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BREASTFEEDING AND CHILD'S GROWTH. INTERPRETING BRAIN DEVELOPMENT THROUGH A BIOLOGICAL AND SOCIOCULTURAL CONTEXT

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ABSTRACT

Human brain begins to develop from uterus to postnatal period, affected by a genetic program in which diet holds a distinguished role. Research evidence has shown that diet in early life has a significant long-term impact on health and development. Moreover, food deprivation during early life affects physiology and brain biochemistry and connects to possible brain disfunction. Breastfeeding is the natural way of feeding the infant and the young child, providing it with an ideal growth and health. Available research evidence proves positive impacts of breastfeeding to the intelligence index, showing higher rates for breast fed infants than formula fed infants. The main objective of this paper is to highlight the role of breastfeeding in child's brain development. The suggested psycho-cultural context of interpretation highlights a series of symbolic dimensions of breastfeeding along with socio-cultural implications that interact with meaning-making processes, consequent practices, relationships and social models.

Introduction

The human brain is the result of a dialectical interaction of hereditary traits and environmental effects. Nowadays, it has been proven that brain microstructure – the internal neuronal pathway or the "neuronal networks" – is guided during its formation by stimuli of the environment, natural and social (Zafrana 2018).

Cognitive development is influenced by a variety of factors, nutrition included. A big bulk of citations underlines the relationship between healthy nutrition and optimum brain function (Yousafzai et al. 2016). Nutrients provide cells with structural elements that play a key role in cell multiplication, DNA synthesis, neurotransmission and hormone metabolism and are important components of the brain's enzyme systems (De Souza, Fernandes and Do Carmo, 2011). During the first years of life, brain development is faster compared to the development of the rest of the body (Black MM, 2018), a fact that renders the brain more vulnerable to nutrient deficiencies.

The present study is based upon various studies that have sought correlations between maternal nutrition during gestation and breastfeeding, infant and toddler nutrition during the first two years of life and cognitive functioning in later childhood. It also investigates the relationship between the psycho-cultural role of breastfeeding in cognitive development in later childhood and the role of the special meaning breastfeeding adds to the mother-infant relationship.

The approach to the symbolic dimension of breastfeeding is based on the concept for cognition

that originates from the theory of culture (Bruner, 2007). This theory emphasizes on the construction of meaning through human transaction in the context of publicly available symbolic systems and the influence of dominant cultural models. It also establishes a psycho-cultural perspective which may serve as a useful context of interpretation about how culture shapes basic meanings, relationships and practices.

The role of nutrition in prenatal brain development

Nutrition affects the brain throughout human life, but it plays a potentially more important role during the crucial prenatal period, when the greatest part of brain development occurs (Lillycrop and Burdge, 2011). The embryonic nervous system consists of the precursory brain and spinal cord and is one of the first systems to develop. Its development is determined during the first days of pregnancy. By the end of pregnancy, the brain is almost complete and is able to learn and form memories (de Rooij et al., 2016).

Some of the nutrients might have an impact on the outcome of pregnancy, changing maternal and embryonic metabolism through their role in the regulation of oxidative stress, enzyme function and metabolic pathways during the early stages of pregnancy (Cetin, Berti and Calabrese, 2010). Consequently, nutrients like iron, iodine, zinc and ω-3 long-chain polyunsaturated fatty acids yield a crucial role in fetal nervous system and brain development. Vitamins A, B6, B12 and folic acid affect oxidative pathways and methylation (Ramakrishnan, Grand, Goldenberg, Zongrone & Martopell, 2012).

Supporting data shows that the time that nutrient deficiencies take place can affect brain development vitally. Folic acid deficiency between 21st and 28th day after conception (when the neural tube closes) predisposes the fetus to a congenital malformation, called neural tube defect (Blencowe, Cousens, Modell & Lawn, 2010).

The connection between endometrial growth, development and health in adult life demonstrates the importance of the education of all women in reproductive age on the responsible attitude they have to adopt during and around pregnancy.

Breastfeeding and brain development

After birth, brain development depends greatly upon the quality of the child's nutrition.

Breastfeeding is the natural nutrition of the infant that guarantees its ideal development and health (World Health Organization [WHO], 2003). The benefits of breastfeeding are important to infant and mother, society and the environment.

This powerful liquid provides an array of bio-energetic ingredients to the growing infant during the crucial period of its brain, immune system and internal organ development (American Academy of Pediatrics [AAPP], 2012). Breastmilk contains the ideal amount of proteins, carbohydrates, lipids and protective agents, and, among the various and important benefits it offers, enhances the child's eyesight and psychomotor development. Also, it has been associated with higher IQ measurements in later childhood (Belford, 2017; Jardi et al., 2018).

Moreover, the necessary fatty acids regulate the expression of genes in the brain (De Souza et al., 2011).

