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Research Paper: The Impact of Nutrition on Babies Brain Development

**Introduction**

Good nutrition is directly linked with the development of babies and particularly with the development of the brain. Normal development of the brain requires adequate nutrition. The important phases of the development of the brain are during infancy and pregnancy, and hence nutrition becomes more important in these phases. The kind of nutrition provided to the babies at these stages acts as the basis for developing socio-emotional, motor, and cognitive skills in them (Johnson 475). Thus, any kind of nutritional deficiency during the stage of pregnancy or infancy will affect the productivity, cognition, and overall behaviour of the babies. Taking necessary measures to avoid the deficiencies of nutrients may produce long-term benefits for the people and societies.

This paper explains the consequences of nutritional deprivation at childhood on productivity and the development of brain function. Although the process of brain development takes place at all the ages, it’s more rapid in the stages of infancy and pregnancy. The first part of this paper explains few of the biological mechanisms are mentioned and explained which explains the effects of nutrient deficiencies on brain development. The second part discusses the following three factors:

* the quality and amount of stimuli the child gets from the environment
* the time of deficiency of nutrient
* the amount of nutrient deficiency

**Function of Nutrients**

After conception, the neural plate takes approximately 22 days to fold and transform into a neural tube, which ultimately becomes the spinal cord and brain. The neural tubes are affected by many nutrients like vitamin A, folic acid, and copper, thus making the availability of a sufficient amount of nutrients necessary, right from the beginning. After seven weeks of conception, the cell starts to break and divide into the nerve cells (also known as neurons) and the glial cells (cells supporting neurons). After the creation of neuron, it moves to a place inside the brain and grows the dendrites and axons there, that project out from the cell body. The projections then connect with other kinds of cells, known as synapses, through which the signals of nerve move from one cell to another. These processes involving the development of neurons start during the period of gestation and continue throughout the stage of infancy. Different pathways are formed by these grouped neurons. Adolescence and childhood remove almost half of the brain cells. The overproduction of Synapses is also recorded and then they are eliminated as well. Child environment is one of the important guiding factors for the refinement of neural pathways. The activation of the cells that are retained, takes place, while other cells are eliminated (Oppenheim 48). This is considered to be the primary mechanism of brain plasticity, which provides the brain with a facility to adapt to the environmental factors and an ability to reorganize in order to recover from any kind of injury during the process of development.

**Factors Influencing the Impact of Undernutrition**

While discussing the role of nutrition in the development of the brain, one must consider the factors which are responsible for enhancing the effects or impact of undernutrition. Some of those factors are explained below:

**Experience from the environment**

Experience does have an effect on brain development. Based on the experience, the following two kinds of processes are defined: “experience-dependent” and “experience- expectant.” In the process of experience-expectant, the brain depends on the particular amount of input to carry out the normal development process. An example of this process is, the brain requires the visual input in order to develop the visual cortex. Many neurodevelopment processes, dependent on such expected experiences, are impaired as a result of their unavailability. Many other kinds of stimulation affect the processes of experience-expectant and do occur in the early stages of life.

However, in contrast, the processes of “experience-dependent” define brain development as a response to the experiences and skills of an individual, which is a method that goes on throughout his whole life. For example, one of the neuroimaging studies shows that the volume of the hippocampus (an element of the brain whose function is to develop the spatial memory) increased as the trainee taxi-drivers of London learned the arrangement of the streets of the city. While the mechanisms of experience-expectant processes cover the environmental features that are universal, the mechanisms of experience-dependent, on the other hand, deals with the features and properties of the environment that are particular or specific to an individual. These processes ensure the adaptness and progress of individuals in their particular environment and culture. The deficiency of nutrients and stimulus from the environment have some strong effects on the process of brain development (Prado & Kathryn 17). These effects operate in the following ways: interacting effects, additive effects, and the effects of mediating, all of which are explained in detail below.

**Additive effects**

The process of brain development may experience some additive effects due to the deficiency of some nutrients and pragmatic environment input. Considering this factor in mind, one can expect the children, having both of the risk factors (deficiency of nutrients and low level of stimulation), to not perform properly, children having one of the risk factor (deficiency of nutrients or low level of stimulation) to perform at satisfactory level, and the children having none of the risk factors (deficiency of nutrients and low stimulation level) to perform at higher levels in socio-emotional, motor, and cognitive development.

The results of several studies, conducted in the discussed field, have proved the influence of both psychological stimulation and the nutritional supplementation on the development of children. Psychosocial stimulation, involved in these studies, comprised of time by time home visits of the community workers during which they carried out different sessions of play with children and mothers. The activities conducted by these workers include signifying play with household toys, focusing on improving the quality of the collaborations (particularly on the verbal interactions) between children and mothers, and training them about the basic concepts of shape, colour, number, and size. During the stage of infancy, children located in Costa Rica exhibited the same improver effects of anaemia, deficiency of iron and less socio-economic status for cognitive scores at the school-going age (Prado & Kathryn 17).

**Interacting effects**

The deficiency of nutrients may have some disturbing effects on the brain development of children but not on the others, depending on the quantitative and qualitative stimuli they get. For example, the children born with low weights and belonging to the families having significant socioeconomic status in Chile were definitely at minor risk for improper development than those born into the locations that are disadvantaged and poor. Therefore, in a few cases, stimuli coming from particular locations can provide the children with the protection from the destroying effects of under-nutrition.

