CHAPTER-V

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY OF THE STUDY:

It is obvious that long-term regular exercises make positive contributions into human organism. Researchers have reported positive contribution of exercise in physical, physiological and motor features (Fox, et. al., 1999). The most important effect of regular exercise is on blood hematology. When we analyze hematology, the effect of regular exercise on hematology is different. It is stated that these differences depend on the severity, duration, and frequency of exercise as well as physical and physiological conditions of subjects. Furthermore, the severity, duration and frequency of exercise should be well-organized to have similar positive influence on blood biochemistry (Baltaci et.al. 1998).

There is not a full consensus as to how exercise makes an effect on hematology. Studies in this field contain different findings concerning blood biochemistry depending on the relevant exercise. Despite the studies showing a decreasing (Ricci et. al.1988) and increasing (Baltaci et.al., 1998, Ercan, et al1996, Gunay et, al. 2006) change in blood biochemistry due to acute and chronic exercises, there are also studies which report that hematological values do not change with exercise (Spiropoulos &Trakada, 2003, Akgun, 1994).

Exercise and physical activity is an important function of living systems. It may affect hematologic and biochemical parameters of most systems. Human adaptation to exercise is characterized by adaptation to cardiovascular activity and changes in hematological and biochemical parameters (Arslan, et.al. 1997, Baltaci et. al, 1998).

Doing exercise regularly has effect initially on preventing cardiovascular illness, besides enabling normal performance of most of the biochemical and hematological parameters; it also regulates breathing system (Thomas, et. al. 2003). When life is sustained without doing exercise, it is an indication that there is a decrease in functional inadequacy illness may grow (Colakogler & Karacan, 2006). But on the other side, exercise causes stress on human organism and the result of this stress can cause different physiological and metabolic effects. Some of these effects are the changes arising in blood. The most important result of exercises done regularly is on blood cell. When blood is investigated, exercises done regularly have different effects on blood level
and these differences are the result of factors such as experiment method, experiment time, type of exercise done, age, sex and training condition of the subjects.

The present study is an attempt to explore a comparative investigation on hematophysiological changes and its influence on performance for 16 weeks duration of three different physically active groups of students. Therefore, the title of the problem stated as “A Comparative Study of Selected Hematological Parameters and its Impact on Performance among Three Different Groups”.

To attain the aim of this study and to compare the hematophysiological changes among three physically active groups and its impact on physical performance after 8 weeks and 16 weeks of activity observation, seven objectives are formulated. Delimitations, hypotheses, significance of the study, limitations and definition of terms as per the nature of the study are narrated in the first chapter.

The investigator, while reviewing, has consulted both the recent as well as old literatures relating to the present study sufficiently and summarized them properly to justify the problem.

The research work was conducted on 17 to 22 years in age ranged 35 student. Those 35 students were categorized into three groups. Highly physically active group (HG) comprising of thirteen (13) students selected from Bardhaman SAI center who were soccer trainees; moderate physically active groups (MG) comprising of twelve (12) students selected from Jadavpur University who were B.P.Ed students; and ten (10) students selected from Bardhaman Raj College, a general college, were considered as very low active sedentary group (LG). Tests of fifteen (15) haematological parameters; systolic and diastolic blood pressure, resting heart rate as physiological parameters; and aerobic and anaerobic capacity, and Vo2 max as physical performance were administered on the subjects using standard instruments, procedures and tests. A pre-test followed by mid-test (after 8 weeks) and post-test (after 16 weeks) of the dependent variables i.e. haematological parameters, physiological parameters and physical performance were administered on the subjects for collection of data. Descriptive statistics, Repeated Measures ANOVA followed by Newman-Kules post hoc test was used. Since, three groups were involved, whenever the F-ratio was found to be significant, Newman-Kuels post hoc test was used to locate exact values of differences in hematological, physiological and performance related variables among three physically active groups.
5.2 MAJOR FINDINGS:

Repeated Measures ANOVA followed by Newman-Kules post hoc test revealed the following results:

