POSTER WEEK

Poster Week 23/2025

ABSTRACT BOOK

7th – 11th April 2025

estesc
Politécnico de Coimbra

PEDAGOGICAL-SCIENTIFIC COMITEE

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Calendário

Poster Week 23/2025

	2ªf	3ªf	4ªf	5ªf	6ªf
	07/abr	08/abr	09/abr	10/abr	11/abr
8-9h					
9-10h			Anatomia Patológica Sistemática II CBL 2º 9P Diana Martins Aud. João Gil	Higiene do Trabalho SA 3º 1P Hélder Simões L1.11	
10-11h		Certificação da Qualidade Alimentar SA 1º 2P Cristina Santos S. 3.11			
11-12h	Neurofisiologia FC 1º 11P Joana Soares Aud. 3.3	Eletrocardiologia II FC 2º 12P Joaquim Pereira S. 2.10			Genética e Epigenética DN 3º 2P Célia Gomes Praça dos Estudantes
12-13h	Tecnologia e Farmácia Galénica I Farm.1º 9P Balteiro S.2.8				
13-14h					
14-15h			Política Nutricional DN 3º 7P J Lima Anf. A.01		
15-16h		Tecnologias de Reabilitação Auditiva Audio 2º 4P Carla Matos S. Zaida Chieira			
16-17h					
17-18h			Imunohemoterapia Clínico-Laboratorial I CBL 2º 9P F. Mendes S.1.3		
18-19h					
19-20h					

LINKS TO POSTER FOLDERS

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23.2	Technology and Galenic Pharmacy I	1st	Pharmacy	https://photos.app.goo.gl/BycBLhCyxcUuUgNi9
23.3	Food Quality Certification	3th	Environmental Health	https://photos.app.goo.gl/44te9o9fBkQh6MxQ7
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ABSTRACTS

HOW ADDICTION TO SCREENS AFFECTS THE SLEEP

Ailton Tavares, Beatriz Nunes, Carolina Guerreiro, Letícia Bulhões

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Introduction: Currently we face a global problem where the addiction to electronic devices is increasing.Excessive exposure to screen light affects sleep from newborns to adult individuals, even at low intensity,this suppresses the release of the sleep-promoting hormone, melatonin, and changes the circadian cycleto a later time, both of which make it harder to fall asleep.
Methods and materials: Studies analyzed the sleep of 1543 children aged 0-18 months, 1559 university Chinese students aged 17-27 years, and 12 young healthy adults. In these three studies, the duration and quality of sleep was evaluated after subjects were exposed to screens during the day and near bedtime.
Results: In the early stages of life, one hour of screen exposure before sleep is associated with areduction of approximately eight minutes of sleep and a shift from nocturnal to daytime sleep. Studies conducted among university students have demonstrated that social media addiction is strongly correlated with emotional disturbances, which in turn adversely affect sleep quality. Additionally, it was observed that young adults who read on e-books took longer to fall asleep, experienced increased nocturnal drowsiness, and exhibited reduced melatonin secretion compared to those who read printed books.
Discussion/Conclusion: Excessive use of electronic devices is significantly associated with reduced sleep quality and duration, with adolescents being the most vulnerable group. This effect is primarily attributable to prolonged light exposure, which disrupts melatonin secretion, leading to changes in the circadian cycle, impacting other physiological functions.

Keywords: Screen addiction, sleep quality, circadian rhythm, neurobiology, melatonin

BRAIN AGING

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The gut-brain axis and neuroplasticity are becoming important mechanisms that link environmental factors to brain health and disease. The objective of this study is to bring together findings from different aspects of neuroscience: 1) the link between gut microbiota composition and brain structure/function in schizophrenia and 2) the influence of musical training on cognitive and neural plasticity in older adults. Although targeting distinct populations, some studies demonstrate mechanisms of brain plasticity and neurodegeneration that may offer insights into therapeutic interventions.

One study evaluated the gut microbiome changes in patients with schizophrenia and associated neuroanatomical and functional changes. Based on rRNA sequencing and structural and resting-state functional MRI, this study showed a decreased of beneficial genera (Roseburia, Ruminococcus) and increased Veillonella in subjects with schizophrenia. Changes in the gut microbiome were correlated with decreased gray matter volume and disrupted regional homogeneity in temporal and cuneus regions.

Other studies investigate the effects of musical training on cognitive function and brain plasticity in older adults. In one study subjects aged 64–78 were assigned to one year of piano lessons or music appreciation training. Neuroimaging and cognitive test assessments show that active musical engagement improves executive function, working memory, and auditory discrimination, leading to structural and functional plasticity in regions of the prefrontal, temporal and parietal cortical brain areas, as well as the basal ganglia.

These studies highlight environmental effects on human brain architecture and function, suggesting musical skill and training may act as neuroprotectant while different gut microbiome compositions are identified as possible biomarkers or treatment targets for schizophrenia.

Keywords: Schizophrenia, gut-brain axis, musical training, brain plasticity, cognitive aging

NEUROPLASTICITY IN CHILDREN WITH ADHD

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Attention-Deficit/Hyperactivity Disorder (ADHD) is a common neuropsychiatric condition characterized by symptoms such as inattention, hyperactivity, and impulsivity. The work aims to demonstrate neuroplastic anomalies in children with ADHD.

Compared to a healthy brain, this neurodevelopmental disorder alters the plasticity of regions such as the pre-frontal cortex, responsible for attention and impulse control, reducing the efficiency in the formation and strengthening of neural connections. It is of significant importance to highlight some of the possible causes of this neuropsychological deficit, as well as its characteristics and treatments.

Studies show that a mutation in the *CAPRIN1* gene (essential for long-term memory formation) alters brain development and function. The presence of atypical development in the microstructures of white matter (particularly delayed brain maturation) and changes in brain wave activity, such as increased theta rythms or reduced beta activity (in regions like the pre-frontal cortex), as well as disorganization in neural networks, have also been corroborated.

The existence of therapeutic interventions such as methylphenidate and transcranial electrical stimulation contribute to the reduction of ADHD symptoms by, for example, the restoration of synaptic spines in the hippocampus.

Through this work, it was possible to demonstrate different neuroplastic anomalies with a fundamental role in the development and manifestation of ADHD. Continued research in this area is essential to improve the quality of life of affected children and to uncover new aspects of neuroplasticity that may be targeted in future interventions.

Keywords: ADHD, hiperactivity, neural connections, neuroplasticity, pre-frontal cortex

COMA: CONSCIOUSNESS ALTERATION

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Consciousness is the ability to perceive and be aware of oneself and the environment. It is a subjective phenomenon that involves perception, sensation, thought and emotions. There are different types of disorders of consciousness (DoC) such as coma, vegetative state, minimally conscious state and post-traumatic confusional state. Coma is a condition of brain failure that can stem from both disorders in the central nervous system and systemic metabolic processes. Its causes can range from metabolic imbalances that can be easily corrected, to severe and imminently life-threatening brain damage. Defined as a state of profound unconsciousness, coma is characterised by a lack of reaction to stimuli, with the eyes remaining closed. Although it is usually a temporary state, its duration can be unpredictable and can last for indefinite periods. Coma affects both the brain functions responsible for wakefulness and alertness, as well as consciousness itself and its contents. Coma can be traumatic, metabolic, neurological, induced, hypothermic, toxic, vegetative and deep. The mechanisms behind coma usually involve the failure of brain areas responsible for consciousness, such as the brainstem, thalamus or cerebral cortex. The severity of the coma can vary depending on the brain damage and the response to treatment. Diagnostic and prognostic tools for coma and disorders of consciousness have evolved beyond bedside examinations, functional neuroimaging and EEG. The European Academy of Neurology (EAN) suggests probing eye movements with a mirror, repeating assessments with the Coma Recovery Scale - Revised, using the Full Outline of Unresponsiveness score instead of the Glasgow Coma Scale, obtaining standard EEG, looking for sleep patterns in the EEG (REM and slow waves) and, when possible, considering positron emission tomography, fMRI, EEG paradigms and quantitative EEG analysis to complement behavioural assessment.

Keywords: consciousness, disorders of consciousness, coma, diagnostic and prognostic, EEG

THE ROLE OF IMAGINATION IN SCHIZOPHRENIA: COGNITIVE DISTURBANCES AND DISTORTION OF REALITY

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Some studies highlight the role of imagination in cognitive functions and how its abnormalities may be the basis of schizophrenia symptoms. Imagination is the ability to form mental representations of non-present experiences, and it is crucial for the construction of meaning and organization of reality.

In patients with schizophrenia, this ability appears to be compromised, manifesting as difficulties in distinguishing reality from imagination, which can lead to disturbances in perception and behaviour.

These deficits can be reflected in a distorted experience of reality, where internal experiences, like thoughts or memories, are confused with external stimuli. Also, the failure to organize and reactivate mental representations observed in some studies suggests that patients' brains are unable to form or access mental images in a structured manner. This affects not only the perception of the world around us, but also the ability to build relationships between different elements of experience, which can result in hallucinations and delusions.

The consequence of this is a global impairment of higher cognitive functions, affecting everything from memory to the ability to make decisions and interact appropriately with the environment.

In conclusion, schizophrenia profoundly interferes with the imagination, leading to a disconnect between internal and external experiences generating psychotic symptoms that distort the perception of reality.

Keywords: imagination; schizophrenia; disturbances; cognitive functions; memory

HOW BRAIN REACTS TO THREATS

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The human brain has highly sophisticated mechanisms for detecting and responding to threats in its environment. However, this ability is not immutable and it's influenced by attention, visual context and the subject's emotions, among other variables.
Neuroimaging research has shown that threat perception is mediated by a network of brain areas, including the superior temporal sulcus, and that such activation can be modulated by attention.
Furthermore, transcranial direct current stimulation has shown potential to enhance threat detection by speeding up occasional learning of perceptual discrimination during complex tasks.
Threat detection can be compromised in reduced visibility or under competing stimuli conditions, requiring the use of tools and strategies to enhance performance and limit failures in threat identification.
The interaction between emotion and action is especially important for the brain's response to danger. Even during emotional perception, the brain activates motor areas that are involved in preparing movements, preparing the body for a reaction, even without the realization of a real threat. It is believed that the interaction between the movement plan and the perceptual plan is altered in people with anxiety, potentially worsening emotional reactions.
In a military context, this ability is even more important. Studies indicate that soldiers have greater brain mass in specific areas and more activation of areas related to visual binding during exposure to battle videos. This indicates that military training generates brain adjustments that help in the treatment of stress and the assessment of danger, emphasizing the importance of effective preparation.

Keywords: threats, brain, neuroimage, attention, anticipation

INFLUENCE OF NON-INVASIVE BRAIN STIMULATION

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Non-invasive brain stimulation has been explored as a tool to modulate cognitive functions related to decision-making. A study demonstrated that transcranial direct current stimulation (tDCS) over the medial prefrontal cortex facilitated decision-making after periods of low outcome controllability, suggesting that this area is involved in adapting to reduced control situations.
Furthermore, investigations into the causal role of different cortical regions revealed that the dorsolateral prefrontal cortex (dlPFC) and the posterior parietal cortex (PPC) have distinct influences on decision-making with multiple options. Specifically, the dlPFC is associated with option selection and evaluation, while the PPC is related to spatial processing and attention.
Another study highlighted that high-frequency repetitive transcranial magnetic stimulation (rTMS) of the left dlPFC reduced drug cravings and improved decision-making ability in individuals with methamphetamine use disorder, indicating the therapeutic potential of this approach.
Finally, the causal role of the prefrontal cortex and the superior medial frontal cortex in the incidental manipulation of decision strategies was investigated, emphasizing the importance of these regions in cognitive flexibility during decision-making.
These findings highlight the relevance of specific brain regions in modulating decision-making and suggest that non-invasive brain stimulation interventions may be promising for enhancing cognitive functions and treating related disorders.

