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Comparative Pulmonary Function Test Among Normal and Malnourished Children

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ABSTRACT

Pulmonary function tests are a broad range of tests that measure how well the lungs take in and exhale air and how efficiently they transfer oxygen into the blood. ***Aims and Objectives:****To compare the differences of pulmonary function between Normal and Malnourished children.* ***Materials and Methods:*** *The number of fifty children, attending Pediatrics Outpatients' Department of Mahavir Institute of Medical Sciences, Vikarabad, in the age group of 7 to 14 years were randomly selected. They were divided into three groups of 7-9, 9-12, and 12-14 completed years.* ***Results:*** *Both FVC (r = 0.22, p <0.02) and FEV1 (r = 0.24, p <0.02) showed direct linear correlation with body weight. %FEV1/FVC was not different in healthy and> malnourished children in 7-9 and 9-11 years age group.*

KEYWORDS :

Introduction:
Malnutrition is a condition that results from eating a diet in which nutrients are either not enough or are too much such that the diet causes health problems. It may involve calories, protein, carbohydrates, vitamins or minerals. Not enough nutrients is called under nutrition or under nourishment while too much is called over nutrition. Malnutrition is often used specifically to refer to under nutrition where there is notenough calories, protein, or micronutrients. If under nutrition occurs during pregnancy, or before two years of age, it may result in permanent problems with physical and mental development. Extreme under nourishment, known as starvation, may have symptoms that include: a short height, thin body, very poor energy levels, and swollen legs and abdomen. People also often get infections and are frequently cold. The symptoms of micronutrient deficiencies depend on the micronutrient that is lacking. Undernourishment is most often due to not enough high-quality food being available to eat. This is often related to high food prices and poverty. A lack of breastfeeding may contribute, as may a number of infectious diseases such as: gastroenteritis, pneumonia, malaria, and measles, which increase nutrient requirements. There are two main types of under nutrition: protein-energy malnutrition and dietary deficiencies. Protein-energy malnutrition has two severe forms: marasmus (a lack of protein and calories) and kwashiorkor (a lack of just protein). Common micronutrient deficiencies include: a lack of iron, iodine, and vitamin A. During pregnancy, due to the body's increased need, deficiencies may become more common. In some developing countries, over nutrition in the form of obesity is beginning to present within the same communities as under nutrition. Other causes of malnutrition include anorexia nervosa and bariatric surgery.

Efforts to improve nutrition are some of the most effective forms of development aid. Breastfeeding can reduce rates of malnutrition and death in children, and efforts to promote the practice increase the rates of breastfeeding. In young children, providing food (in addition to breastmilk) between six months and two years of age improves outcomes. There is also good evidence supporting the supplementation of a number of micronutrients to women during pregnancy and among young children in the developing world. To get food to people who need it most, both delivering food and providing money so people can buy food within local markets are effective. Simply feeding students at school is insufficient. Management of severe malnutrition within the person's home with ready-to-use therapeutic foods is possible much of the time. In those who have severe malnutrition complicated by other health problems, treatment in a hospital setting is recommended. This often involves managing low blood sugar and body temperature, addressing dehydration, and gradual feeding. Routine antibiotics are usually recommended due to the high risk of infection. Longer-term measures include: improving agricultural practices, reducing poverty, improving sanitation, and the empowerment of women.There were 793 million undernourished people in the world in 2015 (13% of the total population). This is a reduction of 216 million people since 1990 when 23% were undernourished. In 2012 it was estimated that another billion people had a lack of vitamins and minerals. In 2013, protein-energy malnutrition was estimated to have resulted in 469,000 deaths—down from 510,000 deaths in 1990. Other nutritional deficiencies, which include iodine deficiency and iron deficiency anemia, result in another 84,000 deaths. In 2010, malnutrition was the cause of 1.4% of all disability adjusted life years. About a third of deaths in children are believed to be due to undernutrition, although the deaths are rarely labelled as such. In 2010, it was estimated to have contributed to about 1.5 million deaths in women and children, though some estimate the number may be greater than 3 million. An additional 165 million children were estimated to have stunted growth from malnutrition in 2013.