Findings on highly physically trained group (SAI) after 2\textsuperscript{nd} and 4\textsuperscript{th} month of respective training:

- The hematological parameters i.e. RDW, MCHC, PDW, MPV, WBC, LYM % were increased more than that of the BPED and GEN groups.
- Some hematological parameters i.e. RBC, PCV, MCV, MCH, PLT, MON % were also increased but slightly low value than moderately physically trained group (BPEd).
- LYM% and EOS % were decreased than the BPED and GEN groups.
- Systolic & diastolic blood pressure and resting heart rate demonstrated a logical reduction.
- $\text{Vo}_2\text{Max}$, aerobic & anaerobic capacity showed significant and best improvement in performances than the BPED and GEN groups along with the above hematological changes.

Findings on moderately physically trained group (BPED) after 2\textsuperscript{nd} and 4\textsuperscript{th} month of respective training:

- The hematological parameters i.e. RBC, PCV, MCV, MCH, PLT, MON % were increased more than that of the SAI and GEN groups.
- Some hematological parameters i.e. RDW, MCHC, PDW, MPV, WBC, LYM % were also increased but slightly low value than highly physically trained group (SAI).
- LYM% and EOS % were also decreased at the same level with highly physically trained group (SAI) but lower than the GEN group.
- Systolic & diastolic blood pressure and resting heart rate established a rational reduction.
Vo₂ Max, aerobic & anaerobic capacity showed better and significant improvement than the low physically active group (GEN) but slightly behind the performance level of SAI trainees along with the above hematological changes.

Findings on low physically active group (GEN) after 2nd and 4th month of observation:

- It was observed that low physically active group (GEN) showed no significant changes in almost all hematological parameters as well as physiological and performance related parameters.

Findings of hematological changes on performance:

- The study declared that hematological changes established after 4 months of training of the SAI and BPED groups might perhaps heighten an important impact on physical performance.

5.3 CONCLUSIONS:

A) Conclusion on Blood constituents:

- Haemoglobin level of SAI, BPEd and General students remained at normal range. The SAI, BPEd and General students could not show significant change in Haemoglobin level during 2nd and 4th months respectively.

- The SAI and general students groups could not show significant change in Red Blood Cell level during 2nd and 4th months respectively. However, for B.P.Ed students, the Red Blood Cell level was found progressively increased significantly.

- In case of Red Cell distribution width, the SAI trainees and General students could not show significant change during 2nd and 4th months respectively. However, for B.P.Ed students, the changes of Red Cell distribution width level were found progressively increased.

- For Packed cell volume, the SAI, BPEd and general students groups could not show significant change during 2nd and 4th months respectively, but progressive trend in improvement was seen among the trainees of SAI and BPEd.

- Progressive trend in improvement in Mean corpuscular volume level was seen among the trainees of SAI and BPEd, which remained in the upper side of normal range, during 2nd and 4th months respectively, but not among the general students.
However, the Mean corpuscular volume of BPEd trainees was statistically higher than the trainees of SAI.

- **Progressive trend in improvement in Mean corpuscular haemoglobin level was seen among the SAI and BPEd groups, although remained in the upper side of normal range, during 2\textsuperscript{nd} and 4\textsuperscript{th} months respectively, but not among the general students.**

- **In case of Mean corpuscular haemoglobin concentration level the SAI and BPEd students groups could show significant improvement, although remained in the upper side of normal limit, during 2\textsuperscript{nd} and 4\textsuperscript{th} months respectively, but not among the general students.**

- **During 2\textsuperscript{nd} and 4\textsuperscript{th} months of training, the SAI students could show significant decrease in Platelet level, although remained in the lower side of normal limit, whereas the BPEd students remained in the middle point of the normal range. Thus, BPEd trainees maintained Platelet level at a better state than the trainees of SAI and general students.**

- **During 2\textsuperscript{nd} and 4\textsuperscript{th} months of training, SAI and BPEd trainees maintained Platelet distribution width at a better state than the trainees of general students. Moreover, the SAI and BPEd trainees maintained higher Mean platelet volume than the general students.**

