



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 university 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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IMPACT OF NUTRITIONAL IMBALANCES ON SLEEP

Author: Assoc. Prof. Dr. Pharm. Gabriela VLĂSCEANU

Faculty of General Medical Assistance, Bioterra University of Bucharest

e-mail: ga.vlasceanu@yahoo.com

Abstract

To maintain both physical and mental health, it is essential to get quality sleep, which includes sufficient deep sleep and REM phases. When these stages are lacking or disrupted, they can negatively affect basal metabolism, physiological functions, cognitive performance, and emotional balance, ultimately impacting productivity and overall well-being. A physician or sleep specialist can evaluate your symptoms, diagnose potential sleep disorders, and recommend appropriate treatment to improve sleep quality. For this reason, deficiencies in vitamins, minerals, or collagen should not be overlooked. These nutrients are vital for maintaining homeostasis and supporting the biochemical processes that regulate circadian rhythm, hormone production, and neuronal communication. Adequate levels of magnesium, vitamin D, B-complex vitamins, iron, zinc, and amino acids involved in collagen synthesis help promote restorative sleep, reduce nighttime awakenings, and improve daytime functioning. Incorporating a balanced diet, proper hydration, and a consistent sleep routine—along with addressing any nutritional imbalances—can significantly enhance sleep quality. Combined with medical guidance when necessary, these measures contribute to better overall health and the optimal functioning of both body and mind throughout the day.

Keywords: *sleep, disturbances, nutrients*

Introduction

The suprachiasmatic nucleus is the command center for hunger, satiety, sleep, stress response, body temperature, fluid intake, hormone synthesis, etc. This segment of the hypothalamus, directly influenced by the circadian cycle, modulates the biological rhythms that coordinate important aspects of our lives (such as *sleep, nutrition, and physical activity*) and maintains a balance between these components for a healthy lifestyle. [1] Restful (quality) sleep has a significant impact on our health and homeostasis. [2] (Fig.1)

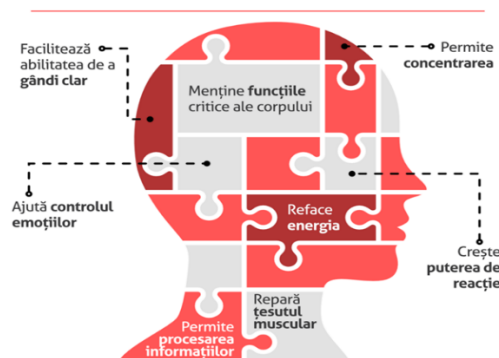


Figure 1 – The benefits of sleep [2]



During sleep, the body and mind go through a series of vital processes that contribute to the body's regeneration and optimal functioning. Here are some of these important processes:

- *Memory consolidation and learning:* During sleep, the brain processes information and events from the day. Sleep helps consolidate memory and improve cognitive performance, such as learning and problem-solving.
- *Cellular regeneration:* During deep sleep, the body releases growth hormones that stimulate the regeneration and repair of tissues and cells damaged during the day.
- *Immune system strengthening:* Adequate sleep plays a key role in maintaining a healthy immune system. During sleep, the body produces cytokines, proteins that help fight infection and inflammation.
- *Hormonal regulation:* Adequate sleep plays a role in balancing levels of key hormones, such as cortisol (the stress hormone) and leptin and ghrelin (hormones that regulate hunger and satiety).
- *Energy conservation:* Sleep provides the body with an opportunity to conserve energy, allowing it to recover and prepare for future activities.
- *Maintaining mental health:* Lack of sleep or poor sleep can contribute to mental health problems such as anxiety and depression. A restful sleep helps maintain emotional balance and mental health.

Material and methods

Sleep and mental health are closely linked, and sleep disorders can contribute to depression and anxiety.

To achieve quality sleep, it is important to follow healthy sleep practices, such as maintaining a regular bedtime and wake-up schedule, creating a comfortable and distraction-free sleep environment (low light and noise, appropriate temperature), avoiding caffeine and heavy meals before bed, and relaxing before sleep (e.g. meditation, reading).

In order to maintain optimal health, it is necessary to respect certain hours of sleep, depending on age [2] (*Tabel 1*).

Table 1 – Age correlated with the number of hours of sleep needed [2]

Age	Hours of needed sleep
Birth to 3 months	14-17 hours
4-11 months	12-16 hours
1 – 2 years	11 – 14 hours
3 – 5 years	10 – 13 hours
6-12 years	9-12 hours
13-18 years	8-10 hours
After 18 years	7 – 9 hours



Results and discussions

Sleep is made up of several cycles, and each cycle includes four distinct stages, with two main types of sleep: NREM (non-REM) and REM (rapid eye movement). These cycles repeat throughout the night, and each has specific characteristics:

- *NREM stage - stage 1:* marks the transition from wakefulness to sleep and is characterized by gradual relaxation. The person may be easily awakened and may experience slow eye movements.
- *NREM stage - stage 2:* sleep becomes deeper, and eye movements stop. Specific brain activities occur, such as K-complex brain waves. Also, in this stage, the brain begins to organize information and transfer it to long-term memory.
- *NREM Stage - Stage 3:* This stage is known as deep or slow sleep where delta brain wave activity is observed. It is difficult to wake someone up during this stage of sleep, and it is crucial for the body to rest and repair itself. Typically, NREM Stage - Stage 3 is longer in duration during the first half of the night.
- *REM Stage - Stage 4:* Characterized by rapid eye movement, rapid brain activity, and vivid dreams. The body is almost completely paralyzed, except for the eyes and respiratory system. It is essential for processing emotions, consolidating memories, and regulating mood. REM is more common in the second half of the night and becomes longer with each sleep cycle.

NREM and REM cycles repeat several times per night, and the duration of each stage varies. [3,4] (Table 2).

Table 2 – Characteristic stages of sleep (a), stages of sleep on electroencephalogram (b)[3,4]

Etapele somnului	Tipul somnului	Durata
Etapa 1	NREM (N1)	1-5 minute
Etapa 2	NREM (N2)	10-60 minute
Etapa 3	NREM (N3, somn profund)	20-40 minute
Etapa 4	REM	10-60 minute

(a) [3]

(b) [4]

Other authors divide NREM sleep into 4 different stages of depth (1 and 2 – light sleep, 2 and 4 – deep sleep), and the 5th stage is assigned to REM sleep (the stage from which we wake up in the morning, which helps us remember dreams from this interval). [4,5] (Fig.2)

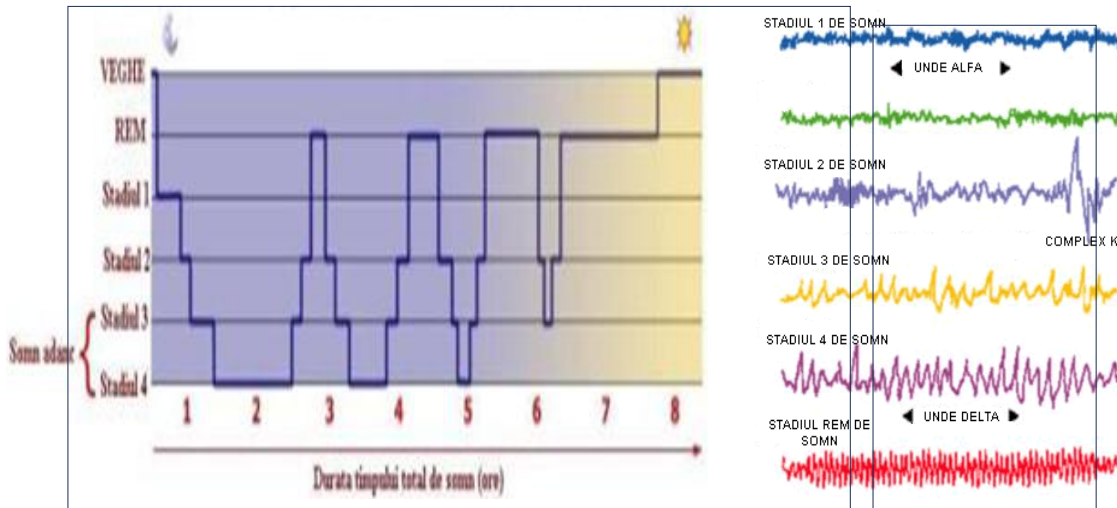


Figure 2 – Sleep stage cycle over 8 hours (a) [4] and on the electroencephalogram (b) [5]

Lack or disruption of these phases/stages of sleep can affect the quality and overall health. We emphasize the importance of *deep* and *REM sleep* for physical and mental recovery. Here are some of the benefits of these phases of sleep:

— *Deep sleep* (stage 3/stage 3 & 4): the body has the opportunity to repair and regenerate itself (tissues are restored, and the immune system is stimulated to fight pathogens); growth hormones are released (essential for normal growth and development, especially in children and adolescents); lack of deep sleep leads to the development of health problems (increases the risk of obesity, diabetes and cardiovascular disease).

— *REM sleep* (stage 4/stage 5): essential for memory consolidation and emotional processing (the brain organizes and integrates information from the day, which helps with learning and adapting to experiences); crucial for optimal cognitive functioning and the ability to cope with stress; its lack can lead to memory deficits and difficulty solving problems (it can also affect mood regulation and induce depression and anxiety).

