins.* The Avi Publishing Company Inc., Connecticut (1977).
- YALÇIN COŞKUNER, ERŞAN KARABABA, *Some physical properties of flaxseed (Linum usitatissimum L.),* Journal of Food Engineering, 78 (2007), 1067-1073.

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SOURCES TYPES OF FOOD CONTAMINATION

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Abstract
Contamination food is a problem health major public and security food supply at a global level. This maybe took place in any chain stage food, from production primary to the consumer. This work ISI propose saddle classify and saddle consider key types of contamination sources A food: biological (microorganisms pathogens, parasites, viruses), chemicals (pesticides, metals heavy metals, toxins, additives not allowed) and physical (bodies) foreign in nature are presented contaminant entry routes in food and influencing factors this process. Understanding THESE source is vital for implementation of some exit effective prevention and control, such as the HACCP (Hazard Analysis and Critical Control Points) system, in purpose insurance some food safe for consumer.

Keywords: *contamination food, sources, chain food, HACCP, safety food*

Introduction

Safety food is a component fundamental right to food and security national. Contamination foods with natural agents biological, chemical or physics maybe have serious consequences for health human , ranging from poisoning feeding mild to diseases chronic or death. Contaminants can come from the environment, can be introduced in time production, processing, transport, storage processes or preparation. Purpose of this work is to systematize knowledge regarding types of contamination sources, providing a basis theoretical for industry professionals and for awareness The analysis will be published focus on the features each categories main and on ways to prevent contamination.

Material and method

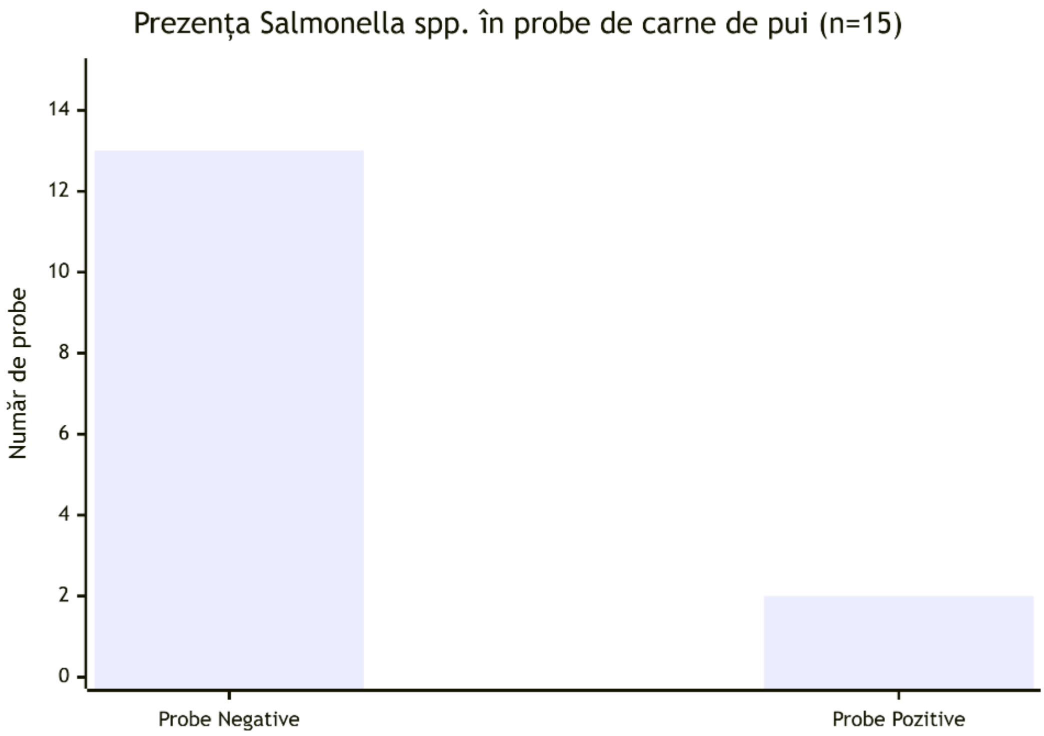
work is a review study, based on the analysis and synthesis data from specialized literature (books, scientific reports of authorities, nation and international organizations such as WHO, FAO, EFSA, ANSVSA). A method was used descriptive and Analytics for classification sources of contamination and for overview transmission routes. The information was select and structured for A provide a clear picture and complete the theme addressed.

Results and discussion

1. Analyses for contamination biology

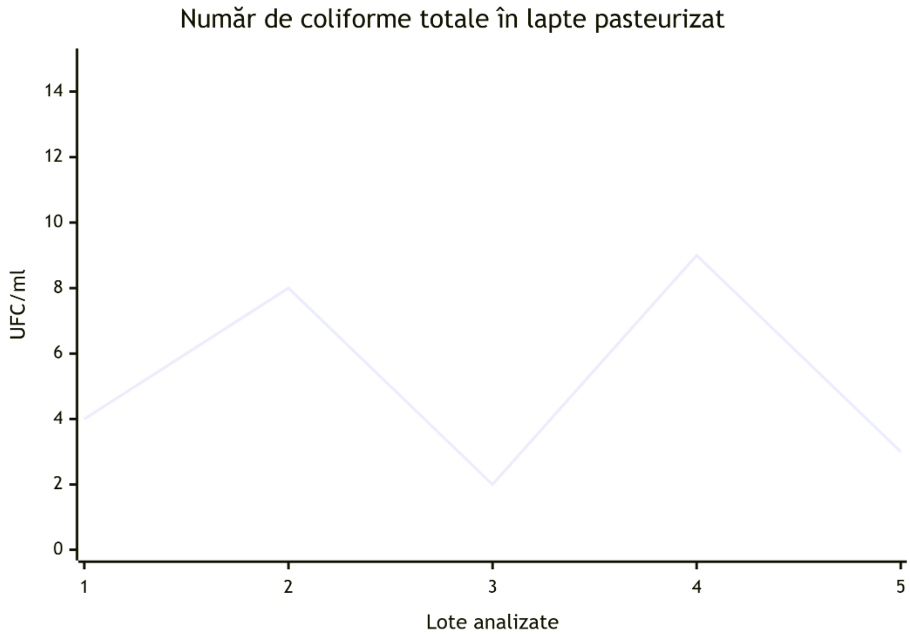
a) Bacteriology:

- **result for chicken meat samples:** using ISO 6579-1 method, was identified present *Salmonella* spp. in **2 out of 15 samples** analyzed (**13.3%**). Colony books typical on selective media (XLD, Rambach) were confirmed through biochemical tests (API 20E) and serological.



Interpretation: Of 15 samples analyzed, 2 (13.3%) were positives for Salmonella spp., exceeding limit legal which prescribes absence total.

- **Counting coliforms total and feces:** In milk samples pasteurized , according to SR EN ISO 4832, a number was recorded average of <10 CFU/ml for coliforms total, **below the limit maxim permissible**, indicating pasteurization efficiency and a manipulation appropriate.



Dotted line red represents limit Maxim permissible (e.g., 10 CFU/ml). All the values are below this limit , confirming a process appropriate.

