Summary and Conclusion

Undernutrition is the main public health problem in the developing countries. Since more information are not available on the respiratory status under nutritional stress, this work was undertaken with a view to study the impact of undernutrition on physical characteristics and respiratory functions in school-going children. Four hundred and thirty-one school children in the age group ranges from 6 to 15 years were the subjects of study.

Anthropometric assessments were done with standard techniques. The age, height, body weight, head circumference and mid upper arm circumference of children were recorded. BMI and BSA were calculated. Then the children were classified into normal, underweight, wasted and stunted according to standard anthropometric method. WHO reference growth data was used as the reference standard. Respiratory functions of children were evaluated through the measurement of lung volumes and airflow rates using spirometry.

The present investigation reveals that undernutrition is very much prevalent in school-going children of which underweight is generally common. Wasting and stunting are also seen among children. The head circumference, mid upper arm circumference, BMI and BSA were significantly reduced in undernourished children. In Kerala, carbohydrate food is the staple diet. Intake of proteins and other essential nutrients are found to be low in school-going children belong to low income family. The education of parents is also an influential factor. The ignorance about the necessity of a balanced diet is the main reason for the prevalence of undernutrition in Kerala. But normal children, in the present study, are taller and heavier than children of other studies conducted previously in
India. The presented data clearly demonstrate that normal children have better physical characteristics than their earlier counterparts.

This study demonstrates that lung volumes were significantly reduced in underweight, wasted and stunted children than healthy normals. The lowest lung volumes were seen in stunted children. The $FEV_{0.5}/FVC\%$, $FEV_1/VC\%$ and $FEV_1/FVC\%$ were in the normal range in undernourished children. Inspiratory as well as expiratory flow rates were decreased in underweight, wasted and stunted children than the normal children. The stunted children had lower lung volumes than wasted and underweight children. The inspiratory flow rates were markedly affected than expiratory flow rates in chronically undernourished children.

The reduction in respiratory functions may be due to the ventilatory muscle wasting. The inspiratory effort was more affected than expiratory effort. Respiratory muscle weakness may be the reason for the reduced inspiratory effort. The present study is of the opinion that the morphological and physiological properties of lung might have been affected by undernutrition. The present data point out that the effect of nutritional stress on respiratory functions is of restrictive pattern rather than obstructive type of dysfunction.

Generally in normal, underweight and wasted children, most of the inspiratory and expiratory flow rates showed a positive linear relation with all physical characters but in stunted children, this relationship was not followed by most of the parameters. The increase of respiratory functions with physical characters is mainly due to somatic growth. From the present study, it was found that in normal and undernourished children, both expiratory and inspiratory flow rates were linearly related to lung volumes. The $MVV_{ind}$ also shows the same trend.
The current innovation leads to the hypothesis that nutritional deficiency influences respiratory functions. While a proper nutritional supplementation can revert underweight and wasted children to a normal state, the growth retardation due to chronic malnutrition is irreversible in later life. It can be concluded, like all other physiological effects, it is necessary to maintain adequate intrauterine and early childhood nutritional status for a better respiratory function.