A chaotic lifestyle contributes to difficulties in maintaining quality sleep. The situation is worse when the duration and quality of sleep are affected by pre-existing diseases:

- *allergies and respiratory problems* (colds and upper respiratory infections can make it difficult to breathe at night because your nose can't breathe properly);
- *nocturia* (refers to the need to interrupt your sleep at night to urinate; it can occur due to a hormonal imbalance or urinary tract diseases);
- *chronic pain* (constant pain can be a cause of insomnia, making it hard to fall asleep or waking you up often - the most common causes of chronic pain are: arthritis, chronic fatigue syndrome, fibromyalgia, irritable bowel syndrome, persistent headaches or ongoing back pain);
- *stress and anxiety* (often have a negative impact on sleep quality);



When these problems become chronic and significantly interfere with daily life, they can induce the presence of **sleep disorders** (there are numerous, with significant impact on physical and mental health. Some examples of common sleep disorders are:

- **Insomnia:** difficulty falling asleep or staying asleep;
- **Sleep apnea:** involves repeated interruptions in breathing during sleep, which can lead to frequent awakenings and poor sleep quality;
- **Restless legs syndrome:** a neurological, sensory-motor condition that involves a persistent urge to move the legs, which makes it difficult to relax and fall asleep;
- **Narcolepsy:** excessive daytime sleepiness, sometimes with episodes of sudden sleep onset.
- **Parasomnias:** abnormal behaviors that occur during sleep (sleep talking, bruxism, sleepwalking, or nightmares). [6]

Sleep disorders can therefore have a variety of causes, related to physical or mental conditions or to a person's habits and lifestyle. It is important to consult a medical professional or a sleep specialist to obtain an accurate diagnosis and receive an appropriate treatment plan, because practically, during sleep certain neuronal processes are regenerated (while we sleep the brain is still awake and produces an important material called *myelin*, which has the role of protecting brain circuits). In order for the cerebral cortex to be involved in the myelin replication process, it generates a hormone, *melatonin*. This is produced in the pineal gland of the brain, in four stages, from the amino acid tryptophan, which is transformed into tryptamine, which is converted into serotonin, then this is transformed into melatonin. [7,8] (Fig. 3)

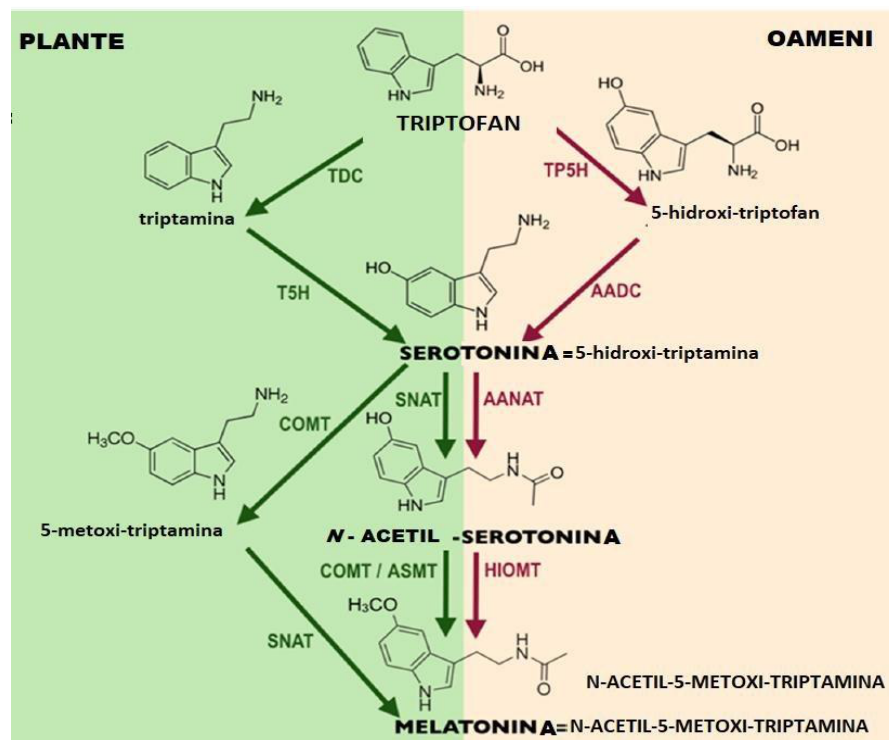


Figure 3 – Comparison of melatonin biosynthesis pathways in plants and humans [8]
 CoAADC, aromatic-amino acid decarboxylase; AANAT, arylalkylamine N-acetyltransferase;
 ASMT, N-acetylserotonin methyl transferase; COMT, caffeic acid O-methyltransferase;
 HIOMT, hydroxyindole-O-methyltransferase; SNAT, serotonin-N-acetyltransferase; T5H,
 tryptamine 5-hydroxylase; TDC, tryptophan decarboxylase; TP5H, tryptophan 5-
 hydroxylase) comparison of melatonin biosynthetic pathways in plants and humans



The pineal gland then releases melatonin into the bloodstream, and eventually it is released to other areas of the body, such as the digestive system. This hormone is vital for inducing sleepiness and is involved in all four stages of sleep (which is why melatonin is also called the “sleep hormone”).

Light limits the amount of melatonin and its impact, so that we can remain alert during daytime activities. With the arrival of night, the brain knows that it needs to release more melatonin in order to rest (this is why a night shift schedule is not healthy for the body, because it disrupts its biorhythms). [9] (Fig. 4)

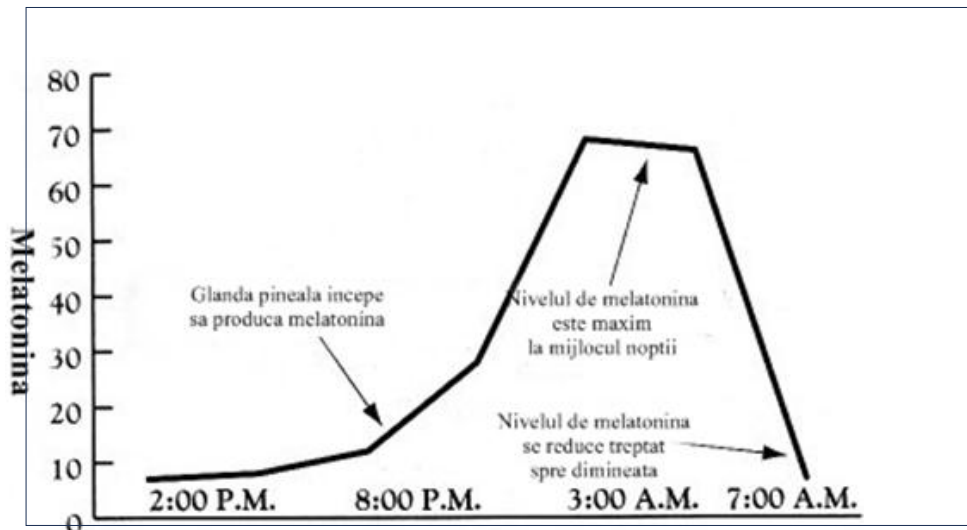


Figure 4 – Variation in melatonin levels depending on the circadian cycle [9]

Melatonin levels begin to rise in the late evening and remain high for most of the night. The amount decreases in the morning, as the sun rises, leading to awakening. Although the main function of melatonin is to induce drowsiness and help us have a restful sleep, its role is much more complex, being responsible for regulating blood pressure, maintaining a constant body temperature, and also having an antioxidant and anti-inflammatory role. e melatonin levels function of the circadian cycle [7,8,9]

It has been shown that nutritional deficiencies can cause numerous imbalances and diseases, including recurrent headaches and chronic fatigue. Therefore, vitamins and minerals are essential for the body's homeostasis, being involved in all physiological metabolic processes. Thus, the deficiency of: vitamin B6, B12 - can cause fatigue, difficulty concentrating, headaches and dizziness; vitamin C - can cause fatigue and weakness; vitamin D - can cause fatigue, muscle pain and headaches; iron - can lead to chronic fatigue, headaches, weakness and anemia; magnesium and zinc - can induce headaches, muscle spasms and fatigue. [10]

Magnesium, zinc, and B vitamins play a major role in sleep, as they stimulate the activity of GABA receptors, which induce relaxation at the nervous system level, facilitating a return to the “rest and recovery” state. Numerous studies have shown that the accuracy of our internal clock is influenced by the level of these essential nutrients (which also help regulate the NREM-REM-wake alternation). [11] (Fig. 5)