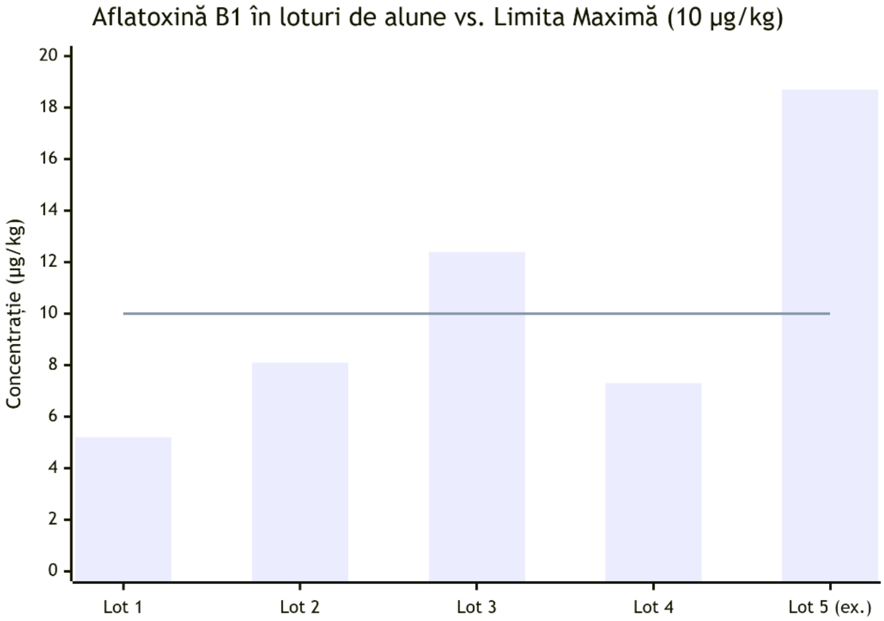
- **Search *Listeria monocytogenes*: Analysis of 20** salami samples smoked by immunochromatography method QUICK and confirmation by culture (ALOA medium) of highlighted **a sample positive (5%)**. This indicates post - processing contamination, probably from the production environment.

b) Microbiology viral:

- **Norovirus Detection:** By RT-PCR technique in real time applied to berry samples frozen, it was identified viral genetic material in **1 batch out of 10 analyzed**. This result confirm RISK associate contamination primary by irrigation water or by manipulation.

c) Mycology:

- **Dosage aflatoxins:** By high - performance liquid chromatography efficiency coupled with mass spectrometry (HPLC-MS/MS) in hazelnut samples, it was found that **3 out of 25 lots (12%)** exceeded limit Maxim regulated by 10 µg/kg for aflatoxin B1, with values CONTAINED between **12.4 and 18.7 µg/kg** . These result POINTS terms unsuitable for drying and storage.



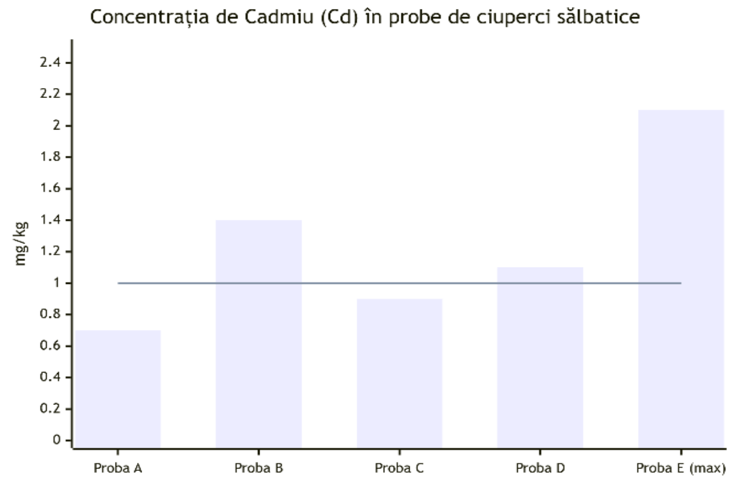
Interpretation: 3 out of 25 lots (represented here of Lot 3 and Lot 5) exceed limit regulatory limit of 10 µg/kg, with values between 12.4 and 18.7 µg/kg.

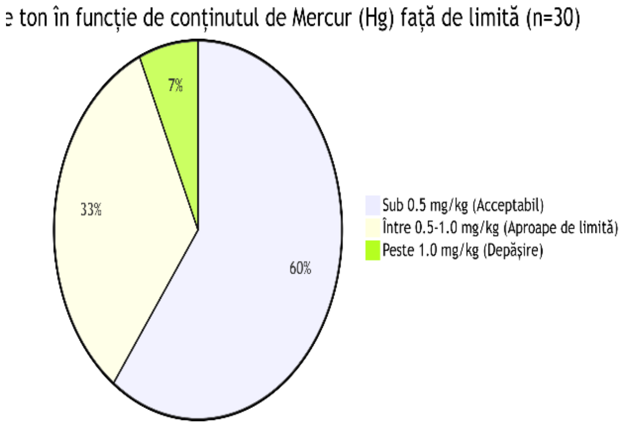
2. Analyses for contamination chemical

a) Metals heavy:

- **Lead and Cadmium:** Plasma mass spectrometry coupled inductively coupled plasma mass spectrometry (ICP-MS) applied to mushroom samples savage A plowing cadmium concentrations of up to **2.1 mg/** kg, **exceeding significant limit of 1.0 mg/kg** established by EU regulations. Lead concentrations were below detection limits.

- **Mercury:** In predatory fish meat samples (tuna), the analysis by the CVAAS (Cold Vapor Atomic Absorption Spectrometry) method recorded important average of **0.8 mg/kg**, approaching the limit maximum of 1.0 mg/kg.





b) Pesticide residues:

- **residue analyses:** Method QUECHERS (Quick, Easy, Cheap, Effective, Rugged and Safe) coupled to GC-MS/MS and LC-MS/MS on apple samples identified **residues of 3 different pesticides** in one sample. Concentrations individually were below the Limit Maximum Residue Limit (MRL), but the result highlights the "cocktail effect" phenomenon.

c) Drug residues veterinary:

- **Antibiotics beta-lactams:** Immunological screening test (ELISA) and confirmation by LC-MS/MS in milk samples bovine detected the presence of amoxicillin in **2 out of 30 samples (6.7%)** with concentrations (5.2 and 8.1 µg/kg) below **the MRL of 10 µg/kg**, but indicating a non-compliance in considering the waiting time.

d) Process contaminants:

- **Acrylamide:** In potato chips, analysis by GC-MS after derivatisation A plowing concentration contained between **350 and 1020 µg/kg**. **80% of the samples exceeded**

value indicative of 750 µg/kg established by the EU, directly correlating with the intensity COLOR brown (degree of roasting).

3. Evaluation of contamination

The analysis are based often on specific inspection - visual methods, separation and identification.

- **Separation by sorting and examination microscopic:** In a batch of spinach frozen, it was reported present SOME plastic fragments (identified as polypropylene by FT -IR spectroscopy) and sand particles in proportion of **0.1% weight / sample**.
- **Use magnetic flux metal detectors:** Inspection in the flow of bakery products condemned 3 batches out of 1000, after what they reported presence of particles metal thin (under 1 mm), probably resulting from wear and tear equipment.

- **Biological Contamination** remain the may frequent, and Salmonella identification rates and *Listeria* stresses importance control temperature and a hygiene surfaces.
- **Data chemistry** reveals the "invisible" threat. Overcoming limits for mycotoxins and metals heavy in products natural (mushrooms, peanuts) show contamination primary from the soil and air, difficult to control at the level manufacturer mayor.
- **Detection multiple pesticide** (although below MRL) and antibiotic residues impose increase checks and reconsideration assessment risk for combinations of substances.
- **Important high levels of acrylamide are a** clear indicator of the need optimization parameters processing in industry food.
- **Physics Contaminants,** though apparent trivial, can have result immediately on consumer and points failure in operational control systems (sieves, metal detectors).

Conclusions

Results laboratory tests carried out on various food categories stresses clearly present and diversity sources of contamination. These results are essential for evaluation risk and implementation of measure corrective in chain food.

1. Biological contamination:

- **Salmonella spp. in chicken meat:** This analysis, criticism for a risky product known, used standard method ISO 6579-1. The results identified a contamination in **13.3% of the samples (2 out of 15)**, which What represents an exceeding of the limit legal requirements absence fill in 25g of product. This fact indicates a potential deficit in control measures at the level slaughterhouse or processing.
- **Total coliforms in pasteurized milk:** Analysis of these hygiene indicators (SR EN ISO 4832) a aimed at verifying effectiveness pasteurization and post-process conditions. The result, **below 10 CFU/ml**, falls within the in limits allowed, confirming a processing correct and a manipulation hygienic.
- **Listeria monocytogenes in salami smoked:** Detection pathogen in **5% of samples (1 in 20)** represents an excess of regulations and suggests contamination from the production environment after Treatment thermal.
- **Norovirus in berries frozen:** For detection this very virus contagious , not multiplying in food but maybe persist, was used method Molecular RT-PCR. Identification viral

genetic material in **1 of 10 lots** confirm risk of contamination primary by water or manipulation and constitutes an excess of standards.

