Summary

Involvement in certain physical activities or sports could help in respiratory muscle strengthening and improvement in pulmonary function. In this study researcher will compared pulmonary function of people with sedentary life styles and active athletes to see if athletes and yogis have better pulmonary function than people with sedentary life styles; and if so, how they differ amongst themselves with respect to various spirometric parameters.

Lakhera SC et al. (1994) evaluated the lung function in Indian athletes and non-athletes during adolescence. They evaluated the lung functions in 40 boys (twenty athlete and twenty non-athletes) in the age range of 13 to 16 years. They studied forced vital capacity (FVC), forced expiratory volume in one second (FEVI), expiratory reserve volume (ERV), inspiratory capacity (IC) and maximum voluntary ventilation (MVV). They suggested that the development of lung during adolescence under proper nutritional and health conditions was governed by the process of growth with no or negligible additional effects of physical activity, however the lung size may increase by a strenuous and prolonged strength training regimen during adolescence. They summarized that physical activity during growth increased endurance in respiratory muscles. Mean value of 108.6 +/- 4.8 (S.E.) vs. 68.03 +/- 8.1 & in the controls (P less than 0.001). They also reported that during breath holding synchronized swimmers have marked apneic brady cardia (expressed as either absolute or heart rate change from basal heart rate) as opposed to the controls in which heart rate increased during breath holds. They concluded that elite synchronized swimmers have increased lung volumes, bluted hypoxic ventilator responses and a marked apneic brady cardia.
Involvement in certain physical activities or sports could help in respiratory muscle strengthening and improvement in pulmonary function. In the present study an attempt has been made to analyses and compared pulmonary function of people with sedentary life styles and elite players of Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming with the age ranging of 18-25 years. This was designed to find out whether sportsman and are have better pulmonary function than people with sedentary life styles; and if so, how they differ amongst themselves with respect to various spirometric parameters.

Statement of the Problem

“A comparative analysis of the pulmonary functions between sportsman and sedentary subjects”

Objectives of study:-

1. To find out the Force Vital Capacity (FVC) of sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming.
2. To find out the Force Vital Capacity (FVC) of non-sportsmen.
3. To find out the Forced Expiratory Volume in one second (FEV1) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming.
4. To find out the Forced Expiratory Volume in one second (FEV1) of non-sportsmen.
5. To find out the Peak Expiratory Flow (PEF) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming.
6. To find out the Peak Expiratory Flow (PEF) in non-sportsmen.
7. To find out the Forced Expiratory Flow (FEF50) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming.
8. To find out the Forced Expiratory Flow (FEF50) in non sportsmen.
9. To find out the Forced Expiratory Volume in three second (FEV3) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming.
10. To find out the Forced Expiratory Volume in three second (FEV3) in non sportsmen.
11. To find out the Forced Inspiratory Vital Capacity (FIVC) of sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming.
12. To find out the Forced Inspiratory Vital Capacity (FIVC) of non sportsmen.
13. To find out the Peak Inspiratory Flow (PIF) of sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming.
14. To find out the Peak Inspiratory Flow (PIF) of non sportsmen.
15. To find out the difference in the Force Vital Capacity (FVC) of sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming.
16. To find out the difference in the Force Vital Capacity (FVC) between non sportsmen and sportsmen of different sports categories.
17. To find out the difference in the Forced Expiratory Volume in one second (FEV1) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming.
18. To find out the difference in the Forced Expiratory Volume in one second (FEV1) between non sportsmen and sportsmen of different sports categories.
19. To find out the difference in the Peak Expiratory Flow (PEF) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basket ball, Volleyball & Swimming.
20. To find out the difference in the Peak Expiratory Flow (PEF) between non sportsmen and sportsmen of different sports categories.

21. To find out the difference in the Forced Expiratory Flow (FEF50) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

22. To find out the difference in the Forced Expiratory Flow (FEF50) between non sportsmen and sportsmen of different sports categories.

23. To find out the difference in the Forced Expiratory Volume in three second (FEV3) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

24. To find out the difference in the Forced Expiratory Volume in three second (FEV3) between non sportsmen and sportsmen of different sports categories.

25. To find out the difference in the Forced Inspiratory Vital Capacity (FIVC) of sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

26. To find out the difference in the Forced Inspiratory Vital Capacity (FIVC) between non sportsmen and sportsmen of different sports categories.

27. To find out the difference in the Peak Inspiratory Flow (PIF) of sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

28. To find out the difference in the Peak Inspiratory Flow (PIF) between non sportsmen and sportsmen of different sports categories.

**Hypotheses of the Study:**

1. There exists no significant difference in the Force Vital Capacity (FVC) of sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

2. There exists no significant difference in the Force Vital Capacity (FVC) between non sportsmen and sportsmen of different sports categories.
3. There exists no significant difference in the Forced Expiratory Volume in one second (FEV1) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

4. There exists no significant difference in the Forced Expiratory Volume in one second (FEV1) between non sportsmen and sportsmen of different sports categories.