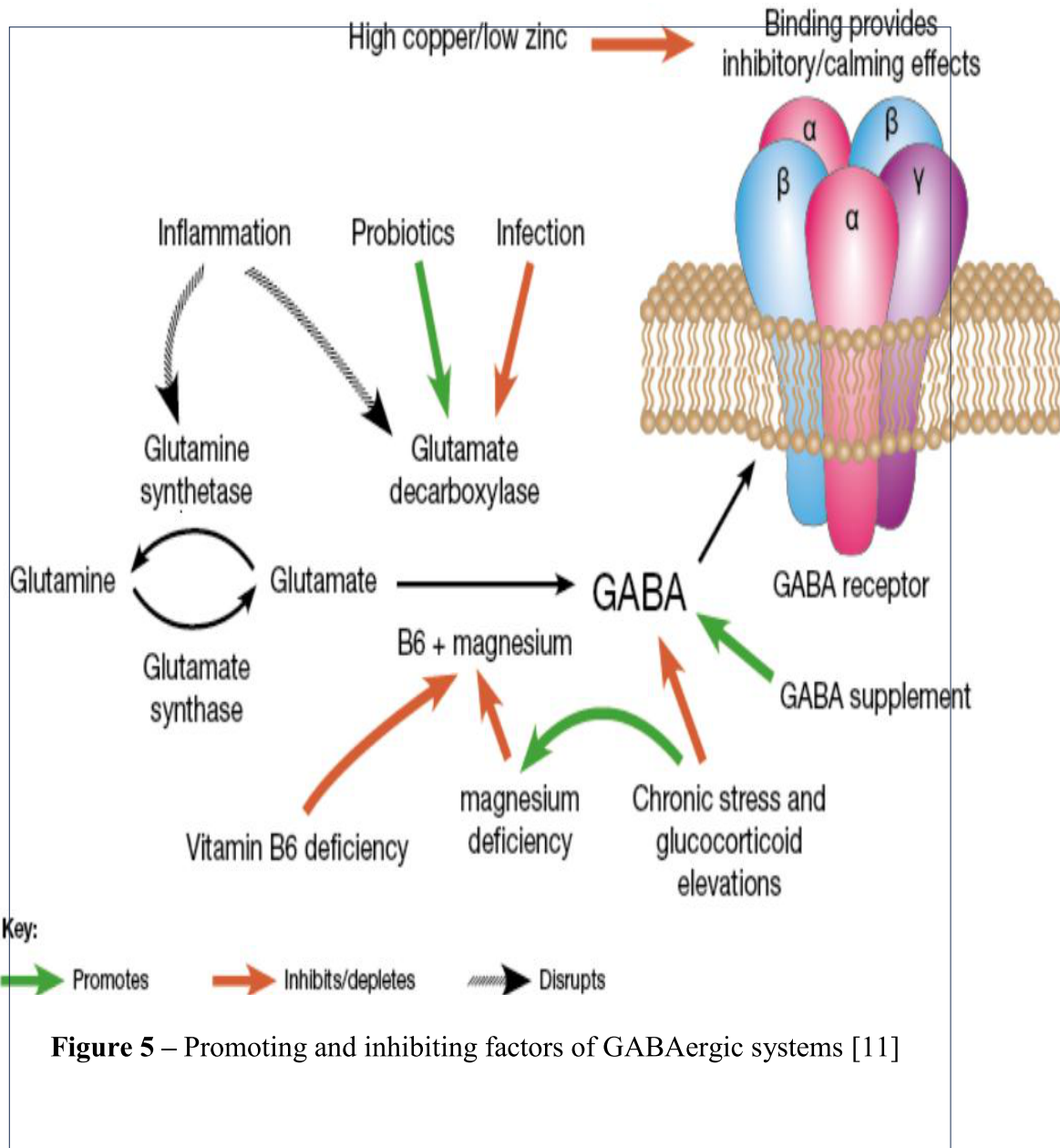


Figure 5 – Promoting and inhibiting factors of GABAergic systems [11]

Conclusion

Good sleep is essential for health and good mood. Omega-3 deficiency causes insomnia and low melatonin levels. Studies conducted on adults and children indicate that omega-3 fatty acid intake influences the quality and duration of sleep. People who do not like fish, are allergic to it or simply do not like the smell of fish can choose to supplement their diet with standardized supplement products. [12]

Human body is a delicate and efficient mechanism, but sensitive to stress factors. This is why diets rich in *mono- and polyunsaturated fatty acids, magnesium, iron and vitamins (B₆, B₁₂, C, D)*, as well as physical exercise (which relieves tension and stimulates the release of endorphins) and, last but not least, other activities that are pleasurable and relaxing, can improve mental state and sleep.

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COMBATING FOOD WASTE – LEGISLATIVE OBJECTIVE OF ACCOUNTABILITY OF ECONOMIC OPERATORS IN THE AGRI-FOOD INDUSTRY

Author- Lecturer Dr. Corina SCARLAT
Faculty of Law, Bioterra University Bucharest
e.mail: v.scarlat.corina@yahoo.com

Abstract

Law 217 of November 17, 2016¹ on reducing food waste, republished in 2024 pursues a series of clear and concrete objectives.

In particular, according to this law, the Ministry of Agriculture and Rural Development, and other bodies must collaborate to create a national strategy against food waste, which must be updated every five years. These institutions must implement clear measures against food waste and create an online platform to collect information from economic operators.

The Ministry of Agriculture must also publish data on companies' food losses and produce information materials for economic operators.

The normative act aims to organize at the national level the activity of all economic operators in the agri-food sector and the measures regarding the reintroduction of food into the economic circuit, the distribution of food to disadvantaged people, to non-governmental associations and the connection of local producers with distributors and traders in Romania.²

Keywords: *food waste, economic operators in the agri-food sector, expiration date, food waste, carbon footprint*

¹Amended by GD 51/2019 and republished pursuant to art. III of Law no. 49/2024 amending and supplementing Law no. 217/2016 on reducing food waste, published in the Official Gazette of Romania, Part I, no. 225 of March 18, 2024, giving the texts a new numbering

² Art. 1 (1) This law regulates the achievement of the sustainable development objectives assumed at European and international level by Romania, in terms of preventing and reducing food waste. Reducing food waste is an objective pursued by all economic operators in the agri-food sector. (2) The purpose of this law is to establish measures to prevent and reduce food waste and related promotional actions, in order to increase the use and valorization of food along the agri-food chain. (3) For the purposes of this law, food waste means the situation as a result of which food leaves the human consumption circuit due to degradation and is destroyed, in accordance with the legislation in force. (4) For the purposes of this law, the terms and expressions used are provided in the annex which is an integral part of this law. (5) In order to achieve the objective pursued by this law, public authorities with regulatory and control powers in the agri-food sector have the responsibility to inform final consumers regarding the date of minimum durability and food hygiene conditions. The operators referred to in art. 2 paragraph (1) may voluntarily participate as partners in the activities and campaigns proposed by the authorities and/or may initiate their own information actions in the spirit of this law.



Introduction

When we refer to food waste, we are referring to food waste from all points of the food supply chain, starting from the farm, to processing and manufacturing, to retail, in restaurants and canteens, as well as in households.

The most important reasons why food waste exists are: high quality standards, improper planning of food purchases, "buy one, get one free" promotions, overproduction or lack of demand for certain products, unclear meaning of "expires on" and "best before", difficulty in anticipating the number of customers, especially for catering services, but also a lack of awareness of the solutions and benefits that arise from reducing food waste.

Law food waste aims to provide a regulatory framework that stimulates the accountability of economic operators in the agri-food sector, through the obligation to implement concrete actions to prevent food waste, before neutralizing the waste generated.

By reducing food waste, we can contribute to meeting food needs, but also to reducing poverty. Food production generates a significant amount of greenhouse gas emissions and uses enormous amounts of natural resources, such as water and agricultural land. Thus, by reducing food waste, we will reduce our carbon footprint, conserve natural resources, and from an economic point of view, we can have significant benefits in the future, both for producers and retailers, as well as for consumers.

The normative act aims to organize at the national level the activity of all economic operators in the agri-food sector and the measures regarding the reintroduction of food into the economic circuit, the distribution of food to disadvantaged people, to non-governmental associations and the connection of local producers with distributors and traders in Romania.

Materials and Methods

The law promotes an environment conducive to the active involvement of economic agents in the fight against waste, by facilitating access to programs and resources aimed at reducing it, but also imposes certain tasks on government authorities. The Ministry of Environment, Waters and Forests, the Ministry of Agriculture and Rural Development, and other bodies, must collaborate to create a national strategy against food waste, an operation that must be updated every five years.

The online platform also collects information from economic operators, and the Ministry of Agriculture must publish data on companies' food losses and produce information materials for economic operators, and consumers can save money by reducing the purchase of food that they would later throw away.

The new law on reducing food waste has a significant impact on the food industry. Reducing food waste is particularly important for a more sustainable and equitable society.

The regulatory act requires economic operators in the food industry to apply concrete measures to reduce food waste before throwing away unsold products, such as the obligation of economic operators in the hospitality industry to allow consumers to take uneaten food at the end of meals, without additional costs.



Moreover, food that is not sold can be donated to various non-governmental organizations or used for animal feed, in partnership with institutions such as food banks, zoos, or sent for transformation into compost or biogas.

Results and discussion

All economic operators in the food industry must understand and effectively implement specific measures to reduce food waste.³ Food industry operators are required to implement at least two measures to reduce food waste and to report relevant data to the authorities, as provided for in the regulatory act.⁴

³Art. 2 (1) Economic operators in the agri-food sector, as defined in Regulation (EC) No. 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety, published in the Official Journal of the European Union, L series, No. 31 of 1 February 2002, are required to take measures to prevent food waste.

⁴Art. 2. (2) Economic operators shall implement measures to prevent and reduce food waste according to the following hierarchy of food waste prevention: a) accountability measures to reduce food waste in the agri-food chain, starting with the production, processing, storage, distribution and marketing of food, including in the hotel industry and food services sector; b) measures regarding the sale at a reduced price of products close to the expiry date, in accordance with the legislation in force; c) measures for the redistribution of food by transfer free of charge, for human consumption, to receiving operators, in accordance with the provisions set out in Chapter V of Annex No. II to Regulation (EC) No. 852/2004 of the European Parliament and of the Council of 29 April 2004 on the hygiene of foodstuffs, as subsequently amended and supplemented, as well as measures regarding the redistribution of food, by transfer, for human consumption, to economic operators; d) measures for the use and consumption of food products in animal feed, until the expiry of their validity period, in compliance with the sanitary and veterinary legislation in the field of animal nutrition; e) measures for the direction of products of animal origin that have become unfit for human consumption to registered users for the use of category 3 material for feeding animals in shelters, in accordance with the provisions of Regulation (EC) No. 1,069/2009 of the European Parliament and of the Council of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No. 1,774/2002 (Animal by-products Regulation), as subsequently amended and supplemented, and of Commission Regulation (EU) No. 142/2011 of 25 February 2011 implementing Regulation (EC) No. 1.069/2009 of the European Parliament and of the Council laying down health rules on animal by-products and derived products not intended for human consumption and implementing Council Directive No. 97/78/EC as regards certain samples and products exempt from veterinary checks at the border in accordance with the said Directive, as amended and supplemented; f) measures for directing agri-food products unfit for human or animal consumption for their recovery by transformation into compost, in accordance with the provisions of Regulation (EC) No. 1.069/2009, as amended and supplemented, as well as Regulation (EU) No. 142/2011, as amended and supplemented; g) measures for directing agri-food products unfit for human or animal consumption for their recovery by transformation into biogas, in accordance with the provisions of Regulation (EC) No. 1,069/2009, as amended and supplemented, and Regulation (EU) No. 142/2011, as amended and



To more quickly comply with the food waste law, businesses in the food industry can become bonapp partners, through the bonapp.eco mobile application, which is a marketplace of food suppliers who sell surplus with discounts between 50% and 70%.

In this application, partners can add items with higher stock levels to attract customers with a varied product selection, while optimizing inventory management in a simple way.

