

Role of Nutrition in Cerebral Palsy

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Abstract

Cerebral palsy is a group of disorders of the development of movement and posture causing limitation of activity that lead to non-progressive disturbances that occurred in the developing fetal or infant brain. This group of syndromes ranges in severity and is the result of a variety of etiologies occurring in the prenatal, perinatal or postnatal period. Cerebral palsy is the most common form of chronic motor disorders in children. Other factors responsible for disability in children include prolonged immobilization, nutritional factors, pubertal disorder and chronic use of anticonvulsants. Children with cerebral palsy having functional neurological damage, often have several disorders along with disagreeing movements resulting in feeding difficulties. These children can have difficulties during all stages of eating and drinking including difficulties with self-feeding, chewing and swallowing. Although cerebral palsy is considered a non-progressive disorder, 25% of adult population with cerebral palsy experience decreases in mobility by the age of 40 years. It has been found that cerebral palsy is associated with decreasing mobility in young adulthood, increased loss of muscle mass, fatigue, progression of motor dysfunction and reduced physical activity.

Introduction

Cerebral Palsy (CP) is a condition, which can be defined as “a heterogeneous group of non progressive motor

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disorders caused by chronic brain injuries that originate in the prenatal period, perinatal period, or first few years of life. There are three cerebral palsy subtypes: spastic, dyskinetic, athetoid, ataxic, and mixed cerebral palsy, with spastic forms being the most common. Persons with cerebral palsy are prone to low bone mineral density (BMD) because of low calcium and vitamin D intake as well as use of anticonvulsant medication which further lead to vitamin D deficiency. Persons with cerebral palsy are generally known to have inactive lifestyles which may adversely affect bone mass density [1,2]. CP is a multifactorial disorder and offers three types of causative factors:

- (1) Prenatal factors such as maternal factors, alterations of coagulation, autoimmune diseases, hypertension, intrauterine infection, trauma, toxic substances, dysfunction thyroid, abnormalities of the placenta.
- (2) Perinatal factors such as prematurity, low birth weight, maternal fever during labor, hypoglycemia, meningitis, encephalitis jaundice, intracranial hemorrhage, hypoxic-ischemic encephalopathy, trauma, cardiac surgery or extracorporeal membrane oxygenation.
- (3) Postnatal factors, as infections (meningitis, encephalitis), head injury, convulsive disorders are often accompanied by disturbances of sensation, perception, cognition, communication and behavior as well as epilepsy and secondary musculoskeletal problems [3].

Persons with cerebral palsy often have nutritional problems. Nutritional status is one of the most important factors for a healthy growth and well being for individuals with cerebral palsy. Greater degree of motor disability, worst nutritional state and longer evolution there will be greater involvement of linear growth and weight [4,5]. Ambulatory persons perform more weight bearing activities compared to non-ambulatory persons, which may prevent development of low bone mass density. As nutritional problems, epilepsy and inactivity (including fewer weight-bearing activities) occur less frequently in ambulatory persons with cerebral palsy [6]. Growth pattern in children with cerebral palsy differs from children without cerebral palsy. Children with cerebral palsy have the linear growth, weight, muscle mass, fat stores and bone mass density below average as compared to the general population. Besides under nutrition, overweight and obesity have also been reported among these children. Deviation from normal growth can be attributed to malnutrition, feeding problems, abnormal endocrine function, decreased weight bearing, disease severity, age, and gender. socioeconomic status and provision of good health care facilities also play a key role [7].

Prevalence of Cerebral Palsy

The prevalence is very high as 3.5 per 1000 children all across the globe with increasing trend in incidence over the years. The available data from India show the prevalence of 3 per 1000 children [8]. In Spain, the estimated population with cerebral palsy is around 120,000 persons. There is no report on the prevalence of cerebral palsy in the adult population over past few years [9]. The prevalence of vitamin D deficiency in cerebral palsy children has been found to range from 19 per cent to 38 per cent as reported by various investigators [10] while the prevalence of vitamin D deficiency / insufficiency in normal population varies from 10 per cent to 70 per cent in various studies [11]. Vitamin D deficiency prevalence has been found to be high among cerebral palsy children (55 per cent) while studies in normal Indian children it has been observed among 37.4 per cent of the population. Thus there is a definite increase in prevalence of Vitamin D deficiency in cerebral palsy groups studied [12]. Incidence of cerebral palsy in multiple births is 7.5/1000

live births and in single births it is 2.1/1000 live births. 10 per cent of the global population with cerebral palsy has some form of disability [13].

