REPORT CARD 2023

DIZZINESS: A LOOK AT THE DAMAGES TO CHILD DEVELOPMENT

Aline Cabral, Piotr Henryk Skarzynski
and Milaine Dominici Sanfins

Journal of Hearing Science®
MEDINCUS®

DIZZINESS: A LOOK AT THE DAMAGES TO CHILD DEVELOPMENT

Aline Cabral, Piotr Henryk Skarzynski and Milaine Dominici Sanfins

In this month's newsletter, the focus will be on dizziness in childhood and its impact on child development. In recent years, there has been an increase in publications in the field of Pediatric Otoneurology, with consequent growth in attention to vestibular disorders in this population.

Do you have certainly heard about dizziness in adults. But how many times have you heard about the existence of dizziness in children?

When it comes to the pediatric population, this theme is not so recurrent, is it?!

Do you may know someone, a friend or adult relative, who has been diagnosed with “labyrinthitis” or migraine; however, few know of children with this type of diagnosis. The prevalence of dizziness in children is underestimated, therefore, there are really few children with complaints and/or suspicion of dizziness or vertigo, resulting in a scarce number of diagnoses in this population.

To have an overview of the episodes of dizziness and vertigo in the pediatric population, one can observe the epidemiological data reported by researchers from the United States and the United Kingdom.

In the United Kingdom, for example, studies reported a prevalence of 5.7% in the school-age pediatric population, whereas in the United States the rate ranged from 5.3% in children aged between 3 and 17 years to 5.6% in children with an average age of 11 years.

THE CHILD'S DIFFICULTY IN EXPRESSING SENSATIONS AND FEELINGS IS A VERY IMPORTANT AND EVEN IMPEDING FACTOR IN DIAGNOSING DIZZINESS IN CHILDREN.

Thus, parents and/or guardians must be aware of the behavior of children and dizziness should not be ruled out when:

- **THE CHILD HAS SOME TYPE OF MALAISE WITH NO DEFINITE CAUSE;**
- **THE CHILD HAS MOTION SICKNESS IN CARS, PLANES (MOTION SICKNESS);**
- **THE CHILD DOES NOT LIKE TO PLAY ON TOYS THAT SPIN;**
- **THE CHILD HAS NOCTURNAL ENURESIS;**
- **THE CHILD IS SOCIALLY ISOLATED;**
- **THE CHILD HAS NAUSEA, VOMITING AND/OR HEADACHE;**
- **THE CHILD HAS ABDOMINAL PAIN;**
- **THE CHILD HAS SOME TYPE OF VISUAL DISTURBANCE (DOUBLE VISION AND/OR NYSTAGMUS);**
- **THE CHILD SHOWS SIGNS OF EXCESSIVE TIREDNESS;**
- **THE CHILD SHOWS SOME AGITATION;**
- **THE CHILD HAS SLEEP DISORDERS;**
- **THE CHILD HAS FREQUENT FALLS, GAIT IMBALANCE AND/OR MOVEMENT INCOORDINATION.**

In addition, there are other signs that may be present in cases of vestibular alterations.

Therefore, evaluators and clinicians should consider and ask parents if:

- **YOUR CHILD WAS SLOW TO CRAWL OR WALK;**
- **YOUR CHILD HAD OR HAS LANGUAGE DELAY;**
- **YOUR CHILD HAD OR HAS A READING/WRITING DISORDER;**
- **YOUR CHILD HAD OR HAS SCHOOL DIFFICULTIES.**