Keywords: brain, prefrontal cortex, decision making, rTMS, tDCS

PREGNANCY STRESS: PLASTIC ALTERATIONS IN THE BRAIN OF THE FETUS

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Stress is a physiological response to situations that disturb us. In the latest years, studies showed an increase in stress levels which leads to professional, family and financial problems.
Pregnant women are one of the most affected groups and causes like family conflict, drug abuse and stress about health have been pointed out. Prolonged stress exposure culminates in mother and fetal disorders.
Higher levels of maternal stress are associated to alterations of the interconnections of fetal frontoparietal and temporoparietal networks. In addition, the connections between the brainstem and the sensory-motor areas are also affected. Lower levels of stress are associated to damage in interhemispheric connections between parieto-frontal and occipital cortex.
The diversity of microbial species in the fetal gut microbiome also induces maternal stress.
The exposure to light/moderate stress in uterus can be associated to a more protective microbiome when compared with fetus that not experienced stressful situations.
In conclusion, the maternal stress besides compromising the mother, has a negative impact on the intrauterine brain development, that can affect in the future the growth and the everyday of the baby.

Keywords: fetus, stress, pregnancy, brain, microbiome

LANDAU-KLEFFNER SYNDROME

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An epileptic syndrome was defined as a complex of signs and syndromes that define a unique epilepsy condition with different etiologies. A syndrome must involve more than just a seizure type. One important characteristic of syndromes is the characteristic age at onset.

Landau-Kleffner syndrome (LKS) is a rare epileptic syndrome and is characterized by language regression and an abnormal EEG. LKS usually develops in a previously normal child older than 4 years and may first manifest as an apparent word deafness, a "verbal auditory agnosia." The majority are classified as idiopathic, although LKS may be caused by any pathologic process affecting the auditory cortex.

After researching PubMed and specialized books in the field, we realized that this includes children with involvement of more anterior areas of language with dysfunction characterized by an expressive disorder with oral motor apraxia, sialorrhea and seizures, children with autism with language regression, and even children with congenital aphasias, also called language development disorders, with epileptiform EEGs.

The EEG in LKS shows bilateral and multifocal spikes and spike-and-wave discharges, usually occurring in the temporal region, with marked activation during sleep. The EEG may improve over time, either spontaneously or with treatment, and EEG abnormalities may be an epiphenomenon. The multidisciplinary approach involving neurology, audiology, speech therapy, and education is crucial in the diagnosis and management of LKS.

Keywords: epilepsy; landau-Kleffner syndrome; language regression; abnormal EEG; verbal auditory agnosia

IMPACT OF CORPUS CALLOSUM LESIONS ON ALIEN HAND SYNDROME

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Alien Hand Syndrome (AHS) is a rare neurological disorder characterized by involuntary movements and intermanual conflict, which describes opposing movements of the patient's limbs. The "alien" hand appears to move involuntarily, while the patient remains fully aware of the limb's actions but is unable to control them. While the term "alien hand" refers to the patient's emotional disconnection from the limb, the term "anarchic hand" describes the involuntary movements of the hand or arm. Studies suggest that lesions in the corpus callosum play a central role in the pathophysiology of AHS, but their relationship with cerebrovascular diseases remains poorly understood. This study investigates the relationship between corpus callosum lesions and the manifestation of AHS.

AHS has been observed in patients after corpus callosum section or ischemic stroke, mostly in individuals with hypertension and diabetes. The patients exhibited symptoms such as involuntary movements, intermanual conflict, and difficulty controlling the affected hand. Treatment with antiplatelets and control of blood pressure and glucose improved the motor aspect, but AHS persisted in some patients.

The exams demonstrated isolated infarctions in the corpus callosum, predominantly in the splenium region, without significant cortical involvement. AHS primarily manifested with intermanual conflict and difficulties in bimanual tasks.

The study results reinforce that restricted lesions in the corpus callosum may be sufficient to trigger AHS. Recognizing this relationship can optimize differential diagnosis and therapeutic approaches in patients with a history of ischemic events.

Keywords: Alien Hand Syndrome; Corpus Callosum; Isolated Infarction; Ischemic stroke;

THE FUTURE OF PARKINSON'S TREATMENT: ARTIFICIAL INTELLIGENCE AS A REVOLUTION IN DIAGNOSIS AND REHABILITATION

Ana Morais, Beatriz Pimenta, Lea Monteiro, Mariana Alberto

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Parkinson's Disease is a neurodegenerative disorder affecting movement, balance and coordination. Recent advances in AI offer promising approaches for monitoring and rehabilitation. For this review, some articles from PubMed were used, focusing on the AI role in Parkinson's disease rehabilitation and diagnosis.

One of the articles focused on the use of AI for voice analysis to differentiate between Parkinson's patients on and off treatment by using Machine Learning and Deep Learning methods, where Machine Learning methods outperformed or equaled Deep Learning in voice analysis for Parkinson's. In another study, digital vocal biomarkers and video technology were used to assess the presence of Parkinson, it's severity and progression. The severity of the disease using the finger test was determined with an AI system, where 47 characteristics of finger movement were extracted, and 22 of which are associated with the disease. Classification achieved 82.25% accuracy. In addition, a publication refers the possibility to differentiate between heathy individuals, Parkinson's patients and those with essential tremor. It was found that tremor in Parkinson's patients has a frequency between 4Hz and 6Hz, while patients with essential tremor show a frequency of 4Hz and 12Hz. This distinction was made using a neural network model. In relation to the risk of falling, an AI model was developed for eye tracking and sensors using accelerometers, which achieved an average accuracy of 81% in detecting objects.

In conclusion, artificial intelligence has proven to be an effective tool in healthcare, although is still being improved.

Keywords: Artificial intelligence (AI), Parkinson's Disease, Rehabilitation, Diagnosis

CLASSIFICATION OF PHARMACEUTICAL POWDERS

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Pharmaceutical powders are defined as dry, homogeneous a mixture of drugs and/or excipients. They are used in the formulation of solid drugs. Can be classified according to their composition, size, shape, and use. In terms of composition, they can be simple powders, resulting from the division of just one drug. Or they can be compound powders, which come from mixing two or more simple powders. Their classification in terms of size makes it possible to determine their physical properties (fluidity, dissolution, and compressibility). They are classified as very coarse, coarse, moderately coarse, fine, and very fine. The size of the particles directly influences the application, with finer powders improving dissolution and absorption, while coarser powders have a lower tendency to aggregate and greater stability. As for the type of use, it can be for internal use, intended to be administered orally or by other internal routes, and it can be for external use, applied to the skin or mucous membranes with the aim of having a local effect, without systemic absorption. Spherical powders have a rounded, smooth shape, excellent fluidity, and good compatibility. They have a low specific surface area and high apparent density. On the other hand, cubic powders have a cubic shape with sharp edges. They have moderate fluidity, good compatibility, a high specific surface area, and relatively high bulk density. Needle-shaped or acicular powders, on the other hand, have an elongated shape, low fluidity, and compactability, with a high specific surface and low apparent density.

Keywords: Pharmaceutical powders; Composition; Characteristics; Forms; Production.

PULVERIZING BY MILLS

Guilherme Coelho, Lara Portela, Mario Faria, Pedro Gaspar, Tiago Lopes

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Mills are tools that have been used by mankind for thousands of years to grind and transform raw materials into powders, making them easier to use. From the Neolithic period, when the first mills were two simple stones, to today, where advanced technologies allow for efficient and precise milling. Mill pulverization is essential for reducing the particle size of laboratory samples, seeking a uniform size and increasing their surface area to facilitate absorption and dilution, and is widely used in the pharmaceutical industry. There are different types of mills, such as: ball mills; hammer mills; roller mills; and jet mills. The principles of milling and pulverizing are fundamental to increasing the surface area of drugs, improving dissolution through mechanical forces such as impact and abrasion, which are influenced by factors such as the type of mill, the milling time and the energy applied. Pulverization has many industrial applications, including the pharmaceutical industry, the environmental industry, the geology industry, the food industry and the cosmetics industry. However, mill operation carries risks that need to be managed, such as respiratory risks, fire and explosion risks, eye injuries, noise exposure and chemical exposure, so it is important to implement safety measures, such as dust extraction systems, the use of Personal Protective Equipment, maintaining proper mill maintenance, regular inspections, lubrication and replacement of worn parts. In conclusion, mill pulverization is an essential process for optimizing the quality of industrial products, especially in the pharmaceutical industry, and is crucial for guaranteeing the efficacy of medicines.

Keywords: Pulverization; Mills; Grinding; Industry.

INCOMPATIBILITY OF PHARMACEUTICAL POWDERS

Adriana Fortuna, Estefânia Aguiar, Gabriela Fonseca, Mariana Rocha, Sofia Martins

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The incompatibility of pharmaceutical powders is important in the field of pharmacy, since great precision is required in the preparation of these powders. It happens when different substances in powder form interact in an opposite way, affecting the efficacy, safety or pharmacological properties of one or more components. These incompatibilities can occur when more than one active principle react with each other, resulting in changes to the drug. Pharmaceutical powders have to follow certain properties, such as: fluidity, solubility, consistency, purity and stability. There are several types of incompatibility: Physical, refers to cases where different powders cannot be mixed or manipulated due to their physical properties. Within this incompatibility we have various causes, such as particle size; density; hygroscopicity; crystallization or dissolution; interactions between components. Chemistry is defined by the partial or total transformation of substances, forming secondary components with new chemical properties. Oxidation-reduction reactions, acid-base reactions, hydrolysis reactions, formation of complexes or agglomerates, disintegration or inactivity are examples of causes of this incompatibility. To avoid incompatibility between powders, it is necessary to carry out compatibility tests, use suitable excipients, separate incompatible drugs and adjust the pH and humidity to avoid chemical manipulation. Preventing incompatibilities in compounding pharmacies requires appropriate methods, good practices and the use of technologies. Techniques such as solubility studies, stability tests and incompatibility tables, as well as care in the choice of excipients, humidity and temperature control, are essential to guarantee the safety and efficacy of formulas. Technology is essential in identifying and preventing incompatibilities between pharmaceutical powders, guaranteeing the quality of formulations. Healthcare professionals are essential in preventing this by selecting excipients and guiding their correct use.

Keywords: Incompatibility; Pharmaceutical powders; Drug; Technology; Active Principle.

DETERMINATION OF THE FINENESS OF THE POWDERS

Adriana Pedrosa, Beatriz Meco, Benedita Maciel, Constança Gaspar, Leonor Costa

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Determining the toughness of powders is crucial in various areas, such as the materials industry, pharmaceutical, cosmetic, and food industries. It refers to the ability of a powder to be composed of fine particles, influencing manufacturing, transportation, and handling processes. The analysis involves the study of the size, shape, and distribution of the particles, impacting properties such as surface area, reactivity, solubility, and behavior in suspended systems. Techniques such as electron microscopy, laser diffraction, and light scattering are used to evaluate the particle size, fluidity, compressibility, and density of powders. The toughness of powders directly affects the efficiency of chemical reactions, drug dissolution, and the quality of food and cosmetic products. It is essential to optimize industrial processes, ensuring quality and stability. In pharmaceutical formulations, it influences the bioavailability of drugs, and in the pigment industry, it affects the uniformity of dispersion. In addition, the characterization of powders is critical for the development of new materials, such as nanomaterials and controlled-release systems. The continuous study of tenuity drives innovation and quality improvement in strategic sectors.

Keywords: Industry; Pharmaceutical; Chemical reaction; Quality.

