Chapter V

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

SUMMARY

Pranayama is a systematic practice of respiration which makes the lungs stronger, improves blood circulation, and makes the individual healthier. If this exercise of respiratory system is done regularly and efficiently, it leads to increase respiratory stamina, relax the chest muscles, expand the lungs, raise energy levels, calm the body and also cause marked improvement in lung functions.

The objectives of the study were to compare the effect of different ratios of Puraka, Kumbhaka and Rechaka in Suryabhedana Pranayama on selected circulatory and respiratory function, to compare the effect of different time durations of Suryabhedana Pranayama with different ratios of Puraka, Kumbhaka and Rechaka on selected circulatory and respiratory function and to identify and compare the pattern of improvement in different ratios of Puraka, Kumbhaka and Rechaka in Suryabhedana Pranayama in different time durations on selected circulatory and respiratory function.

80 male school students out of 400 from Jawahar Navodaya Vidyalaya Bohani, Narsinghpur, M.P. were selected randomly with the help of IBM SPSS Software as the subjects for the study. The ages of the subjects were 11 to 15 years. The students were randomly assigned into four groups, each consisted of twenty students. Further, the experimental treatment was also assigned randomly to three experimental groups and one group served as a control group. The three experimental groups were administered three different ratios of Puraka, Kumbhaka and Rechaka in Suryabhedana Pranayama i.e. 1:1:1, 1:2:2 and 1:4:2 respectively.

The selected variables of Circulatory and Respiratory Function were Positive Breath Holding Time (PBHT), Respiratory Rate (RR), Peak Expiratory Flow Rate (PEFR), Vital Capacity (VC), Forced Vital Capacity (FVC), Maximum Voluntary Ventilation (MVV), Forced Expiratory Volume in first second (FEV1), Systolic
Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Resting Heart Rate (RHR).

Positive Breath Holding Time (PBHT) and Respiratory Rate (RR) were measured in seconds and breath per minute respectively with the help of stopwatch. Vital Capacity (VC) was measured with the help of Dry Spirometer in litre. Peak Expiratory Flow Rate (PEFR) was measured with the help of Peak Flow Meter in litre per second. Forced Vital Capacity (FVC), Maximum Voluntary Ventilation (MVV) and Forced Expiratory Volume in first second (FEV1) were measured with the help of Spirometry test in litre. Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) were measured with the help of Digital Blood Pressure Monitor in mmHg. Resting Heart Rate (RHR) was measured in beats per minute with the help of Digital Blood Pressure Monitor.

The training of Suryabhedana Pranayama was conducted for a period of eight weeks (five days a week) from January to March. For the purpose of the study four groups were formulated. The three experimental groups Ratio 1, Ratio 2 and Ratio 3 were administered three different ratios of Puraka, Kumbhaka and Rechaka in Suryabhedana Pranayama i.e. 1:1:1, 1:2:2 and 1:4:2 respectively. And one group served as the Control group.

The data was collected three times at different time durations from all the four groups i.e. before the training, after four weeks and finally after the eight weeks training of Suryabhedana Pranayama. Reliability of the data was ensured by the reliability of test by using standard instruments, subject’s reliability and by establishing tester’s competency. Mixed-Model design (Between-Within) was used for the study.

To attain the objectives of the study, the analysis part included the various statistical techniques. Descriptive statistics were used to describe the nature and characteristics of the data. To see the effect of different experimental treatments in different time durations, $4 \times 3$ mixed analysis of variance (Between-Within) was used. Post Hoc test was applied to compare the group means by using the Bonferroni correction. Eta Square was also calculated to see the effect size of significance. Level of significance ($\alpha = 0.05$) was set at 0.05.
The findings of the study showed no significant improvement and no interaction effect in all the selected circulatory function i.e. systolic blood pressure, diastolic blood pressure and resting heart rate.

On the other hand, a significant improvement and interaction effect was found in all the selected respiratory function i.e. positive breath holding time, respiratory rate, peak expiratory flow rate, vital capacity, forced vital capacity, maximum voluntary ventilation and forced expiratory volume in first second.

Findings also showed a significant difference in the effect of all the three selected ratios of Puraka, Kumbhaka and Reehaka in Suryabhedana Pranayama in respiratory function. Out of the three ratios, 1:4:2 were found better than the other two for each variables of respiratory function followed by 1:2:2 and then 1:1:1.
CONCLUSIONS

On the basis of analysis of data and the results of the study following conclusions is drawn:

Respiratory function

Positive Breath Holding Time (PBHT)

- From the above findings, it is concluded that the Suryabhedana Pranayama with all the three selected ratios of Puraka, Kumbhaka and Rechaka i.e. 1:1:1, 1:2:2 and 1:4:2, has a significant effect on positive breath holding time in 4 weeks as well as in 8 weeks.
- The rate of improvement in positive breath holding time is different in the ratio 1:4:2 but similar in the ratio 1:1:1 and 1:2:2 in 4 weeks as well as in 8 weeks.
- Suryabhedana pranayama with the ratio 1:4:2 is better for improving positive breath holding time followed by other two ratios 1:2:2 and 1:1:1, and 4 weeks and 8 weeks time is sufficient with all the three variations.