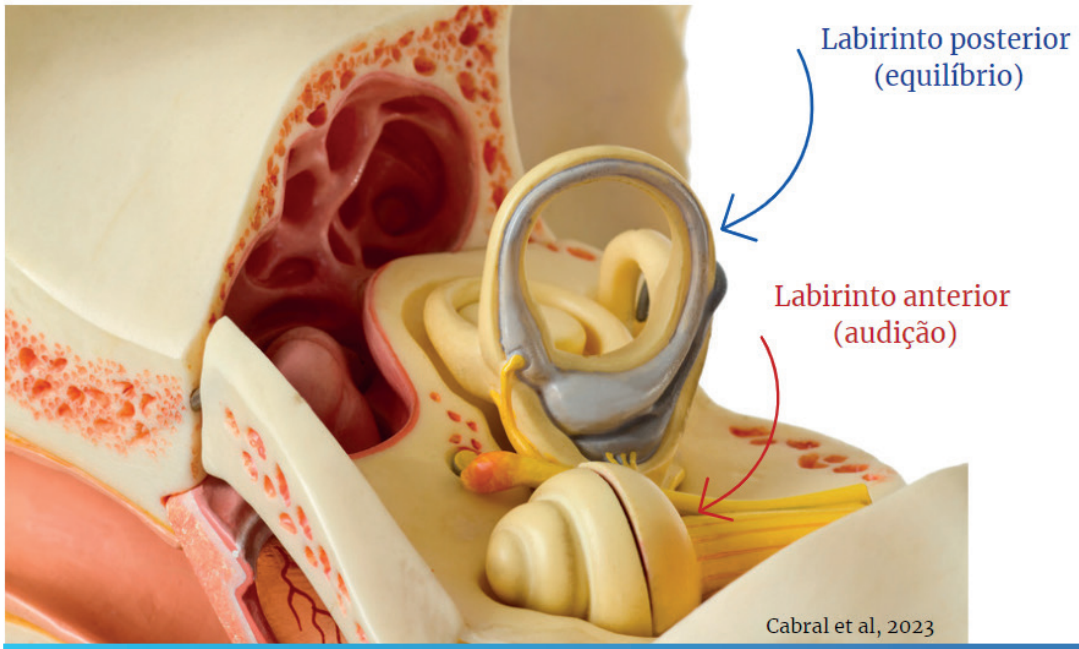
The consequences of vestibular changes are diverse and it is not uncommon for children to present psycho-emotional impairments such as anxiety, depression and social isolation.

The impacts on the child's quality of life are diverse and may also contribute to impairment in cognitive and motor development, in addition to the reported psychosocial-emotional development.

Dizziness can also cause a significant delay in the psychophysical and emotional health of children due to the close relationship between the vestibular and limbic systems, the latter responsible for regulating emotions and storing experiences.

Another extremely important point that should be highlighted is the relationship between hearing and balance. Therefore, it is relevant to return to some principles of anatomy and physiology. The inner ear can be divided into two portions that are inserted into a small cavity called the vestibule; the names of these portions are anterior labyrinth and posterior labyrinth. The anterior labyrinth is made up of the cochlea, whose main function is hearing, while the posterior labyrinth is made up of the vestibular system, whose main function is balance.

There is a clear distinction in the functionality of the auditory and vestibular systems, however, given the anatomical and physiological proximity between the systems, it is not possible to rule out the coexistence of auditory and vestibular alterations in the same individual.



Therefore, a child with vestibular complaints must be submitted to an audiological evaluation. And a child with hearing complaints should undergo a vestibular evaluation.

Vertigo/dizziness can be caused by a dysfunction located in the peripheral vestibular system (vestibule - saccule, utricle and semicircular canals) or by an alteration in the central nervous system region (brain stem, cerebellum and vestibulospinal tract).

There are countless causes of problems related to balance, however, if the alteration occurs in the child population, attention must be paid to its peculiarities and differences when compared to studies carried out in adults.

Vertigo results from causes arising from central involvement, including disturbances of the vestibular nuclei of the brainstem, medullary point, and the pathways connecting the vestibular nuclei to the cerebellum, brainstem, thalamus, and cortex; or of peripheral etiology, which includes damage to the labyrinth and vestibular nerve.

Among the possible diagnoses of imbalance in children, the following stand out:

- **CHILDHOOD VESTIBULAR MIGRAINE;**
- **RECURRENT VERTIGO OF CHILDHOOD (ALSO KNOWN AS BENIGN PAROXYSMAL VERTIGO OF CHILDHOOD – BPPV);**
- **VESTIBULAR NEURITIS;**
- **MOTION SICKNESS;**
- **PERSISTENT PERCEPTUAL POSTURAL DIZZINESS (PPPD);**
- **BENIGN PAROXYSMAL POSITIONAL VERTIGO (BPPV);**
- **MENIERE'S DISEASE (MD).**

EUSTACHIAN TUBE DYSFUNCTION WITH OR WITHOUT MIDDLE EAR EFFUSION AND SUPPURATIVE OTITIS MEDIA CAN ALSO BE EVIDENCED AS AN ETIOLOGICAL FACTOR.