- **Aflatoxin B1 in Peanuts:** Mycotoxin analysis carcinogen by HPLC-MS/MS in products susceptible to mold A highlighted that **12% of lots (3 out of 25)** exceeded limit Maxim regulated at 10 µg/kg, recording important between **12.4 and 18.7 µg/kg**. This result POINTS terms unsuitable for drying or storage of raw materials.

2. Chemical contamination:

- **Cadmium in mushrooms wild:** using inductively coupled plasma mass spectrometry (ICP-MS) for A evaluate bioaccumulation metals heavy metals from the soil, it was found that mushroom samples exceeded the limit of 1.0 mg/kg, reaching up to 2.1 mg/kg this represents a risk chemical significant for health long-term renal failure.
- mercury in tuna meat: analysis of this neurotoxin by spectrometry atomic in predatory fish revealed a concentration average of 0.8 mg/kg, close to the limit maxim permitted level of 1.0 mg/kg, emphasizing need consume moderate.
- multi-pesticide residue in apples: practice method quick quechers coupled to mass spectrometry (gc/lc-ms/ms) allowed simultaneous screening for many substances. in one sample were identified residues of 3 different pesticides, although strengths individually were below the limits maximum residue limits (MRLS). this fact highlights the reality of the "cocktail effect".
- amoxicillin in milk bovine: control antibiotic residues (by ELISA and lc-ms/ms confirmation) verifies compliance waiting time. detected residues below the mrl (5.2 and 8.1 µg/kg) in 6.7% of samples (2 out of 30), indicating use close to the drug limit.
- acrylamide in potato chips: analysis of this process contaminant formed during frying (by gc -ms) has plowing that 80% of the samples exceeded value indicative european standard of 750 µg/kg, with concentrations contained between 350 and 1020 µg/kg. this directly correlates with the degree of roasting and require optimizations parameters thermal.

3. Physics contamination

- plastic fragments in spinach frozen: inspection and separation mechanics, followed by identification materiality by ft-ir spectroscopy, they identified polypropylene, constituting 0.1% by weight of the sample. this indicates a malfunction a package or a processing equipment.
- particle metal in bakery products : monitoring operational by metal detectors in the flow led to the rejection of 3 batches out of 1000 tested, due to present some particle, fine metal particles (<1 mm). this is a clear indicator of wear equipment and confirm usefulness critical a these control devices.

Conclusions

Results demonstrate empirically the presence simultaneous of those three types major contamination in chain food. Exceedances limits for agent biological (Salmonella, Listeria) and chemicals (cadmium, aflatoxins) are alarming and heaven are the measures immediate control. The presence contaminants physical and pesticide residues or antibiotics, even below limits, emphasizes importance continuous vigilance and improvement manufacturing practices. All these data validate importance vital A laboratory analyses as the basis of a system effective safety assurance food.

References

- World Health Organization (WHO). **(2022).** ***Food safety*.** **https://www.who.int/news-room/fact-sheets/detail/food-safety**
- European Food Safety Authority (EFSA). **(2022).** ***Chemical contaminants*.** **https://www.efsa.europa.eu/en/topics/topic/chemical-contaminants-food**
- Food and Agriculture Organization (FAO). **(2021).** ***The future of food safety*. FAO.**
- Forsythe, SJ **(2020).** ***The microbiology of safe food*** **(4th ed.). Wiley-Blackwell.**
- Mortimore, S., & Wallace, C. **(2013).** ***HACCP: A practical approach*** **(3rd ed.). Springer.**
- Agency Nation for Safety Food (ANSVSA). **Guidelines and norms methodological. http://www.ansvsa.ro**
- Banu, C. (coord.). **(2015).** ***Hygiene and control quality products food*. ASAB Publishing House.**
- Jay, JM, Loessner, MJ, & Golden, DA **(2005).** ***Modern food microbiology*** **(7th ed.). Springer.**
- Ropkins, K., & Beck, AJ **(2003). Evaluation of worldwide approaches to the use of HACCP to control food safety.** ***Trends*** *in Food Science & Technology, 14* (5-8), 376-389.

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IMPORTANCE OF DIETARY FIBER IN HUMAN DIGESTION

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Abstract

Foods rich in dietary fiber have been associated with numerous health benefits, including a reduced risk of cardiovascular and metabolic diseases. Harnessing the potential to provide positive health outcomes relies on understanding the fundamental mechanisms that drive these associations. Dietary fiber is a component of plant material that is extremely important in the diet because it resists enzymatic digestion in the digestive tract, playing a role in improving intestinal transit. Dietary fiber is mostly carbohydrates such as cellulose, hemicellulose, pectic substances, gums and mucilages, but also non-carbohydrates.

Keywords*: dietary fiber, plant material, intestinal transit*

Introduction

The human gastrointestinal (GI) tract utilizes a complex array of biochemical transformations and physical interactions to convert food into energy. A health-promoting diet that includes a generous intake of dietary fiber (DF) from whole foods such as fruits, vegetables, legumes, and whole grains is associated with a reduced risk of cardiovascular disease (Perez-Cornago et al. 2020), type 2 diabetes (Weickert and Pfeiffer Citation2018), obesity (Wanders et al.2014), liver cancer (Singh et al. Citation2018), and colorectal cancer (Encarnação et al.,2018; Ma et al.,2018). Furthermore, consumption of DF contributes to improved gastrointestinal health, reducing the likelihood of irritable bowel syndrome (IBS) (So et al.,2021). The importance of FA in protecting against noncommunicable diseases and promoting long-term public health is reflected in nutritional guidelines that advocate diets rich in whole, plant-based foods. These guidelines recommend~30 g of fiber per day (25 g for women and 38 g for men) (Slavin,2008). These were developed based on a rigorous analysis of available population-based epidemiological studies (Scientific Advisory Committee on Nutrition, 2015).

Consumption of FA leads to the formation of a gel-like substance in the upper intestine (McRorie and McKeown Citation2017). This "viscous" material slows down the enzymatic breakdown of macronutrients, thereby delaying the absorption and reabsorption of small molecules and metabolites from the intestinal lumen (Stribling and Ibrahim, 2023; EFSA Panel on Dietetic Products, Nutrition and Allergies, 2011). The impact of this effect may be manifested by a reduced rate of starch hydrolysis and a reduced diffusion of hydrolysis products such as maltose, which play a role in improving glycemic control (Feinglos et al.,2013; Anderson et al., 1999).

Similarly, the slowing of bile acid (BA) reabsorption caused by this gel formation has been shown to contribute to the reduction of LDL cholesterol (Wolever et al.2010). A high glycemic index and elevated LDL cholesterol are well-established risk factors for the development of type 2 diabetes and cardiovascular disease.

Dietary fibers are components of plant material, extremely important in the diet. They are not digested in the small intestine because humans do not produce enzymes capable of hydrolyzing them into their constituent monomers (Turner et al., 2011), but they have a beneficial role in improving intestinal transit. FA is considered a non-caloric nutrient that does not contribute calories to our diet because it reaches the colon intact. However, in the colon, they are available for fermentation by some bacteria, and the released metabolites can be used to cover part of the body's energy requirements (Cronin et al, 2021). In recent decades, FA has been highly promoted for its nutritional and functional effects, FA having been used over time precisely for their beneficial role in body health. However, looking back in time, FA have always been present in people's daily diet and have promoted their beneficial effects.