A particularly important regulation of the law is the mention that, the free transfer of food is made to the receiving operators or final consumers, they being prohibited from selling food to other operators in the food sector or to the final consumer⁵, with the exception of associations and foundations, which operate under Government Ordinance 26/2000.⁶

The Fiscal Code offers economic operators who transfer food free of charge to receiving operators the tax facilities provided for in art. 25 para. (4) let. c) points 4-6.⁷

Conclusions

Economic agents that violate the provisions of Article 3 of the law risk a fine of between 10,000 and 20,000 lei.

supplemented; h) measures for directing animal by-products not intended for human consumption to an authorised processing plant in accordance with the provisions of Regulation (EC) No. 1,069/2009, as amended and supplemented, and Regulation (EU) No. 142/2011, as amended and supplemented; i) in the case of the measures provided for in letters f)-h), the environmental protection legislation in force shall apply; j) measures for the disposal and use of animal by-products and derived products, category 3 materials, in accordance with the provisions of Regulation (EC) No. 1,069/2009, as amended and supplemented, and Regulation (EU) No. 142/2011, with subsequent amendments and completions, under the conditions provided by the sanitary-veterinary legislation in force.

⁵Art. 3 (1) The free transfer of food is made to the receiving operators or final consumers, who are prohibited from selling food to other food sector operators or the final consumer.

⁶Art. 3 (2) By way of exception to the provisions of paragraph (1), associations and foundations operating under Government Ordinance no. 26/2000 on associations and foundations, approved with amendments and completions by Law no. 246/2005, with subsequent amendments and completions, social enterprises operating under Law no. 219/2015 on the social economy, with subsequent amendments and completions, or social services of public providers operating under art. 27 of Law on social assistance no. 292/2011, with subsequent amendments and completions, which are operators in the agri-food sector, registered with the National Sanitary Veterinary and Food Safety Authority, and which carry out activities in accordance with the provisions of the normative acts provided above, may sell food to the final consumer, at a price that allows covering the operating costs of the respective activity. The maximum level of operating costs is established by the methodological rules for the application of this law.

⁷Art. 4 Economic operators who transfer food free of charge to recipient operators, according to the provisions of this law, benefit from the tax facilities provided for in art. 25 paragraph (4) letter c) points 4-6 and in art. 270 paragraph (8) letter d) of Law no. 227/2015 on the Fiscal Code, with subsequent amendments and supplements.



Also, violation of the aforementioned obligations after 6 months from the launch of the national platform that allows economic operators to electronically upload reports and plans to reduce food waste may be sanctioned with a fine between 10,000 and 40,000 lei.⁸

The institutions competent in detecting contraventions and applying sanctions are: representatives of the Ministry of Agriculture and Rural Development, respectively of the National Sanitary, Veterinary and Food Safety Authority with control responsibilities in the agri-food sector.⁹ A healthy environment is vital for human society. Current legislation in the agri-food industry addresses all kinds of measures to protect nature, including: restoring essential ecosystems, solutions to reverse negative effects, adaptation to minimize damage, or protecting ecosystems so that they can be passed on intact to future generations.

The impact of the law on reducing food waste on society is complex, of particular importance, which has as its primary purpose to reduce environmental pollution, increase consumer awareness and contribute to consumer food safety, first and foremost.

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⁸Art. 5 (1) Violation of the provisions of art. 3 constitutes a contravention, if it does not meet the conditions of a crime, and is sanctioned with a fine of 10,000 to 20,000 lei. (2) Violation of the obligation provided for in art. 2 para. (4) and (5) constitutes a contravention, if the constitutive elements of a crime are not met, and is sanctioned with a fine of 10,000 to 40,000 lei, after 6 months from the date of operation and use of the national platform that allows economic operators to electronically upload reports and plans to reduce food waste. Violation of the provisions of art. 2 para. (4) by economic operators that fall within the definition of micro and small enterprises, within the meaning of art. 4 para. (1) letters a) and b) of Law no. 346/2004 on stimulating the establishment and development of small and medium-sized enterprises, with subsequent amendments and completions.

⁹Art. 5 (3) The detection of contraventions and the application of sanctions are carried out by representatives of the Ministry of Agriculture and Rural Development, respectively of the National Sanitary, Veterinary and Food Safety Authority with control responsibilities in the agri-food sector.



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RESEARCH ON NATURAL DYES CHARACTERISTICS OF DYEING PLANTS

**Authors: Reader. dr. Daniela-Fănuța MIHĂILĂ, Lecturer dr. Florentina EREMIA,
Lecturer dr. Roxana MUNTEANU**

*Bioterra University of Bucharest, Faculty of Food Control and Expertise
mihaila_md_daniela@yahoo.com*

Abstract

This work analyzes characteristics, sources, extraction methods and the applications colors natural products of plant origin, with an emphasis on tradition Romanian textile dyeing- industry. The study highlights that, although colors synthetics have replaced largely those natural for economic reasons and practical, painting vegetable remains a practice valuable from a cultural, ecological and aesthetic. They are presented many plants dyeing local and exotic, the factors that influence quality color, as well as the advantages and limitation use colors natural. The work stresses revitalization potential of this practice in background sustainability. Vegetal natural dyeing is an essential component of intangible Romanian cultural heritage and a sustainable practice, aligned with the principles of circular economy.

Keywords: *natural dyes, plants dyeing, traditional dyeing, sustainability, cultural heritage, natural textile fibers.*

Introduction

Painting with materials naturally is one from the may old arts of humanity, with origins since the Neolithic.

In Romania, this tradition has crystallized in popular port and in ornament textiles, becoming a component essential part of cultural heritage. The emergence colors synthetics at the end the 19th century triggered a decline significant use colors vegetables, thanks to costs may small and the palette color may however, concerns contemporary for health, environment and recovery local traditions bring back in careful potential colors natural.

This work propose an overview on this field, systematizing knowledge about sources, properties, techniques and future prospects.

Material and methods

The research was based on an extension and integrative bibliographic analysis, which included:

- source historical and ethnographical Romanian (works by Ion Ionescu de la Brad, Simion Florea Marin);
- specialized works in field chemistry dyes, textiles and ethnobotanists;
- online sources (database, specialized websites, images);
- systematization and classification of over 30 plant species dyeing use in Romania and globally;
- process analysis of traditional technology (*harvesting, preparation, dyeing*).



Results and discussion

1. History and cultural context

Use colors natural is certificate archaeological from the Neolithic. In Romanian area, the tradition has origins from Geto-Dacians, exemplified by the representations on Trajan 's Column. Until the beginning of 20th century, the threads and fabrics (wool, cotton, silk) were dyed almost exclusively with dyes from vegetal, contributing to the chromaticity specific to folk costumes and carpets.

2. Classification of natural colors

They are classified by origin in: vegetable, animal (*ex: carmine*) and minerals.

The paper focuses on colorants of vegetal origin, which are obtained from different parts of plants.

Part of the plant	Examples of plants	Obtained colors	Main pigment
Leaf	Spinach, Tobacco	Green, Yellow	Chlorophyll
Flora	Rose, Hibiscus, Marshmallow	Pink, Red, Purple	Anthocyanins
Fruits	Blackberry, Blueberry, Elderberry	Blue, Purple, Black	Anthocyanins
Roots / Tubers	Beet tomato, Turmeric, Red mulberry	Red, Yellow, Red-Violet	Betalaine, Curcumin, Alizarin
Bark /Wood	Oak, Walnut, Alder	Yellow, Brown, Black	Tannins

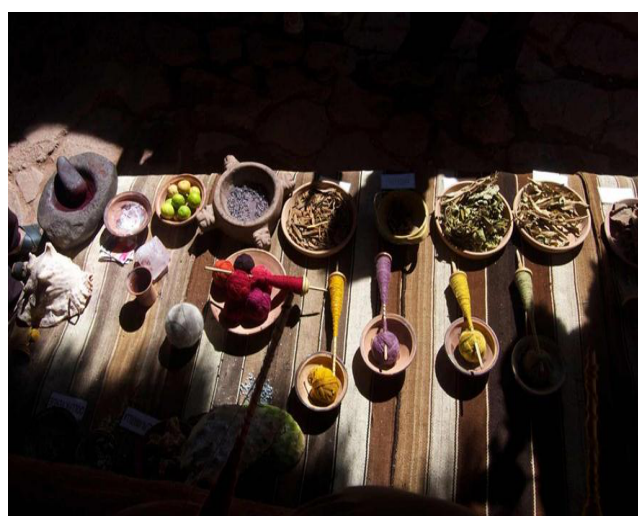


Fig1: Classification of vegetal dyes

3. Tinctorial Romanian plants

- **Rowan (*Rubia tinctorum*):** the most importance source of red.



Fig. 2: Rowan (*Rubia tinctorum*)

- **Red-bellied gorse (*Isatis tinctoria*):** source of natural indigo. The process of its obtaining is complex, involving fermentation of leaves.



Fig.3: *Isatis tinctoria*

- **Wild apple (*Malus sylvestris*):** Considered the "champion", offering a range wide from bright red to light yellow, in depending on the used part (flowers , leaves, roots).



Fig. 4: Wild apple (*Malus sylvestris*)

- **Other notable plants:** Troscot (*Polygonum aviculare*), Tobacco, Mallow, Alder, Horseradish (*Armoracia rusticana*), each with its own specific nuances.



Fig. 5: Tobacco (*Nicotiana tabacum*) and common cowslip (*Polygonum aviculare*)

4. Technology used

The process is complex and influenced by numerous factors:

1. **The role of water:** Must be light (minimum salts Ca/Mg) in order not to interfere with fixation of dye (could be used spring water, rain or fountain water).
2. **Preparation of the dye:**
 - Maceration: softening plant in water, at normal temperatures.
 - Decoction: boiling plants in water. Acidity (with vinegar) favors the extraction.
3. **Essential role of mordants:** substances (aluminum, iron, copper salts) that "fix" the dye to the fiber, increasing washing resistance. The same plant can give different colors using different mordants.
4. Influential critical factors: time of harvesting (related to the traditional calendar), part of the plant, quantity, duration of dyeing, temperature, pH of the dye bath.