Diagnosis in the pediatric population must therefore include a detailed neurological, otological, audiological and vestibular evaluation, complemented, when necessary, by instrumental investigations.

It should be noted that the vestibular function is essential for body balance and alterations in the vestibulospinal pathways can contribute to motor delays, with damage to the perception of the body schema, laterality, rhythm, fine motor coordination and spatial orientation, especially in the early stages of human development.

These neuropsychomotor delays can impact the organization of symbolic activities that are essential to the learning process. The subject's restriction to interact with the environment, associated with the need to seek better head and body adjustments for comfort and safety, can impair the exploration of the environment as well as their social interactions.

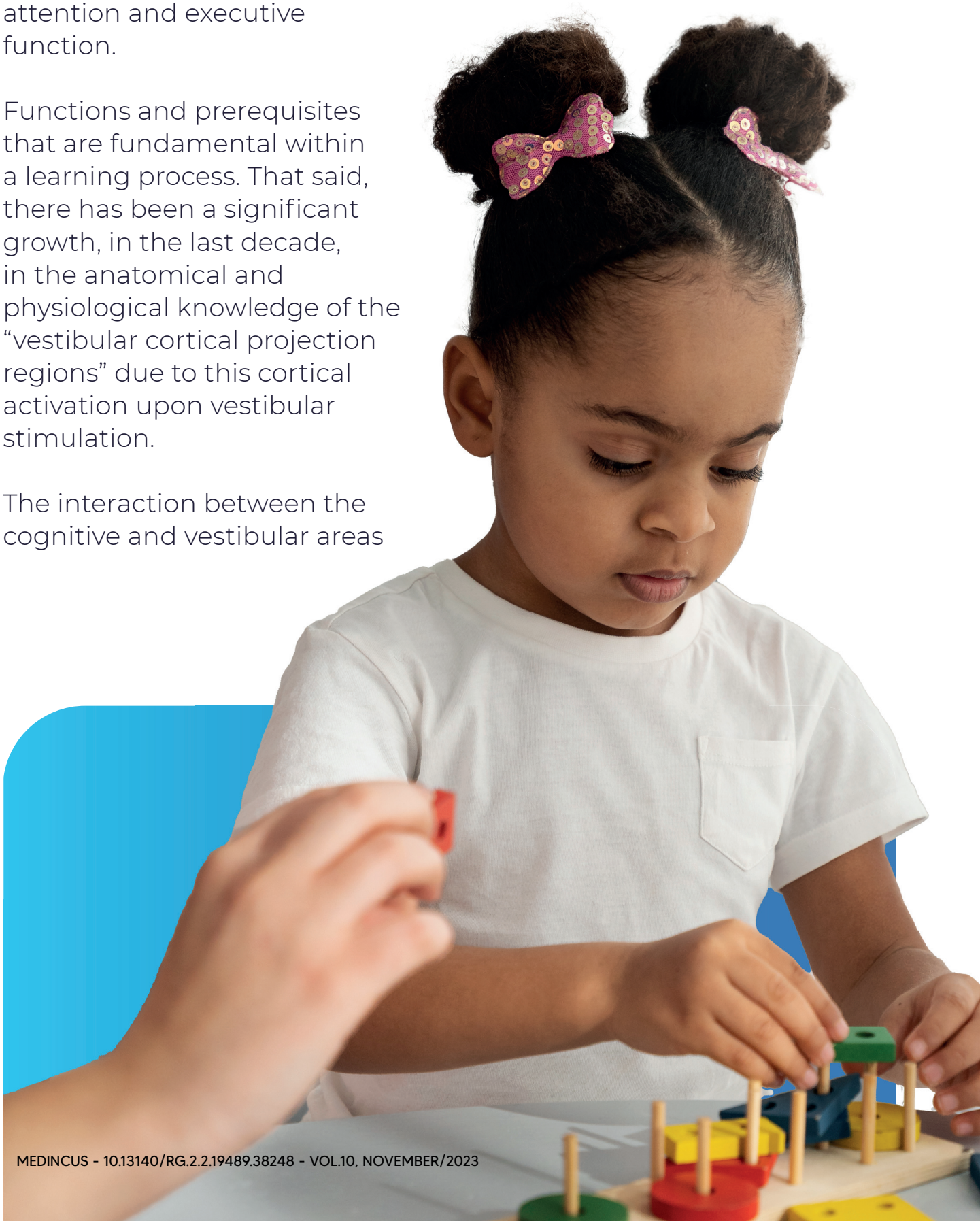
Concomitantly, it should be noted that children with vestibular impairments may also show restlessness, dispersion and inattention, making these processes of interactions and exchanges even more difficult.