Since ancient times, FA has been ubiquitous in the diet of the population. There is evidence that, as early as ancient Greece, bran cereals were known to help prevent constipation, as well as promote well-being and health. In the 1930s, Kellogg confirmed the positive effects of wheat bran on patients with constipation and colitis. However, the real name of fiber was not mentioned until 1953, by Dr. Eben Hipsley, in an article on toxemia in pregnancy (Hipsley, 1953). Concern about the effects and functions of FA on health continued, so in the 1970s the first definition of DF appeared, which read as follows: "Dietary fiber consists of edible plant cell debris, polysaccharides, lignins and associated substances resistant to digestion by human digestive enzymes" (Trowell, 1974).

Material and Methods

Studies have shown that wheat bran fractions with different particle sizes have different effects on obesity, inflammation, and gut microbiota (Suriano et al. 2017). Specifically, smaller particle sizes were associated with reduced hepatic and systemic inflammatory markers in the presence of high fructose intake, likely due to beneficial modulation of gut microbiota. In contrast, larger particle sizes influenced gut microbiota composition and fat binding capacity differently, illustrating the critical role of fiber particle size in determining health outcomes. The continuum between soluble and insoluble fiber (Gidley and Yakubov, 2019) presents a need for improved analytical methods to accurately assess fiber functionality. Dietary fiber is defined as the part of plant material in the diet that is resistant to enzymatic digestion (Dhingra et al.,2012). This includes both “soluble” and “insoluble” fibers, a simple classification based on the behavior of the material when FA is dispersed in water.

To better understand the health benefits, Gidley and Yakubov (2019) and Williams et al. (2019) proposed a classification system based on fiber size and density. This approach moves away from the traditional categorization of “soluble” and “insoluble” fibers and instead focuses on semi-quantitative functional properties, such as their ability to inhibit macronutrient digestibility and availability for fermentation. However, due to the inherent complexity and heterogeneity of fibers and their components, it remains difficult to develop a coherent framework for characterizing fibers at the polymer, cell wall, and tissue levels (Burton, Gidley, and Fincher, 2010). Furthermore, establishing a direct link between dietary components and their specific health benefits is difficult (Capuano, 2017), as the mechanisms underlying nutritional functionality vary at different stages of digestion. The nutritional benefits of whole foods are influenced by three key structural domains: supramolecular assembly, colloidal microstructure, and polysaccharide primary structure. Whole foods (Figure 1(A)) consist of cell clusters containing fragments of epidermis, bran layer, and vascular tissue (Figure 1(B)). The primary cell walls of these cells are composed of hemicellulose (xylan, mannan, xyloglucan, β-glucan) adsorbed onto a network of cellulose microfibrils, with pectin polysaccharides filling the middle lamella to contribute plasticity and lubrication between adjacent cells (Figure 1(C)) (Dolan et al. 2017; Bidhendi, Chebli, & Geitmann,2020); (Cosgrove, 2018).

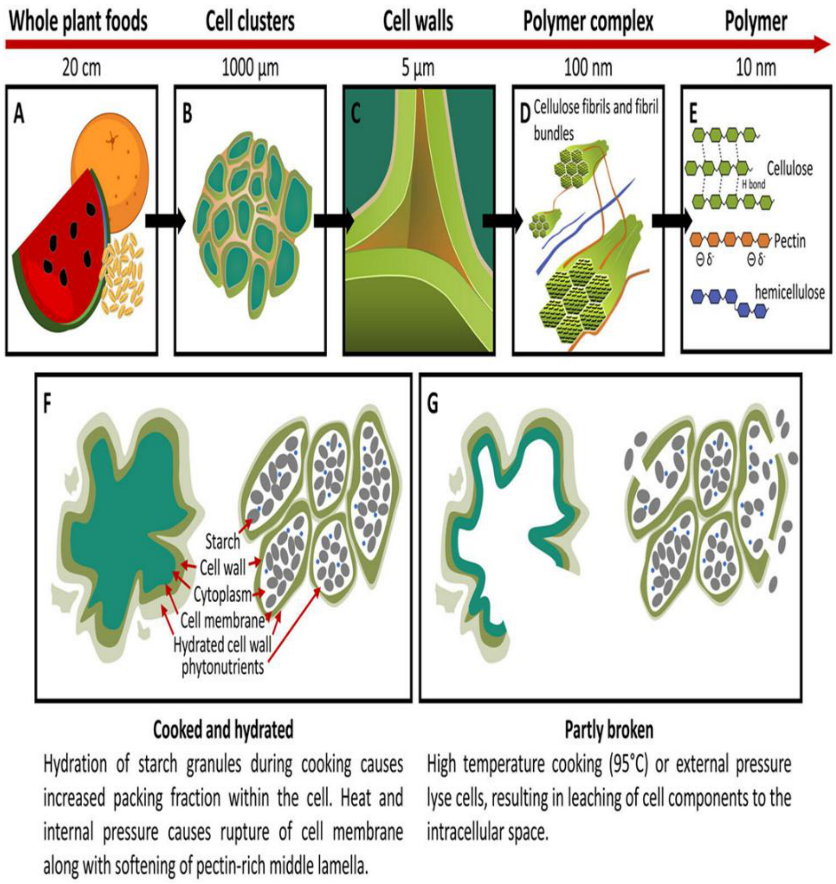

Figure 1. *Hierarchical organization of whole plant foods. The red horizontal arrow represents relative sizes, including (A) whole plant foods; (B) cell clusters; (C) cell wall/middle lamella contacts between adjacent cells; (D) polymeric complex of supramolecular assemblies, including cellulose fibrils and fibril bundles containing hemicellulose and pectin; and their individual polymeric structures (E). (F) Cells and cell groups in non-starch (left) and starch-containing (right) tissues, such as legumes and cereals, can undergo swelling, rupture, and chemical transformation during processing, storage, food manufacturing, and digestion of crops, with processing (G) allowing enzymes to penetrate the interior of the cells, facilitating the release of cellular contents, including starch, vitamins, and phytonutrients.*

Results and discussion

Fruits and vegetables exhibit diverse microstructural properties, including particle size, porosity, and surface area, which directly influence their physiological effects. These properties include both soluble and insoluble elements, characterized by high hydration but low solubility, and vary depending on the plant origin and composition, including the proportion of DF and protein content (Table 1). For example, apples are composed primarily of simple sugars such as fructose, while their dietary fiber is predominantly composed of pectin, along with smaller amounts of hemicellulose, cellulose, and structural proteins (Lopez-Sanchez et al.2020). In contrast, the primary cell wall of the starchy endosperm of cereals contains AX (~35%) with ferulic acid cross-links and a smaller proportion of mixed (1 → 3)(1 → 4)-β-D-glucan (β-glucan) linkage, which helps maintain cell wall integrity (Gartaula et al.,2018).

The cooking process can alter the porosity of cell walls through physical and chemical changes in cell wall components (Dhital, Brennan, and Gidley, 2019; Bhattarai et al. 2017; Li, Zhang, and Dhital, 2019; Moelants et al. 2014) (Figure 1(F)). At high temperatures, water absorption into plant structures determines the degree of swelling of plant-based foods and is partly responsible for the solubilization of hemicellulose and pectin in cell walls. Once released, soluble DF polysaccharides can spontaneously form supramolecular aggregates in the digestive tract, such as the formation of pectin gels in the acidic environment of gastric juice (Khramova et al.,2019; MacDougall and Ring, 2003).

Industrial food processing, such as shell or husk removal, particle size reduction and homogenization (such as cutting, grinding, milling or blending), thermal treatment (high pressure cooking or drying) or enzymatic treatment can lead to the highest levels of FA extraction. However, this is often accompanied by fragmentation and separation of plant tissue matrices (Figure 1(G)). Depending on the cell wall structure and the force applied, the resulting fiber fragments may undergo physical degradation of complex molecules, chemical decomposition or modification (Kumar et al., 2023).