Under nutrition leads to higher susceptibility of children to suffer from various infections and nutritional deficiencies and contributes to high rates of morbidity and mortality. Acute respiratory infections (ARI) in children constitute an important group of diseases with very high morbidity and deaths. The WHO initiated ARI Control Programme worldwide to effectively and timely treat ARI and improve quality survival in children. Literature pertaining to the respiratory status of Indian children both in health and disease is very scanty. There are, virtually, no reports available on the effect of protein energy malnutrition on respiratory functions. Non-availability of simple and sensitive equipments, non-cooperation on the part of child patient, logistic problems and indifference might have been the impediments to carry out research in this area. Thus, this study was undertaken to evaluate the effects of nutritional status on lung functions in the age group of 7-14 years.

Materials and Methods:
The number of fifty children, attending Pediatrics Outpatients' Department of Mahavir Institute of Medical Sciences, Vikarabad, in the age group of 7 to 14 years were randomly selected. They were divided into three groups of 7-9, 9-12, and 12-14 completed years. The weight (kg) and height (cm) were recorded by standard method and body surface area was calculated by Du Bois' formula. The nutritional assessment was done according to the Indian Academy of Pediatrics classification) reference weight was taken to be the fiftieth percentile of the weight for the particular age from the NCHS standard. The children were divided into healthy and malnourished according to the Indian Institute of Pediatrics classification. Children suffering from chest infections, bronchial asthma, heart problems and hyper pyrexia were excluded from this study. Lung function tests, namely Forced Vital Capacity (FVC), Forced Expiratory Volume in first second (FEV1), Peak Expiratory Flow Rate (PEFR), Percentage of FEV1/FVC (% FEV/ FVC) and Empty Index (FEV1/PEF were calculated using Pocket Spirometer.The procedure was demonstrated number of times to each subject individually up to our satisfaction. Three readings were taken from each subject by one of us and the most consistent one was noted. The data

was subjected to correlation and regression analysis using SPSS package. 'Unpaired t-test' was applied as and when necessary.

Results and Discussion:

There were 32 healthy and 50 malnourished children. The overall male to female ratio was 2:1. FVC, FEV_1 and PEFR in healthy and malnourished children are shown in table respectively. FVC and FEV_1 were reduced significantly.

Table.1.Forced vital capacity(FVC)

Age(yrs)	Subjects		FVC(L)	
	Control	Test	Control	Test(MC)
7-9	18	6	0.72±0.12	0.43±0.11*
9-12	7	24	0.95±0.23	0.62±0.33*
12-14	7	20	1.22±0.42	1.04±0.15

Table.2.Forced expiratory volume(FEV_1)

Age(yrs)	Subjects		(FEV_1)	
	Control	Test	Control	Test(MC)
7-9	18	6	0.89±0.11	0.57±0.21*
9-12	7	24	0.96±0.21	0.72±0.43*
12-14	7	20	1.12±0.46	0.98±0.18

Table.3.Peak expiratory flow rate (PEFR)

Age(yrs)	Subjects		(PEFR)	
	Control	Test	Control	Test(MC)
7-9	18	6	1.14±0.17	0.98±0.31*
9-12	7	24	1.56±0.48	1.22±0.13
12-14	7	20	1.76±0.32	1.34.±0.47

($p<0.05$) among malnourished children in all age groups. Both FVC ($r = 0.22$, $p <0.02$) and FEV1 ($r = 0.24$, $p <0.02$) showed direct linear correlation with body weight . %FEV1/FVC was not different in healthy and> malnourished children in 7-9 and 9-11 years age group (Table.III). Similarly, Empey Index was also not significantly different in healthy and malnourished children. All malnourished children in our study were suffering from acute protein energy malnutrition since their height was >80% of the expected height for the age. FVC and FEVj were significantly reduced in mal-nourished children in all age groups. The inspiratory and expiratory capacity depends upon endurance and strength of the respiratory muscles and bony cage. The muscle is a principal protein reservoir and gets utilized during nutritional deprivation resulting in its wasting. Flabbiness, hypo-tonia, tenderness and stiffness of muscles are clinical manifestations of MC in order of severity reduction in the number and size of muscle fibres, myotube formation, loss of cross-striations, disorganization of sub-sarcolemmal nuclei, perivascular edema and fibrous metaplasia in severe cases. Further the reduction in size and number of muscle fibres is directly related to the degree of Malnutrition. It was, therefore, expected that respiratory functions would be affected in the presence of Malnutrition. Indeed, FVC, FEV1 and PEFR were reduced in the Malnutrition subjects in our study.

Conclusion:

These findings have great clinico-therapeutic implications. Reduction in respiratory parameters need not be pathognomonic of some respiratory illness but may be the effect of Malnutrition which is so common in all the developing nations including India. One should be cautious in interpreting the abnormal respiratory functions in malnourished children.

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