Table of contents:

List of Figures:

List of Tables:

Abstract

Protein energy malnutrition is the most common form of nutritional deficiency among children and it's a worldwide health problem. Statistics and studies found that a wide range of cognitive, physical activity and physical growth shortfalls has been reported in malnourished children. In this study, two groups of children were selected, undernourished group and nourished group. Three main trials were applied to each group: height, weight and head circumference measurement, physical activity measurement and cognitive process measurement. The undernourished group was shorter, and the girls had smaller head circumference. The weight: height ratio was smaller in boys only. From physical activity measurement waking hours began on between 6 and 7 am, from which time activity rose up to 9 am, and then declined to reach around 2 pm, and decreased afterwards. The malnourished group differed from the nourished group on test of attention, memory, comprehension and verbal memory, and didn't vary on the test of finger tapping. The study confirmed that protein energy malnutrition (PEM) affects the weight, height, physical activity and decelerating the level of the development of cognitive processes during childhood.

Keywords: *XX, XX, XX, XX*

Introduction

Malnutrition is a combination of insufficient intake of protein, carbohydrate and micronutrients. Protein energy malnutrition is the most common form of nutritional deficiency among children and it's a worldwide health problem. Because of that it is important to study the prevalence of protein malnutrition and its impact among children. A wide range of cognitive and physical growth shortfalls have been reported in malnourished children. Moreover, protein malnutrition affects the physical activity of children. Physical activity is essential to the current and future health of children. Higher levels of physical activity in childhood are associated with increased well-being, and better cognitive and motor development. However, early protein malnutrition produces postponement in growth and development process. Also, it affects the children life specially their height, weight and head size. It could also cause stunting and continuing development of higher cognitive processes during childhood. Therefore, this study was aimed to assess the impact of protein energy malnutrition on physical growth, cognitive and physical activity in malnourished children.

Materials and Methods

Prevalence of protein energy malnutrition

A group of children were selected. Demographic and observation instrument was used. The observation was recorded of grades of protein energy malnutrition as per weight for age based on IAP classification. The score was divided into five categories; normal (>80%), grade I (71-80%), grade II (61-70%), grade III (51-60%) (Soja and Kiran, 2016).

Height, weight and head circumference measurement

Two groups were selected: 1- Undernourished group-20 boys, 20 girls

2- Nourished group (control group)-20 boys, 20 girls.

The data of sex, height (cm), weight (kg) and head circumference (cm) were collected and recorded for every child in both undernourished and nourished group (control group). Body weight was measured using the beam scale. Head circumference was measured using a metallic tape measure. The nutritional state of children was analyzed by expressing their measurement as percentage of the expected weight for height, height for age, and head circumference for age according to the standard of World Health Organization (WHO) (Alvear et al,. 2008).

Physical activity measurement

Physical activity was measured accurately by triaxial accelerometer. The accelerometer was attached to an elastic belt placed on the skin of the right side of the hip and worn for the six following days. The monitors were removed during bathing. The data recorded by the device

starting seven hours after the leaving the clinic and ended seven hours before returning to the clinic. After the monitor was removed, the caregiver was administrated a physical activity questionnaire including awareness and suitability of the device. The recorded activities were uploaded from the monitor by Antilife 6 software. Raw accelerometer data were collected at the rate of 100 Hz. Data recorded included all times of measurement period including night (and other nap) time in the analysis. The total physical activity was calculated as mean vector magnitude are valid days (count per minute, cpm) (Charles et al,. 2017).

Cognitive process measurement

20 Kids recognized as malnourished and 20 as adequately nourished in the age of 5-7 years old and 8-10 were tested. Neuropsychological battery for children sensitive to the effect brain function and age associated improvement was employed. The battery contained examinations of motor speed, attention, executive function, comprehension and learning and memory. Finger tapping trial was used to measure of motor speed. The children were asked to tap on rising key on a finger-tapping tool as fast as possible by the index finger. Five trials were given for each hand, each test lasting for 10 second. Mediocre number of taps for each hand included the score. Color test was used to measure the attention of children. Phonemic Fluency exam was used to measure executive function. This trial assesses spontaneous making of words start with giving letter within a restricted time. Token test was used to measure of comprehension. Its responsive trial of amenable aphasia (Bhoomika et al,. 2007).

