

How to enhance the learning of children with Congenital Zika Virus Syndrome?

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Abstract. In 2015, in northeastern Brazil, numerous cases of children born with microcephaly emerged. After several studies, the link between microcephaly and contamination by the Zika Virus during pregnancy was proven. The work seeks to highlight the need to enhance the learning of children with Congenital Zika Virus Syndrome. Recognizing this need to improve learning processes for children affected by Congenital Zika Virus Syndrome (CZVS) and questioning how to enhance this learning for children situated within this scenario, the following article has the general objective: seek alternatives to enhance children's learning affected by CZVS. This objective will be achieved through the characterization of the syndrome and its impacts on health and learning, so that there is a better understanding of its effects not only in the physical scope, but also recognizing its implications for cognitive development. The production of this research is justified by the need to understand the learning processes that are carried out by these children within their limitations and thus develop means that meet their demands and can enhance these processes, so that they are assisted and welcomed taking into account consideration of the context of their realities arising from the CZVS. It was concluded that the neural differences caused by CZVS should not be a limiting factor for professionals who will guide the learning process of microcephalic children.

Keywords. microcephaly, Congenital Zika Virus Syndrome, learning.

1. Introduction

In 2015, in the region of Bahia, located in the Northeast of Brazil, numerous cases of children with microcephaly emerged, describing it as a congenital malformation which reduces the size of the children's skulls, due to this increase, there is a notable concern in identifying the possible causes that would be leading to this scenario. With attention focused on the problem, investigations were able to determine an association between cases of microcephaly and contamination by the Zika virus (ZIKV) transmitted by the *Aedes aegypti* mosquito, with a taxonomic nomenclature that emerged in Brazil in a previous period, specifically, transmission of the virus was recorded by authorities in May 2015 as reported by the Pan American Health Organization. However, the virus would have entered the Americas two years earlier, according to Escosteguy [1] "Phylogenetic and molecular clock analyzes suggest that the introduction of ZIKV in Americas occurred between May and December 2013 and that there is similarity with the Asian genotype."

Due to the increasing number of cases of children

with microcephaly the events were reported through the Public Health Event Registry (RESP). The RESP-Microcephaly was made possible on December 19, 2015 by the Ministry of Health, taking into account that, at this moment, due to the worsening of the situation, the cases reached national concern, being declared as National Public Health Emergency (ESPIN) [2].

According to the Ministry of Health, the Zika virus (ZIKV) when present in the pregnant woman's body, it can cause not only microcephaly of the fetus, but also a sequence of other congenital anomalies, as it affects the neurological parts, and also parts of the central nervous system. The range of symptoms arising from the Zika virus characterizes it as Congenital Zika Virus Syndrome (CZVS), the affected fetus may show the following symptoms: congenital anomalies of the nervous system, visual and hearing changes, changes in the muscles of the joints and limbs, neuro psychomotor changes, craniofacial deformities [3]. Its transmission can occur through the bite of the *Aedes aegypti* vector, the contamination can also occur through sexual relations with partners who carry the virus and through blood transfusion.

Based on published epidemiological reports and available on the government website, statistical data studies confirm that the presence of Congenital Zika Virus Syndrome (CSZK) initially stood out in the Northeast region of Brazil, in main evidence in the State of Bahia and the State of Pernambuco, however, not only remaining in the Northeast region, but also expanding to the Southeast region of Brazil, with the highest concentration in Rio de Janeiro, between 2015 and 2019 [4]. In Bahia alone, in the period from 2015 to 2020, 2095 were registered 2095 cases of Congenital Syndrome ZikaVirus(CSZK). Among them, 585 were confirmed, with 215 possible cases and another

451 still under analysis [5]. According to the Health Surveillance Secretariat (SVSA) -created in 2003- in conjunction with the Ministry of Health, in the year 2020, CZVS cases had their highest occurrence in Manaus, Belo Horizonte, Águas Lindas de Goiás and Brasília, which means that this time the largest number of events were no longer located in the Northeast, they were recorded in the central-west, north and southeast regions of Brazil [4].