Fibers are very important in food processing because they can change the consistency, texture, rheological behavior and sensory characteristics of the final products. The emergence of new fiber sources has offered new opportunities for their use in food products. FA has all the necessary characteristics to be considered an important ingredient in the formulation of functional foods, due to its beneficial effects on health. Dietary fibers used in the food industry are mainly carbohydrate polymers derived from plant cell walls, such as cellulose, hemicellulose, lignin and pectin, but several types of DF can be extracted from waste from the processing of cereals, fruits and vegetables (Galanakis, 2012). Dietary fibers have a high capacity to absorb and retain water, and in the dough preparation process they compete with gluten, which is also water-loving, but has a slower water absorption capacity. FA derived from the pulp or peel of fruits or vegetables is an affordable version adopted by manufacturers looking for ingredients with high nutritional value. The bakery industry uses a high percentage of insoluble fiber from cereals containing cellulose fiber, cereals or cereal flour – especially those from wheat fibers derived from the cell wall structure of soybeans, peas, carrots, citrus fruits and a smaller percentage of soluble fiber – gums. Pectin, cellulose and β-glucans are other soluble fibres that may have potential applications. Oat fibres have been supplemented in fruit and vegetable juices, instant drinks (breakfast drinks, milkshakes, sports drinks, iced tea, wine).

FA can also be integrated into beverages prepared for people with special weight loss needs. Fortifying fibre ingredients such as cellulose gels, guar gums and alginates can be a good substitute for fat, which is also designed to improve emulsion, viscosity and foam, reduce synergy, control melting properties and stimulate ice crystal formation. Gums are excellent ingredients used in beverage formulation because they do not influence taste or odour when formulated correctly. They can provide many functions such as stabilising emulsions in beverages, providing a pleasant mouthfeel and good suspension. In recent years, new sources of hydrocolloids have been developed that have been used as soluble fiber in beverages, for example fructose polymers inulin and oligofructans (Gallo-Torres & O'Donnell, 2003) and polydextrose (Brooks, 2003)

The addition of FA can increase the stability and viscosity of beverages and beverages. Soluble FA is often used due to its greater water-dispersibility properties compared to insoluble fibers. Pectin, cellulose, and β-glucans are other soluble fibers that may have potential applications. Oat fiber has been supplemented in fruit and vegetable juices, instant beverages (breakfast drinks, milkshakes, sports drinks, iced tea, wine), and other snack products.

Conclusions

Dietary fibers are components of plant material, extremely important in the diet; they have a beneficial role in improving intestinal transit.

Dietary fibers are valuable ingredients in food recipes. The water solubility of FA, fiber composition, and the soluble/insoluble FA ratio in an ingredient are critical parameters for the demonstrated functionality of added fibers.

They can be successfully formulated into different types of food products to improve nutritional values by increasing fiber, reducing sugar or fat, and increasing consumer acceptance.

Fibers are very important in food processing because they can change the consistency, texture, rheological behavior and sensory characteristics of the final products.

Dietary fibers show specificity and behavior in different products and for this reason, it is important to know very well the chemical and behavioral properties to help us in food processing. DF are also considered fibers with a functional role both in food and in the body

References

- AACC (2001). Report, The Definition of Dietary Fiber, 46(3) DFDef.pdf (cerealsgrains.org)
- Ambort, D., MEV Johansson, JK Gustafsson, HE Nilsson, A. Ermund, BR Johansson, PJB Koeck, H. Hebert, and GC Hansson. 2012. Calcium and pH-dependent packing and release of the gel-forming MUC2 mucin. Proceedings of the National Academy of

Sciences of the United States of America 109 (15):5645–50. two: 10.1073/pnas.1120269109.

- Ames, NP, SV Harding, PJH Jones, SJ Thandapilly, SM Tosh, and Y. Wang. 2017. Barley β-glucan reduces blood cholesterol levels via interrupting bile acid metabolism. The British Journal of Nutrition 118 (10):822–9. two: 10.1017/S0007114517002835.
- Bhattarai, RR, S. Dhital, P. Wu, XD Chen, and MJ Gidley. 2017. Digestion of isolated legume cells in a stomach-duodenum model: Three mechanisms limit starch and protein hydrolysis. Food & Function 8 (7):2573–82. two: 10.1039/c7fo00086c.
- Chau, C., Y. Wen, and Y. Wang. 2006. Effects of micronisation on the characteristics and physicochemical properties of insoluble fibres. Journal of the Science of Food and Agriculture 86 (14):2380–6. two: 10.1002/jsfa.2628.
- Choy, JYM, AT Goh, G. Chatonidi, S. Ponnalagu, SMM Wee, M. Stieger, and CG Forde. 2021. Impact of food texture modifications on oral processing behavior, bolus properties and postprandial glucose responses. Current Research in Food Science 4:891–9. two: 10.1016/j.crfs.2021.11.018.
- Crouzier, T., K. Boettcher, AR Geonnotti, NL Kavanaugh, JB Hirsch, K. Ribbeck, and O. Lieleg. 2015. Modulating mucin hydration and lubrication by deglycosylation and polyethylene glycol binding. Advanced Materials Interfaces 2 (18):1500308. two: 10.1002/admi.201500308.
- Dhital, S., C. Brennan, and MJ Gidley. 2019. Location and interactions of starches in plants: Effects on food and nutritional functionality. Trends in Food Science & Technology 93:158–66. two: 10.1016/j.tifs.2019.09.011.
- Regulation (EC) No 1924/2006 of the European Parliament and of the Council of 20 December 2006 on nutrition and health claims made on foods.http://data.europa.eu/eli/reg/2006/1924/2014-12-13
- Trowell, H. (1974). Definitions of fibers. The Lancet, 303(7856), 503, 6736(74)92802-5. https://doi.org/10.1016/S0140 Tungland, BC, & Meyer, D. (2002) Non-digestible oligo- and polysaccharides (Dietary Fiber): their physiology and role in human health and food. Comprehensive Reviews in Food Science and Food Safety, 3, 90–109.
- Yangilar, F. (2013). The Application of Dietary Fiber in Food Industry: Structural Features, Effects on Health and Definition, Obtaining and Analysis of Dietary Fiber: A Review. Journal of Food and Nutrition Research, 1(3), 13-23.

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THE USE OF PESTICIDES AND CHEMICAL FERTILIZERS IN CORN CROPPING

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Abstract
Modern agriculture faces challenges major issues related to the impact on environment and health public awareness of the intensive use of pesticides and fertilizers chemical substances. This work analyzes exit for reduction dependence on these entrants in corn crop,one from the may important crops cereal at the level worldwide. The study evaluates, through research methods experimental, efficacy integrated practices, such as rotation crops, use biofertilizers, stimulants natural growth and methods of combating biology and pest mechanics. The results points the fact that addressing integrity maybe maintain or even improve return long-term economic, in time which reduces pollution ground and a water underground, increases biodiversity and promotes a system agricultural may resistant. We conclude that transition by production systems may sustainable for corn is not only necessary, but also feasibility technical and economic.

Keywords: *corn, integrated pest management (IPM), biofertilizers, natural pesticides, health soil.*

Introduction

Maize (*Zea mays* L.) is of great importance vital in food humanity and animal, in biofuel industry and in economy several countries. production conventional is based strong on fertilizers chemical synthetics (nitrates, phosphates) and on a range wide range of pesticides for a touching yields maxima. This dependence generates serious problems: eutrophication water, contamination soil, decrease biodiversity, the emergence herbicide resistance and insecticides in pest populations , as well as risks for health ops and consumers . In Background change climate and growth application for products may healthy, it is imperial needed adoption some practice agricultural that minimize these negative effects. The purpose of this work is to identify, analyze and discuss practice and technically effective for reduction substances synthetic chemicals in corn crop, maintaining in same time a productivity economic acceptable.

Material and method

The research was conducted over a period of three agricultural years (2021-2023) on plots experimental sites located in the plains of Romania. It was use corn hybrid drought tolerant, adapted area.