Results

The gathered data were first summarized and analyzed by Excel (Figure 1). The prevalence of PEM was 41.28% had grade I PEM, 4.59% identified with grade II PEM, 1.83% had grade III PEM (Soja and Kiran, 2016). The nutrition state of children in the study group showed difference in weight: height, height: age and head circumference: age ratio at admission and at discharge during the first period of hospital cure in the both boys and girls. During four years of follow up, however, the study group grew at a systematically slower rate than the experimental treatment period at the hospital. In comparison with the control group they were significantly shorter ($p<0.001$), and the girls had smaller head circumference ($p<0.05$). The weight: height ratio was smaller in boys only ($p<0.02$) (Figures 2 and 3) (Alvear et al,. 2008). Children with physical activity data 97% completed 6 consecutive days of recording with daily median wear time of 24 hours. Judging from the diurnal design of activity, waking hours began on average between 6 am and 7 am, from which time activity rise up to 9 am, and then declined to reach a local lowest point at around 2 pm, and decreased afterward (Figure 4) (Charles et al,.

2017). ANOVA was computed to associate the show of the two groups of children crosswise the two age groups (Table1). Table 1 show that the malnourished group differed significantly from the nourished group in the test of attention, memory, comprehension and verbal memory. The two groups didn't vary on the test of finger tapping. It was ascertained that malnourished children did not have any problems with meaningful speech. In both age groups the nourished kids did better than malnourished kids in the cognitive process (Bhoomika et al,. 2007).

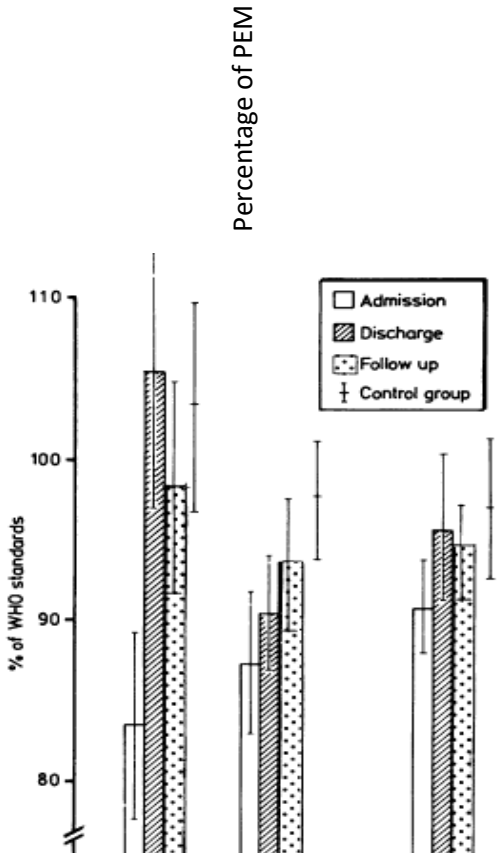

Figure 3. Nutritional state in boys in study group (% of WHO standards) at various times compared with control group (Alvear et al,. 1986)

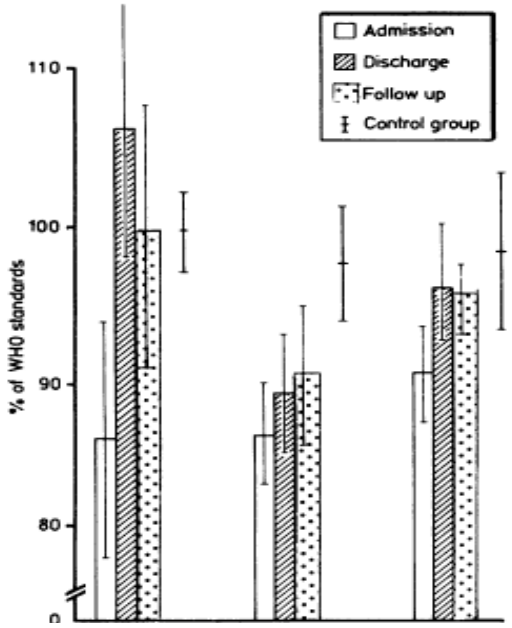

Figure 2. Nutritional state in girls in study group (% of WHO standards) at various times compared with control group (Alvear et al,. 1986)

Table 1. Mean comparisons for the cognitive functions across the two age groups of adequately nourished and malnourished children (Bhoomika et al,. 2007)