DIFFICULTY IN TABLET COMPRESSION

Cristiana Cortez, Filipa Brás, Leonor Tomé, Margarida Baptista

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Tablet compression is a critical step in the pharmaceutical industry, ensuring quality, efficacy, and safety. However, challenges may arise, influenced by formulation, equipment, and compression parameters. The process involves mixing and homogenizing components, granulation (if necessary), drying, compaction, and, in some cases, coating. Quality control evaluates parameters such as weight, hardness, friability, thickness, and disintegration time to ensure compliance with regulatory standards. The main problems are Capping: separation of the tablet's upper part, caused by high compression speed and the elastic behavior of materials; Sticking and Picking: material adhesion to the punch (sticking) and removal of material from the tablet's surface (picking), influenced by humidity and excipients; Mottling: stains or discoloration due to poor distribution of dyes or inconsistencies in humidity levels; Variation in Mass and Hardness: results from irregular mold filling, differences in material density, and inconsistent compression parameters. We conclude that tablet compression is a complex process that requires strict control to ensure a safe, effective medication with the appropriate physical and chemical properties for its administration and bioavailability.

Keywords: Tablet's; Compression; Quality control.

EFFERVESCENT PILLS

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Effervescent pills are solid pharmaceutical forms that, when dissolved in water, release carbon dioxide, facilitating the absorption of the active ingredient. This chemical reaction occurs due to the interaction between acids, such as citric or tartaric acid, and bases, such as sodium bicarbonate. They are widely used in medications such as analgesics, vitamin supplements, and antacids. One of the main advantages of effervescent pills is their rapid absorption in the body, providing an immediate effect compared to conventional tablets. Additionally, they are an easier alternative to ingest, especially for people who have difficulty swallowing pills. However, they also have some disadvantages, such as a high sodium content, which can be harmful to individuals with hypertension or cardiovascular diseases, as well as the risk of gastrointestinal discomfort if consumed in excess. To ensure their effectiveness, effervescent pills should be dissolved in water, avoiding other liquids that may interfere with absorption. Proper storage is also essential, as they are sensitive to humidity, which can compromise their stability. During the manufacturing process, precautions such as humidity control, the use of appropriate packaging materials, and quality testing are fundamental to ensuring their safety and efficacy. In conclusion, effervescent pills offer significant benefits, particularly regarding absorption and ease of consumption. However, their use should be approached with caution, following storage and dosage recommendations to prevent potential adverse effects.

Keywords: Effervescent pills; Stability; Sodium bicarbonate; Active ingredient; Storage.

DRAGEE COATING

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Dragee coating is an essential process in the pharmaceutical industry, used to coat tablets and granules, protecting them against external factors, masking unpleasant flavors and controlling the release of the active ingredient. This coating occurs in rotating basins, which can be classic or automated, ensuring the uniform application of the protective layers. The main components of these basins include the rotating structure, heating and ventilation systems for drying and spray nozzles for precise application of the coating. The types of coating vary between sugar, polymeric and functional, each with specific characteristics to modify the stability and dissolution of the drug. The dragee coating process can be manual or automated, with the traditional approach involving multiple steps, such as sealing, sub-coating, coloring and polishing, while the automated approach optimizes time and quality. Among the advantages of the traditional method are the low initial cost and the glossy finish, while the automated version improves uniformity and efficiency. However, disadvantages such as humidity control, coating adhesion and scalability need to be managed. Modern technologies, such as fluidized beds, spray coating and automated systems, have been replacing traditional basins, offering greater precision and quality. In addition, new excipients and even 3D printing are emerging as alternatives for customizing pharmaceutical forms. These innovations make the process more efficient and safer, ensuring higher quality medications and controlled performance in the body.

Keywords: Dagueification; Coating; Automation.

EMULSIFYING AGENTS

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Emulsifying agents are essential for stabilizing emulsions, which are colloidal dispersions of immiscible liquids, such as oil and water. These emulsions have an internal phase, where the droplets are dispersed, and a continuous external phase. Since they are unstable systems, emulsifying agents reduce interfacial tension, delaying phase separation. Emulsions can be oil-in-water (O/W), water-in-oil (W/O) or multiple (W/O/W or O/W/O), combining these structures for greater stability. Emulsifying agents are amphiphilic compounds that form a protective film around the droplets, ensuring rigidity, elasticity and recomposition. They include synthetic surfactants, materials of plant origin and finely divided solids. Emulsions are widely used in different forms of administration. By the oral route, they facilitate absorption and mask unpleasant tastes. By the parenteral route, they allow controlled release of drugs. In topical application, its effectiveness depends on the active ingredient's skin permeation. Therefore, emulsifying agents play an essential role in the formulation of stable and homogeneous products, being widely used in the pharmaceutical, food and cosmetic industries, enabling the mixing of immiscible liquids and ensuring versatility in applications.

Keywords: Emulsifying agents; Amphiphilic compounds; Stable and homogeneous products; Stability; Applications.

HYDROPHILIC LIPOPHILIC BALANCE

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The hydrophilic-lipophilic balance (HLB) is fundamental in the science of surfactants, since it indicates the affinity for water and oil. This balance is crucial when choosing emulsifiers, wich are essencial for stabilizing emulsions. The interaction of the hydrophilic and lipophilic partes determines the solubility and effectiveness of products such as detergents. The most used method to determine this balance is the Griffin method. It is used to calculate the value of HLB in the end of an emulsion, but before the final calculation we need to know the HLB values for the fat and emulsifying constituents that make this emulsion. Multiple emulsions present many advantages and ways of being used, however keeping their stability is a hard challenge. The presence of electrolytes, the concentration of the osmotic active component, the influence of stabilizing additives, the nature of the oily phase, the properties of the interfacial films and the volume ratio between the phases, as well as the preparation method, stand out. The hydrophilic-lipophilic balance aplies in the preparation of two solutions with a fixed amount of surfactant. In one solution we add a higher HLB surfactant (solution A) and in the other solutions we add a lower HLB surfactant (columbino B). After mixing the solutions A and B we proceed with the emulsion stability test. The proportion with the best result has the closest HLB to the ideal HLB. The HLB is a technique used as a starting point for selecting the right type of surfactant for an emulsion.

In conclusion, the hydrophilic-lipophilic balance, developed by Griffin in 1949, classifies the affinity of surfactants for water (hydrophilic) or oil (lipophilic) on a scale of 0 to 20. Lower values (0-6) indicate greater affinity for oils, medium values (7-9) are intermediate and higher values (10-20) show affinity for water. This concept is crucial in the formation of emulsions, ensuring the effectiveness and stability of the products.

Keywords: Surfactants; Emulsions; Solubility; Hydrophilic-lipophilic.

THE IMPORTANCE OF FOOD CERTIFICATION - CONSUMER PERCEPTION

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Certification is not just a formal requirement, but a differentiating element that reinforces the credibility of companies and facilitates access to demanding markets. Furthermore, consumers' growing concern for health and the environment has increased the demand for certified products, ensuring high standards of food safety and traceability.

Based on literature analysis and the application of a questionnaire, this study assesses the level of consumer knowledge about certifications, the influence of demographic characteristics on the perception of certified quality and the relationship between the presence of certification seals and consumer trust. The results obtained allow for reflection on the importance of certification in the competitiveness of the food sector and in the informed choice of consumers.

With the questionnaire applied, 40 responses were collected, where 50% of respondents stated that they never check the certification of a product before purchasing it. This result can be explained by the fact that 42,5% of participants are not aware of any specific certification. However, when asked if they would be willing to pay more for a certified product, 55% said yes, if the price was reasonable.

It can be concluded that companies should communicate their certifications more clearly to consumers, as this helps them to have a safer consumption of the products they buy.

Keywords: certification; quality; safety; food sector; consumers

THE ROLE OF CERTIFICATION IN PREVENTING FOOD FRAUD

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Food fraud is a growing concern that affects consumer safety and trust in the food sector. Although it does not always pose a direct threat to public health, it can have serious implications, including the development of illnesses and, in extreme cases, death.

This study aims to analyse the role of certification in preventing food fraud, ensuring the safety and quality of food products. To achieve this, specific objectives were established, such as defining food fraud and identifying its most common types, assessing its consequences, examining food certification systems, and understanding consumer awareness of the issue through a questionnaire.

The methodology adopted was based on a mixed approach, combining a theoretical review of scientific literature and legislation with an empirical study, in which an online questionnaire was applied.

The questionnaire applied to the population allowed us to verify that 85,2% of participants correctly identified the definition of food fraud, while 14,8% answered incorrectly, highlighting some remaining difficulties. Regarding ISO 22000:2018 food certification, 96,3% recognised the presence of a seal on the product's packaging as a means of identifying this certification, indicating a positive outcome. Despite these encouraging results, some participants still displayed a degree of misinformation.

Therefore, to reinforce the impact of certification in preventing food fraud, it is essential to promote greater awareness of its importance, ensure rigorous audits, and encourage measures that facilitate access to these systems.

Keywords: food fraud; food certification; public health; audits; food safety

HYPERTROPHIC CARDIOMYOPATHY: PATHOPHYSIOLOGY AND CLINICAL MANAGEMENT

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Hypertrophic cardiomyopathy is a genetic heart disease marked by abnormal thickening of the myocardium, primarily in the left ventricle, without secondary causes like hypertension or valvular disease. Mutations in sarcomeric proteins often underlie this condition, leading to left ventricular outflow obstruction, arrhythmias, and an elevated risk of sudden cardiac death, particularly in young athletes.

HCM development involves specific anatomical regions, including the myocardium and conduction system, influenced by genetic and biomechanical factors. Myocardial disarray and fibrosis play a crucial role in disease progression, affecting electrical activity in both symptomatic and asymptomatic individuals. Advanced imaging techniques, such as echocardiography and cardiac MRI, are essential for diagnosis and monitoring.

Management strategies include pharmacological treatments like beta-blockers and calcium channel blockers, along with invasive interventions such as septal myectomy and alcohol septal ablation. High-risk patients may require implantable cardioverter defibrillators (ICDs) to prevent sudden cardiac death. The variability in symptom severity necessitates individualized treatment approaches.

Despite its complexities, HCM is manageable with proper diagnosis and tailored care. Understanding the interplay between genetic predisposition, structural abnormalities, and therapeutic strategies is crucial for optimizing patient outcomes.

Keywords: Hypertrophic; Cardiomyopathy; Genetic Heart Disease; Myocardial Thickening; Left Ventricular Outflow Obstruction; Artificial Intelligence.

VENTRICULAR FIBRILLATION: FROM THE POINT OF VIEW OF ARTIFICIAL INTELLIGENCE

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Ventricular fibrillation (VF) is a life-threatening cardiac arrhythmia characterized by rapid, chaotic electrical activity in the ventricles, leading to an immediate loss of effective cardiac output and, if untreated, sudden cardiac death. This condition arises due to multiple reentrant circuits and abnormal automaticity, preventing the coordinated contraction of the myocardium, resulting in asynchronous contractions of individual muscle fibers. This breakdown in coordinated depolarization is often triggered by ischemic events, myocardial infarction, electrolyte imbalances, or structural heart diseases. The loss of organized ventricular contraction leads to the cessation of effective blood circulation, rapidly causing tissue hypoxia and multi-organ failure if untreated.

The diagnosis of VF is primarily made through ECG analysis, which reveals an irregular, fibrillatory pattern without discernible QRS complexes, the absence of distinct P waves or T waves, instead displaying irregular, rapid oscillations of varying amplitude and frequency. In a clinical or emergency setting, VF is suspected in patients with sudden loss of consciousness, absence of a palpable pulse, and apnea. Early recognition of VF is crucial, as immediate intervention with defibrillation or in cases of persistent VF, pharmacological interventions such as epinephrine and amiodarone may be administered to enhance the chances of successful defibrillation.

In clinical practice, the prompt identification of VF by healthcare professionals is essential for improving patient survival rates. Ongoing research continues to explore the underlying mechanisms of ventricular fibrillation, aiming to optimize therapeutic outcomes.

Keywords: Ventricular Fibrilation; Electrocardiography; Artificial Intelligence.

TAKOTSUBO SYNDROME

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Takotsubo syndrome, also known as stress cardiomyopathy, is a transient condition that mimics acute myocardial infarction (AMI) both clinically and electrocardiographically but without significant coronary obstruction. Its electrocardiogram (ECG) manifestations evolve over time and can make differentiation from ST-elevation myocardial infarction (STEMI) challenging.