However, the children coming from disadvantaged homes and who are not provided with proper nourishment may show more engagement and active response to many kinds of interventions and nutrition. For example, the positive effects and the overall impact of the energy drinks on the preschoolers’ development, belonging to the low-status families, were greatest in Guatemala (Prado & Kathryn 17).

**Mediating effects**

Finally, an improved nutritional status may create some significant improvements in the overall experiences and stimulation, the children get from the environment. Undernutrition might disturb the physical activity, physical growth, and important developments like that of motor and brain development, by moving through two pathways. The first path is dependent on the behaviour of caregiver and the second pathway covers the self-exploration of the environment by the children. In the first case, the primary reason for the improper development of the brain is the negligence of caregivers and inappropriate behaviour towards the children. They may treat the children as younger than they actually are. Also, the children coming from undernourished backgrounds are frequently fussy and ill, which leads the caregivers to act and treat them harshly than they would treat a healthier and happier child. The children belonging to undernourished environments may not be able to explore the world around them as significantly as the children from healthier and better backgrounds, which would automatically lead to the poor brain development (Prado & Kathryn 17).

**Importance of Timing of supplying nutrients**

The chances for the deficiency of nutrient to disturb the process of brain development increases significantly if the deficiency occurs at the time when the requirement and dependency on that nutrient for neurodevelopment are higher. Every neurodevelopment process relies on some particular nutrients. The effects of supplementation or deprivation of the nutrients on the development of the brain can be measured and recorded by establishing the links between the particular nutrients, neurodevelopment processes, and the time period of supplementation or deprivation. For example, for the auditory pathway of the brain stream, myelination occurs from week number- 26 of gestation until one year after the birth of a child. Fatty acids, also known as docosahexaenoic acid, are the necessary requirement for myelination.

Thus we can conclude that the supplementation with fatty acids in the first year after birth and in the 26th week may develop myelination of this specific pathway. As stated before, we can conclude a hypothesis based on the links between the timing, specific nutrients and neurodevelopment methods, and the concerned brain areas, but the future studies in this regard must clarify the fundamental effects and influence of nutrition on the development of the brain and its mechanisms (Prado & Kathryn 17).

**Degree of nutrient deficiency**

Many studies have shown that the development of the brain is compromised when the deficiency of a nutrient is ranging from moderate to severe but it is spared when the deficiency is slight to moderate. There are numerous mechanisms of homeostatic that provide the basic protection to the developing brain and evolving fetus against the shortage of nutrient to a definite degree or level. An example of this is, during the period of placental inadequacy, when the available amount of oxygen and nutrients are insufficient, a cardiac output is spread in such a way that decreases the flow of blood to the peripheral tissues and at the same time, increases the blood flow towards the heart, brain, and the adrenal glands. This mechanism positively contributes towards the growth of the brain even during reduced fetal growth. The improved amount of iron transfer towards the placenta as the stages of maternity decreases is yet another phenomenon that provides the fetus protection against the shortage of iron (Black 24).

However, there is a specific threshold existing for both the nutrients, and if it is surpassed, then the deficiency of either nutrient may lead to poor development of the brain. The following example shows the negative effects of nutritional supplementation on the development of the brain. In Chile, the infants aged around 6 months, with lower haemoglobin concentration have comparatively better cognition at the age of ten years if they had been provided with an iron formula during infancy, however, children with higher haemoglobin rates at the age of six months performed way better in accomplishing their tasks at the age of ten years if they were provided with the iron formula (Tolsa 132). Conclusively, the severity of a deficiency of a nutrient escalates both the chances of producing harmful effects on the development of the brain as well as the chances of positively reacting and responding to the supply of nutrients (Prado & Kathryn 17).

**Conclusion**

A sufficient supply of the protein, micronutrients, and fatty acids is necessary for the development of the brain. The optimal development of the brain is dependent on the healthier and effective interactions of the well-nourished children with their caregivers as well as with their environment. Children belonging to undernourished backgrounds are at the risk of not reaching their potential of development in socio-emotional, motor, and cognitive abilities. These abilities have huge importance as they are directly linked with economic productivity and academic performance. Therefore, mitigating or preventing the losses in early childhood developmental is necessary in order to make the economic conditions of low-income countries better, along with decreasing the economic disproportions in high-income countries. To enhance and complement the effect of the intervention, it is recommended to improve the quality of interactions between the caregivers and the infants. Many negative effects of the environments of undernutrition are eliminated by these healthier interactions. In order to provide all children with an opportunity to complete their development process in a healthier manner, some strategies targeting various factors like risk factors, and nutrition, must be developed and followed. These strategies will not only help to reduce inequality but also to promote motor, socio-emotional, and cognitive development in undernutrition environments.

**Works Cited**

Black, Robert E., et al. "Maternal and child undernutrition and overweight in low-income and middle-income countries." *The lancet* 382.9890 (2013): 427-451.

Oppenheim, Ronald W. "Cell death during development of the nervous system." *Annual review of neuroscience* 14.1 (1991): 453-501.

Johnson, Mark H. "Functional brain development in humans." *Nature Reviews Neuroscience* 2.7 (2001): 475.

Tolsa, Cristina Borradori, et al. "Early alteration of structural and functional brain development in premature infants born with intrauterine growth restriction." *Pediatric research* 56.1 (2004): 132.

Prado, Elizabeth L., and Kathryn G. Dewey. "Nutrition and brain development in early life." *Nutrition reviews* 72.4 (2014): 267-284.