- **White Blood Cell of SAI and BPEd students remained at the normal range during 2\textsuperscript{nd} and 4\textsuperscript{th} month of training. Likewise, the White Blood Cell level of the General students was also lying within the normal range. Thus, SAI and BPEd trainees maintained similar level White Blood Cell like the general students.**

- **The SAI trainees had low level in Neutrophils or polymorphs during 2\textsuperscript{nd} and 4\textsuperscript{th} month of training, but the BPEd and general students had the normal level of Neutrophils or polymorphs.**

- **The SAI trainees had high level in Lymphocytes during 2\textsuperscript{nd} and 4\textsuperscript{th} month of training, but the BPEd and general students had the normal level of Lymphocytes.**

- **Increasing trend in Eosionophil, although remained in the normal range, was seen among the SAI trainees during 2\textsuperscript{nd} and 4\textsuperscript{th} month of training, but not in BPEd and**
General students during the tenure of the experiment. Thus, BPEd students seem to be healthy than the SAI trainees and General students so far as Eosionophil content in the blood is concerned.

- During 2nd and 4th months of training, both the SAI and BPEd students could show significant increase in Monocytes, although remained in the average level of the normal range. However, the Monocytes level of the General students was lying in the lower portion of the normal range.

B) Conclusion on Physiological abilities:

- During 2nd month of training, the SAI trainees showed sudden increase in Systolic blood pressure and sudden decrease in the same during 4th month of training. However, BPEd students showed a trend of reduction in Systolic blood pressure (although not statistically significant) during 2nd month of training, but during 4th month significant reduction in Systolic blood pressure was evident. Amazingly, Systolic blood pressure of general students’ remained unchanged during 2nd and 4th months respectively. Thus, progressive reduction in Systolic blood pressure was evident in BPEd students, but the SAI trainees could not.

- During 2nd month of training, the SAI trainees showed sudden decrease in Diastolic blood pressure, but again increased during 4th month of training. However, BPEd students showed a progressively slow but significantly steady trend of reduction in Diastolic blood pressure (although not statistically significant) during 2nd and 4th month of training. It is also noted that Diastolic blood pressure of general students’ remained unchanged during 2nd and 4th months respectively. This suggests that SAI trainees had no significant control over the Diastolic Blood Pressure. Thus, the BPEd students showed progressive trend of reduction in Diastolic blood pressure, but SAI trainees could not.

- The SAI trainees showed progressive but sudden reduction in Heart rate during 2nd and 4th month of training. However, BPEd students showed a progressively slow but significantly steady trend of reduction in Heart rate during 2nd and 4th month of training respectively, whereas the Heart rate of general students’ remained unchanged during tenure of the experiment. Thus, progressively slow trend of
reduction in Heart rate was evident in BPEd students, but the SAI trainees could show faster trend of reduction.

C) Conclusion on Physical abilities:

- Progressive improvement in Aerobic capacity was evident in both the SAI and BPEd groups during 2nd and 4th months of the experiment, but not among General students. Thus, both the SAI and BPEd training programmes had similar effects on Aerobic capacity.

- During 2nd month of training, the SAI trainees and the BPEd students could show significant increase in Anaerobic capacity. However, during 4th month of training the BPEd students decreased in Anaerobic capacity, whereas SAI trainees maintained progressive improvement in Anaerobic capacity but general students’ Anaerobic capacity level remained unchanged. Moreover, the SAI trainees had significantly better Anaerobic capacity than the BPEd students and General students.

- VO2 max of both the SAI trainees and BPEd students could show significant increase during 2nd and 4th month of training, whereas this ability of the General students remained unchanged. Thus, progressive improvement in VO2 max was evident in both the SAI trainees and BPEd students.

5.4 RECOMMENDATIONS:

A) Recommendations on Blood constituents:

- Different types of training could not alter the level of Haemoglobin and White Blood Cell and, therefore, it is recommended that normal level of Haemoglobin and White Blood Cell may not be a performance indicator of normal healthy individuals or sports persons.