5. There exists no significant difference in the Peak Expiratory Flow (PEF) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

6. There exists no significant difference in the Peak Expiratory Flow (PEF) between non sportsmen and sportsmen of different sports categories.

7. There exists no significant difference in the Forced Expiratory Flow (FEF50) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

8. There exists no significant difference in the Forced Expiratory Flow (FEF50) between non sportsmen and sportsmen of different sports categories.

9. There exists no significant difference in the Forced Expiratory Volume in three second (FEV3) in sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

10. There exists no significant difference in the Forced Expiratory Volume in three second (FEV3) between non sportsmen and sportsmen of different sports categories.

11. There exists no significant difference in the Forced Inspiratory Vital Capacity (FIVC) of sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

12. There exists no significant difference in the Forced Inspiratory Vital Capacity (FIVC) between non sportsmen and sportsmen of different sports categories.
13. There exists no significant difference in the Peak Inspiratory Flow (PIF) of sportsmen participating in Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming.

14. There exists no significant difference in the Peak Inspiratory Flow (PIF) between non sportsmen and sportsmen of different sports categories.

Delimitations of study:-

1. The study was confined to 153 sportsmen of Athletics (long distance & sprinters), Boxing, Wrestling, Basketball, Volleyball & Swimming with the age ranging of 18-25 years.

2. The domain of study was delimited to sportsmen belonging to Universities of Haryana.

3. The study was further delimited to only elite sportsmen who have won first/second/third position at least at national/inter-university levels during the years of study in the discipline of Basketball, Athletes (Sprinters), Athletes (Long Distance Runners), Swimming, Volley Ball, Boxing, and Wrestling and were engaging in that sport for ≥16 h per week.

4. In the non sportsmen category sample of 129 subjects were taken from the subjects who are pursuing their master degree from any university of Haryana and never ever participated in any competitive sports at any level.

5. In the present study only seven variables of pulmonary function were studied which were Force Vital Capacity (FVC), Forced Expiratory Volume in one second (FEV1), Peak Expiratory Volume (PEF), Forced Expiratory Flow (FEF50), Forced Expiratory Volume in three second (FEV3), Forced Inspiratory Vital Capacity (FIVC) and Peak Inspiratory Flow (PIF) with the help of spirometer.

Limitations of the study:

The life style, habits, heredity, nutritional intake, physical fitness level, other psychological and physiological variables are beyond control of the research worker. These will be considered as limiting factors of the study.
Procedures and Methods:

To achieve the objective of the study the research worker has to plan the entire process of the work in term of research design suited to the study, therefore the design of the present study systematically under the following headings

Selection of Subjects:

The study was based on purposive sampling method and only those subjects were selected as samples who have won first/second/third position at least at national/inter-university levels during the years of study in the discipline of Basketball, Athletes (Sprinters), Athletes (Long Distance Runners), Swimming, Volley Ball, Boxing, and Wrestling during the years of research work.

Non sportspersons (both male and female) who had never participated in any sports/games belonging to Delhi, Haryana, Chandigarh and Punjab. The age group of subjects belonging to both categories will be 18 to 25 years. The bifurcation of category wise numbers of subjects is as under:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name of Game</th>
<th>No. Of subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Basketball</td>
<td>22</td>
</tr>
<tr>
<td>2.</td>
<td>Athletes (Sprinters)</td>
<td>22</td>
</tr>
<tr>
<td>3.</td>
<td>Athletes (Long Distance Runners)</td>
<td>21</td>
</tr>
<tr>
<td>4.</td>
<td>Swimming</td>
<td>23</td>
</tr>
<tr>
<td>5.</td>
<td>Volley Ball</td>
<td>22</td>
</tr>
<tr>
<td>6.</td>
<td>Boxing</td>
<td>20</td>
</tr>
<tr>
<td>7.</td>
<td>Wrestling</td>
<td>23</td>
</tr>
<tr>
<td>8.</td>
<td>Non-Sports Men</td>
<td>129</td>
</tr>
<tr>
<td>9.</td>
<td>Total</td>
<td>282</td>
</tr>
</tbody>
</table>
Selection of variables:

In the present study following seven variables of pulmonary function were studied:

1. Force Vital Capacity (FVC)
2. Forced Expiratory Volume in one second (FEV1)
3. Peak Expiratory Flow (PEF)
4. Forced Expiratory Flow (FEF50)
5. Forced Expiratory Volume in three second (FEV3)
6. Forced Inspiratory Vital Capacity (FIVC)
7. Peak Inspiratory Flow (PIF)

Tool to be used for the Collection Of data:

Minispir Spirometer made by MIR Medical International Research S.r.l. - via del Maggiolino 125, 00155 Roma Italy - P.IVA IT04564101006 was used for the collection of data.

Statistical Technique to be used:

Keeping in view the objectives and design of the study, the statistical technique of mean, standard deviation, analysis of variance and ‘t’ – test was used to analyze the data for finding the results. All analysis were done with the help of statistical software program SPSS (Statistical Package for the Social Sciences).
FINDINGS:

i) Force Vital Capacity (FVC) Liters/Seconds

1. A significant different was found in the Force Vital Capacity (FVC) Liters/Seconds of sportsmen of various categories.