The fats DHA and ARA, important components of brain microstructure, are found in higher concentrations in breastfeeding infants compared to formula-fed infants (Willats, 2018).

DHA fatty acids are considered one of the main factors for breastmilk's ability to ameliorate children's cognitive functioning. Humans can synthesize endogenous DHA from its precursor α-linoleic acid. However, the transition rate varies according to genetically determined polymorphisms on two genes, FADS1 and FADS2. Furthermore, the transition to DHA seems very limited in infants (Guesnet and Alessandri, 2011).

Only few studies support the hypothesis that iron levels of maternal blood during pregnancy affect cognitive development in later childhood (Tran et al., 2013). However, early iron deficiency has been positively linked to cognitive deficits in later childhood (Mudd, et al., 2018). Iron is crucial for the preservation of adequate erythrocyte count. Erythrocytes carry

oxygen, which is essential to early brain growth and development (Falkingham, et al., 2010).

The possible correlation between breastfeeding and cognitive growth of the child is limited or even reduced to zero considering factors that can affect it, such as the mother's IQ, which tends to be the strongest indication (Kramer et al., 2008; Horta, Loret de Mola & Victora, 2015)

Studies conducted in the 90s have proven that breastfeeding increases the IQ measurements of term infants by 2,7 and of preterm infants by 5,2. Unfortunately, only 6 of these studies take the IQ of the mother into account (Anderson, Jonhstone & Remley, 1999). However, in more recent studies, children who were breastfed for over a year and were evaluated with IQ tests at the age of 6, have shown higher IQ measurements compared to those who were breastfed for shorter periods of time or were not breastfed at all. This time, concurrent factors have been considered (Kramer et al., 2008; Lenehan et al., 2019).

Furthermore, studies that have used cranial ultrasound in children younger than two years, have shown that breastfed infants have developed a greater gangliothalamic diameter and head circumference and a smaller ventricular volume compared to formula-fed infants (Herba et al., 2012).

The investigation of the role of breastfeeding in human cognitive development continues. However, neuroscientists can use technology that might enlighten their research. Finally, according to most studies, exclusive early breastfeeding is the most important source of nutrients and is recommended strongly to all mothers.

A psycho-cultural context of interpretation

This approach is based upon an alternative concept about the nature of cognition, and hence about learning, that is signaled by a shift of interest towards the mind and the meaning (Bruner, 1996). This revolutionary insight compels psychology to combine elements from various scientific fields, such as anthropology, linguistics, philosophy and history, in order to formulate principal hypotheses on the formation of meaning, which holds a pivotal role in human existence. According to Bruner (1996), cognition is structured and materialized in relation to human culture using symbolic systems, to which the members of a community have access. Human ability to symbolically represent reality and negotiate it through social interaction plays an important role.

The ground hypothesis is that breastfeeding does not only constitute a behavior with nutritional value, but also a rich field of social interaction (Fouts, Hewlett & Lamb, 2012) with symbolic implications. From a cultural point of view, humans: (a) form their way of thinking, feeling and acting, based upon publicly accessible symbols and meanings, which are produced, reproduced and transformed through social interaction and (b) organize their experience and form a way of understanding the world, themselves and others, under the influence of dominant cultural models they have internalized.

This interpretation context may contribute to a psycho-cultural understanding of: (a) the symbolic dimensions of breastfeeding and breastmilk, (b) the relationship between the meaning that is attributed to this special social mother/infant interaction through social knowledge and learning procedures, (c) the dynamics of the framework that is created for the formation of notions about the self and others.

Theoretical Background

The theory of culture is, in contrast to the theory of processing information, based upon the fact that cognition cannot exist and develop independently of culture (Bruner, 1996). It specifically refers to an intersubjective process of formation and reformation of our views of the world in the context of any social interaction. In the center of this process lies the attribution of meaning, which depends upon the setting and the occasion. According to Geertz (2003) culture consists of a complex web of meanings, that people weave in their interactions through their access to available symbolic systems.

In the frameworks of the same approach, symbols

function as vehicles for meanings. They point to complex meanings, they connotate, imply, suggest, provoke strong feelings and organize human action (Papataxiarchis, 1996). The cultural view helps us comprehend that we do not act upon an objective reality, as perceived by the senses, but rather based upon our views of the world. Reality is symbolically depicted and is imprinted on stories, images, feelings, values, classifications. The meaning that is attributed to it does not preexist, it is formed in a process of interpretational construction and through enrichment of human interaction with values, views and feelings (Charissi, 2017). In conjunction with the social nature of the human brain, as it is depicted in contemporary findings for neuroplasticity, we comprehend the vulnerable nature of human learning and the potential of relationships to form mental images (Gournas, 2011). Honneth's theory of recognition uses the psychoanalytical concept of recognition in order to reach a critical approach to the meaning of relationships on a number of levels and during distinct stages of life. Honneth attempts a new approach to the critical social theory , putting the focus on human individual development through intersubjective processes of mutual recognition, in relationships with important other ones (Fleming, 2014). Moreover, he attributes a dynamic role to these relationships: by placing the changes in the way we perceive ourselves psychologically, physically, socially, culturally in transformational processes that ourselves and others are involved in. On a first level, quality relationships setting off early in life are of primary importance. They produce perception models about the world and our place in it as well as internal potential for future relationships (West, 2014).