	WN (n = 20)			MN (n = 20)		
Functions	**Test scores**	**Mean (SD)**		**Mean (SD)**		**F ratio**
		5–7 yrs	**8–10 yrs**	**5–7 yrs**	**8–10 yrs**	
Motor functions (primarily mediated by frontal cortex)						
Motor speed-Right hand	Finger tapping test: Avg no. of taps	26.5 (8.6)	27.9 (4.5)	24.7 (2.2)	28.3 (3.2)	1.63ns
Motor speed-Left hand	Finger tapping test: Avg no. of taps	26.1 (9.1)	26.2 (5.08)	21.5 (2.8)	24.9 (1.51)	.85ns
Attention (primarily mediated by frontal and parietal cortex)						
Selective attention	+Colour cancellation test	129" (20.2)	95.9" (18.3)	202.8" (17.7)	153.6" (19.6)	9.4**
Focused attention	Colour trails test +Trail A	---	105" (25.8)	---	249" (49.2)	4.09**
Comprehension, learning and memory (primarily mediated by bilateral medial and anterior lateral temporal cortex)						
Verbal comprehension	Token test	27.7 (2.0)	30.6 (1.5)	19.6 (4.4)	23 (5.4)	14.2**
Verbal learning	Rey's auditory verbal learning test (RAVLT)-total learning score	32.4 (11.8)	42.3 (11.7)	26.9 (11.0)	30.7 (9.3)	4.2*
Verbal memory	Delayed recall score, RAVLT	7.1 (2.2)	8.9 (1.7)	5.6 (2.01)	6.0 (1.8)	5.08*
Visual memory	Delayed recall score, memory for designs test	6.6 (1.6)	9.7 (3.5)	2.2 (1.8)	2.4 (1.6)	8.04**

Discussion

The goal of this experiment was to assess the impact of protein energy malnutrition on physical growth, cognitive and physical activity of malnourished children. The Prevalence of PEM was high among under five children of the area studied (Soja and Kiran, 2016). The children of control group were able to grow up to WHO standards in spite of their inadequate living condition. This might depend on the head of the family having social security and better schooling and is a fact that shows the inadvisability of using local standards for height and weight in an undernourished community, as these norms will reflect sub-optional growth in population. We found that admission to hospital was capable of relapsing the undernutriton and of giving healthier living expectation to the children with protein energy malnutrition. They were able to grow at a quicker rate. Perhaps, because of the additional amount of fat saved during admission to hospital, but they were not able of attempting the growth of children who were not malnourished. Furthermore, the evidence presented in this study shows that mother's height and weight influences the height and weight of their children and that protein energy malnutrition is related to birth weight so it seems significant to give distinct nutritional support to low birth weight kids (Alvear et al,. 2008). During designs in physical activity showed peaks of activity in the morning and afternoon. This could signify times where children were more involved in unstructured play. The fall of activity observed during the middle of the day is likely due to nurturing and snoozing (Charles et al,. 2017). The rate of cognitive development was found to be different for different cognitive function. The degree of development was affected for some of the cognitive function showing minimal age connected improvement across the age range of 5-7 and 8-0 years such as design fluency, working memory, verbal comprehension and learning and memory (Bhoomika et al,. 2007).

Conclusion

In summary, the commonness of protein energy malnutrition was very high among children of the area studied. The study allows us to emphasis that protein energy malnutrition affects the weight, height and physical activity of malnourished children. Furthermore, chronic protein energy malnutrition effects in cognitive weakening as well as decelerating in the level of the development of cognitive processes during childhood rather than simply showing a general cognitive dysfunction as compared to nourished children. Stunting could result in a delay in the advancement of the mental function.

Reference

Alvear, J., Artaza, C., Vial, M., Guerrero, S., & Muzzo, S. (1986, March 01). Physical growth and bone age of survivors of protein energy malnutrition. Retrieved March 19, 2017, from http://adc.bmj.com/content/61/3/257.short

Kar, B. R., Rao, S. L., & Chandramouli, B. A. (2008, July 24). Cognitive development in children with chronic protein energy malnutrition. Retrieved March 19, 2017, from https://behavioralandbrainfunctions.biomedcentral.com/articles/10.1186/1744-9081-4-31

Soja, S. L., & Kiran, N. U. (2016). Protein Energy Malnutrition among Children. (n.d.). Retrieved March 19, 2017, from http://www.indianjournals.com/ijor.aspx?target=ijor%3Aijone&volume=8&issue=2&article=027

Yaméogo, C. W., Cichon, B., Fabiansen, C., Iuel-Brockdorf, A., Shepherd, S., Filteau, S., . . . Faurholt-Jepsen, D. (2017, February). Correlates of Physical Activity among Young Children with Moderate Acute Malnutrition. Retrieved March 19, 2017, from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5282395/