We present the case of a 65-year-old woman admitted with sudden-onset chest pain and dyspnoea following an episode of severe emotional stress. The initial ECG showed ST-segment elevation in the precordial leads and diffuse T-wave inversion, raising suspicion of an acute coronary syndrome. However, coronary angiography revealed no obstructive lesions, and echocardiography demonstrated apical hypokinesis with basal hyperkinesis, a pattern characteristic of Takotsubo syndrome. Serial ECGs over the following days showed progressive resolution of ST-segment elevation, followed by a phase of deep and prolonged T-wave inversions, a hallmark feature of the condition. The patient received supportive treatment with beta-blockers and ACE inhibitors, progressing well with complete recovery of ventricular function within four weeks.

The dynamic evolution of ECG changes in Takotsubo syndrome, characterised by ST-segment alterations and T-wave abnormalities, can be indistinguishable from AMI in the acute phase. However, the absence of significant coronary lesions and the typical ECG progression help establish the diagnosis. Early recognition of the electrocardiographic pattern, alongside complementary imaging such as echocardiography and cardiac MRI, is crucial to avoiding unnecessary invasive interventions and optimising patient management.

Keywords: Takotsubo Syndrome; ST-segment; T-Wave Inversion, Stress Cardiomyopathy; Artificial Intelligence.

WOLFF PARKINSON WHITE SYNDROME

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Wolff-Parkinson-White (WPW) syndrome, a congenital cardiac condition with an estimated prevalence of 1 to 3 per 1000 individuals, is characterized by the presence of an accessory atrioventricular pathway, predisposing individuals to tachyarrhythmias and potentially life-threatening complications.

This case report details the clinical presentation, diagnostic evaluation, and management of a young adult male with symptomatic WPW syndrome. The patient presented with recurrent episodes of palpitations, dizziness, and syncope, significantly impacting his quality of life.

Electrocardiographic analysis revealed a shortened PR interval, delta wave, and episodes of paroxysmal supraventricular tachycardia (PSVT), consistent with WPW syndrome. An electrophysiology study (EPS) was performed, demonstrating the presence of a left lateral accessory pathway with anterograde conduction. Radiofrequency catheter ablation was successfully performed, eliminating the accessory pathway and preventing further episodes of tachycardia. Post-ablation ECG showed resolution of the delta wave and normalization of the PR interval.

This case highlights the importance of recognizing WPW syndrome in patients presenting with palpitations or syncope, and the efficacy of catheter ablation as a curative treatment option, improving the patient's quality of life and preventing potential complications such as atrial fibrillation and sudden cardiac death. The successful management of this case underscores the importance of early diagnosis and intervention in WPW syndrome to mitigate the risk of adverse outcomes.

Keywords: Accessory Atrioventricular Pathway; Palpitations; Syncope; Artificial Intelligence.

ARRHYTHMOGENIC RIGHT VENTRICULAR DYSPLASIA

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Arrhythmogenic Right Ventricular Dysplasia (ARVD) is a genetic cardiomyopathy characterized by a replacement of the right ventricular myocardium with fat and fibrous tissue. This transformation of cardiac tissue affects the heart's electrical conduction, which can result in severe complications, particularly in young athletes.

We report the case of a 24-year-old football player who experienced episodes of palpitations and near syncope following intense exercise. His family history was significant since his father suddenly died due to cardiac arrest at the age of 40. Electrocardiography revealed ventricular tachycardia, ventricular premature beats, QRS widening, QT interval prolongation, inverted T waves in precordial leads V1-V3 and the presence of Epsilon waves. Holter monitoring identified episodes of nonsustained ventricular tachycardia and ventricular extrasystoles, while echocardiography showed mild right ventricular dilation. Cardiac magnetic resonance imaging confirmed the replacement of the right ventricular myocardium with fat and fibrous tissue. Based on these findings, a diagnosis of ARVD was established. The patient was advised to discontinue competitive sports and initiated on pharmacologic therapy.

ARVD is often associated with a genetic defect inherited. This case highlights the importance of early recognition of this heart disease, particularly in athletes who experience syncope and a family history of sudden cardiac death. A multidisciplinary approach involving ECG, Holter monitoring, cardiac imaging, and genetic testing is crucial for treatment plan. Early intervention with lifestyle modification, pharmacologic therapy and ICD placement can significantly reduce the risk of fatal arrhythmias.

Keywords: ARVD, Epsilon Waves, T Waves Inversion; Artificial Intelligence.

COMMOTIO CORDIS *VS* CONTUSIO CORDIS

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Commotio Cordis and Contusio Cordis are distinct clinical entities often mistaken for one another, both resulting from thoracic trauma.

Commotio Cordis is a lethal arrhythmia induced by direct chest impact, typically without structural myocardial damage, occurring mainly in young athletes due to a blow during the heart's vulnerable phase. In contrast, Contusio Cordis refers to structural myocardial injury caused by direct trauma, leading to cellular necrosis, hemorrhage, and potential hemodynamic compromise. While Commotio Cordis is strongly associated with ventricular fibrillation and sudden death, Contusio Cordis may present with arrhythmias, heart failure, and ventricular dysfunction, depending on the severity of the injury.

Differentiating between these conditions is essential and involves clinical assessment, ECG, cardiac troponins, and imaging studies such as echocardiography and magnetic resonance imaging. The prognosis of Commotio Cordis depends on the speed of defibrillation, whereas Contusio Cordis requires careful monitoring to prevent late complications.

Recognizing the differences between these conditions is crucial for optimizing prevention, diagnosis, and management strategies.

Keywords: Commotio Cordis, Contusio Cordis, Cardiac Trauma, Arrhythmias, Sudden Death; Artificial Intelligence.

SUDDEN CARDIAC DEATH IN SPORTS

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Sudden cardiac death (SCD) in athletes, although rare, is a devastating event that raises significant concerns. This study analyzes the main causes of SCD in athletes, differentiating between young athletes (≤ 35 years) and veterans (> 35 years). In young individuals, cardiomyopathies and coronary anomalies predominate, while in veterans, atherosclerotic coronary artery disease is the most common cause. Additional risk factors, such as doping and exercise in extreme conditions, are explored. The prevention of SCD is crucial and includes pre-participation medical examinations, awareness of warning symptoms, availability of automated external defibrillators, and basic life support. This work highlights the importance of vigilance and preventive measures to protect at-risk athletes, balancing the benefits of exercise with the need for cardiovascular safety.

Keywords: Sudden Cardiac Death; Athletes; Cardiovascular Safety; Artificial Intelligence.

BRUGADA SYNDROME

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Brugada Syndrome is a rare genetic condition characterized by abnormalities in the electrocardiogram (ECG) and a high risk of fatal ventricular arrhythmias, such as ventricular fibrillation. This syndrome is associated with gene mutations that encode ion channels, especially the *SCN5A* gene, which is responsible for producing the cardiac sodium channel. These mutations result in abnormal depolarization of the heart cells, impairing electrical conduction in the heart and increasing the likelihood of arrhythmic events.

Clinically, Brugada Syndrome is often diagnosed in asymptomatic patients or individuals with a history of sudden unexplained death, usually in male patients between the ages of 30 and 40. The typical Brugada ECG reveals a pattern of ST-segment elevation in leads V1 to V3, with a characteristic “little horse” shape, which is suggestive of this disease.

The syndrome is considered one of the leading causes of sudden cardiac death in apparently healthy individuals, and its control involves, in addition to early detection, close monitoring and therapeutic intervention to prevent fatal events.

Keywords: Brugada Syndrome; Genetic Condition; Ventricular Arrhythmias; Ventricular Fibrillation; Artificial Intelligence.

CARDIAC MAGNETIC RESONANCE

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Cardiac magnetic resonance imaging is a non-invasive imaging modality that provides high-resolution anatomical and functional assessment of the heart. It utilizes strong magnetic fields and radio waves to generate detailed images, offering superior soft tissue contrast without ionizing radiation. This exam is widely used for evaluating myocardial function, perfusion, fibrosis, inflammation and congenital heart diseases. Advanced techniques such as late gadolinium enhancement allow precise detection of myocardial scar tissue, aiding in the diagnosis of ischemic and non-ischemic cardiomyopathies. Stress cardiac magnetic resonance plays a crucial role in detecting ischemia and assessing coronary artery disease. Despite its advantages, it has limitations, including long scan times, contraindications related to implanted devices and accessibility constraints. Continuous advancements in technology and protocols are improving the efficiency and applicability of cardiac magnetic resonance in clinical practice.

Keywords: Cardiac Imaging; Myocardial Assessment; Artificial Intelligence.

THE ROLE OF AI ON CARDIAC CT ANGIOGRAPHY IN DETECTING CORONARY ARTERY DISEASE: CURRENT INSIGHTS AND INNOVATIONS

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Cardiac Computed Tomography Angiography (CCTA) is a non-invasive imaging modality that provides high-resolution visualization of coronary arteries, playing a crucial role in the diagnosis and management of coronary artery disease (CAD). By assessing coronary stenosis and plaque characteristics, CCTA aids in clinical decision-making, preoperative risk evaluation, and post-intervention monitoring. Technological advancements, including radiation dose reduction techniques and functional assessments such as Fractional Flow Reserve CT (FFR-CT), have improved its clinical utility.

Artificial intelligence (AI) integration in CCTA has further enhanced diagnostic accuracy and efficiency. AI-driven applications, such as automated plaque detection, stenosis quantification, motion correction, and risk prediction models, enable precise evaluation of coronary lesions while streamlining workflow and reducing reporting time. These innovations minimize the need for invasive procedures and support personalized risk assessment. However, challenges remain, including the need for regulatory approval, data privacy concerns, and seamless clinical integration.

Despite its limitations, including radiation exposure, contrast risks, and susceptibility to motion artifacts, CCTA continues to evolve as a cornerstone in cardiovascular imaging. Future advancements in deep learning, real-time image reconstruction, and predictive analytics will further enhance its role in CAD diagnosis and management. AI-powered CCTA represents a paradigm shift in cardiovascular care, improving patient outcomes through early detection, risk stratification, and optimized treatment planning.

Keywords: Cardiac CT Angiography; Coronary Disease; Artificial Intelligence.

KAWASAKI DISEASE WITH MYOCARDITIS: EARLY DIAGNOSIS AND MANAGEMENT

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Kawasaki disease (KD) is an acute systemic vasculitis of unknown etiology, primarily affecting children under 5 years. Myocarditis, a potentially life-threatening complication, can occur in up to 20% of KD cases. This report details a case of KD complicated by myocarditis, emphasizing the importance of early diagnosis and comprehensive management.

A 4-year-old child presented with 6 days of persistent high-grade fever, polymorphic rash, bilateral non-exudative conjunctivitis, and erythema/edema of the hands and feet. Physical examination revealed strawberry tongue and cervical lymphadenopathy.

The electrocardiogram showed ST-segment and T-wave abnormalities, and echocardiography revealed mild left ventricular dysfunction, indicative of myocarditis.

Myocarditis in KD can lead to significant morbidity, including heart failure and arrhythmias.

Early recognition through clinical and electrocardiographic evaluation is crucial. Prompt initiation of intravenous immunoglobulin (IVIG) and aspirin, coupled with close monitoring of cardiac function, is essential for optimal outcomes. This case underscores the importance of a multidisciplinary approach, including cardiology consultation, in the management of KD with myocarditis.

This case highlights the critical role of early diagnosis and comprehensive management in KD complicated by myocarditis. A high index of suspicion, coupled with thorough clinical and cardiac evaluation, can lead to timely intervention and minimize the risk of long-term cardiac sequelae.

Keywords: Kawasaki Disease; Myocarditis; Pediatric Cardiology and Vasculitis; Artificial Intelligence.