- The SAI and general students groups could not show significant change in Red Blood Cell level (indicating poor oxygen transporting ability from the lungs to the rest of the body), Red Cell distribution width (i.e., deficiency in iron and vitamin B12), Packed cell volume (tendency of anemia, deficiency of vitamin B6), Platelet level (below normal blood clotting ability), Platelet distribution width (poor platelet function), Mean platelet volume (akin to different disorders), and Neutrophils or polymorphs (tendency of overall infection and causes bone marrow depression)
during 2\textsuperscript{nd} and 4\textsuperscript{th} months respectively, whereas it increases progressively in B.P.Ed students. Thus, modification in training is recommended for SAI trainees for improving or maintaining these variables.

- The SAI trainees had high level in Lymphocytes than the BPEd and general students. This recommends that BPEd training needs slight modification in incorporating some stretching as well as relaxation techniques for improving the level of Lymphocytes, which in turn improves heart congestion and to control renal failure and well as inflammatory bowel diseases.

- Further, increasing trend in Eosionophil was evident in SAI trainees, which is not a healthy sign. This is not seen among the BPEd trainees. This indicates that SAI trainees are susceptible to allergic reaction than the BPEd students and seem to be less healthy. This in fact recommends that there is a need for modification in the programme of SAI training so as to improve immunity power for control of the Eosionophil content in the blood.

- The Mean corpuscular volume of BPEd trainees was statistically higher than the trainees of SAI. Such results in turn suggest that the BPEd training was sufficiently good to maintain level of iron content and vitamin B12. Thus, the result recommends that there is a need to improve the SAI training programme inclusive of diet.

- Progressive trend in improvement in the level of Mean corpuscular haemoglobin level, Mean corpuscular haemoglobin concentration level, Monocytes was seen among the SAI and BPEd groups, although remained in the normal range, during 2\textsuperscript{nd} and 4\textsuperscript{th} months respectively, but not among the general students. This in fact recommends that both SAI and BPEd training programmes are sufficiently good to maintain better level of Mean corpuscular haemoglobin level and its level of concentration indicating better control of thalassemia.

**B) Recommendations on Physiological abilities**

- The result indicates that progressive reduction in Systolic blood pressure was evident in BPEd students, but the SAI trainees could not. This study suggests that minimum 4 months training intervention is required for significant reduction in Systolic blood pressure and for this, the BPEd training is recommended.
The result suggests that SAI trainees had no significant control over the Diastolic Blood Pressure, whereas the BPEd students showed progressive trend of reduction in Diastolic blood pressure. Thus, BPEd method of training is recommended for controlling Diastolic blood pressure.

The SAI trainees showed progressive but sudden reduction in Heart rate during 2nd and 4th month of training. However, BPEd students showed a progressively slow but significantly steady trend of reduction in Heart rate during 2nd and 4th month of training respectively, whereas the Heart rate of general students’ remained unchanged during tenure of the experiment. Thus, progressively slow trend of reduction in Heart rate was evident in BPEd students, but the SAI trainees could show faster trend of reduction. Hence, BPEd training is again recommended.

C) Recommendations on Physical abilities:

Although both the SAI and BPEd training programmes had similar effects on improving Aerobic capacity, this study recommends for BPEd training method because of its positive influence not only on aerobic capacity but also on blood constituents.

In case of Anaerobic capacity, the SAI trainees had significantly better result than the BPEd and General students respectively. Obviously, the SAI training is preferably for improving Anaerobic capacity and to be recommended. However, if we consider the status of blood constituents of the SAI trainees, the healthy status is commendable for the BPEd trainees.

VO₂ max of both the SAI trainees and BPEd students could show significant increase and no statistically significant difference is evident for the General students. Hence both SAI and BPEd training procedures are recommended if the VO₂ max status is to be improved.

Further study may be conducted on female subject of different team games with large number of subjects covering larger area.