As a way to deal with the infection scenario resulting from the Zika Virus and other etiologies, the Ministry of Health (MS) together with the Health Surveillance Secretariat (SVS) and the Health Care Secretariat (SAS) prepared a document with guidelines and procedures to be adopted to identify any aggravating factors in relation to infections caused by the Zika virus and other etiologies, in addition to establishing efficient care for children who have the syndrome, with the aim of contributing to a better quality of life given the situation [2].

As previously stated, the presence of the Zika virus in a pregnant woman's body can cause a series of problems for the development of the fetus. one of them being the malformation of the child's head circumference, causing a reduction compared to what is normally expected from a healthy fetus, this malformation is called microcephaly, the virus infection occurs intrauterine [2]. Microcephaly can also occur due to infections caused by other viruses(herpes simplex virus and Rubella Virus), in addition to being the result of infections caused by bacteria and protozoa, as is the case with syphilis and toxoplasmosis. Children with Microcephaly may present learning problems due to compromised intellectual development, physical impairments, visual and hearing deformities and even being exposed to developing convulsive disorders [2].

Focusing on ZIKV this virus is found in the Flaviviridae family and belongs to the Flavivirus genus. When present in a pregnant woman's body acts on the neural progenitor cells (fetal brain cells), it is these cells that will allow the development of the skull cartilage to occur, in addition to its bones [6] , causing a reduction in head circumference. To identify microcephaly, the doctor must have a tape that does not have elasticity so that he can take the

precise measurements of the child's head contour.

It is true that the congenital syndrome associated with Zika virus infection (SCZ) causes numerous complications, such as anomalies resulting from Zika virus (ZIKV) infection in pregnant women, which are a health concern. Children who are victims of this situation have their lives damaged and lack support over time so that they can have a quality of life in all sectors in which they are located. It is in this sense that there is a concern about how to establish learning situations that are appropriate, taking into account their real conditions, so that they are not harmed and their rights are exercised

Recognizing this need to improve learning processes for children affected by Congenital Zika Virus Syndrome (CZVS) and questioning how to enhance this learning for children situated within this scenario, the following article has the general objective: seek alternatives to enhance children's learning affected by CZVS. This objective will be achieved through the characterization of the syndrome and its impacts on health and learning, so that there is a better understanding of its effects not only in the physical scope, but also recognizing its implications for cognitive development; The objective is specifically to investigate resources and methods capable of enhancing the learning of children with CZVS, thereby highlighting viable means and approaches; and propose stimuli for the neuropsychological processes of learning. The production of this research is justified by the need to understand the learning processes that are carried out by these children within their limitations and thus develop means that meet their demands and can enhance these processes, so that they are assisted and welcomed taking into account consideration of the context of their realities arising from the CZVS.

2. Research Methods

To develop this article, the methodology adopted consisted of a selection of articles, documents and other published works that addressed the key theme of this discussion, so that - based on the research of other authors - it was possible to arrive at the elucidation of the proposed objectives, constituting a bibliographical research. The research was carried out based on a qualitative approach, as the intention was not to work with data quantification, but based on reflection on the learning of children affected by Congenital Zika Virus Syndrome (CZVS), specifically how to enhance this learning , understanding that it occurs in different ways and through the use of different methods that will be formulated and even reformulated depending on the needs of the group. Data analysis was carried out with the aim of understanding the syndrome, its origin and characteristics, so that there was an understanding of the scenario and from there establishing, in the context of learning, the necessary measures to carry it out in an effective and coherent way, taking into account the needs and limitations arising from

children with CZVS.

3. Results and discussions

3.1 Syndrome Congenital Virus Zika and Learning

The development of the Central Nervous System occurs from the 14th week of pregnancy [7], and from this a series of events occur during pregnancy that result in the formation of the Central and Peripheral Nervous System. The Zika Virus, transmitted in Brazil mainly through the *Aedes Aegypti* vector, is capable of overcoming the blood-brain barrier; research already proves this data [7], and as a result, fetal neural development - when contamination by the virus occurs - is potentially compromised by Congenital Zika Virus Syndrome, mainly with reduced head circumference, that is, microcephaly. The virus works by attacking the cells responsible for the formation of the skull, the neural progenitor cells [6], and because of this, a series of congenital anomalies can arise in the development of the fetus.