Experimental design: They were compared three management systems, with laboratory assessments for each:

1. **System conventional (SC):**
   - **Fertilization:** 200 kg/ha NPK 20:20:0 at the base + 150 kg/ha urea at maintenance (V6-V8).
   - **Protection weeds:** HERBICIDES hormonal (2,4-D + dicamba) in post-emergence early.

- **Protection Insects:** Chemical insecticides (lambda- cyhalothrin) at the damage threshold for *Ostrinia nubilalis*.

2. **System integrity reduced (SIR):**
   - **Fertilization:** 100 kg/ha NPK 15:15:15 + 10 t/ha compost + inoculation with *Pseudomonas fluorescens*.
   - **Protection weeds:** Hoeing mechanical between rows + herbicides with action reduced (topramezone) only in turn.
   - **Protection insects:** Monitoring with pheromone traps; interventions with biological insecticides (*Bacillus thuringiensis* var. *kurstaki*) or chemical insecticides selective (teflubenzuron) only when exceeded economic threshold.
3. **system (ES):**
   - **Fertilization:** 15 t/ha compost + fertilizer green (peas for feed) incorporated autumn.
   - **Protection weeds:** Two sowing mechanical.
   - **Protection insects:** Treatment with wormwood extract (*Artemisia absinthium*) 5% at emergence first O. *nubilalis* eggs + hotel placement for INSECT for promotion predators.

Laboratory analyses carried out:
A. **Soil (taken at 0-30 cm):**

- **Fertility:** Total N (Kjeldahl), available P and K (methods spectrophotometric with extraction in ammonium acetate), pH (potentiometric), matter content organic (Walkley-Black).
- **Biology:** Activity desinogenic (triphenyltetrazolium test), respiration soil (CO_2 capture), biodiversity microbiological (PLFA analysis - Phospholipids Fatty Acids).
- **Residues:** Pesticide analyses (GC-MS/MS) and nitrates (chromatography ionic) in soil samples after harvest.

B. **Plants:**

- **Status nutritional:** Foliar analyses (N, P, K, Mg, microelements) in flowering phase (ICP-OES).
- **residues:** Pesticide analyses in leaf and grains (LC-MS/MS for herbicides, GC-MS/MS for insecticides).
- **Quality harvest:** Protein content, oil and starch in grains (NIR - Spectroscopy in Infrared Appropriate).

C. **Drainage water:** monitoring by lysimeters liabilities for nitrate concentration and compounds herbicides.

Statistical methods: The data was examined using analysis of variance (ANOVA) with Tukey HSD test for distinction significant ($p<0.05$).

Results and discussion

1. **Fertility and health soil:**
   - **Organic matter:** SE increased from 2.4% to 2.9% in 3 years ($p<0.05$), and SIR from 2.4% to 2.7%. SC remained at 2.4%. **PLFA analysis A showed a diversity microbiological 30% higher in SE compared to SC , SIR being** intermediary.

   - **Nutrients available:** The levels of P and K were LIKE in SC and SIR, but in **SE**, **analyses** showed an increase gradual release of phosphate available throughout years, correlated with growth activity microbiological (disinfection test 40 % more high in SE than in SC).
   - **Pollution: Residue analyses** in the soil they detected herbicide sprays hormonal (2,4-D) in SC (0.02 mg/kg) and SIR (0.005 mg/kg). In SE, residues were below the detection limit. Nitrate levels in SC soil were 45 mg/kg, compared to 25 mg/kg in SIR and 18 mg/kg in SE.
2. **Status plant and protection:**
   - **Foliar nutrition: ICP-** OES **analyses** showed levels adequate N and P in all systems , but with values may constant throughout SEASON in SIR and SE. In SC it was observed a post -fertilization nitrogen "peak" followed by a decrease.
   - **Waste in harvest: LC/GC-MS/** MS confirmed absence insecticide residues in grains from SE. In SIR, a trace was detected insignificant amount of teflubenzuron (0.001 mg/kg, below the MRL). In SC, lambda - cyhalothrin was present at 0.03 mg/kg (below, but close to the MRL).
   - **Quality grains: NIR analysis** A indicated an 8% higher protein content in SE compared to SC, probably thanks to mineralization slower and assimilation better synchronized A Nitrogen. The yield confirmed trends previous ones.
3. **Impact on environment:**
   - **Drainage water:** strength average nitrates in leachate was: SC: **65 mg/L**, **SIR: 28 mg/L**, **SE: 15 mg/L**. This demonstrate clear reduction drastic reduction of nutrient pollution in systems low and ecological. The compounds herbicides were detected only in leachates from SC.

Laboratory analyses provides confirmation quantitative and qualitative benefits integrated systems and ecological. In time What the gross yield in SE is may low, **quality superior grain** (**protein**, absence of residues) and **health exceptional soil** (material) organic, activity microbiological) represents capital for long-term production . SIR succeeds to combine **efficiency close to the conventional one** with a **much lower ecological and toxicological risk profile reduced**, confirmed by residue analyses and water. In SC, the risk of pollution broadcast and soil degradation it is obvious, even if production is maximum in the short term.

Conclusions

1. **Scientific Validation:** Laboratory analyses (soil, plant, water) provide a basis solid for conclusions, demonstrating differences quality vital from systems, beyond the simple yield
2. **Key indicator:** growth **material substrate** and diversity **microbiological (PLFA) in SE and SIR, combined with the decrease in dramatic increase in nitrates and pesticide residues** in the soil and water, are indicators undeniable aspects of sustainability these systems.

3. **Safety food: residue analyses** in beans confirm superiority the product from SE (zero residues) and safety of the SIR (residues below limits legal), providing argument for niche markets and consumers aware.
4. **Recommendation decision-making:** for adoption at scale wide, **SIR** is optimal, because analysis prove that reduces the impact environmental by over 50% (according to measurements in water) without penalties significant production or major economic risk. **SE** requires a policy framework and market that harness investment in natural capital and quality superior, proven in laboratory.

References:

- Altieri, MA, Nicholls, CI (2018). *Agroecology: The Science for agriculture sustainable*. Publishing house Academy.
- European Commission. (2020). *Farm to Fork Strategy – For a fair, healthy and environmentally friendly food system*.
- Smith, RG, et al. (2017). "Cover Crops and Nutrient Cycling in Maize Systems." *Agronomy Journal*, 109(2), 512-522.
- *S.* , & Preda, C. (2021). *Cultivation technologies integrity for Corn*. Ceres Publishing House.
- Pretty, J., & Bharucha, ZP (2015). "Integrated Pest Management for Sustainable Intensification of Agriculture in Asia and Africa." *Insects*, 6(1), 152-182.
- ***Institute National Institute of Agricultural Research and Development (INCDA) Fundulea.*** (2022). *Recommendations technology for culture corn*.
- Tilman, D., et al. (2002). "Agricultural sustainability and intensive production practices." *Nature*, 418, 671-677.
- * EU regulations on use sustainable use of pesticides (Directive 2009/128/ EC)*.

PSAMMOPHYTES PLANTS FROM ROMANIA

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Abstract
Psammophytes constitute a specialized ecological plants grou, adapted to the extreme conditions of habitats sand, characterized by soil unstable, poor in nutrients and with low retention capacity a water. In Romani, these plants are widespread in sand areas of Black Sea coast, on the sand dunes Danube river basins, as well as in plain sandy beaches in Oltenia and Banat. Their living environment is marked by temperatures high, winds strong and water deficit, which what a required development some adjustments morphologic and physiological specific. This work analyzes main representatives of the flora Psammophytes from Romania, their ecological role in stabilizing substrates and maintaining biodiversity, as well as key threats to which they are exposed. The study highlights need some conservation measures effective for protecting these habitats vulnerable and the rare species they shelter.