TORSADES DE POINTES

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Torsades de Pointes is a ventricular arrhythmia characterized by a polymorphic pattern in "twist" in the QRS complex, usually associated with the prolongation of the QT interval on the electrocardiogram. This condition, which can occur acutely or chronically, often results from a combination of factors such as the use of drugs that prolong QT, electrolyte disorders (especially hypokalemia and hypomagnesemia), and underlying cardiac conditions, including congenital QT prolongation syndromes. Clinically, it manifests itself by rapid and irregular heartbeats, leading to symptoms such as dizziness, syncope and palpitations, and may progress to ventricular fibrillation and cardiac arrest if not promptly treated. Therapeutic management emphasizes the correction of electrolyte imbalances, the suspension of QT prolonging agents and, in cases of instability, emergency interventions such as defibrillation and the use of pacemakers.

Keywords: QT Prolongation; Ventricular Arrythmia; Eletrolyte Disorders; Artificial Intelligence.

HEARING PROTECTORS

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Introduction: Hearing allows us to identify and recognize objects by sound, and enables communication and understanding, being fundamental to people's quality of life. Prolonged exposure to high levels of noise (above 80dB) can compromise this ability, requiring the use of protective measures. Objective: Based on a literature review, to study the different types of hearing protection used to prevent noise-induced hearing loss (NIHL). Methodology: The following databases were consulted: Web of Science, PubMed, the ESTeSC library, using the keywords: hearing protection, noise, attenuation and hearing health, in Portuguese and English, obtaining a total of 5 articles for analysis. Results: There are several types of hearing protectors that help reduce noise as well as the Signal to Noise Ratio (SNR), including: earplugs (pre-molded or moldable); headphones, which can be used in conjunction with earplugs to increase the level of protection, and even custom-made protectors, tailored to the ear canal. The effectiveness of hearing protectors depends on the characteristics of the noise, comfort and the length of time they are worn. The necessary level of attenuation must be assigned according to the legal framework. Conclusion: Hearing protectors are essential for preventing NIHL. Improper use can significantly reduce attenuation, thus compromising their effectiveness in protecting hearing. It is essential to educate the population and raise their awareness of the importance of hearing protection, ensuring better hearing health and quality of life.

Keywords: Hearing protection; Noise; Attenuation; Hearing health

IN EARS: HEALTH, PERSONALIZATION AND HEARING PROTECTION

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Introduction: In-ear devices have evolved beyond their traditional audio monitoring function to play key roles in areas such as healthcare, audiology and hearing protection. 3D scanning allows the creation of customized molds, improving acoustic sealing and comfort. On the other hand, microphone innovation enables clearer communication by reducing noise. Objective: To explore the advanced functionalities of in-ear devices. Methodology: A literature review was carried out using the databases Academic Search Complete (EBSCO); Web of Science (Clarivate); B-on; Elsevier; Pubmed; Scopus using the words Ear Molds; In ears; Music and Technology in Portuguese and English as search engines, and a total of 11 articles were obtained. Four were excluded because they didn't fit the criteria previously defined, leaving seven articles for this study. Results: The literature review highlights advances and developments that make it possible to measure the arterial pulse wave using sensors incorporated into the system. 3D scanning makes it possible to customize the in-ear according to the anatomy of the user's external ear canal. Similarly, the use of microphones with innovative technologies not only provides hearing protection, but also improves sound quality and suppresses noise, improving speech discrimination in noisy environments. Conclusion: The evolution of in-ears reinforces their importance beyond entertainment, encompassing medical, ergonomic and hearing safety applications. The integration of artificial intelligence and biometric sensors will continue to improve these devices, consolidating them as indispensable tools in health, music and professional communication.

Keywords: In ears device; 3D Scanning; Hearing biometrics; Hearing protection; Artificial intelligence

WATER RESISTANT HEARING AIDS

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Introduction: Corrosion caused by humidity and sweat affects durability, to minimize this hydrophobic coatings, corrosion resistant materials and inductive charging systems are used. The IP68 standard classifies resistance to water and dust, ensuring greater durability, although it may compromise sound quality. Objective: To analyse the technologies and strategies used to make hearing aids water resistant, evaluating the performance, durability and sound quality of these devices. Methodology: The following databases were consulted: PubMED, Web of Science, ESTeSC Library, Wiley Online Library and Medline- National Library of Medicine, using the following keywords: IP68 standard, impermeability, hearing aids in children, IP69 standard, water-resistant devices, humidity index and hearing aid components, both in Portuguese and English, obtaining a total of 28 articles for analysis, of which we excluded 26, since they were not relevant to this study. Results: the choice of materials, application of coatings and charging technology play a key role in the durability of hearing aids. Corrosion failures were registered in water-resistant hearing aids with ion and lithium batteries using Failure Mode and Effects Analysis.Conclusion: The combination of different technologies allows devices to become smarter and more efficient, providing not only water resistance, but also dynamic adjustments that guarantee the best sound quality in any environment.

Keywords: IP68, Resistance; Hearing aids; Waterproofing

ARTIFICIAL INTELLIGENCE IN NOISE SUPPRESSION

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Introduction: Noise suppression is the process used to eliminate or reduce unwanted sounds in an audio signal. Artificial Intelligence (AI) is a field of computer science dedicated to developing systems capable of performing tasks that typically require human intelligence. Objective: To explain the role of AI in noise suppression within the context of auditory rehabilitation and its impact on sound quality. Methodology: A literature review was conducted using the databases of the ESTESC library, Web of Science, and PubMed, with specific keywords. Out of a total of nine published articles, only four were selected, as the remaining ones did not address the core research question. Results: Based on the analyzed articles, AI significantly impacts noise suppression, particularly in cochlear implants and hearing aids. AI enhances the separation of sound sources and speech perception in noisy environments. Neural networks are particularly effective in noise suppression in both hearing aids and cochlear implants. Regarding hearing loss, AI is primarily applied to sensorineural hearing loss, improving speech comprehension in noisy settings. In cochlear implants, AI automatically adjusts parameters (acoustic, electrical, neural processing, and user customization) to optimize sound quality. In hearing aids, AI adapts to users' individual needs, providing a clearer and more personalized auditory experience. Conclusion: AI, particularly through neural networks, plays a crucial role in improving auditory devices, offering enhanced noise suppression and better sound quality for users.

Keywords: Artificial intelligence; Noise suppression; Cochlear implants; Hearing aids; Hearing rehabilition

MOLECULAR TESTING FOR BLOOD GROUPS IN SCIENCE TRANSFUSION

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Molecular testing for blood groups is a major tool in modern transfusion science, allowing to overcome some of the barriers that other techniques offer.

While the serological method is used to determine the antigens present on the surface of red blood cells or antibodies in blood plasma, through reactions with known reagents, molecular testing focuses on the genetic aspect of blood typing using DNA-based assays such as polymerase chain reaction (PCR), DNA microarrays and next-generation sequencing (NGS).

This technique identifies the genes responsible for major blood group systems like AB0, Rh, Kell, Duffy, Kidd and MNS and plays a vital role in transfusion science for several reasons such as identifying rare phenotypes. Some patients express antigens at a very low level leading to inconclusive results in standard agglutination tests proving once more the importance of molecular testing. It also prevents alloimmunization by ensuring better donor-recipient compatibility, specifically in chronic transfusions (in cases of sickle cell disease or thalassemia) and is crucial in non-invasive prenatal typing of fetal blood groups to manage hemolytic disease of the fetus and newborn.

Molecular testing detects genes that may have suffered mutations and are no longer expressed, so the patient has the gene but not the antigen. On the other hand, serologic tests are associated with false positives due to clots or rouleaux that can mimic agglutination, the presence of autoantibodies (which may cause panreactivity making it difficult to identify specific alloantibodies or antigens) and mixed cell populations in patients who have recently received transfusions.

Keywords: molecular testing; serological testing; red blood cells; antigen; blood transfusion

MOLECULAR TESTING FOR BLOOD GROUPS IN SCIENCE TRANSFUSION

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Although hemagglutination continues to be the gold standard technique for searching for blood group antigens (Ag), molecular testing has been demonstrating to be crucial in improving transfusion safety. These techniques are once the Ag expressed on the red blood cells surface are the product of genetic expression, making it possible to determine their presence looking only at the genes.

Currently, numerous techniques are employed for blood group typing, with the most prevalent being various forms of Polymerase Change Reaction (PCR), microarray-based methods, and DNA sequencing (Sanger or Next Generation Sequencing (NGS)).

Molecular biology methods are especially useful in patients with a Direct Antiglobulin Test positive (DAT+), donors with weak expression of Ag not detected by the conventional methods, discrepant results between cellular and serological typing, genotyping of blood group antigens to identify "Ag negative" donors for patients with alloantibodies against high-frequency Ag, and many others.

These methods present us many advantages compared to serological testing, such as the fact that these techniques may also be applied in DNA obtained from various types of cells, the interpretation of the results is computerized (less errors), any Ag, if known on the molecular basis, can be typed, among others.

However, the application of these techniques can also have some limitations, as costs associated, being limited to a relatively small number of individuals with known Ag profiles and demanding some level of specific technical skills.

The future of molecular testing is very promising, considering the speed and specificity in DNA sequencing of the several techniques that have been developed.

Keywords: blood group; molecular testing; science transfusion; genotyping

MOLECULAR TESTING FOR BLOOD GROUPS IN SCIENCE TRANSFUSION

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Since the first discovery of the ABO blood groups, agglutination has been the method used to detect the presence of specific blood group antigens (Ag) and antibodies (Ab). However, with technological progress, it is possible to understand the blood group's molecular bases and its Ag, allowing us to predict the presence or absence of the Ag and overcoming some limitations of agglutination tests.

Some of the molecular tests most commonly used are the detection of single nucleotide polymorphisms (SNP), initially simply based only on the Polymerase Chain Reaction (PCR) amplification technique, but it was improved by the using microarray technology to be able to identify numerous alleles of the blood systems in a rapid way. In addition, another method is the Real Time PCR, where we use fluorescent probes to measure the amplified DNA over time. This method is commonly used to detect the Kell, Kidd and Duffy alleles.

The 0 Bombay group, an extremely rare blood type mainly found in India, is characterised by the lack of the A, B and H Ag on the red blood cells surface and contains anti-A, anti-B and anti-H Ab in the serum. This unusual H Ag absence occurs because they are homozygous hh, unlike a normal 0.

Due to its mutations in the FUT1 (Bombay) and FUT2 (Para-Bombay) genes, demonstrated in some studies, it is possible to do some molecular testing helping to enable appropriate transfusion strategies, for example sourcing compatible donors or employing intraoperative blood management techniques.

Keywords: Molecular tests, SNP, 0 Bombay group, transfusion strategies

MOLECULAR TESTING FOR BLOOD GROUPS IN SCIENCE TRANSFUSION

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Molecular testing has revolutionized the field of transfusion science, as it can predict blood group phenotypes in situations where the standard serological tests can't, allowing for the selection of better-matched blood units and reducing the risk of alloimmunization.

Molecular genotyping can be useful in resolving ambiguous serological results, in transfusing blood to patients with special requirements or for those in need of frequent transfusions, such as individuals with diseases like sickle cell anemia and thalassemia, as molecular techniques improve donor-recipient matching, and is additionally able to facilitate the identification of rare antigens.

It can also be valuable in identifying the risk of haemolytic disease of the fetus and newborn in prenatal testing. On the other hand, despite its advantages, these techniques have some limitations, such as the higher costs, requirement of specific technical skills and equipment as well as the risk of false positives and negatives, which can negatively impact patients' lives.

For the execution of this molecular test, several techniques can be used to identify genetic variations, including single nucleotide polymorphisms (SPN), deletions and hybrid alleles that define blood group antigens in systems such as ABO, Rh, Kell, Duffy and Kidd. These techniques comprehend polymerase chain reaction (PCR), microarrays and next-generation sequencing (NGS).

Keywords: Molecular testing, Blood group phenotype, Donor-recipient matching, Transfusion science.

