Chapter 1

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From conception to death the fate of life is decided by what we eat. Good nutrition is essential for proper growth and development. Genetical as well as maternal, hormonal, nutritional and environmental factors contribute to a child's growth. Children need protein rich food than adults for proper growth and maintenance. Any deficiency of protein in children may lead to growth retardation and subsequent failure of immune system (Motil, 1985).

Studies have shown that in developing countries like India, there is a very high prevalence of severe grades of undernutrition and ill-health leading to high death rates in various vulnerable segments of population namely infants, toddlers, school going children and pregnant women. Nutritional surveys carried out among populations reveal that diets lack required amount of calories, vitamins and minerals (Rao and Gopalan, 1972; Rao 1974). Analysis of hospital records from the southern and eastern part of India shows that about 15 per cent of the cases were of malnutrition, especially protein-energy malnutrition (PEM), hypovitaminosis and anaemia (Gopalan, 1968).

The prevalence of underweight is very high in South Asian countries like Bangladesh, Bhutan, India, Pakistan and Sri Lanka. The risk of being underweight is 1.5 times higher in Asia than Africa. (Onis, Monteiro, Akre and Clugston, 1993). The prevalence of anaemia was also high in school going children, adolescent children and pregnant women. Mild and severe anaemia may impair well being and reduce maximal work capacity (Rao, Radhaiah, and Raju, 1980).
Diets, inadequate in calories and proteins lead to nutritional dwarfs or 'bonsai babies'. Acute malnutrition results in weight loss, mainly from depletion of subcutaneous fat and muscles which leads to anthropometric disproportions, especially between weight and height (Jelliffe, Jelliffe, Zerfas and Neumann, 1989). The main clinical features of mild and moderate PEM is weight loss leading to decrease in subcutaneous adipose tissue. In chronic cases of PEM, the children show growth retardation in terms of weight (wasting) and height (stunting). There is also decrease in physical activity and energy expenditure of children. Other functional indicators of immunocompetence, gastrointestinal functions and behaviour may also be altered. Non-specific manifestations include more sedentary behaviour, frequent episodes of diarrhoea and apathy, lack of liveliness and short attention spans. Biochemical information is not consistent in mild and moderate PEM. Laboratory data related to low protein intake may include low urinary excretion of creatinine leading to a low creatinine-height index in children, low urinary urea nitrogen and hydroxyproline excretions, altered plasma patterns of free amino acids with a decrease in branched chain essential amino acids, slight decrease in serum transferrin and albumin and reduced number of circulating lymphocytes (Torun and Viteri, 1988).

There is a paucity in respiratory function data among PEM children in Indian literature. The application of respiratory function tests in the diagnosis and management of disease is not routinely done in this country. The influence of nutritional deficiency on respiratory functions in health and disease remains a relatively unexplored area.

The primary function of the lung is oxygen uptake and carbon dioxide elimination, which may be affected by malnutrition-induced anaemia. Malnutrition results in muscle wasting and the wasting of
respiratory muscles result in poor ventilation. The inspiratory and expiratory capacity depends upon endurance and strength of the respiratory muscles and boney cage. The nutritional factors, especially in the early childhood may have an important bearing on the subsequent development of thoracic cage and hence the lung volumes. The nutritional factors may influence the muscular strength of the individual even in the later part of life (Jain and Ramaiah, 1969).

The ventilatory muscles require high-energy phosphate compounds such as ATP for the physical and biochemical activities, i.e. contraction and relaxation. Intracellular concentration of these compounds depends on intracellular substrate concentration and delivery of these substrates into the arterial blood flow. In addition to the delivery of substrates, blood flow also helps in the removal of metabolic by-products, which on accumulation exerts a negative effect on several excitatory and contractile processes of muscles (Hussain, 1996). Inadequate nutrition may lead to decrease in the concentration of intracellular substrate, which affect the structure, and contractile properties of ventilatory muscles.

One of the most important methods of assessment of respiratory muscle function is the vital capacity manoeuvre which depends on maximum inspiratory and expiratory effort by the muscles (Nava, 1998). The values of respiratory function tests are influenced by anthropometric, environmental, genetic, ethnic, socio-economic and technological variations. The present study explores the impact of undernutrition on physical characteristics along with respiratory functions in school going children of Kerala.

Many changes occur in a child's life when formal education begins. The noon meal is frequently taken at school, and the environment in which
food is taken will be very different from home. Going to school in time can interfere with breakfast, children may be unwilling to get up in time to eat, and some parents may not provide their children with adequate breakfast.

The nutritional needs of the school-going children vary according to the level of growth. The nutritional problems associated with these include undernutrition, which is characterised by poor growth and anaemia, particularly in children from low-income groups or due to a poor diet. During adolescence due to the rapid growth spurt, energy and nutrient requirements are greatly increased. With these in mind, the present study was undertaken with a view to establish whether nutritional status influences respiratory functions or not.