Keywords: *Psammophytes, xerophiles, sandy habitats, biodiversity, anthropogenic threats, conservation, Romania*

Introduction

Sandy habitats sandy represents ecosystems dynamic and extremes, subject to some terms severe abiotic: instability substrate, deficit chronic water, temperatures fluctuating and exposure to strong winds. *Psammophytes*, by their set of adaptations, not just survive in these conditions, but plays a crucial ecological role in stabilizing ground and in creation a life system for other organisms. In Romania, these habitats are spread throughout seaside Black Sea coast, in the Danube Delta, on the terraces sandy beaches of the seas rivers and in the plains of the south and the west of the country. They shelter a specific flora, where they are found both cosmopolitan species, both and endemism or rare, high- value species for national natural heritage. The pressure anthropogenic increased in the form of urbanization, intensive tourism, agriculture and change climate, threatens but existence these fragile ecosystems. This work provides a synthesis on characteristics, role and conservation status of *Psammophytes* plants from Romania.

Material and methods

The study was based on bibliographic exhaustive analysis, which integrated:

- Reference works in floristics field, phytosociology and ecology plants from Romania;
- Case studies and monographs dedicated to *Psammophytes* plants habitats;
- Specialized online sources (botanical databases, research institution websites, articles);

- Identification and description of five species representative for sandy habitats: *Ephedra distachya*, *Convolvulus persicus*, *Stipa capillata*, *Marrubium peregrinus* and *Prunus spinosa*;
- Comparative analysis.

Results and discussion

Features and general plant adaptations of *Psammophytes*

To survive in sandy environment sandy, ***Psammophytes*** plants psammophiles have developed a number of remarkable morpho-physiological adaptations:

Adaptation	Description function	Examples of species
Deep root system	Fixation in unstable substrate access to levels ground deep	*Ammophila arenaria*, *Ephedra distachya*
Reduction area	Small , transformed leaves in scaly or needle to limit water loss	*Ephedra distachya*, *Artemisia campestris*
Protection against radiation and wind	The presence of hairs or cera to reflect light and reduce evaporation; creeping port.	*Convolvulus persicus*, *Corispermum sharp*
Drought tolerance - xerophytic features	Tissues with cells with large vacuoles for water storage ; acid metabolism of crassulas (CAM) in some species	Various species of *Psammophytes*
Germination	Seeds with a long period of dormancy, germinating quickly after rains	Sandy plants

Habitats and distribution in Romania

Psammophytes are found in the main sandy areas of the country:

- Black Black Sea and Danube Delta: sea dunes, beaches. Examples: *Cakile maritima*, *Eryngium maritimum*, *Convolvulus persicus*.
- Danube terraces: fluvial sand. Examples: *Gypsophila perfoliata*, *Stipa borysthenica*.
- plains sandy beaches in Oltenia and Banat: Examples: *Astragalus vesicarius ssp. saharae Secale sylvestre*, *Alyssum borzaeanum*.

Case studies: five representative *Psammophytes* species

A. *Ephedra distachya (Tendril)*

Figure 1: Ephedra distachya – shrub relict, adapted to sands.

- Description: Dioecious shrub, short (25-50 cm), intermediate morphological between angiosperms and gymnosperms.
- Adaptations: Strong root system, stems greens that ensure photosynthesis, leaves reduced to scales.
- Importance: Relict species, valuable from a conservation perspective pharmacological thanks to ephedrine content, used in medicine traditional.
- State of preservation: Rare, reported in reserves such as the Marine Dunes of Agigea.

B. *Convolvulus persicus (Sand vole*)

Figure 2: Convolvulus persicus – plant vulnerable, indicator of consolidated sands.

- Description: Plant herbaceous perennial, with stems up to 35 cm, leaves meat covered with greenish-gray hairs.
- Adaptations: Compact, hairy habit to reduce evaporation and to reflect radiation.
- Importance: Strictly protected species, endemic for Pontic Zone, indicator of fixed sands Distribution - very limited in Romania (Sulina, Sf. Gheorghe beaches).
- State of preservation: vulnerable (VU), threatened by human activities and destabilization of dunes.

C. *Stipa capillata (Nagara, Collilie*)

Figure 3: Stipa capillata – plant grasses decorative, specific meadow dry

- Description: Grass, perennial, decorative, with long, fluffy, purple - colored inflorescences (arises) silver.
- Adaptations: Roots deep , hard leaves and thin to reduce sweating.
- Importance: Characteristic meadow steppe and forest-steppe. It contributes to the stabilization soil poor.
- State of preservation: Threatened by loss habitation by afforestation or agriculture.

D. *Marrubium peregrinus*

Figure 4: Horehound peregrinum – plant aromatic, specific HABITAT xerophiles.

- Description: Plant herbaceous perennial, up to 60 cm, with stems hairy and flora white.
- Adaptations: Drought resistance and wind, typical Family *Lamiaceae*.
- Importance: It is part of phytocenoses psammophiles of the Reservation Agigea Marine Dunes.
- State of preservation: Localized, depends on maintenance dune habitats.

E. *Prunus spinosa (Prunus spinosa*)

Fig. 5: Prunus spinosa –thorny shrub , with ecological and medicinal role.

- Description: Shrub tall (1-3 m), with branches thorny, flowers whites early and black-eggplant drupe fruits.
- Adaptations: Drought resistant and poor soil, colonize disturbed areas.
- Importance: Not strictly psammophilous, but is frequent in transition areas, stabilizing soils. Valuable from a medicinal point of view (diuretic, astringent).
- State of preservation: Common, but its edge habitats are becoming increasingly rare.

Ecological role of *Psammophytes*

1. stabilizing and fixation sand: plants with rhizomes (e.g. *Ammophila arenaria*) or roots deep are ecosystem engineers, preventing erosion wind.
2. creation and maintaining biodiversity: vegetation *psammophilous* offers shelter, food and microclimate for invertebrates, reptiles, birds and mammals small.
3. pioneer and succession: they are the first plants that colonize the sands, preparing land for installation some community plant may complex.
4. cycle nutrients: contributes to the accumulation of matter the organic in soils extremely poor.

Main Threats and state of preservation

Habitats of *Psammophytes* are among the most vulnerable in Romania:

Threat	Impact on *Psammophytes*	Examples
Urbanization and intensive tourism	Destruction habitat physics, compaction soil, pollution.	Black Sea
Agriculture and afforestation	transformation naturally habitat in agricultural land or plantation forest	Sandy Plains in Oltenia
Off-road traffic	compacting and fragmentation soil - destruction direct plant growth	Accessible dune areas.
Invasion of other species	competition for resources - modification of the habitat.	*Robinia pseudoacacia*, *Ailanthus altissima*
Climate change	intensifying droughts, storms and marine variations level	All habitats from the coastline

Conservation status: Many species of *Psammophytes* are included on red lists, either at the national (e.g. *Convolvulus persicus*) or European level. Their habitats are protected by Direction Habitats (e.g. coastal dunes with *Ammophila arenaria* - code 2120).

Conclusions

Psammophytes plants are models of adaptation to extreme environments, playing a indispensable role in stabilizing quicksand, in prevention of soil erosion and maintaining biodiversity. They are pioneers environmental plants with major impact on ecosystems structure. These habitats and the species they shelter face pressures human major (destruction, pollution, invasive species) amplified by climate change.

It is imperative necessary:

- Protection and practice strict legislation in protecting existing areas
- (Reservation Marine Dunes at Agigea, Danube Delta Natural Park).
- Restoration ecological management of the dunes degraded by methods specific
- (placement of obstacles, replanting with native species).
- Monitoring scientifically continued population of rare species.
- Education and public involvement for reduction impact sightseeing and recognition value these ecosystems unique.

In ensemble, *Psammophytes* plants and their habitats is not only an obligation to protect natural heritage, but also a vital condition for ecological areas coastal stability.