5. Properties of vegetal dyes

Characteristic	Description	Examples & Impact
Solubility	Anthocyanins are soluble in water; chlorophylls are fat-soluble .	Determine medium extraction and application
pH sensitivity	Anthocyanins are red in acid, and blue in basic	Allows collection of colors shades from the same source .
Stability thermos	Chlorophylls and some Anthocyanins degrade in heat	Limitation for some industrial processes
Light stability	Variable, but generally lighter than synthetic dyes	Textile colors may fade in time.
Toxicity	Very reduced , recognized by the FDA and EFSA (e.g. E162 - beetroot , E100 - curcumin).	Allows use in foods, cosmetics, pharmaceuticals.

6. Applications

- Applications : Food industry (E100-E199), cosmetics (lipsticks) natural), pharmaceutical (coloring tablets), textiles (fashion - ecological).
- Advantages compared to synthetics : Biodegradability, safety for health, cultural value.
- Disadvantages: Higher costs, color pallet may be restricted, inferior stability to physicochemical agents.

7. Future prospects

- Research for improving stability
- Green Extraction technologies
- Circular Economy
- Market niches: Premium eco-fashion, eco- foods, "clean" cosmetics.

Conclusions:

- Vegetal natural dyeing is an essential component of intangible Romanian cultural heritage and a sustainable practice, aligned with the principles of circular economy;
- The process is laborious and influenced by many factors; their safety features and biodegradability provide a great potential in the current context;



- It is needed further applied research - are necessary investment in research to improve stability, intensity, as well as for documentation and keeping traditional Romanian customs.

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IMPORTANCE OF DIETARY FIBER IN REMOVING TOXINS FROM THE HUMAN BODY

Author: Lecturer dr. Florentina EREMIA

*University Bioterra of Bucharest,
Faculty of Food Control and Expertise
email: eremiaflorentina89@yahoo.com*

Abstract

In the context of modern society, characterized by an alert lifestyle and constant exposure to environmental pollutants and food additives, the body's ability to detoxify itself has become a central topic in preventive medicine. Although the human body has complex waste elimination systems (via the liver, kidneys, lungs and skin), their efficiency is often compromised by the typical Western diet. This is defined by an excessive intake of refined sugars, saturated fats and, critically, a major deficiency of dietary fiber. The World Health Organization (WHO) recommends a daily intake of 25-35 grams of fiber, but epidemiological studies show that the average consumption in developed countries is below 15 grams. This deficiency not only leads to transit disorders, but also profoundly affects the natural mechanisms of toxin purification. The present work aims to demonstrate that dietary fibers are not simple agents regulating intestinal transit, but essential bioactive elements that act through physical (adsorption), chemical (chelation) and biological (microbiome modulation) mechanisms to neutralize and eliminate xenobiotics and endogenous toxic metabolites.

Keywords: *foods, dietary fiber, nutrition, deficiency, daily intake*

Introduction

Dietary fiber is that part of edible plants (carbohydrates) that is resistant to digestion and absorption in the human small intestine, undergoing complete or partial fermentation in the large intestine. Chemically, these are non-starch polysaccharides (cellulose, hemicellulose, pectins, gums), oligosaccharides (inulin) and lignin.

The physicochemical property determining their role in detoxification is their solubility in water. Soluble fiber (fruit pectins, oat/legume gums, mucilages) dissolve in water, forming viscous solutions or gels.

The gel formed has a high capacity to sequester substances. It encapsulates secondary bile acids (potentially carcinogenic) and delays the absorption of sugar and fats into the blood, preventing metabolic shocks that generate oxidative stress.

Insoluble fiber (cellulose, lignin from wheat bran, fruit peels) do not dissolve in water, but have the ability to absorb it (hydrophilic), significantly increasing their volume.

It acts mechanically, like a "piston" or an intestinal broom. By increasing the volume of the fecal bolus, it stimulates peristalsis (contraction of the intestinal muscles) and reduces the time that toxic fecal matter stagnates in the colon.



The liver is the main detoxification unit, processing toxins and excreting them through bile into the intestine. Without fiber, up to 95% of bile acids are reabsorbed in the ileum and return to the liver (enterohepatic circulation), bringing toxins back into the body. Soluble fiber chemically binds to bile acids, forming insoluble complexes that are eliminated in the feces. This process forces the liver to synthesize new bile acids from circulating cholesterol, thus achieving a double detoxification: of the colon and the blood.

Material and methods

Chelation of Heavy Metals - environmental pollution introduces heavy metals (Lead, Mercury, Cadmium) into the food chain. In vitro studies have shown that certain fibers, especially pectin and alginates (from algae) have chemical groups (e.g. carboxyl groups) that can bind heavy metal ions, preventing their passage through the intestinal mucosa into the bloodstream.

Dilution Effect - the toxicity of a substance is concentration-dependent. Insoluble fiber, by drawing water into the colon, dilutes the concentration of carcinogens (such as nitrosamines) in the feces. A toxic substance diluted in a large volume of feces is less aggressive to the cells of the colon (colonocytes) than a substance concentrated in a small volume (specific to constipation).

Gut Microbiome – although historically the large intestine was considered merely an excretory organ, modern research has redefined it as an active metabolic organ, home to trillions of microorganisms (the microbiome). The relationship between the host and the microbiome is symbiotic, and the "exchange currency" is fiber. In the absence of fiber (prebiotics), the composition of the flora degrades (dysbiosis), transforming the intestine from a cleansing organ into a source of auto-intoxication.

Production of Short Chain Fatty Acids (SCFA) - soluble fibers are fermented by beneficial bacteria (*Bifidobacterium*, *Lactobacillus*), resulting in Short Chain Fatty Acids (SCFA): butyrate, acetate and propionate.

Butyrate and the Intestinal Barrier: butyrate is the main source of energy for colon cells. It maintains tight junctions between cells, preventing "leaky gut" syndrome. When the barrier is intact, bacterial toxins (LPS) and undigested food residues cannot pass into the bloodstream and are forced to be eliminated through stool.

pH Regulation and Inhibition of Rot - fiber fermentation lowers the pH of the colon (acidifies it).

This implies:

1. **Hostile environment for pathogens:** an acidic pH (5.5 – 6.5) inhibits the growth of putrefactive bacteria (e.g. *Clostridium*) that produce ammonia and toxic biogenic amines;
2. **Mineral solubility:** acidic environment favors the absorption of calcium and magnesium, but insolubilizes certain toxic substances, making them inert and easy to eliminate.

Impact on health - adequate fiber intake is directly correlated with a reduced incidence of colorectal cancer. The mechanism is twofold: reducing the contact time between the mucosa and toxins, and the antitumor effect of butyrate produced from fiber. Fiber also contributes to the elimination of excess estrogen, reducing the risk of hormone-dependent cancers.

Food Sources and Recommendations - the best sources combine both types of fiber:



- **Legume:** Beans, lentils, chickpeas (rich in resistant starch);
- **Whole grains:** oats, barley, rye;
- **Fruits and vegetables:** apples (with skin), berries, cruciferous vegetables (broccoli, cabbage).

The introduction of fiber must be accompanied by proper hydration (minimum 2L of water/day), otherwise the fiber can cause intestinal blockages.

Study Methodology

To exemplify the importance of fiber, a comparative observational study was conducted on two subjects (A and B), over a period of **30 days**.

- **Subject A:** Low-fiber diet (<10g/day), fast-food type.
- **Subject B:** Optimized diet (>30g/day), based on whole plants.
- **Monitored parameters:** Bowel transit time (food dye test or hourly monitoring), stool frequency, and general well-being.

Results and discussions

To highlight the major differences in nutritional intake that influence detoxification capacity, we present the comparative menu in Table 1.

Table 1: Comparative Analysis of 24-Hour Fiber Intake

Mass	Subject A (Deficiency Diet)	Fiber (g)	Subject B (Optimized Diet)	Fiber (g)
Breakfast	Coffee + Chocolate Croissant	0.5	Oatmeal (50g) + Blueberries + Flax Seeds	6.5
Snack 1	Salty biscuits	0.2	One medium apple with peel	4.4
Lunch	Pasta carbonara (white flour)	1.5	Lentil stew with vegetables + Brown rice	11.0
Snack 2	Milk chocolate	0.0	Greek yogurt + Nuts (20g)	2.0
Dinner	Pizza (2 slices)	1.0	Large salad (spinach, tomatoes) + Fish	5.5
DAILY TOTAL	Toxic Diet	~3.2g	Detoxifying Diet	~29.4g

Observation: Subject A achieves only 10% of the daily requirement, which leads to stagnation of waste.

Transit time is the amount of time it takes for food to travel through the digestive tract.



The longer this time, the greater the exposure to toxins (putrefaction).

Intestinal Transit Time (Hours)

- **Subject A (No Fiber):** 72 hours (3 days)
- **Subject B (With fibers):** 24 hours (1 day)
- **Average healthy population:** 24-48 hours

Interpretation - Subject A retains the waste 3 times longer than Subject B. During this additional 48 hours, putrefactive bacteria generate ammonia and skatole, which are reabsorbed into the blood, explaining the chronic fatigue reported by Subject A.

Case Study Results

At the end of the 30 days:

- **Subject A:** He reported ongoing constipation, severe bloating, and a flushed complexion. The Bristol scale indicated type 1-2 (hard stools).
- **Subject B:** He reported normalization of bowel movements (1 stool/day), disappearance of the feeling of heaviness, and improvement in skin appearance. The Bristol scale indicated type 4 (optimal).

Conclusions

The study and the analysis of the specialized literature confirm the hypothesis that dietary fibers are indispensable for the detoxification process. They do not act through a single mechanism, but synergistically:

1. **Mechanical:** They reduce transit time, preventing the reabsorption of toxins (demonstrated by the difference of 72h vs 24h).
2. **Chemical:** Sequesters heavy metals and bile acids.
3. **Metabolic:** They nourish the microbiome, which maintains the integrity of the intestinal barrier.

In conclusion, "detoxification" does not require expensive commercial products, but a return to a diet rich in whole plant fibers.