These aspects may also interfere with the acquisition and development of oral language, reading and writing; in addition to leading to attention deficits, poor school performance, learning difficulties and auditory processing disorder (CAPD).

The correlation and importance of the vestibular system in the cognitive process are well established. Read cognitive process as visuospatial ability, concentration, memory, attention and executive function.

Functions and prerequisites that are fundamental within a learning process. That said, there has been a significant growth, in the last decade, in the anatomical and physiological knowledge of the “vestibular cortical projection regions” due to this cortical activation upon vestibular stimulation.

The interaction between the cognitive and vestibular areas occurs through neuronal projections between vestibular centers in the brainstem, cerebral cortex, and cerebellum.



Limitations in social interactions, added to postural changes, imbalance and motor incoordination, can cause problems in the acquisition and development of oral and written language.

In addition, a change in reading may also be associated with dysfunction in the oculomotor system, with consequent difficulty in recognizing letters.

The literature reports that children with school difficulties frequently present alterations in the vestibulo-ocular reflex. In addition to the reading ability, patients with vestibular dysfunction may also present alterations in writing, since this ability requires the integrity of cortical functions related to attention, language, memory, motivation, perception and sensation processes; and balance neuropsychomotor skills, such as lateralization, fine motor skills and body scheme.

THIS BULLETIN, THEREFORE, AIMS TO REINFORCE THE IMPORTANCE OF EARLY DIAGNOSIS OF VESTIBULAR DISORDERS IN CHILDREN. FURTHERMORE, THE AUTHORS EMPHASIZE THE CORRELATIONS BETWEEN THE LIMBIC, AUDITORY, COGNITIVE SYSTEMS WITH THE VESTIBULAR SYSTEM.

Therefore, attention and care with issues related to body balance can contribute to the prevention of cognitive, motor, oral language, reading and writing, school performance, attention deficits and psycho-emotional changes.

Aspects that are substantially important for an adequate child development and, when neglected, can cause relevant disorders in the quality of life of children with complaints of dizziness and/or vertigo and/or imbalance.

References Consulted:

1. Bigelow RT, Agrawal Y. Vestibular involvement in cognition: Visuospatial ability, attention, executive function, and memory. J Vestib Res. 2015;25(2):73-89. doi: 10.3233/VES-150544. PMID: 26410672.
2. Bigelow RT, Semenov YR, Hoffman HJ, Agrawal Y. Association between vertigo, cognitive and psychiatric conditions in US children: 2012 National Health Interview Survey. Int J Pediatr Otorhinolaryngol. 2020 Mar;130:109802. doi: 10.1016/j.ijporl.2019.109802. Epub 2019 Nov 28. PMID: 31809971; PMCID: PMC7008084
3. Bower CM, Cotton RT. The spectrum of vertigo in children. Arch Otolaryngol Head Neck Surg. 1995 Aug;121(8):911-5. doi: 10.1001/archotol.1995.01890080077015. PMID: 7619420.
4. Cabral, A. Tratado de Otoneurologia Infantil. Editora Book Toy: Ribeirão Preto/SP. 1 edição. 2023. 440 p.
5. Li CM, Hoffman HJ, Ward BK, Cohen HS, Rine RM. Epidemiology of Dizziness and Balance Problems in Children in the United States: A Population-Based Study. J Pediatr. 2016 Apr;171:240-7.e1-3. doi: 10.1016/j.jpeds.2015.12.002. Epub 2016 Jan 27. PMID: 26826885.
6. O'Reilly RC, Morlet T, Nicholas BD, et al. Prevalence of vestibular and balance disorders in children. Otol Neurotol. 2010;31(9):1441-1444.
7. Hungria, H. Otorrinolaringologia. 8. ed. Rio de Janeiro: Guanabara Koogan, 2000. 593 p.Zhang J, Zhu Q, Shen J, Chen J, Jin Y, Zhang Q, Duan M, Yang J. Etiological classification and management of dizziness in children: A systematic review and meta-analysis. Front Neurol. 2023 Mar 2;14:1125488. doi: 10.3389/fneur.2023.1125488. PMID: 36937528; PMCID: PMC10018681.
8. Sleifer P, Skarzynski PH, Sanfins MD. Motion Sickness – part I. Medincus – 10.13140/RG.2.2.15982.48964 – vol 02, March/2023.