Nutritional Deficiencies Associated With Cerebral Palsy

Vitamin D is a necessary vitamin for bone metabolism, which has the potential to be synthesized on the skin. Nowadays, in order to avoid vitamin D deficiency, milk is supplemented with vitamin D, but milk products such as cheese, yoghurt and ice cream are not generally supplemented with vitamin D. There are few foods that contain naturally significant amounts of vitamin D, including fatty fish and fish oils. It is known that lack of vitamin D in children causes rickets. Studies have highlighted the fact that vitamin D deficiency along with cerebral palsy is a probable cause for spontaneous fractures in children [14,15]. The incidence of anemia tends to be significantly high among children with cerebral palsy due to lack of nutritional food intake, families depending on staple diet, recurrent infections and multiple drug intakes, adding on to their morbidity. Other vitamin deficiencies such as Vitamin B complex and Vitamin A are also high among them due to inadequate intake of all food groups including fruits and vegetables [16]. Vitamin D deficiency is an increasing public health concern among individuals of all ages. The endocrine society recommends that children and adults at high risk of vitamin D deficiency, with factors or conditions that reduce the synthesis or intake of vitamin D, were candidates for preventative vitamin D supplementation [17]. Majority of person's daily requirement of vitamin D is fulfilled from sun exposure. Individuals having limited sun exposure are more likely to suffer from vitamin D deficiency and further leading to limited mobility and cerebral palsy later on. This results in decreased bone mineral density, causing muscular weakness, deformity of muscle, functional impairment, and pathological fractures [18]. Children having severe motor impairment such as spastic quadriplegia will experience greater oropharyngeal dysphasia than diplegics, resulting in both macro-nutrient and micro-nutrient deficiencies, pulmonary complications, decreased gross motor attainment and decreased well-being [19]. Children with quadriplegic cerebral palsy have been found to be suffering from more physical and neurological abnormalities [20].

Nutrition in Cerebral Palsy

The nutritional status and adequacy assessments in children with cerebral palsy are important. Children with cerebral palsy are frequently described as having altered growth and compromised nutritional status. Malnutrition, as indicated by short stature, low fat stores, and low muscle mass has been correlated with poorer health status and decreased societal participation in children with moderate-to-severe motor disability. In contrast, risk of overweight and obesity is an increasing concern across the spectrum of functional impairment in children cerebral palsy with. Obesity is of particular concern for children with cerebral palsy because of long-term health risks associated with adiposity in general and also because of the potential for increased impairment to functional mobility that is related to being obese. Obesity can also increase the caregiver burden and has been linked to increased fracture rate [21]. It was observed in a study that as the duration, frequency, and volume of resistance training increase, protein supplementation may promote muscle hypertrophy and enhance gains in strength for both untrained and trained individuals [22]. A carbohydrate is considered to be the most basic unit of energy. All carbohydrates are eventually broken down into glucose (simple sugar)-molecules that are used to supply muscle and tissues with energy to perform daily tasks and exercise. It is therefore important to consume and store carbohydrate as a source

of fuel for the muscle and brain during exercise. Carbohydrate intake prior to exercise allows for blood glucose homeostasis during exercise and replaces muscle glycogen during recovery [23]. Adequate protein intake is essential to build and repair tissue, for adequate growth and development in childhood and adolescence and to promote lean tissue gain. An intake of 2.0g/kg per day of protein and an additional 20% increase in energy intake should be sufficient in these instances. Calcium-rich foods such as milk, cheese, yogurts, milk puddings, dark green leafy vegetables, tinned fish and sesame seeds/paste are necessary. Vitamin D is important, which is found in egg yolk, liver, oily fish, fortified milk or spreads, and through 15-20 mins exposure to sunlight particularly between March to September. In the absence of specific recommendations for use in individuals with CP, standard recommendations for dietary intakes of vitamins, minerals and trace elements should be utilized. Inadequate dietary intakes may be addressed through the inclusion of foods rich in the micronutrient at risk or through supplementation [24].

Conclusions

Nutrition is an important area of the management in children with cerebral palsy. Ill effects of malnutrition on physiology, motor, neurological and psychological functions are wide ranging. Malnutrition may cause impairment of the immune system, cognitive problems and neuromuscular disabilities. Children with cerebral palsy who have very low weight are at increased risk of death. With increase in severity of cerebral palsy, the mean number of chronic medical conditions also increases. Low bone mineral density in children with cerebral palsy is the major cause of brittle bones and bone fractures, and thus deteriorates their quality of life. The primary goal of management of cerebral palsy should therefore be improving the quality of life of both the child and the family. Focus should be laid on maximizing independence in activities of daily living, mobility and nutrition. Good nutrition is the cornerstone of health & well-being for all children. Weight gain & growth along predicted trajectories, reassure families & care providers that a child is thriving & is healthy. This true for children with cerebral palsy, but in these children the measuring & monitoring of growth is fraught with challenges that must be overcome to effectively interpret growth & nutritional adequacy.

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