The complex analysis of the role of dietary fiber in human physiology, carried out during this work, allows the formulation of broad conclusions, which go beyond the simplistic vision of regulating intestinal transit. We can summarize the importance of fiber in the detoxification process through the following six major directions:

1. Scientific Validation of the Concept of "Detoxification"

The term "detoxification" is often misused in the marketing of natural products. However, this paper demonstrates that detoxification is a real and ongoing physiological process, not an occasional "cure". Dietary fiber is the only sustainable natural mechanism by which the body can be assisted in this process. Unlike liquid diets or drastic supplements that can destabilize metabolism, a constant intake of fiber provides logistical support for the liver and kidneys, without depriving the body of nutrients. We conclude that a high-fiber diet transforms detoxification from an acute event into a state of metabolic normality (homeostasis).

2. The Microbiome as a Partner in Immunity and Protection

One of the most important conclusions of recent studies is the paradigm shift: fiber does not only nourish the human body (indirectly), but is the vital substrate for the microbiome. A healthy



bacterial population, nourished by prebiotics (fiber), functions as a biological barrier against toxins. Without fiber, the intestinal barrier breaks down (intestinal permeability), allowing toxins and pathogens to migrate into the circulatory system. Thus, fiber is the first line of defense of the immune system, preventing chronic systemic inflammation, which is the basis of most modern diseases.

3. The Direct Correlation Between Speed and Toxicity

The case study presented in Chapter 6 highlighted a mathematical reality: the risk of self-poisoning is directly proportional to transit time.

A slow transit (over 48 hours), specific to low-fiber diets, transforms the colon into a putrefaction bioreactor, generating carcinogenic compounds (ammonia, phenols).

A rapid transit (under 24 hours) induced by fiber minimizes the time window in which the colonic mucosa is exposed to these aggressive agents. Therefore, fiber acts as an oncological protective factor by simply reducing the time of exposure to carcinogens.

4. Impact on Metabolic Diseases (Metabolic Syndrome)

Fiber-mediated detoxification has profound implications on glycemia and lipemia. By binding cholesterol and excess sugar in the gelatinous matrix formed in the intestine, soluble fibers prevent overloading the pancreas and liver. We conclude that the reintroduction of fibers into the diet is a mandatory therapeutic measure, not just an adjuvant, in the treatment of type 2 diabetes, obesity and hypercholesterolemia. They cleanse the blood of excess energy substrate which, not being consumed, becomes toxic (through glycation and atherosclerosis).

5. Economic and Public Health Aspect

Beyond the individual benefits, the lack of fiber in the diet is a public health problem. The costs of treating diseases caused by a "toxicogenic" diet (colorectal cancer, cardiovascular disease, diverticulitis) are immense. Nutritional education focused on returning to whole foods (legumes, cereals, fruits) is the most effective and inexpensive method of prevention. Fiber is accessible to anyone, regardless of socioeconomic status, unlike complex medical procedures to treat diseases resulting from its deficiency.

6. The Need for Hydration

A critical, often overlooked conclusion is the interdependence between fibers and water. Fibers are hydrophilic; they only function in the presence of water.

With water: The fibers swell, clean, lubricate.

Without water: Fibers cement together, blocking transit and aggravating toxicity. Thus, the recommendation to increase fiber intake must necessarily be accompanied by a hydration protocol (minimum 30-35 ml of water/kg body weight).

In light of all the evidence presented, we can say that dietary fiber is the body's "metabolic broom." In an increasingly chemically polluted world, our ability to eliminate toxins depends fundamentally on what we put on our plate. Returning to a plant-rich diet is not a trend, but a biological necessity for the survival and optimal functioning of the human body.



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THE ROLE OF SPECIALIZED LABORATORY ANALYSES IN THE MANAGEMENT OF THE QUALITY AND KEEPING CONDITION OF CORN DURING STORAGE

Authors: *Lecturer dr. Roxana MUNTEANU, Lecturer dr. Florentina EREMIA*

Bioterra University of Bucharest, Faculty of Food Control and Expertise

munteanu.roxana73@gmail.com

Abstract

The quality of corn after harvest is a dynamic parameter, subject to continuous biochemical and microbiological processes that can lead to rapid depreciation of its value under inadequate storage conditions. While standard analyses upon receipt (moisture, impurities) establish a starting point, they are insufficient for preventive risk management during storage. This paper aims to present and validate a specific set of advanced laboratory analyses, designed to monitor the latent state of corn in storage. The study focuses on indicators such as the Free Acidity Index (FAA) – marker of lipid degradation and incipient rancidity, Water Activity (a_w) – key determinant of microbiological stability, the population of thermogenic germs – predictor of the risk of spontaneous heating, and the evolution of the mycotoxin profile – indicator of secondary contamination. By presenting a concrete case study with monthly monitoring data, the paper demonstrates how these analyses allow the detection of spoilage processes 4-6 weeks in advance, before they become visible or irreversible. The fundamental conclusion is that the integration of these specific analyses into a systematic control program represents the shift from reactive to predictive and data-driven management, essential for minimizing losses, ensuring food safety and maximizing profit in the corn value chain.

Keywords: *laboratory analysis of stored corn, free acidity index (FAA), water activity (a_w), thermogenic germs, mycotoxins, predictive monitoring, biochemical profile, preventive management.*

Introduction

Maize (*Zea mays* L.) is one of the most important cereals worldwide, with diverse uses in human food, animal feed and the processing industry. Its economic value is directly proportional to its quality, which is not static after harvest. The storage period, which can vary from a few months to over a year, is a critical phase in which complex interactions between the grain substrate, humidity, temperature, oxygen and associated microflora can lead to significant qualitative and quantitative losses (Christensen & Kaufmann, 1969). These processes include rancidity, spontaneous heating, proliferation of storage fungi and the production of mycotoxins. Conventional landfill management relies heavily on monitoring interstitial air temperature and humidity. While these parameters are useful, they are often late indicators, reflecting already advanced degradation processes.



For effective and preventive intervention, it is necessary to understand and measure the incipient biochemical and microbiological processes underlying these phenomena.

The purpose of this paper is to define, describe and argue the utility of an integrated package of specialized laboratory analyses, explicitly dedicated to the evaluation of the conservation status of corn during storage. The specific objectives are: (1) identification of the analytical parameters with the highest predictive value (FAA, aw, thermogenic germs); (2) their methodological description and the practical significance of the results; (3) presentation of a case study illustrating the application and impact of these analyses in the operational management of a warehouse; (4) formulation of recommendations for the implementation of a preventive monitoring program.

Material and method

1. A systematic review of the literature was provided to select the most relevant analytical methods, followed by their application and interpretation in the context of monitoring a real corn lot.

2. Monitored Lot:

- **Species:** Hybrid corn of the dentate type.
- **Harvest:** October 2023.
- **Storage conditions:** Vertical steel silo, capacity 500 tons.
- **Critical initial parameter:** Humidity at loading: 14.2% (maximum recommended threshold for medium-term storage).

2. Applied Analysis Methods:

Samples (1 kg each) were taken monthly, aseptically, from two strategic points: the center of the grain mass and the upper area, approximately 1 m below the surface.

Table 1

Analytical Group	Parameter	Method/Standard	Frequency	Equipment
Physicochemical	Moisture	SR EN ISO 712:2010 (Oven)	Monthly	Drying oven
	Water Activity (aw)	Hygrometric sensor method	Monthly	Aw-meter (Aqualab 4TE)
	Free Acidity Index (FAA)	AACC 02-01.02 (modified)	Monthly	Extraction bath, automatic titrator



Analytical Group	Parameter	Method/Standard	Frequency	Equipment
Microbiological	Thermogenic Germs Number	Plating on PDA, incubation at 45°C, 5 days	Monthly	Thermostatic incubator, sterility hood
	Total Mold Count	SR EN ISO 21527-1:2008	Monthly	Selective culture media
Food Safety	Screening Mycotoxins (DON, ZEA)	Enzyme-linked immunosorbent assay (ELISA)	Monthly	ELISA plate reader
	Mycotoxin Profile (Aflatoxins, OTA)	Liquid Chromatography with Mass Spectrometry (LC-MS/MS)	Confirmation after alarm	LC-MS/MS (UPLC-QToF)
Support	Mass temperature	Thermal probe with recorder	continuously	Thermo-couple probe, datalogger

4. Action thresholds (Defined based on literature and experience):

- **FAA:** Increase >80% from input value = Major alarm.
- **aw:** Values >0.70 = Increased microbiological risk.
- **Thermogenic Germs:** Increase >10x between two consecutive measurements = Latent Heating Alert.
- **Temperature:** Difference >5°C from ambient temperature = Intervention required.

Results and discussion

1. Dynamics of Integrated Monitoring and Interpretation Parameters

The data collected over three months of storage for the "at-risk" corn batch are summarized in the table below and commented on in an integrated manner.



Table 2: Results of corn batch monitoring analyses

Period (month of storage)	Analyzed parameter	Result obtained	Interpretation and recommended action
Input (M0)	Moisture	14.2%	Lot classified as "Medium Risk" Requires intensive monitoring
	Mycotoxin screening (DON, ZEA)	Negative	According to the reception
	Free acidity (FAA)	18 mg KOH/100g	Base value, within normal limits for freshly harvested corn.
	Water activity (aw)	0.68	Close to the critical threshold of 0.70. Watch out for condensation.
	Thermogenic Germs	50 CFU/g	Normal, insignificant population.
	Temperature (center)	16°C (ambient 15°C)	Minor difference (1°C).
	Thermogenic Germs	1,200 CFU/g	MAJOR ALARM. Population explosion (<i>24 times</i>). Confirms heat-generating microbiological activity.
	Temperature (center)	18°C (ambient 15°C)	Increased difference to 3°C, confirming latent heating.
Month 3 (M3) <i>(Post-intervention)</i>	Mycotoxin Profile (LC-MS/MS)	Aflatoxin B1: 3.2 µg/kg Ochratoxin A: <LOD	Confirmation of secondary contamination. Detection of active <i>Aspergillus flavus</i> . The value is below the EU legal limit (5 µg/kg) but demonstrates the presence of the outbreak.
	FAA (after airing)	38 mg KOH/100g	Growth has stopped. The value remains high, the degradation has been stopped, not reversed.
	aw (after aeration)	0.66	Reduced to a safe level by surface drying induced by ventilation.