MOLECULAR TESTING FOR BLOOD GROUPS IN SCIENCE TRANSFUSION

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Hemagglutination is the classical method used to determine blood groups in transfusion sciences. However, this technique's results may be inconclusive in cases of weak or variant antigen (Ag) expression and rare blood group variants, leading to transfusion reactions.

Since the genes for each blood group are located on different chromosomes, molecular testing has made it possible to overcome these challenges, providing precision and accuracy by analyzing DNA variations focusing on single nucleotide polymorphisms. Individuals who have received multiple transfusions are more likely to develop antibodies (Ab) against foreign Ag, and molecular genotyping provides great precision to transfuse blood with compatible Ag to avoid hemolytic transfusion reactions or alloimmunization. Molecular diagnosis also aids in several fetal and neonatal alloimmune conditions.

To provide exact genotyping molecular testing relies on polymerase chain reactions (PCR), like real-time PCR or PCR with sequence-specific primers (PCR-SSP), and microarrays to increase DNA areas linked to each blood type Ag. Another method frequently used is NGS, Next-Generation Sequencing, for blood typing on a larger scale and to examine several Ag, all at once, being helpful for patient matching for chronic transfusions.

This method may become demanding since it requires a high technological cost and specific technical skills for the interpretation of the results, considering that genetic variability can infer blood phenotyping, leading to the appearance of false positives.

Future improvement plans for a broadening of computerized genotyping and for incorporating molecular outcomes, simplifying standard blood bank processes, and decreasing all human errors resulting in faster outcomes for clinical choices.

Keywords: Hemagglutination; molecular testing; transfusion reactions; PCR; NGS; microarrays; alloimmunization;

MOLECULAR TESTING FOR BLOOD GROUPS IN SCIENCE TRANSFUSION

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Serological assays based on agglutination are the classical approach for blood group testing, however, they have limitations. Molecular testing is a modern way of characterizing alleles that define blood group antigens, like AB0, Rh, Kell, Duffy and Kidd. Its relevance relies precisely identifying antibodies and rare alleles, which makes it useful for selecting compatible donors for patients with alloimmunization, and accurate blood type screening for polytransfused patients. It stands out primarily for its precision, accuracy, and ability to detect genetic variants that serologic methods may miss.

Molecular testing techniques, such as Polymerase Chain Reaction (PCR) and Next Generation Sequencing (NGS) have been evolving, improving the efficiency of transfusional medicine. Despite complex and expensive techniques, the development of cheaper alternatives and growing database of blood group genotypes makes molecular genotyping a highly promising tool in transfusion science and prenatal care, particularly in assessing the risk of hemolytic disease of the fetus and newborn (HDFN) through RHD genotyping.

Although molecular methods are very effective compared to classical methods of blood group detection, these tests are not completely reliable. Within the possible limitations of the test we can find additional polymorphisms, variants that are not yet detected by genotyping platforms, mutations outside the specific segment that are not identified and others. This approach enhances transfusion safety, allowing more efficient management of blood resources, especially for rare blood types. Molecular approaches are the ideal way of complimenting traditional approaches while improving patient care.

Keywords: Molecular Testing, Blood Group Genotyping, Science Transfusion, PCR, NGS

MOLECULAR TESTING FOR BLOOD GROUPS IN SCIENCE TRANSFUSION

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Molecular testing has dramatically transformed science transfusion by enabling precise prediction of blood group phenotypes through DNA analysis. Traditional serological methods, such as hemagglutination, can be limited by recent transfusions, autoantibodies, or the unavailability of specific antisera. In contrast, molecular techniques provide a reliable alternative by identifying genetic variations that determine blood group antigens (Ag).

Techniques such as polymerase chain reaction (PCR), sequencing, and microarrays enable the identification of Ag on red blood cells, overcoming limitations of conventional hemagglutination tests, especially in transfused patients or those with weak Ag. These tests assist in the typing of both patients and donors, enhancing transfusion safety by identifying rare Ag and reducing the risk of transfusion reactions. Additionally, molecular typing is crucial in managing conditions like sickle cell anemia, thalassemia, and autoimmune hemolytic anemia, allowing for more accurate blood matching.

Molecular methods are also crucial in prenatal care, especially in assessing the risk of hemolytic disease of the fetus and newborn. By analyzing cell-free fetal DNA from maternal plasma, clinicians can determine the fetal blood group and implement timely interventions when necessary.

Although innovative, this testing also has some rare limitations. Silent genetic variations can affect Ag expression, and factors such as natural chimerism, stem cell transplants, and kidney transplants can lead to mixed DNA populations, complicating results. Additionally, the presence of multiple alleles per phenotype may require multiple assays for accurate typing. For these reasons, additional testing may sometimes be necessary, and a thorough review of the patient's clinical history remains essential.

Keywords: Molecular Testing, Blood Groups, Genetic Variation, Antigens, Transfusion

MOLECULAR TESTING FOR BLOOD GROUPS IN SCIENCE TRANSFUSION

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Molecular tests play a crucial role in science transfusion. They can be used to determine an individual's blood group and effectively discover alleles expression in blood groups, ensuring donor-recipient compatibility and facilitating pathogen detection. This approach can also address inconsistencies in serological blood typing when Ag expression is weak, epitopes are absent or altered, patients have recently received transfusions and show a positive Direct Antiglobulin Test (DAT), or when the presence of autoantibodies is detected.

The International Society of Blood Transfusion (ISBT) acknowledges over 43 distinct blood group systems, including ABO, Rh, Kell, among others. Molecular genotyping is essential for correctly identifying these groups, particularly in patients with sickle cell disease or thalassemia, who are highly susceptible to alloimmunization. By identifying Ag-negative and rare or unknown phenotypes, genotyping aids in selecting compatible donors and minimizing transfusion complications. Additionally, this technique supports prenatal testing for fetal blood group determination, which is crucial for managing hemolytic disease of the fetus and newborn.

In practice, molecular tests involve DNA extraction from a blood sample, followed by amplification of specific regions of interest, directly examining genetic material. There are various techniques, such as Polymerase Chain Reaction (PCR), used in ABO genotyping, which consists of using enzymes to identify alleles in a blood group. Microarray, that hybridizes amplified DNA targets for easy detection. Sequencing can be also used to detect unknown or rare genetic variants of blood groups. Molecular testing is increasingly important in transfusion medicine, enhancing accuracy, safety, and patient outcomes.

Keywords: Molecular pathology, Blood transfusion, Genotyping techniques, Alloimmunization

MOLECULAR TESTING FOR BLOOD GROUPS IN SCIENCE TRANSFUSION

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Serologic antibody-based techniques have become insufficient to properly match a donor to a patient in transfusion medicine. Those who have specific antigen (Ag) requirements or alloimmunized people require a more detailed phenotypic study to avoid adverse transfusion reactions, therefore molecular testing has become a revolutionary technique to accurately predict red blood cell (RBC) phenotypes. Additionally, it allows the identification of rare Ag for which there are no serological test agents commercially sold.

What differentiates most types of Ag is the variation in a single nucleotide in the sequence of a gene, this leads to the existence of different blood groups such as ABO, Rh, Kell, Duffy, Kidd, Lewis and others; therefore it's possible to identify them with techniques including, polymerase chain reaction (PCR), DNA microarrays, and next-generation sequencing (NGS)

Molecular Testing not only is beneficial in multi-transfused patients to find a more compatible donor for the sake of minimizing the risk of alloimmunization but also helps pregnant women at risk of hemolytic disease of the fetus and newborn since it detects fetal blood group Ag that do not match the mother's, producing antibodies against the baby. Some blood groups also require further investigation for silent mutations to help distinguish different alleles considering that these are not detected by serologic testing

Serological typing can lead to false positives either by the existence of blood clots that can be mistakenly confused with agglutination or patients who have been transfused recently that have the donor's RBC, making this technique so important nowadays.

Keywords: genotyping techniques, antigens, hemolytic disease of newborn, serological testing, blood transfusion

SJÖGREN'S SYNDROME

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Sjögren's syndrome (SS) is a systemic autoimmune disease that affects moisture-producing glands, such as the salivary and lacrimal gland tissues, leading to symptoms like dryness in the eyes (keratoconjunctivitis sicca) and mouth (xerostomia). Furthermore, it can also involve other organs and systems, so it is common to occur other systemic manifestations that vary amongst patients. SS can be defined as primary or secondary, the former being the isolated variant that does not involve other diseases, and the latter associated with other autoimmune diseases, such as rheumatoid arthritis, systemic sclerosis and systemic lupus erythematosus.

Women are the most affected, with a ratio of 9:1 compared to men. It is usually diagnosed after the age of 50, although symptoms can appear years earlier. The mortality rate of SS is associated with an increased probability of lymphoma and other complications involving respiratory, cardiovascular, and renal systems.

The causes are yet to be defined. Although there has been research into genetic, environmental and lifestyle factors, there is no causal association that would explain this immune response. Due to this, the diagnosis is usually built on a combination of clinical history, analysis results, imaging and histological examinations (biopsies), since the symptomatology is non-specific.

The treatment aims to relieve dryness and control systemic disease with immunosuppressants. Due to the comorbidities of SS, it still presents many limitations in terms of treatment and makes standardized therapy among patients difficult.

Keywords: Sjögren's syndrome, autoimmune disease, xerostomia, keratoconjunctivitis sicca

GAUCHER DISEASE

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Gaucher Disease (GD) is an inherited metabolic disorder with an autosomal recessive pattern caused by mutations in the *GBA1* gene that lead to a deficient beta-glucocerebrosidase activity. This results in toxic glucocerebroside lipid accumulation within lysosomes, affecting multiple organs and tissues.

This disease has three classic forms: type 1, type 2 and type 3 but there are also two rare variants: the cardiovascular and the perinatal lethal (the most severe). Regarding symptoms, there are some pathological changes like painless hepatosplenomegaly and clinical manifestations such as pancytopenia (which provokes fatigue and easy bruising, caused by anemia and thrombocytopenia, respectively), less bone density and Erlenmeyer flask deformity, neurological complications, abnormal body weight, among others. Although, the symptoms may differ between the different types of this disease.

The diagnosis can be achieved by detecting a reduced activity of the glucocerebrosidase enzyme in leukocytes of the peripheral blood or with identification of biallelic pathogenic variants in the *GBA1* gene through molecular genetic testing. This genetic test is also used to diagnose prenatal cases.

The treatment includes enzyme replacement therapy (ERT), substrate reduction therapy (SRT) and hematopoietic stem cell transplantation (HSCT),

To summarize, Gaucher Disease is a complex genetic disorder with diverse clinical presentations depending on its type. Early diagnosis through enzyme activity assays or genetic testing is crucial for effective management. While treatments like ERT and SRT help alleviate symptoms, they are not effective for all types, particularly type 2. Ongoing research is vital for better therapies.

Keywords: Gaucher, Glucocerebroside, Lysossomal disorder, *GBA1* gene mutation, Treatment

SPINOCEREBELLAR ATAXIA

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Neurodegenerative diseases (ND) result from the deterioration or loss of neurons in the peripheral and/or central nervous system, leading to excessive cell death and impairing cognitive and motor abilities. Spinocerebellar Ataxia (SCA) is an autosomal dominant degenerative disorder within this group, characterized by cerebellar ataxia causing imbalance in gait, imprecise movements, vision problems, speech alterations and vertigo.

The pathogenesis of SCA involves genetic mutations caused by CAG repeat expansions that result in toxic polyglutamine proteins (ataxins), transcriptional dysregulation, mitochondrial dysfunction, channelopathies and impaired autophagy. Purkinje cells are the most affected due to their complex structure and high energy demands, causing motor and coordination deficits. Longer polyglutamine chains are correlated to increased neurotoxicity and earlier disease onset. Diagnosis of SCA involves a series of tests to evaluate abnormal eye movements, speech difficulties, tremors and lack of precise movements. Magnetic resonance imaging (MRI) helps identify possible causes, such as immune diseases, tumours, or infections. In addition, blood and cerebrospinal fluid tests are also performed to detect vitamin deficiencies, autoimmune diseases, or paraneoplastic conditions. SCA is a genetic disease that has no definitive cure and treatment is mainly focused on symptomatic relief to improve the patient's quality of life, consisting in both pharmacologic and non-pharmacologic approaches. Neurorehabilitation and physical therapy for improving motor functions have a crucial role in the management of SCA.