Symbolic dimensions of breastfeeding and socio-cultural implications

Breastmilk can be seen as a kind of cultural 'object'. A cultural object is anything that has a meaning for the members of a culture, has a form, tells a story and is therefore full of meaning and symbolic value to the members of a culture (Griswold, 2013). Breastmilk can be identified as the ultimate act of nurture and as life itself. Furthermore, it can point to connotations of extremes such as a good or a bad mother, basic or complementary food, pure versus formula milk, private or public breastfeeding and feelings of collective shame (taboos) (Athanasopoulou, Kaitelidou, Zyga, Malliarou, & Kalokairinou, 2013). Representations of all the above can be found among the anthropological observations of Mary Douglas. In her work Purity and Danger (2006), she examines cultural views for substances such as milk, that are secreted by the human body and can be held as impure or dangerous.

At times, breastfeeding has been associated with views of maternity and childhood and the reproduction of patriarchic relationships of power in patriarchic societies, in which the rules for breastfeeding have been set by men and men-dominated institutions (Zamani, 2006). Moreover, breastfeeding has been linked with matters of freedom and ownership of a woman's body. According to the French tradition, breastfeeding is one of the fields of construction of discourse and of reproduction of knowledge, experienced through the human body. The work of Julia Kristeva focuses on the fact that "we become talking subjects through the primordial pleasure of feeding. The infant incorporates 'another person's' discourse, just as it incorporates milk" and the body of the mother serves as an intermediate in this process (Zamani, 2006, p.9).

Changes that have been brought about in the collective imagination concerning the way we perceive breastmilk can grant us useful information about its socio-cultural implications. Since the mid of the 20th century, advertisement of formula milk as the modern and scientific way in infant nutrition and the need for prompt return of mothers to work after birth, have led to its dominance in the United States and the UK. However, after the war, there has been a turn towards breastmilk and a movement for breastfeeding based upon all the medical evidence for its benefits. Moreover, many changes have occurred in the fields of nurturing and feelings, as a

result of the contemporary way of life. Breast pumping and storage has led to a new understanding on the portable character of breastmilk (Boyer, 2010).

The circulation of bio-substances (nursing/pumping) has an effect on the views of the 'natural position' of breastmilk, creating thereby a new 'space' of nurturing (Boyer, 2010). Further research evidence derived within the field of sociology of donation highlights implications of breastmilk donation and reveals how gender dynamics shape issues of human tissue donation. Within this body of research, types of tissue derived from women's body, amongst which and breastmilk, acquire a value of their own depending on particular purposes and reasons. It is also suggested that these special bioeconomies should be considered in relation to a social understanding of the risk, safety and benefit which shape the experience of donation and gender outcomes (Kent, Fannin, & Dowling, 2019).

Breastfeeding can be considered a meaningful act, as it consists of meanings which are reflected in choices and practices, that as such, define relationships and reproduce social models. Depending on the social, cultural and health dimensions attached to it, within different geographical areas and periods of time, breastfeeding may also raise various issues related to the aforementioned dimensions. Skin-to-skin care after vaginal birth and during and after cesarean surgery (Crenshaw, 2014), implications and challenges associated with human milk exchange (Cassidy, Dowling, Mahon, & Dykes, 2018) or the experience of breastfeeding long-term (Dowling & Cooper, 2019) have become some of the main interests of contemporary research related to the symbolic dimensions of breastmilk and breastfeeding.

Conclusions

Breastfeeding intermediates the construction and expression of views of the world and the role of children and parents in the world. These views are reflected on attitudes and behaviors related to breastfeeding; for instance, the prompt or delayed response to hunger, feeding positions, regarding breastfeeding as a response to a nutritional or psychological need, as a scheduled action or an action that answers to the infant's needs. The process of breastfeeding and its recognition as a pleasure or a need and the practices that proceed from it, define future views and attitudes about relationships, development, nurturing, nutrition and health and predestinate expectations for acceptable or unacceptable behaviors.

To summarize, beyond its nutritional value: Breastmilk and breastfeeding constitute a rich field of symbolic activity and construction of meanings. The meaning attributed to breastmilk and breastfeeding provides us with cognitive and emotional models for the formation of distinct forms of behavior and identity. It is important to consider, not just the nutritional value, but also the socio-cultural implications of breastfeeding, as they contribute to the conservation and reproduction of cultural knowledge and cultural practices.

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