2. All the sportsmen were found with significantly better Force Vital Capacity (FVC) Liters/Seconds then the non-sportsmen.

3. Basketball and Volleyball players were found with found with significantly better Force Vital Capacity (FVC) Liters/Seconds than their counterparts of participating in Athletes (Sprinters), Athletes (Long Distance Runners), Swimming, Boxing, and Wrestling.

ii) Forced Expiratory Volume in one second (FEV1)

1. A significant different was found in the Forced Expiratory Volume in one second (FEV1) of sportsmen of various categories.

2. All the sportsmen were found with significantly better Forced Expiratory Volume in one second (FEV1) then the non-sportsmen.

3. Basketball and Volleyball players were found with found with significantly better Forced Expiratory Volume in one second (FEV1) than their counterparts of participating in Athletes (Sprinters), Athletes (Long Distance Runners), Swimming, Boxing, and Wrestling.

4. Further with sportsmen of participating in Athletes (Sprinters), Athletes (Long Distance Runners), Swimming, Boxing, and Wrestling were found with similar Forced Expiratory Volume in one second (FEV1) as no significant difference was found between them.

iii) Peak Expiratory Flow (PEF)

1. A significant different was found in the Peak Expiratory Flow (PEF) of sportsmen of various categories.

2. All the sportsmen were found with significantly better Peak Expiratory Flow (PEF) then the non-sportsmen.
3. Basketball and Volleyball players were found with significantly better Peak Expiratory Flow (PEF) than their counterparts of participating in Athletes (Sprinters), Athletes (Long Distance Runners), Swimming, Boxing, and Wrestling.

4. Further with sportsmen of participating in Athletes (Sprinters), Athletes (Long Distance Runners), Swimming, Boxing, and Wrestling were found with similar Peak Expiratory Flow (PEF) as no significant difference was found between them.

iv) Forced Expiratory Flow (FEF50)

1. A significant different was found in the Forced Expiratory Flow (FEF50) of sportsmen of various categories.

2. All the sportsmen were found with significantly better Forced Expiratory Flow (FEF50) than the non-sportsmen.

3. Basketball and Volleyball players were found with significantly better Forced Expiratory Flow (FEF50) than their counterparts of participating in Athletes (Sprinters), Athletes (Long Distance Runners), Swimming, Boxing, and Wrestling.

4. Further with sportsmen of participating in Boxing, and Wrestling were found with significantly better Forced Expiratory Flow (FEF50) as compare to Athletes (Sprinters), Athletes (Long Distance Runners).

v) Forced Expiratory Volume in three second (FEV3)

1. A significant different was found in the Forced Expiratory Volume in three second (FEV3) of sportsmen of various categories.

2. All the sportsmen were found with significantly better Forced Expiratory Volume in three second (FEV3) than the non-sportsmen.

3. Basketball and Volleyball players were found with significantly better Forced Expiratory Volume in three second (FEV3) than their counterparts of participating in Athletes.
(Sprinters), Athletes (Long Distance Runners), Swimming, Boxing, and Wrestling.

4. Further with sportsmen of participating in Boxing, and Wrestling were found with significantly better Forced Expiratory Volume in three second (FEV3) as compare to Athletes (Sprinters), Athletes (Long Distance Runners).

vi) Forced Inspiratory Vital Capacity (FIVC)

1. A significant different was found in the Forced Inspiratory Vital Capacity (FIVC) of sportsmen of various categories.

2. All the sportsmen were found with significantly better Forced Inspiratory Vital Capacity (FIVC) then the non-sportsmen.

3. Basketball and Volleyball players were found with found with significantly better Forced Inspiratory Vital Capacity (FIVC) than their counterparts of participating in Athletes (Sprinters), Athletes (Long Distance Runners), Boxing and Wrestling.

4. Further with sportsmen of participating in Boxing were found with significantly better Forced Inspiratory Vital Capacity (FIVC) as compare to Athletes (Sprinters), Athletes (Long Distance Runners).

viii) Peak Inspiratory Flow (PIF)

1. A significant different was found in the Peak Inspiratory Flow (PIF) of sportsmen of various categories.

2. All the sportsmen were found with significantly better Peak Inspiratory Flow (PIF) then the non-sportsmen.

3. Basketball and Volleyball players were found with found with significantly better Peak Inspiratory Flow (PIF) than their counterparts of participating in Athletes (Sprinters), Athletes (Long Distance Runners), Boxing and Wrestling.

4. Further with sportsmen of participating in Boxing and wrestling were found with significantly better Peak Inspiratory Flow (PIF) as compare to Athletes (Sprinters), Athletes (Long Distance Runners).
Recommendations

1. Similar study can be taken up on different games/sports.

2. Similar study can be taken up on different psychological and physiological variables.

3. Research work can be done on larger population of different ethnicity.

4. Current studies may be used in predicting efficiency of lungs.

5. Study may be used in talent identification.