Keywords: Neurodegeneration; Spinocerebellar Ataxia; Purkinje Cells; CAG repeat; Polyglutamine

NEUROFIBROMATOSIS

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Neurofibromatosis (NF) is characterized by the development of tumors that affect the skin and the nervous system due to genetic mutations. This disease can be expressed in different types, neurofibromatosis type 1 (NF1) and various types of Schwannomatosis (SWN), being NF2-related Schwannomatosis (formerly known as NF2) the most common form of SWN.

NF1, otherwise known as von Recklinghausen disease, is the most common form caused by a mutation in the *NF1* gene leading to the appearance of neurofibromas, cafe-au-lait spots, freckling, and optic gliomas. Signs and symptoms of NF2-SWN include schwannomas (mainly vestibular schwannomas), meningiomas and ependymoma tumors. Although most of these tumors are benign, some may evolve and become malignant.

This condition can be inherited as an autosomal dominant disorder. It also can result from a spontaneous (non-inherited) genetic change unrelated to family history. It is expected that 1 in every 2000 individuals will be born with NF, impacting approximately 4 million people worldwide and nearly 4000 in Portugal. NF1 has an estimated incidence of 1 out of every 2500 births, while NF2- related Schwannomatosis affects 1 in 25000.

Diagnosis is based on the patient's family history, physical exam findings and genetic testing confirmation. Despite the fact that there is no cure for NF or SWN, there are treatments that can reduce the symptoms, such as medication, surgery to remove the tumor, chemotherapy and radiotherapy.

Keywords: neurofibromatosis; schwannomatosis; mutation; autosomal dominant disorder

DUCHENNE MUSCULAR DYSTROPHY

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Duchenne muscular dystrophy (DMD) is a severe X-linked recessive neuromuscular disorder caused by mutations in the dystrophin gene, affecting approximately 1 in 3,500 males. It leads to progressive muscle degeneration, with symptoms typically appearing in early childhood, including muscle weakness, frequent falls, and gait abnormalities. Most patients lose the ability to walk by their early teens and develop severe respiratory and cardiac complications, often resulting in death by the second or third decade of life.

Currently, there is no cure for DMD. Treatment focuses on managing symptoms and delaying disease progression. Corticosteroids, such as prednisone and deflazacort, have been shown to slow muscle degeneration and improve function. Surgical interventions, including spinal fusion, may help manage complications such as scoliosis. Supportive care, including physical therapy, respiratory assistance, and mobility aids, is crucial in maintaining function and quality of life.

Recent advancements in gene therapy, including exon skipping and CRISPR-based genome editing, offer promising potential by restoring partial dystrophin function. Additionally, stem cell therapy and anti-inflammatory treatments are being explored to address muscle degeneration and improve patient outcomes. Even though these therapies are still in experimental stages, they represent a significant step towards more effective long-term treatment options.

Despite the challenges, ongoing research in genetics and molecular medicine continues to provide hope. Continued clinical trials and innovative therapeutic approaches are essential for developing effective treatments, improving patient quality of life, and ultimately finding a cure for this devastating disease.

Keywords: Duchenne muscular dystrophy (DMD), Dystrophin gene, Muscle degeneration, Gene therapy, Clinical trials.

IMMUNOTHERAPY

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Immunotherapy has become a leading approach for treating cancer, with an increasing number of drug approvals and many more in clinical and preclinical trials. It is a treatment that uses the patient's own immune system to treat cancer. Some strategies include: monoclonal antibodies, cytokines, growth factors, immune system modulators, vaccines, adoptive cell transfer or CAR-T and virus therapy. These strategies were obtained with great advancement and application in the therapy of transplants, autoimmunity, cancer and infectious diseases. Immunotherapy is also a promising approach in the treatment of diseases. Monoclonal antibodies can be used to attenuate multiple myeloma symptoms, CAR-T are a good solution for autoimmune diseases like rheumatoid arthritis, immune system modulators can be used to reduce extreme inflammation, among others examples for the other strategies. Immunotherapy can also have secondary effects on the patient, such as mistakenly attacking healthy cells instead of pathological ones, since it has the ability to control our immune system. This therapy can cause side effects such as autoimmunity and inflammation and these can be on a single organ or systemic. It is essential to ensure highly personalized treatment, as it may not be justified in certain cases. These methods, although already widely used, are still evolving with the objective to make the therapy as personalized as possible, always using these in combination with other conventional forms of treatment, such as chemotherapy and radiotherapy.

Keywords: Immunotherapy, Cancer, CAR-T Cells, Treatment, Antibodies, Autoimmunity, Inflammation

TWIN-TO-TWIN TRANSFUSION SYNDROME (TTTS)

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Twin-to-Twin Transfusion Syndrome is a condition that manifests due to an unbalanced blood sharing between monochorionic fetuses due to vascular anastomoses that extend across the chorionic plate and connect the two fetal umbilical circulation. This vascular connection is a necessary condition for the disease to evolve. Although the process of anastomoses is still unclear, the Twin-to-Twin Transfusion Syndrome is associated with the number, size, and type of anastomoses that grow between monochorionic fetuses, which are responsible for the unregulated blood flow. This transfusion syndrome typically takes place between the 16th and 26th week of gestation, affecting around 10-15% of all monochorionic twins.

Twin-to-Twin Transfusion Syndrome screening can be performed throughout the pregnancy, requiring ultrasounds in the first trimester, and then every two weeks after the 16th week of gestation, in addition to maternal education about the symptoms of polyhydramnios. Regarding the diagnosis, ultrasound confirms the disease by detecting an unbalance in amniotic fluid where one fetus has too much liquid due to excessive urination, whereas the other has a reduced amount due to decreased urination. Fetoscopic laser ablation of placental vessels is the only curative treatment for this condition, giving each fetus a chance of survival. After the laser surgery, ultrasound monitoring is required to confirm disease resolution.

Keywords: Monochorionic twins, Vascular anastomoses, Fetoscopic laser ablation, Ultrasound screenings

RAYNAUD'S SYNDROME

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Raynaud's syndrome (RS) is a vasospastic disorder characterised by transient episodes of excessive vasoconstriction in the fingers, typically triggered by cold exposure or emotional stress. It can present as primary RS, of idiopathic nature, or secondary RS, associated with autoimmune conditions, such as systemic sclerosis. RS affects approximately 3–5% of the population, with a higher prevalence in women. In primary RS vascular dysfunction is predominantly functional, whereas secondary RS involves both functional and structural vascular abnormalities, increasing the risk of ischemic complications, like ulcers and gangrene. Diagnosis is based on clinical history and symptom patterns, but periungual capillaroscopy can be used to differentiate primary and secondary RS. Early recognition and appropriate management are crucial to improving patient outcomes and preventing severe digital ischemia. Treatment focuses on symptom control and ischemic complication prevention, with first-line approaches including lifestyle modifications and calcium channel blockers to promote vasodilation. Alternative pharmacological therapies, namely phosphodiesterase-5 inhibitors, prostaglandins, and botulinum toxin injections, may be considered in refractory cases. Further research is needed to elucidate RS's complex pathophysiology and develop more targeted therapeutic strategies, particularly for secondary RS.

Keywords: Raynaud's syndrome, vasospasm, systemic sclerosis, vascular dysfunction, ischemia

FRAGILE X SYNDROME

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Fragile X Syndrome (FXS), or Martin-Bell Syndrome, is a neurodevelopmental disorder linked to the long arm of the X chromosome, caused by the expansion of CGG triplets and highly localized methylation of the *FMR1* gene, which reduces functional FMRP. It is the main hereditary cause of intellectual disability and the genetic condition most commonly associated with autism spectrum disorder.

This syndrome is X-linked dominant, especially related with neuronal dysregulation due to an imbalance between neurotransmitters that contribute to the interruption of synaptic plasticity. Newborns with FXS typically don't display any physical features, which only become more apparent during childhood. Usually, they present delays in motor and language development and features of the autism spectrum.

This syndrome occurs in approximately 1 in 7000 males and 1 in 11000 females, varying with region, ethnicity and environmental effects.

Molecular genetics are now the gold standard to diagnose FXS, especially Southern blotting, but other technologies are also used to offer a complete characterization of molecular profiles.

There are treatments focused on the different cognitive symptoms of patients, however, there is no cure for FXS. Early non-pharmacological interventions, such as occupational therapy, behavior therapy, psychiatric counseling and special education, in addition to pharmacotherapy are crucial for better outcomes.

Keywords: Fragile X Syndrome; *FMR1* gene; X-linked dominant; neurodevelopment disorder; Southern blotting

REDUCING FOOD WASTE IN HOUSEHOLDS

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Introduction: Food waste is a significant problem at European level, around 59.2 million tons in 2022, with households responsible for 54% of this waste. Fruit and vegetables are the most wasted, accounting for 46%.
Objective: Develop a nutritional policy to reduce household food waste.
Methodology: Information from organizations and institutions such as FAO and EUROSTAT was used to support the analysis.
Results: This policy will last for 2 years, starting in June 2025, and will be disseminated through digital campaigns, distribution of leaflets in strategic locations, partnerships with nutritional education organizations and dissemination on social networks, ensuring the involvement of the population. The policy will be based on the creation of an online platform that will provide various strategies available to the entire community, the strategies are: a shopping list with the quantities needed according to the size of the household and meal planning, meal planning for the week, recipes that use leftovers, ways of storing food correctly, solutions on how to measure the right portions so as not to generate leftovers and finally composting. The platform will warn of the consequences associated with this problem worldwide, and a tool will be available on how to access waste before and after implementing the strategies mentioned above.
Conclusion: With the implementation of this policy, we hope to achieve a significant reduction in food waste.

Keywords: Nutrition policy, food waste, household

SOLIDARITY GROCERY STORES

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Introduction: The Universal Declaration of Human Rights (UDHR) establishes the fundamental human rights that must be protected universally, including the right to food. The Food and Agriculture Organisation of the United Nations (FAO) defines Food Insecurity (FI) as a situation in which the consumer's physical, social, and economic access to nutritionally adequate food is scarce or non-existent. According to the Inquérito Alimentar Nacional e de Atividade Física 2015-2016 (IAN-AF 2015-2016), 10.1% of Portuguese households experienced food insecurity, a figure that has since risen to 19.3%. Nevertheless, in 2023, Portugal's per capita annual food waste reached 124 kg, with total household food waste reaching almost 1.3 million tons.

Objective: Implementation of a nutritional policy to combat food insecurity and waste by promoting the consumption of locally grown fruits and vegetables, supporting both public health and local farmers.

Methodology: The identification of issues was carried out through the analysis of technical reports, including IAN–AF, PNPAS, UNICEF, Acta Portuguesa de Nutrição, and FAO.

Reliable sources and scientific publications were prioritized in analyzing the intersectionality of nutritional policies in Portugal.

Results: The intervention outlined in this policy is expected to be implemented over a three-year period and is structured around five key axes that are: "Food and Nutrition Security," "Local Agricultural Development," "Solidarity Economy," "Social Inclusion and Responsibility," and "Food Waste Reduction."

Conclusion: This policy is expected to improve food security, reduce food waste and their associated problems among the Portuguese population.

Keywords: Food Security, food policy, food consumption, Portugal, scale

EAT WELL, AGE BETTER

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Introduction: The ageing Portuguese population is growing, with 23% aged 65 or over in 2022. Elderly vulnerability stems from socio-economic and cultural factors, as well as limited access to adequate food. In 2022, 17.1% were at risk of poverty, and 37.1% of pensioners received pensions below the minimum (€278.05). Additionally, 14.8% were at risk of malnutrition, and 1.3% were undernourished. It is urgent to implement a nutritional policy to mitigate this problem in the elderly.