According to the Brazilian Ministry of Health, Congenital Zika Virus Syndrome comprises a set of abnormalities, including auditory, visual, neuropsychomotor changes which affect fetuses and embryos infected by the Zika Virus. The earlier - at gestational age - infection occurs, the bigger the signs and symptoms. In 2015, due to the increase in cases of microcephaly among babies in Brazil, a State of Public Health Emergency of National Importance was declared, and later, International. After research, the relation between contamination by the virus during pregnancy and microcephaly was proven.

Children affected by microcephaly may experience mental delays and physical disabilities. [6]. The impacts of the syndrome directly affect the cognitive and intellectual processes of individuals, resulting in mental, intellectual and motor deficiencies, little or no oral skills, low stature and poor school performance. Learning for micro-encephalic children becomes a challenge for teaching, as higher psychic functions are impaired.

Early stimulation of children affected by Congenital Zika Virus Syndrome is an alternative that seeks to alleviate gaps in intellectual development deficits caused by mental deficiencies already existing in the sensorimotor period. Stimulating babies is essential, exchanges and interactions must be promoted from an early age, [8] such early stimulation must be assisted by a multidisciplinary professional team. In the case of the educational sphere specifically, the inclusion of these children in daycare centers and preschools, valuing interaction with other children, pedagogical stimulation through colors, textures, shapes, movements, expressions can enhance experiential learning and the development of skills that later will be relevant to academic life.

To understand the learning process of children with SCVK, it is necessary to understand (in a general

sense) how this process occurs and what its determining variants are.

The process of learning occurs through the intersection between the brain, cognition and society [9], learning is not an exclusive neural function, even though the nervous system is a factor of singular importance. There are several determinants that are expressed in the learning process, determinants that alter the course of the process directly and indirectly. The existence of these variants leads us to believe that children with congenital disabilities, with the maximization of psychic, cognitive and social stimuli, can learn within their conditions and possibilities. Culture and social practices produce the subjects of learning and their means to accomplish this task [9]. The learning subject is not limited to his biology, he is a social being, a knowing being who is socially and culturally influenced, which means that learning is not only linked to the individual's physiological conditions, which breaks with the idea of the innateness of knowledge, as learning is the result of the action of several biological, cognitive, social, cultural, economic and affective factors.

The brain works according to its biological functions and experience [9], that is, experiences also modify brain functions, since in addition to biology itself, the environment is capable of influencing neural functioning. Therefore, even if there are deficits in the biological functions of children with microcephaly, learning experiences can provide them with better cognitive development.

To work with children with multiple disabilities (as is the case with many children affected by CZVS) it is essential to understand how this child's development process takes place, not restricting oneself only to understanding the deficiencies they have, but seeking to situate the reorganization of the child's organism in the face of this deficit [10].

The development of children with disabilities follows a peculiar, unique, unique sequence, and investigating its progression is a task that serves to capture the procedural essence in which such development occurs [10]. In the case of congenital disabilities arising from CZVS evaluating the developmental progression of each individual's learning, specifically, favors an understanding of the configuration of this process in that individual. The organism of children who were victims of CZVS is organized in light of their limitations and potential, the team that accompanies them must dedicate themselves to understanding their personality, identifying their modus operandis in the development process, seeking the best ways to conduct learning moments and the resources that best adapt to their needs, in order to then offer the necessary and effective support.

The learning process morphologically alters the brain, due to neural plasticity [11], that means

“learning” changes the brain, especially during childhood, which is the period of greatest neural neuroplasticity. The first years of childhood constitute a window for development due to the ability to form a greater number of connections between nerve cells (the neuroplasticity) therefore, it is a time when cognitive development and learning are in a “fertile field”. This interval must be fully utilized when it comes to children with Congenital Zika Virus Syndrome, so, early stimulation, inclusion in regular education and multidisciplinary work must begin as soon as possible.