Period (month of storage)	Analyzed parameter	Result obtained	Interpretation and recommended action
	Temperature (center)	16°C (ambient 16°C)	Normalized after ventilation.

Results and Discussion

A. FAA – First Indicator of Biochemical Degradation:

The results demonstrate that FAA is the most sensitive biochemical indicator. Its increase from 18 to 35 mg KOH/100g in two months signaled an accelerated hydrolysis of triglycerides in the germ, releasing free fatty acids – the core of the rancidity process (White & Jayas, 2001). This change was detected before the appearance of any perceptible odor. The action threshold of +80% proved effective in triggering timely intervention. The FAA value remaining high after aeration underlines the irreversible nature of lipid degradation – the process can be stopped, but the nutritional quality (energy value) is already affected.

B. aw and Thermogenic Germs – The Predictive Duo of Microbiological Stability:

The stability of **aw** at 0.68 in the first month explained why the microbiological activity was reduced. Exceeding the threshold of 0.70 in the second month created ideal physical conditions for the proliferation of microflora. This was immediately confirmed by the explosion of the population of thermogenic germs (from 50 to 1200 CFU/g). These microbes, in particular certain species of *Aspergillus* and actinomycetes, have a strongly exothermic metabolism (Fleurat-Lessard, 2017). Their direct measurement provides a quantitative and specific warning long before the heat generated by them is detectable in the entire mass of cereals. The combination of **aw** >0.70 + exponential growth of thermogenic germs is an infallible diagnostic signal of the start of a spontaneous heating process.

C. Confirmation by Safety Analysis – Mycotoxin Profile:

The detection of aflatoxin B1 in the third month sample, given that the incoming screening had been negative, is indisputable evidence of secondary contamination in the warehouse. *Aspergillus flavus*, a thermotolerant and toxigenic fungus, found growth conditions in the “hot spot” indicated by the other parameters. This result emphasizes that mycotoxin monitoring should not be limited to reception; warehouse processes can generate new food safety hazards (Magan & Aldred, 2007). The value below the limit still allowed the batch to be used, but confirmed the correctness of the decision to evacuate it quickly.



D. Corrective Action and System Efficiency:

The alarm triggered at M2 allowed a rapid intervention: forced ventilation for 72 hours. This had three effects: (1) it reduced a_w below the critical threshold, (2) it stopped the temperature increase by evacuating heat and (3) it froze the microbiological activity. The system worked predictively: it identified the problem when it was still biochemical and microbiological localized, not thermal and extensive. The cost of the analyses (approximately 150-200 EUR for the entire program on this batch) was insignificant compared to the value of the 500 tons of corn saved and the potential total losses or penalties.

Conclusions

1. Corn quality management in storage requires a distinct and specialized set of laboratory analyses, different from that at reception, focused on process indicators with high predictive value.
2. The Free Acidity Index (FAA) has proven to be the most sensitive biochemical marker for early detection of spoilage and rancidity, providing a significant time advantage for intervention.
3. Combined monitoring of Water Activity (a_w) and the population of thermogenic germs is the most effective method to anticipate the risk of spontaneous heating and take corrective measures before the phenomenon occurs.
4. Periodic mycotoxin profiling (LC-MS/MS) is essential to detect secondary contamination in the warehouse, ensuring ongoing compliance with food safety legislation.
5. Implementing a structured program based on these parameters (e.g. monthly analyses for at-risk lots, bimonthly for stable ones) transforms the warehouse from a passive storage space into an active unit of intelligent value preservation, leading to substantial reductions in post-harvest losses.
6. Future vision: Integrating laboratory data with IoT sensor data (temperature, relative humidity) into a software platform with artificial intelligence algorithms could allow for automatic forecasting of batch status and generation of operational recommendations in real time.

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RATIONAL NUTRITION - FUNDAMENTAL PILLAR OF HUMAN HEALTH AND METABOLIC PREVENTION

Lecturer. Dr. Florentina EREMIA
*Bioterra University of Bucharest,
Faculty of Food Control and Expertise
e-mail: eremiasflorentina89@yahoo.com*

Abstract

Rational nutrition is more than just the act of eating to satisfy hunger; it is the science of providing the body with exactly what it needs to function optimally. The term "rational" comes from the Latin ratio (thought, calculation), suggesting that the act of eating should be conscious, not instinctual or governed solely by pleasure.

Proper nutrition ensures physical growth and development, maintains work capacity, contributes to mental well-being and, most importantly, prevents degenerative diseases. The human body is an open system that exchanges matter and energy with the environment, and food is the main source of input.

Keywords: *rational nutrition, calculation of energy needs, matter and energy*

Introduction

In the 21st century, the nutritional paradox is evident: although we have unlimited access to food, the population suffers from qualitative malnutrition. Obesity coexists with vitamin deficiencies. The transition from traditional nutrition, based on natural products, to industrialized nutrition, rich in calories but poor in nutrients, has led to the explosion of civilization diseases: type 2 diabetes, hypertension and cardiovascular diseases. This paper aims to analyze the mechanisms by which a return to a rational diet can reverse these trends.

Material and Method

The present paper is structured as a mixed study, including a documentary research of recent specialized literature and an observational and interventional case study on an adult human subject, with the aim of demonstrating the effectiveness of the transition from disordered to rational eating. To develop the theoretical basis, three main categories of materials were analyzed:

1. Official Guides: World Health Organization (WHO) reports on the consumption of sugars, fats and iodized salt (published in 2023).

2. Nutrition Treatises: Nutrition and dietetic compendiums, food composition tables (for determining macronutrient values).



3. Research Subject: For the practical part, the study material was represented by the subject "Andrei M.", male, age 35, urban environment, with sedentary professional activity.

Research methodology - to analyze the nutritional status and develop the dietary plan, the following specific methods, recognized in international dietetic practice, were used:

Results and discussion

Basal Metabolism (BMR) - to understand how much we should eat, we need to understand how we use energy. Basal metabolism is the minimum amount of energy the body needs to survive at rest (heart, lungs, brain, kidneys functioning). It consumes approximately 60-70% of total daily calories.

The factors that influence MB are:

- Age: It decreases with age (loss of muscle mass).
- Gender: Men generally have a higher MB due to their greater muscle mass.
- Body composition: Muscle burns more calories than fat tissue, even at rest.

Energy Balance - The fundamental formula for body weight is simple:

$$\Delta E = E_{\text{input}} - E_{\text{output}}$$

Where In represents calories from food, and Out represents energy expenditure (MB + food thermogenesis + physical activity). Rational nutrition involves a caloric balance (isocaloric) for a healthy adult, or a slight controlled caloric deficit for those who want to lose weight, without depriving the body of essential nutrients.

Macronutrients – Fuel and Structure

Macronutrients are substances that the body needs in large quantities (tens or hundreds of grams daily).

Proteins – The "Bricks" of the Body - are essential for cell structure, enzymes, hormones, and antibodies. They are made up of chains of amino acids. There are 20 amino acids, 9 of which are essential (the body cannot produce them and must be obtained through diet).

- Animal sources (complete proteins): Meat, eggs, dairy, fish – contain all the essential amino acids.
- Plant sources (incomplete proteins): Beans, lentils, nuts, grains. Vegans need to combine sources (e.g. rice with beans) to get a complete amino acid profile.
- Recommendation: 10-15% of total caloric intake, or approx. 0.8 - 1g protein / kg body weight.

Lipids (Fats) – The Energy Reservoir- Although demonized in the past, fats are vital for the absorption of fat-soluble vitamins (A, D, E, K) and for brain function.

- "Good" fats (Unsaturated): Omega-3 and Omega-6. Found in olive oil, avocado, fatty fish (salmon), flax seeds. They have an anti-inflammatory and cardiovascular protective role.
- "Bad" fats (Saturated and Trans): Saturated fats (from fatty meats, butter) should be consumed in moderation. Trans fats (industrial margarine, baked goods) are toxic and should be eliminated completely, as they are directly linked to the risk of atherosclerosis.



- Recommendation: 25-30% of caloric intake.

Carbohydrates – Primary Source of Energy - They are the body's favorite "gasoline", especially the brain's.

- Simple (fast) carbohydrates: Sugar, honey, very sweet fruits, white flour. They are absorbed quickly, increase blood sugar levels suddenly and cause large insulin releases. They should be limited.
- Complex carbohydrates (slow): whole grains, brown rice, vegetables, legumes. They contain fiber, are slowly digested and provide constant energy over 3-4 hours.
- Dietary fiber: although they are indigestible carbohydrates, they are crucial for intestinal transit and cholesterol reduction.
- Recommendation: 50-55% of caloric intake, with an emphasis on complex ones.

Micronutrients – Vitamins and Minerals

Although necessary in tiny quantities (milligrams or micrograms), their lack leads to serious diseases (scurvy, anemia, rickets).

Vitamins

- Water-soluble (C and B complex): It is not stored in the body (excess is eliminated in the urine), so it must be supplied daily through diet. Fresh fruits and vegetables are the main source. Heat treatment destroys much of the vitamin C.
- Fat-soluble (A, D, E, K): It is stored in the liver and adipose tissue. Vitamin D is unique in that it is also synthesized through sun exposure.

Minerals

- Calcium and Phosphorus: Essential for the skeletal system.
- Iron: Vital for the transport of oxygen in the blood (hemoglobin). Iron from animal sources (heme) is better absorbed than plant-based iron.
- Magnesium: Involved in over 300 enzymatic reactions and in muscle relaxation.
- Sodium and Potassium: They regulate water balance and blood pressure. The modern diet has an excess of sodium (salt) and a deficiency of potassium.

Hydration

Water makes up approximately 60-70% of an adult's body mass. It is the reaction medium for biochemical processes, regulates body temperature (through sweating) and eliminates toxins. The feeling of thirst is already a late signal of dehydration. A loss of just 2% of water leads to a decrease in concentration and physical performance.

Hydration rules:

1. Consumption of 30-35 ml of water/kg body weight.
2. Avoiding sweetened drinks that dehydrate (through diuretic and osmotic effects).
3. Water should be drunk constantly throughout the day, not just at meals.