Objective: Develop and implement a nutritional policy for low-income elderly Portuguese.

Methodology: Data was collected from reports such as Inquérito Alimentar Nacional e de Atividade Física 2015-2016, the e-book Alimentação no Ciclo de Vida: Alimentação na Pessoa Idosa, and official sources like DGS's "Estado Nutricional" and the Commission for the Elderly.

Results: This nutrition policy will last for 2.5 years and is based on 3 strategies. The first focuses on food education, through the creation of educational programmes, the distribution of materials and the organization of events at national level. The second, a plan of activities, includes subsidy programs, food vouchers, the distribution of nutritional kits and the creation of community fairs. The third strategy then focuses on evaluating and monitoring the policy to analyze its impact and implementation, identify points for improvement, gather feedback and use indicators to ensure the effectiveness and evolution of the program.

Conclusion: We hope that this nutritional policy will help to improve the quality of life and health of low-income elderly people, as well as reducing dietary inequalities.

Keywords: Elderly, nutritional policy, health, dietary

DEVELOPMENT OF A NUTRITIONAL POLICY TO PROMOTE FOOD EDUCATION IN SCHOOLS

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Introduction: According to DGS data, 4 out of the 5 top risk factors contributing to mortality are directly related to eating habits, which are hypertension, hyperglycemia, inadequate eating habits and being overweight. As stated in the IAN-AF 2015-2016, among adolescents, the pre-obesity rate is 23.6% and the obesity rate is 8.7%, this data is concerning considering that these values tend to increase and obesity is a risk factor for multiple diseases.
Objective: Development a national policy that promotes nutrition education for adolescents and their parents from the 5th to the 9th grade of schooling.
Methodology: Documents from DGS, PNPAS and IAN-AF 2015-2016 were consulted.
Results: The policy lasts for 5 years, starting in the 5th grade and following students through to the 9th grade. The policy is structured around 3 axes: teacher training, in partnership with “Associação Nacional de Professores”; food education classes, taught by teachers who attended the training sessions; the 3rd axis focuses on the adolescents’ families.
Conclusion: This policy aims to increase nutritional education for adolescents, future adults, with the intention that they have the necessary literacy to make adequate choices for their health throughout their life.

Keywords: Nutritional Policy, Food Education, Food Literacy, School Community, Health promotion

INTEGRATED NUTRITION AND SUPPORT PROGRAM FOR PEOPLE WITH TUBERCULOSIS (PINAPT)

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Introduction: Tuberculosis (TB) remains a pressing global health concern, with malnutrition documented as a major predictor of poor treatment outcomes and increased mortality. In line with the World Health Organization's emphasis on integrated patient care, nutritional support is viewed as essential for enhancing adherence and overall clinical success.

Objectives: The proposal of an implementation Nutrition Policy, the Integrated Nutrition and Support Program for People with Tuberculosis (PINAPT), coordinated by Portugal's National Health Service (SNS) and social assistance partners.

Methodology: A structured literature review was performed, focusing on WHO documentation, policy guidelines, and studies encompassing nutritional interventions, social welfare, and patient adherence. Extracted data were synthesized to identify core elements impacting TB management success.

Results: PINAPT prioritizes individuals and families facing food insecurity, establishing eligibility criteria and ensuring rapid referral of TB patients. Each food basket provides sufficient protein, micronutrients, and calories to prevent further malnutrition and support faster recovery. A vitamin-mineral supplement secures adequate micronutrient intake. To ensure financial sustainability, the program leverages partnerships with nonprofit organizations for food distribution logistics.

A monthly monetary allowance covers additional costs such as transportation or expenses related to food preparation. By integrating nutrition with social protection, PINAPT is anticipated to enhance adherence, minimize therapy abandonment, and strengthen TB control efforts. The PINAPT program will have a duration of 5 years.

Conclusion: The implementation of this policy is expected to boost treatment success rates, reduce dropout, and promote overall well-being, reflecting Portugal's commitment to TB elimination.

Keywords: Nutrition, Tuberculosis, Health Policies

A TABLE FOR ALL: THE POWER OF COMMUNITY AGAINST FOOD WASTE

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Introduction: In 2022, Portugal recorded a food waste of 184 kg per inhabitant, while 20% of the population faces poverty and food insecurity. The lack of access to adequate nutrition compromises health and exacerbates inequalities, making it essential to adopt effective strategies to redistribute resources and ensure dignified nutrition.
Objective: Develop a nutritional policy that uses surplus food from restaurants, hospitals and supermarkets to provide meals for vulnerable populations through a public and social space.
Methodology: Databases such as PubMed and ScienceDirect were consulted, as well as organizations like UNICEF and INE.
Results: A community space will be created where people in vulnerable situations will be able to access meals at a symbolic cost or for free. To make this policy viable, partnerships will be established with supermarkets, hospitals and local authorities. Social security will assist in the identification and socioeconomic validation of the beneficiaries and in the distribution of identification cards. Volunteers, duly trained by professionals, will ensure food security. The policy will last for two years and will be evaluated through indicators such as the number of people covered and the reduction of food waste per capita.
Conclusion: This initiative aims to minimize food waste and ensure access to dignified meals for vulnerable populations, promoting social inclusion and the sustainable use of resources.

Keywords: waste, food, portugal

ADEQUATE NUTRITION IN NURSING HOMES: THE NEED FOR LEGISLATION TO ENSURE COMPLETE MEALS

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Introduction: Inadequate nutrition in nursing homes, often restricted to soups and fruits, can lead to nutritional deficiencies due to insufficient macronutrients, such as proteins, compromising health. The lack of legislation that guarantees balanced meals makes this situation worse. As the population ages, it's essential to establish regulations that ensure adequate nutrition in these locations. Including proteins in main meals can help combat sarcopenia and other complications.
Objective: Our objective is to develop a nutritional policy that assures a balanced and adequate diet in nursing homes, securing the intake of macronutrients, especially protein. This policy applies to all institutions for the elderly, whether public, private or in the solidarity sector, which provide food services to their residents.
Methodology: The development of this nutritional policy took place through research on platforms such as «PubMed» and «ScienceDirect». Additional support (IAN-AF 2015-2016) was used.
Results: A nutrition policy for nursing homes was created with three main axes: training nursing home managers on the importance of balanced meals, establishing and specifying the norms for the main meals, and offering nutritional monitoring to the residents. Partnerships with specialized entities will be established to ensure that nursing homes meet the dietary needs of elderly people. This policy takes effect on the date of its publication and institutions will have a period of 180 days after its publication to adapt to the new guidelines.
Conclusion: We expect that it's possible to achieve food security in all nursing homes by applying this nutritional policy.

Keywords: elderly people, nursing homes, protein, dietary needs

NOISE POLLUTION

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Introduction: Noise pollution is a serious environmental and public health issue, primarily caused by transportation, industrial activities, and construction. Prolonged exposure to high noise levels can lead to severe health consequences, including stress, sleep disturbances, hearing impairment, and cardiovascular diseases. Given its widespread impact, especially in urban and industrial areas, addressing noise pollution is crucial for public health. Objective: This study aims to examine the main sources of noise pollution, its effects on human health, and strategies to reduce its impact. The research focuses on identifying effective measures that individuals and organizations can take to minimize exposure and prevent long-term health risks. Methodology: The study is based on a review of scientific literature and reports from health and environmental organizations. Research findings on noise pollution's physiological and psychological effects have been analyzed, along with data on personal and workplace noise protection measures. Results: Findings indicate that noise pollution significantly increases the risk of hearing loss, stress-related disorders, and cardiovascular diseases. Studies emphasize the importance of noise regulations, protective equipment, and public awareness. Effective measures include using noise-canceling devices, limiting exposure in high-risk areas, and enforcing stricter workplace safety regulations. Conclusion: Reducing noise pollution requires a combination of legal regulations, technological advancements, and personal protective measures. Continued research and education on noise-related health risks are essential to mitigating its long-term effects and improving overall well-being.

Keywords: noise pollution, health effects, enviroment effects

CEREBRAL CREATINE DEFICIENCY SYNDROMES

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Cerebral Creatine Deficiency Syndromes (CCDS) are inborn errors of creatine metabolism that affect its biosynthesis or transport. Creatine is essential for energy storage and transfer, mainly as phosphocreatine. Its synthesis involves two enzymatic steps catalyzed by arginine:glycine amidinotransferase (AGAT) and guanidinoacetate methyltransferase (GAMT), followed by cellular uptake via the transporter (CT1/SLC6A8). Pathogenic sequence variants (PSV) in the genes coding for these enzymes or the transporter underlie three main subtypes of CCDS: AGAT deficiency (CCDS3), from PSV in *GATM* at 15q21.1; GAMT deficiency (CCDS2), linked to *GAMT* at 19p13.3; and creatine transporter deficiency (CCDS1), due to PSV in *SLC6A8* at Xq28.

Clinically, affected individuals present with heterogeneous neurodevelopmental disorders, including intellectual disability, speech delays, epilepsy, and autism from diminished cerebral creatine. While AGAT and GAMT deficiencies follow autosomal recessive inheritance, and involve reduced endogenous creatine synthesis, CT1 deficiency compromises creatine transport into cells. Early recognition through neuroimaging demonstrating low cerebral creatine can expedite diagnosis. Long-term treatment of patients with AGAT and GAMT deficiencies using high doses of creatine can partially and slowly replenish brain creatine. Although creatine transport across the blood-brain barrier occurs, its permeability is limited and relatively inefficient, making supplementation less effective.

Nutritionists' contribute in CCDS management: in AGAT deficiency by developing dietary strategies and optimizing creatine supplementation. In GAMT deficiency, creatine supplementation combined with arginine restriction plus ornithine supplementation mitigates guanidinoacetate accumulation, while experimental amino acid supplementation is under investigation for transporter defects.

This review aims the genetic basis of CCDS, and their impact on affected individuals.

Keywords: AGAT; GAMT; CT1; *SLC6A8*; Cerebral Creatine Deficiency

CITRULLINEMIA TYPE 1: UNDERSTANDING THE DISEASE AND ITS GENETIC TRANSMISSION

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Citrullinemia type 1 (CTLN1) is a rare autosomal recessive genetic disease caused by pathogenic sequence variations in the *ASS1* gene, responsible to produce the enzyme argininosuccinate synthetase (ASS). ASS is an enzyme that plays a role in the urea cycle. Deficiency of this enzyme results in excessive accumulation of ammonia.

CTLN1 is caused by alterations in the *ASS1* gene, and its prevalence and incidence are 1:100.000 and 1:57.000, respectively. In Portugal, the diagnosis is currently made through neonatal screening “Teste do Pézinho”. The symptoms include vomiting, refusal to eat, progressive lethargy, signs of increased intracranial pressure and developmental delay. Treatment involves prompt diagnosis, control of hyperammonemia and intracranial pressure, as well as protein dietary restriction. There are several pathogenic sequence variations in the gene, some of which are: absence of exon 5, 6, 7 or 13; C:G-to-T:A transitions in CpG dinucleotides; G>C substitution in the last position of intron 15; deletion of the first 7 bases in exon 16 and insertion of 37 bases between the regions of exon 15 and 16 of the mRNA.

Considering the severity of the symptoms, aspects such as prompt diagnosis and proper dietary management are essential to ensure the patient's well-being.The nutritionist has a fundamental role since it is necessary to limit the amount of protein intake. However, it is also necessary to guarantee sufficient protein intake to ensure adequate growth.

The objective of this work is to describe the fundamental aspects of CTLN1, including its etiology, symptoms, prevalence, diagnosis, treatment options and the genetic transmission over the generations.

Keywords: Citrullinemia type 1, Classic citrullinemia, Genetics, Mutation, Urea cycle disorders