Work with these infants must be aimed at expanding their capabilities, in order to favor their cognitive development, as “The plasticity of the Central Nervous System is present in all phases of human development, from intrauterine life (embryological development phase) to adult life”[12]. Starting from the understanding of the brain as an open system, as Luria argues, it is based on its interactions with the environment through the construction of knowledge across perceptions and mental representations that a change occurs in the structure and mechanism of the brain. It means that the brain is not a closed system, with restricted and localized areas for the functioning of the body and the CNS, but is an integrated system, which works in a combined and interdependent way [13].

The nervous system changes constantly in the early stages of life (period of greater neuroplasticity), adapting to the individual's new behaviors and intellectual capabilities. Although the maturation of the CNS begins in the embryonic period, it is not only biological aspects that influence this process. Environmental factors have their due importance in the development of the CNS, as they favor the necessary changes in nervous cellular structures, favoring (later) the motor, cognitive and social skills [12].

Therefore, even though the brain structure of children with microcephaly has its peculiarities specific to the syndrome, causing congenital deficiencies, understanding that the brain is an open and alterable system through sensory and perceptual interactions the environment is a way of countering the deterministic idea of the non-development of these children, fixing them in a static point, where their learning and potential are not explored and these only receive assistance treatment, but their cognitive development is not boosted.

3.2 Methods, Resources and Stimulation

To enhance the learning of children affected by CZVS, some methods and resources can become allies in conducting this process.

Initially, the educational rights of children with disabilities must be guaranteed, such as the multi-resource room, specialized educational care, the presence of a therapeutic companion, the use of

resources adapted to their needs, the adaptation of teaching resources and the accessibility of school infrastructure. Only by complying with the Brazilian Law on the Inclusion of Persons with Disabilities is it possible to integrate individuals with congenital disabilities into regular education. That said, brain functions potentially impaired by microcephaly (caused by CZVS) should not occupy the main focus during the teaching-learning process, the affectivity inherent to the psyche [9] it also influences the cognitive process. Children affected by the syndrome experience learning difficulties due to changes in brain functions and, consequently, in the cognition process. However, it is worth investing in other variables that are limited to learning, among them, focusing on affectivity is a valid alternative.

Through the establishment of connections between teacher and student, the development of cognition is facilitated. To achieve this, it is important that the school environment is welcoming and receptive, as well as the entry of this child into this space occurs in a procedural manner, with the presence of a therapeutic companion and, if necessary, a guardian with whom the child already has close ties.

Integrating this child with other children facilitates reception, social interaction and affection in the educational process. The learning process of these individuals tends to be deficient, but not impossible. To understand it is important to dissociate the concept of learning from the concept of school performance and the mere assimilation of information, “learning” consists of understanding, situating oneself and intervening in the reality surrounding the individual, it is an act that involves cognitive, affective, social, cultural, neurological and psychic processes. Learning is mentally constructed, through the acquisition of new knowledge, being constructed internally and subjectively, through interaction (Carrera, 2009). Learning is not transmitted, but is found in a construction space, that is, it becomes evident that the concept of learning in the school space should not be limited to the mere assimilation of knowledge, but also the construction and resignification of knowledge, behaviors and skills.

To conduct learning, the presence of a multidisciplinary team is a determining factor: monitoring by neurologists, pediatricians, psychologists, occupational therapists, physiotherapists, psychomotorists, psychopedagogues, neuropsychopedagogues and speech therapists is of paramount importance for the development and health of these individuals. Within the school microsystem there are other factors that also contribute to the learning of micro-encephalic children, such as the involvement with the family, the appreciation of playful and interactive activities, the presence of a mediator (Therapeutic Companion), an adapted space with the necessary resources, the reception of this child, inclusive academic activities, good school

management, teacher preparation and adequate infrastructure.