Practical Principles of Menu Planning

Food Pyramid - It is a visual guide that illustrates the proportions:

- Base: Physical activity and hydration.



- Level 1: Whole grains, vegetables, fruits (daily, abundant consumption).
- Level 2: Healthy vegetable oils, nuts.
- Level 3: Dairy, fish, poultry (moderate portions).
- The peak: Red meat, sweets, white rice, potatoes (occasional consumption).

The "Healthy Plate" Model (Harvard) A simple way to visualize a correct table:

- 1/2 of the plate: Vegetables and fruits (varied in color). Potatoes are not included in the vegetables due to their impact on blood sugar.
- 1/4 of the plate: Whole grains (whole wheat, barley, quinoa, oats).
- 1/4 of the plate: Healthy proteins (fish, chicken, legumes).

Eating Behavior and Meal Rhythm

Rational nutrition emphasizes how we eat.

- **Breakfast:** It's the metabolic "starter." Studies show that people who skip breakfast have a higher risk of obesity because they tend to compensate for calories in the evening.
- **Meal frequency:** 3 main meals and 2 snacks are recommended. This rhythm keeps blood sugar constant, preventing lethargy and acute hunger that leads to poor food choices.
- **Slow chewing:** It takes about 20 minutes for the brain to receive the satiety signal from the stomach. Eating quickly inevitably leads to overeating.

Modern Errors – Ultra-Processed Foods

Ultra-processed foods are industrial formulations that contain additives, colorings, preservatives, and flavor enhancers. Hidden dangers:

- **Added sugar:** It is present in sauces, bread, fruit yogurts, not just sweets. It is the main cause of metabolic syndrome.
- **High caloric density:** A burger with fries can contain the calorie requirement for an entire day, but without micronutrients (vitamins). This is the concept of "empty calories."

Peculiarities (Age and Effort)

Nutrition is not a "one-size-fits-all" measure.

- **Children and Adolescents:** They need a higher protein and calorie intake per weight to support accelerated growth and cognitive development. Calcium is critical.
- **Sedentary adults:** They need to reduce their caloric intake and focus on nutrient density to prevent weight gain.
- **Athletes:** They need a surplus of carbohydrates to replenish glycogen reserves and protein to rebuild muscle fiber.
- **Elderly:** Metabolism slows down, nutrient absorption decreases. They need easily digestible foods, rich in fiber and quality protein.

Anthropometric Assessment

Physical measurements were taken to determine body composition:

- **Weight (G):** Measured in the morning, on an empty stomach.



- Height (H): Measured with a thalimeter.
- Body Mass Index (BMI):

The standard Quetelet formula was used:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

The interpretation of the results was done according to WHO criteria:

18.5 – 24.9: Normal weight

25.0– 29.9: Overweight

30.0: Obesity

Calculating Energy Needs (Metabolism)

To establish a personalized and rational diet, generic values (like "2000 kcal") were not used, but precise metabolic formulas were applied.

A. Basal Metabolic Rate (BMR)

The Mifflin-St Jeor equation was chosen, currently considered the most accurate for overweight and obese people, having a smaller margin of error than the classic Harris-Benedict formula.

- *Formula for men:* $\text{RMB} = (10 \times G) + (6.25 \times H) - (5 \times V) + 5$
- *Formula for women:* $\text{RMB} = (10 \times G) + (6.25 \times H) - (5 \times V) - 161$

(Where G=weight, H=height in cm, V=age).

B. Total Energy Requirement (TDEE)

The RMB value was adjusted with the Physical Activity Level (PAL). For the study subject (office work, no sports), the coefficient of 1.2 (sedentary) was applied.

Monitoring and Planning Tools

To structure the rational menu, the following were used:

- **The "Healthy Plate" Model (Harvard Medical School):** As a visual nutritional education tool for the patient, replacing strict weighing of food with visual estimation of portions (1/2 vegetables, 1/4 protein, 1/4 carbohydrates).
- **Nutritional databases:** (Ex: USDA Food Data Central) to verify the caloric content of processed foods consumed by the subject in the initial phase.



Case Study – Transition from Disordered Eating to Rational Eating

To illustrate the concrete impact of the theoretical principles presented in the previous chapters, we will analyze the profile of a typical subject for the active but sedentary urban population and design a nutritional intervention based on rational nutrition.

Subject Profile

- Name: Andrei M.
- Age: 35 years old
- Occupation: IT Programmer (predominantly office work, high sedentary lifestyle).
- Anthropometric data: Height 1.80m, Weight 95 kg.
- Historical: He complains of chronic fatigue in the afternoon, difficult digestion, and constant weight gain over the last 3 years.

Initial Assessment

A. Calculating Body Mass Index (BMI)

The first step in assessing nutritional status is calculating BMI:

$$\text{BMI} = \frac{\text{Weight(kg)}}{\text{Height(m)}^2} = \frac{95}{1.80^2} = \frac{95}{3.24} = 29.3$$

Interpretation: A BMI of 29.3 places the subject in the Overweight category, at the upper limit of Grade I Obesity. The risk of cardiovascular disease and type 2 diabetes is high.

B. Current Diet Analysis (Dietary History)

Following 3-day monitoring, the following average dietary pattern ("Modern Style") was established:

- Breakfast: Frequent skipping (only coffee with sugar).
- Lunch (1:00 p.m.): Fast food order (burger/shawarma/pizza) + carbonated drink (500ml).
- Snacks: Processed pastries or sweets, consumed under stress at the office.
- Dinner (9:00 PM): A hearty meal (pasta, fried meat), consumed quickly in front of the TV.

Identified deficiencies:

1. Excessive caloric intake: Approx. 3200 kcal/day (much more than necessary).
2. Chaotic distribution: Massive calorie intake in the evening, when metabolism slows down.
3. Nutritional quality: Excess saturated and trans fats, excess simple sugar, chronic lack of fiber (vegetables, fruits).



Results and discussion

- ***Rational Food Planning***

To correct these problems, we will calculate the subject's actual energy needs, using the Mifflin-St Jeor formula (considered the gold standard in current clinical nutrition).

Step 1: Calculating Basal Metabolic Rate (BMR)

This represents the energy needed just to keep the body alive (breathing, brain function).

$$RMB = (10 \times G) + (6.25 \times H) - (5 \times V) + 5$$

$$RMB = (10 \times 95) + (6.25 \times 180) - (5 \times 35) + 5$$

$$RMB = 950 + 1125 - 175 + 5 = 1905 \text{ kcal/day}$$

Step 2: Calculating Total Energy Requirement (TDEE)

Since Andrei is sedentary, we multiply RMB by the activity factor 1.2.

$$TDEE = 1905 \times 1.2 = 2286 \text{ kcal/day}$$

Step 3: Setting Your Calorie Target

To lose weight at a healthy and sustainable pace (without affecting muscle mass), we apply a moderate calorie deficit of 500 kcal.

$$\text{Daily Target: } 2286 - 500 = \mathbf{1786 \text{ kcal}} \text{ (rounded to 1800 kcal).}$$

- ***Implementing the Rational Menu (Practical Example)***

Based on the target of 1800 kcal, we structure the menu respecting the proportions of macronutrients: 50% Complex Carbohydrates, 25% Proteins, 25% Lipids.

Mass	Menu Composition	Nutritional Reasoning (Why?)
Breakfast (08:00)	Porridge: 50g oatmeal cooked in water/vegetable milk, 100g berries, 10 almonds.	The oats provide slow-release carbohydrates (steady energy). The fruit provides antioxidants, and the almonds provide healthy fats that keep hunger at bay.



Mass	Menu Composition	Nutritional Reasoning (Why?)
Snack 1 (11:00)	Greek yogurt (2%)+ 1 apple.	Protein and calcium intake. Apples provide pectin (fiber) that regulates blood sugar.
Lunch (2:00 PM)	"The Ideal Plate":150g grilled chicken breast + 150g baked sweet potato + Large cabbage/carrot salad with 1 tablespoon olive oil.	Follow the volume rule: salad fills the stomach with few calories. Lean protein maintains muscle mass.
Snack 2 (5:00 PM)	2 Raw carrots Cut into sticks (or a bell pepper).	The need to "nibble" under stress is satisfied with a crunchy, yet low-calorie food.
Dinner (7:30 PM)	White fish (cod/trout) in the oven with sautéed green vegetables (broccoli/green beans).	A light meal, rich in easily digestible proteins. The lack of heavy carbohydrates in the evening promotes fat burning during sleep.

Comparative Analysis and Results

In the table below we compare the nutritional parameters between the old diet and the proposed rational one:

Parameter	The Old ("Modern") Diet	Rational Nutrition (Proposed)	Difference / Impact
Total Calories	~3200 kcal	1800 kcal	Caloric deficit necessary for weight loss.
Added Sugar	> 80g (approx. 20 teaspoons)	< 15g (natural, from fruit)	Drastically reduces the risk of diabetes.



Parameter	The Old ("Modern") Diet	Rational Nutrition (Proposed)	Difference / Impact
fiber	< 10g	> 30g	It improves digestion and reduces cholesterol.
FATS	Mostly Saturated/Trans	Predominantly Unsaturated (Omega 3, 6)	Cardiovascular protection.
Energy Level	Fluctuating (peaks and dips)	Constantly throughout the day	Increases productivity at work.

Conclusions

By simply reorganizing his meals and replacing processed foods with whole foods, subject Andrei M. can lose about 0.5 kg of pure fat per week. Furthermore, eliminating the "glycemic spikes" caused by sweets will eliminate afternoon fatigue.

This study demonstrates that rational nutrition is not a restrictive diet (the subject eats 5 times a day), but one based on nutritional density, not calories.

Rational nutrition is, in essence, an act of respect for one's own body. There are no "miracle" foods or "forbidden" foods, only right and wrong proportions. The transition to a rational diet should not be a sudden, traumatic change, but an ongoing educational process.

Investing in food quality is the safest investment in long-term health, reducing medical costs and improving quality of life into old age. Nutrition education should become a priority, starting in schools and continuing into adult life.

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