Respiratory Rate (RR)

- Suryabhedana pranayama, with all the three selected ratios of Puraka, Kumbhaka and Rechaka i.e. 1:1:1, 1:2:2 and 1:4:2, has a significant effect on respiratory rate in 8 weeks. 4 weeks’ time is not sufficient to improve respiratory rate.
- The rate of improvement in respiratory rate is similar in the entire three ratios in 8 weeks.
- Suryabhedana pranayama, with the entire three selected ratios 1:1:1, 1:2:2 and 1:4:2, is equally better for improving respiratory rate, and the duration of 8 weeks’ time is sufficient with all the three variations.
**Peak Expiratory Flow Rate (PEFR)**

- From the above findings, it is concluded that the Suryabhedana Pranayama with all the three selected ratios of Puraka, Kumbhaka and Rechaka i.e. 1:1:1, 1:2:2 and 1:4:2, has a significant effect on peak expiratory flow rate in 4 weeks as well as in 8 weeks.
- The rate of improvement in peak expiratory flow rate was different in the ratio 1:4:2 but is similar in the ratios 1:1:1 and 1:2:2 in 8 weeks.
- Suryabhedana pranayama, with the ratios 1:1:1 and 1:2:2 has a significant effect on peak expiratory flow rate in 8 weeks. 4 weeks’ time is not sufficient to improve peak expiratory flow rate with these two ratios.
- Suryabhedana pranayama, with the ratio 1:4:2, is better for improving peak expiratory flow rate and 4 weeks and 8 weeks time is sufficient, followed by the ratios 1:2:2 and 1:1:1, and 8 weeks time is sufficient with these two ratios.

**Vital Capacity (VC)**

- From the above findings, it is concluded that the Suryabhedana Pranayama, with all the three selected ratios of Puraka, Kumbhaka and Rechaka i.e. 1:1:1, 1:2:2 and 1:4:2, has a significant effect on vital capacity in 4 weeks as well as in 8 weeks.
- The rate of improvement in vital capacity was different in the ratio 1:4:2 but is similar in the ratio 1:1:1 and 1:2:2 in 4 weeks as well as in 8 weeks.
- Suryabhedana pranayama, with the ratio 1:4:2 is better for improving vital capacity followed by other two ratios 1:2:2 and 1:1:1, and 4 weeks and 8 weeks’ time is sufficient with all the three variations.

**Forced Vital Capacity (FVC)**

- From the above findings, it is concluded that the Suryabhedana Pranayama, with all the three selected ratios of Puraka, Kumbhaka and Rechaka i.e. 1:1:1, 1:2:2 and 1:4:2 has a significant effect on forced vital capacity in 4 weeks as well as in 8 weeks.
- The rate of improvement in forced vital capacity was different in the ratio 1:4:2 but is similar in the ratios 1:1:1 and 1:2:2 in 8 weeks.
Suryabhedana pranayama with the ratio 1:4:2 is better for improving forced vital capacity, and 4 weeks and 8 weeks' time is sufficient, followed by the ratio 1:2:2 and 1:1:1 in 8 weeks. 4 weeks are not sufficient to improve forced vital capacity with these two ratios.

**Maximum Voluntary Ventilation** (MVV)

- From the above findings, it is concluded that the Suryabhedana Pranayama, with all the three selected ratios of Puraka, Kumbhaka and Rechaka i.e. 1:1:1, 1:2:2 and 1:4:2 has a significant effect on maximum voluntary ventilation in 4 weeks as well as in 8 weeks.

- The rate of improvement in maximum voluntary ventilation was quite different in the ratio 1:4:2 but is similar in the ratios 1:1:1 and 1:2:2 in 4 weeks. Whereas it was similar in the ratio 1:4:2 and 1:2:2 but is different in the ratio 1:1:1 in 8 weeks.

- Suryabhedana pranayama, with the ratio 1:4:2 and 1:2:2, is equally better for improving maximum voluntary ventilation followed by the ratio 1:1:1 and 8 weeks time is sufficient with all the variations.

**Forced Expiratory Volume in first second** (FEV1)

- From the above findings, it is concluded that the Suryabhedana Pranayama, with all the three selected ratios of Puraka, Kumbhaka and Rechaka i.e. 1:1:1, 1:2:2 and 1:4:2 produces a significant effect on forced expiratory volume in first second in 4 weeks as well as in 8 weeks.

- The rate of improvement in forced expiratory volume in first second is different in all the three variation of Suryabhedana Pranayama in 8 weeks.

- Suryabhedana pranayama, with the ratio 1:4:2 is better than the other two in 4 weeks as well as in 8 weeks for improving forced expiratory volume in first second. Suryabhedana pranayama, with the ratio 1:1:1 and 1:2:2, has a significant effect on forced expiratory volume in first second in eight weeks. 4 weeks are not sufficient to improve forced vital capacity with these two ratios.
Circulatory function

Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Resting Heart Rate (RHR)

It is concluded from the findings that the Suryabhedana pranayama, with all the three selected ratios of Puraka, Kumbhaka and Rechaka i.e. 1:1:1, 1:2:2 and 1:4:2, does not have a significant effect on systolic blood pressure, diastolic blood pressure and resting heart rate.
RECOMMENDATIONS

On the basis of this study the following recommendations are made:

Recommendations for Research Scholars:

1. A similar study can be conducted on the subjects of different age groups as it may help to understand whether there are any age related changes in the findings of similar study.
2. A similar study can also be conducted on the female subjects as it may help to compare the outcomes of the study carried out on male subjects.
3. A similar study can be undertaken on different factors of respiratory as well as circulatory function.
4. A similar study can be conducted with different variations of Suryabhedana Pranayama.
5. Similar studies can be conducted on different types of Pranayama.
6. Similar type of studies can be undertaken on patients with respiratory as well as circulatory disorders.

Recommendations for Yoga Instructors/Teachers:

1. Suryabhedana Pranayama can be a part of their training programme with the specific ratio of Puraka, Kumbhaka and Rechaka.
2. According to the standard of the subjects / students / practitioners, particular ratio of Puraka, Kumbhaka and Rechaka in Suryabhedana pranayama can be undertaken.