The repetition of motor activities helps in the formation of motor schemes [9], in other words, we know that microcephaly can affect the individual's motor skills, however, in the school space, reinforcement and repetition of activities that working on motor skills can help children with congenital disabilities caused by the Zika virus adapt and learn to control their bodies. Physical Education receives special emphasis on carrying out activities that involve motor skills, psychomotricity, laterality, visual-spatial control, among other important aspects for children's body development.

Another valid resource in the cognitive stimulation of the individuals in question is the body itself, the sensory system itself, even if some senses carry alterations or deficiencies, working with sensory stimuli is a method that leads to learning and bodily awareness. The sensory system constitutes the basis of human development and learning, which is perceived by the dynamism of interconnections spread throughout the body [13], Exposing individuals to different textures, varied visual and auditory stimuli is a way of stimulating the body's senses, as well as working on broad motor skills.

The various activities that involve drawings, mimes, facial expressions model human communication, being essential to development and learning, by favoring an increase in the repertoire of communicative knowledge (Freitas 2006), working with micro-encephalic children's communication is a challenge, mainly due to the non-orality that some have, however, a few alternative means may be viable in facilitating these children's communication. Sign language, such as LIBRAS, the use of technological resources, monitoring with speech therapists and the use of facial expressions are alternative means that allow non-oralized children to communicate.

Dealing with the neuropsychological bases of learning and its possible stimuli a priori, according to Luria, the attention is a mental process that selects the stimuli and information of greatest importance for achieving a given stimulus [14] therefore, carrying out activities that focus the attention of people with microcephaly is a means of promoting a neuropsychological basis for learning. These exercises can be "isolated" or contextualized, that is, there can be a moment of emphasis only on the child's attention, with the use of games, toys and games, or during various other activities that require concentration, such as adapted school activities. The moments of emphasis on attention should preferably be conducted individually, to stimulate concentration and focus, materials and recreational activities should be prioritized.

The perception, according to Luria, occurs through the search for information, comparisons and formulation of hypotheses [14], to stimulate perception, the use of concrete materials during

school activities is a means of instigating comparisons, collecting information and creating mental schemas in these children. Montessori materials, handcrafted educational objects produced according to special educational needs, cuisenaire scales, Legos, mobile alphabets, Froebel games, abacuses, digital whiteboards, among various resources, can be used.

Memory stimulation, another neuropsychological basis for learning, must be constant in the teaching process. Remembering past activities, carrying them out again both in the educational space and in the family space, establishing interconnections between the topics covered and using games that work on this specific basis are alternatives for stimulating memory. To improve memory, it may be necessary for activities to be repeated constantly, with the aim of improving the child's performance in carrying them out.

Better directing the monitoring of these people's learning, planning the skills to be developed, evaluating the child's progression, setting goals and strategies to enhance their development are ways of organizing (didactically) educational action plans. The production of monitoring plans for these children must be an inherent activity for all professionals who monitor them in a multidisciplinary way, the team must jointly produce guidelines, taking into account the specificities of each area.

4. Conclusions

Given the above, it is clear that for children affected by Congenital Zika Virus Syndrome (CZVS) it is understood that the effectiveness of learning occurs in the process, respecting their conditions and limitations, but not making them conditions that restrict the continuity of their learning. Therefore, it is necessary that they are stimulated from an early age with motor and sensory activities, activities that provoke stimuli and that awaken them and lead to interaction and the development of their skills.

In this sense, it is necessary to prepare the environment and its real adaptation, so that it is possible to receive these children, bringing comfort and a feeling of belonging, which occurs through the organization of the environment, planned activities and social insertion through interaction with other children. Furthermore, this work cannot be carried out without the presence of a qualified team to meet the demands.

Therefore, it is concluded that the neural differences caused by CZVS should not be a limiting factor for professionals who will guide the learning process of microcephalic children. These professionals must seek to enrich their practices with the use of affection, welcoming, adaptation, inclusion, valuing experiences, adapted teaching resources and, mainly, through the recognition of the uniqueness of these children.

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