Authors:

PROF. DR. ALINE CABRAL

- Associate Professor II of the Federal University of Sergipe – UFS and head and coordinator of the Speech Therapy Course at UFS.
- Post doctorate in human communication disorders at the Federal University of São Paulo – UNIFESP;
- Doctor and Master in Otorhinolaryngology from the University of São Paulo – USP;
- Certified by the Audiology vestibular international Science Academy;
- Specialist in Audiology from the University of Health Sciences of Alagoas – UNCISAL;
- Author and organizer of the Treatise on Pediatric Otoneurology (2023)
- Invited professor of postgraduate courses in Clinical Audiology and Otoneurology at several teaching institutions.
- Researcher in the areas of Otoneurology; neuroaudiology and auditory processing.
- Lecturer at several congresses in Brazil and abroad.
- Reviewer of scientific articles in the field of Otoneurology and Neuroaudiology.

PROF. DR. PIOTR HENRYK SKARZYNSKI

- Professor, ENT, Master and Doctorate by Medical University of Warsaw;
- Research, didactic, clinical, and organizational work in World Hearing Center of Institute of Physiology and Pathology of Hearing, Institute of Sensory Organs and Medical University of Warsaw;
- Specialist in ENT, pediatric ENT, audiology and phoniatrics, and public health. Participated in the 3rd Stakeholders Consultation meeting during which the World Hearing Forum of WHO was announced;
- Member of the Roster of Experts on Digital Health of WHO, Vice-President and Institutional Representative of ISfTeH;
- President-elect of International Advisory Board of AAO-HNS, member of Congress and Meeting Department of EAONO, Regional Representative of Europe of ISA, Vice-President of HearRing Group, Auditor of EFAS, member of the Facial Nerve Stimulation Steering Committee;
- Board Secretary of the Polish Society of Otorhinolaryngologists, Phoniatrists and Audiologists. Member of Hearing Committee (2018–19);
- Goodwill Ambassador representing Poland at the AAO-HNSF 2021 Annual Meeting & OTO Experience, and since 2021 a member of Implantable Hearing Devices Committee and Otology & Neurotology Education Committee of AAO-HNS;
- Consultant Committee of International Experts of CPAM-VBMS (by special invitation), honorary member of ORL Danube Society, and honorary member of Société Française d'Oto-Rhino-Laryngologie;
- Member of the Council of National Science Center;
- Expert and member of numerous national organizations.

PROF. DR. MILAINE DOMINICI SANFINS

- Postdoc at the World Hearing Center, Warsaw, Poland;
- Sandwich Doctorate by School of Medical Sciences, State University of Campinas (FCM-UNICAMP) and by Università degli Studi di Ferrara/Italy;
- Expertise in Audiology by Federal Council of Speech Therapy and Audiology;
- Speech Therapist and Audiologist, Master by Medical School of University of São Paulo (FMUSP);
- Professor of the Post-graduate program in Clinical Audiology at the Albert Einstein Israelite Institute of research and teaching;
- Invited professor in undergraduate, specialization and postgraduate courses;
- Reviewer of scientific articles in the area of Neuroaudiology, Neuroscience and Audiology;
- Research group member, Institute of Physiology and Pathology of Hearing, Kajetany, Poland.
- Instagram @dramisanfins / email: msanfins@uol.com.br