Chapter 6

SUMMARY
The alteration of respiratory functions in athletes during exercise was always an exciting area in sports science. Athletes engaged in physical activity require an efficient O₂ transport system. The respiratory functions play a key role in assessing the athlete’s fitness. Adaptations of respiratory functions achieved by athletes vary with the type of athletic training involved in each discipline of sports and games.

During exercise, respiratory functions equip athletes with better O₂ transport in relation to the demands of physical activity. When respiratory functions were measured immediately after training session in each athlete, viz. runners, snake-boat rowers, freestyle strokers, butterfly strokers and athletes engaged in warm-up, a gradual decline in ‘lung volumes’ and ‘flow rates’ was observed in the present context. Respiratory muscle fatigue can be considered a possible reason for the decline in lung functions. During exercise, lactate accumulation of diaphragmatic muscles results in fatigue of the diaphragmatic muscle which plays a key-role in respiratory muscle fatigue. The cardiac output and thereby blood supply to the respiratory muscles becomes limited during exercise as the respiratory muscle begins to compete with the locomotor muscles. The reduced force-generation capacity of the diaphragm was observed from pre to post-exercise which might have resulted in lowered respiratory functions after exercise compared to resting condition. The continuous co-ordinated volley of impulses for fixed breathing frequency with exercise rhythm results in fatigue of neural drive. The slowing of calcium pumping and leakage of potassium ions within the active muscle fibres result in alteration of electrophysiological properties of the
conducting mechanism. The fatigue to the neural drive together with leakage of electrolytes results in respiratory muscle fatigue. Apart from the above observation, an increased trend in lung volumes and flow rates was observed in gymnasts, kalaripayattu warriors, breast strokers, back strokers, and rowers from resting condition to after exercise condition. The above results of increased lung capacities indicate efficiency of respiratory muscles and their capability of meeting the required demands during exercise in the athletes.

Another feature of the present study is that athletic training is found to benefit the ‘lung volumes’ and ‘flow rates’ of athletes. The above statement is confirmed from the observed higher lung volumes and flow rates in athletes as compared to age- and height-matched controls at resting condition except in snake-boat rowers and gymnasts. The efficiency of respiratory system with respiratory muscle hypertrophy, lesser airway resistance and better calibre of airways, better mechanical properties like elastic recoil of lungs, lung compliance, together with improved neuromuscular co-ordination achieved by athletic training may be the possible reason behind the significant increase in lung volumes and flow rates in athletes. The regular forceful inspiration and expiration during exercise results in strengthening the respiratory muscles. This helps the lungs to inflate and deflate maximally. This maximal inflation and deflation results in release of lung surfactant and prostaglandin into the alveolar spaces thereby increasing the lung compliance and decreasing the bronchial smooth muscle tone respectively.

Lung volumes of athletes engaged in sports events of greater aerobic demand show higher lung capacities than their control counterparts as in the case of long distance runners, swimmers and rowers of the present study. The sports
involving greater anaerobic demand, like gymnastics, show a lower capacity of lung functions than their control counterpart.

Among athletes of the present study, rowers exhibited the highest capacities for all lung volumes but higher flow rates were shared among back strokers, runners, gymnasts and kalaripayattu warriors. Thus clear from the present study that the highest capacity accomplished for each parameter of respiratory functions varies with different disciplines of athletics.

The study leaves scope for following future work:

1. The study can be extended to various other sports events.
2. The role of respiratory muscles during physical exertion of exercise is the other area where more research is essential.
3. The duration of time required by athletes to recover from reduced lung volumes and flow rates immediately after exercise.