References

- Ciocârlan, V. (2009). *Illustrated Flora of Romania. Pteridophyta and Spermatophyta*. Bucharest: Ceres Publishing House.
- Sanda, V., Öllerer, K., & Burescu, P. (2008). *Phytocenoses in Romania*. Bucharest: Ars Docendi Publishing House.
- Donita, N., Popescu, A., Paucă -Comănescu, M., Mihăilescu, S., & Biriş, I. (2005). *Habitats in Romania*. Bucharest: Publishing House. TECHNICAL Forest.
- Popescu, A., & Sanda, V. (1998). *Vegetation Romania*. Bucharest: Agricultural .Publishing House.
- Rákosy, L., & Munteanu, C. (2002). *Ecosystems vulnerable in Romania: sand dunes*. Cluj-Napoca: *Presa* Universitară Publishing House Cluj-Napoca.
- Borza, A., & Boşcaiu, N. (1965). *Flora and vegetation SEASIDE Black Sea*. Bucharest: Publishing House Academy Romanian.
- N., & Oprea, A. (2013). *Vascular plants from Romania – illustrated field determinant*. *Bucharest*: Publishing House Victor.
- Oltean, M. et al. (1994). *Red List of Plants higher education institutions in Romania*. Bucharest.

- ***Online sources:***
  - https://agroromania.manager.ro/articole/plante-medicinale/ephedra-distachya-carcelul-de-nisip-specie-din-arealul-dunelor-marine-de-la-agigea-424.htm
  - https://www.videoguide.ro/ro/volbura-convolvulus-persicus-delta-dunarii.html
  - https://en.wikipedia.org/wiki/Stipa_capillata
  - https://www.biolib.cz/en/image/id100110

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ANALYTICAL STUDY ON THE RISKS ASSOCIATED WITH WHEAT AND CORN IN ROMANIAN AGRICULTURE

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ABSTRACT
Wheat and corn constitute the basis of human and animal nutrition at global and national levels, and their safety has major economic and public health implications. This study aimed to assess the main risks associated with these cereals under Romanian agricultural conditions, focusing on chemical (pesticide residues, mycotoxins, heavy metals) and biological (insect infestation, presence of toxic weeds) hazards. Samples collected from three important production regions were analyzed, before and after storage. The results revealed the presence of some mycotoxins (aflatoxin B1, deoxynivalenol) in concentrations below the maximum permitted limits, except for one corn sample, where the limit for fumonisins was exceeded. Pesticide residues were detected within legal limits, and quality and hygiene indicators were generally compliant. The study highlights that ***storage under controlled conditions (temperature, humidity)*** *represents the most critical control point for limiting the formation of mycotoxins, the dominant hazard for these cereals.*

Keywords: *cereals, wheat, corn, mycotoxins, pesticides, chemical risk, storage, HACCP, sustainable agriculture.*

Introduction

Romania is one of the main cereal producers in the European Union, with wheat and maize crops occupying significant agricultural areas. The safety of these cereals is not only a concern for export, but also for domestic food security, as they are part of hundreds of final products. The main associated risks are chemical contaminants, especially mycotoxins produced by fungi of *Aspergillus*, *Fusarium* and *Penicillium*, which pose teratogenic, carcinogenic and immunosuppressive risks. Other hazards include pesticide residues used in plant protection and heavy metal contamination in the soil. This study aims to identify the level of these risks in cereals produced under local conditions and to propose critical control points for their reduction.

Material and method

Samples: 15 wheat samples (5/lot) and 15 corn samples (5/lot) collected from three counties with significant production (e.g.: *Ialomiţa, Teleorman, Timiş*).

Samples were taken at harvest and after 3 months of storage in conventional warehouses. Sample volume: 1 kg/lot, taken according to sampling standards.

Reagents and media: Reference standards for mycotoxins (aflatoxin B1, ochratoxin A, zearalenone, deoxynivalenol, fumonisins), pesticide standards, extraction and cleanup reagents (SPE), HPLC grade solvents.

- **Equipment:** Liquid chromatography-mass spectrometer (LC-MS/MS) for mycotoxins and pesticides, inductively coupled plasma mass spectrometer (ICP-MS) for heavy metals, moisture determination apparatus.

Methods:

- **Sample preparation:** The samples were ground homogeneously and fractions below 500 µm were worked with.
- **Chemical analyses:**
    - **Mycotoxins:** Simultaneous determination by LC-MS/MS after solvent extraction and SPE column cleanup, according to the validated internal method, based on Reg. (EU) 401/2006.
    - **Pesticides:** Multi-residue analysis by LC-MS/MS and GC-MS/MS, QUECHERS method, compared to the MRLs in Reg. (EC) 396/2005.
    - **Heavy metals (Cd, Pb):** Determination by ICP-MS after acid digestion, according to Reg. (EC) 1881/2006.
- **Quality and hygiene analyses:** Determination of moisture (%) at harvest and after storage, macroscopic examination for the presence of live/dead insects and toxic weed seeds.
- **Statistical analysis:** Comparative analysis of results by cereal, region and sampling time.

Results and discussion

Table 1: Presence of mycotoxins in cereals (maximum values detected)

Cereal	Mycotoxin	Detected value [µg/kg]	MRL [µg/kg] (Reg. 1881/2006)	Conformity
Wheat	Deoxynivalenol (DON)	750	1250	**YES**
Wheat	Zearalenone (ZEA)	50	100	**YES**
Maize	Fumonisins (FB1+FB2)	2250	2000	**NO** (1 sample)
Maize	Aflatoxin B1 (AFB1)	3	5	**YES**

Table 2: Other risk and quality indicators

Parameter	Wheat (rec./after stock.)	Corn (rec./after stock.)	Observations
Average humidity (%)	13.5 / 14.2	16.0 / 16.8	Easy growth in storage
Pesticide residues	Detected in 4 samples (<50% MRL)	Detected in 5 samples (<30% MRL)	All within legal limits
Cadmium (Cd) [mg/kg]	0.08	0.05	Below the limit of 0.1 mg/kg (wheat)
Insect infestation	0% / 7% lots	0% / 13% lots	Significant in storage

Results and discussion

The results clearly highlight that **the critical danger for Romanian cereals is the generation of mycotoxins,** influenced by**:**

1. **Agro-climatic conditions:** Excessive rains during the corn flowering period favor *Fusarium* spp.
2. **Storage practices:** The slight increase in humidity and the appearance of insect infestation in the tested warehouses (Critical Control Point - CCP) demonstrate suboptimal conditions. Insects increase the local temperature and humidity, creating a microclimate favorable to toxigenic fungi.
3. **Differences between cereals:** Maize is more susceptible to aflatoxins and fumonisins due to the structure of the cob and the longer drying period. Wheat is more exposed to DON and ZEA.
4. **Under-control risks:** Pesticide residues and heavy metals are not a major problem in the samples analyzed, indicating good agricultural practices in these areas. However**, storage remains the weak point.**

Conclusions

1. **Post-harvest management, especially strict control of humidity (below 14%) and temperature in warehouses, is the absolute CCP in preventing mycotoxin formation and infestation.** Investment in warehouse monitoring and ventilation systems is essential.
2. **Regionally differentiated surveillance** is needed, with an intensified program of testing corn for fumonisins and wheat in areas of high climatic risk.
3. Producers should be encouraged and trained to apply **Good Agricultural Practices (GAP) and Storage Practices (GSP)**, with emphasis on timely fungicide treatments and drying conditions immediately after harvest.
4. The study confirms that ensuring the quality and safety of cereals is a continuous process, from field to warehouse, and the control of accredited laboratories is vital for the early detection of risks.

References

- **Regulation (EC) No 1881/2006** on maximum levels for certain contaminants in foodstuffs.
- **Regulation (EU) No 401/2006** laying down the methods of sampling and analysis for the official control of the levels of mycotoxins in foodstuffs.
- EFSA (European Food Safety Authority). (2020). *Risk assessment of aflatoxins in food* EFSA Journal.
- **Ministry of Agriculture and Rural Development.** (2021). *Guide to good agricultural and storage practices for cereals*.
- Magan, N., Aldred, D. (2007). *Post-harvest control strategies: Minimizing mycotoxins in the food chain*. International Journal of Food Microbiology.
- **ANPC & ANSVSA.** Guidelines for the control of cereals and cereal products on the domestic market.