

## EFFECT OF EXERCISE ON PACKED CELL VOLUME (PCV) AMONG THREE DIFFERENT PHYSICALLY ACTIVE GROUPS

Arnab Ghosh

Assistant professor, Deptt. of Physical Education, UCTC, Berhampore ,W.B.

[arnabcricket007@gmail.com](mailto:arnabcricket007@gmail.com)

### Abstract

#### Introduction:

The aim of this study was to compare and examine the Results on Packed cell volume (PCV) among highly physically active, moderate physically active and low physically active groups in 16 weeks of observation.

#### Methods:

Thirteen (13) SAI football students as highly physically active group (SAI), twelve (12) professional physical education students as moderate physically active group (B.P.Ed) and ten (10) general college going students as very low physically active group (GEN) who has normal blood cell count at the beginning of the session with an average age of  $21.16 \pm 1.85$  have participated in this study voluntarily. SAI and B.P.Ed groups were involved in their respective training schedule under the supervision of experts. Researcher observed the all the groups for 16 weeks and collected the data three times for every sample. After being informed, blood samples of subjects have been taken on an empty stomach at their respective ground between 7:00-8:00 in the morning. PCV has been determined by using Syxmex auto-hemato analyzer.

#### Result:

In case of SAI trainees, no significant change in Packed cell volume was evident after 2<sup>nd</sup> month ( $q=1.79$ ,  $p>0.05$ ) and 4<sup>th</sup> month of training ( $q= 0.45$ ,  $p>0.05$ ). Similar result was evident in case of BPED students (after 2<sup>nd</sup> month:  $q=1.95$ ,  $p<0.05$  and after 4<sup>th</sup> month:  $q= 0.56$ ,  $p>0.05$ ) and General students (after 2<sup>nd</sup> month:  $q=0.32$ ,  $p>0.05$  and 4<sup>th</sup> month:  $q= 0.30$ ,  $p>0.05$ ). Though its insignificant at  $p>0.05$  level but in SAI trainees and BPED students the Packed cell volume level (%) during 1<sup>st</sup> test to 2<sup>nd</sup> test and 3<sup>rd</sup> were increase. Here, the changes in Packed cell volume level were found progressively increased, but remained in the normal range.

#### Conclusion:

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

Key words: Packed cell volume, physically active, blood, Training.

#### Introduction:

Packed cell volume is a blood test that measures the percentage of the volume of whole blood that is made up of red blood cells. This dimension depends on the number of red blood cells and the size of red blood cells.

Physical performance is dependent on the hematological parameters. Red cell mass decrement has negative effect on physical exercise capacity (Schumacher YO. et al. 2002, Portal S et.al. 2003). Low red blood cell count and hemoglobin values and make it difficult to transport oxygen in to the cells. Mechanisms for dropped RBC mass could be intravascular hemolysis by mechanical rupture while passing through capillaries in working muscles as well contraction during bottom strike during running (Mairburl H.et al, 2013). There have indeed been reports of “sports anemia” performing from ferocious physical exercise in humans (Hasibeder et al. 1987).

Ozyener et al. (1994) showed that acute submaximal exercise significantly increases erythrocyte, hematocrit, hemoglobin, leukocyte, and trombocyte counts in comparison to the levels before exercise. Abbasciano et al. (1998) stated that the RBC decreased during endurance sports. Actually, during physical exercise, red blood cells must deliver oxygen to tissues at a higher flow rate in a more viscous fluid, due to a reduced plasma volume (Gabriel et al. 1992). During the exercise, certain amount of liquid enters into the tissues leaving the veins and the density of erythrocyte, hemoglobin and plasma proteins increases (K. Karacabey et al., 2004, Ozyener et al., 1994). However, there is no complete consensus in the literature how exercise affects on blood concept. While some researchers express that exercise increase blood volume (M.Gunay et al., 2006), others state that it does not change (N. Akgun, 1994).

So, in this study researcher wants to find out some fruitful findings about Packed cell volume changes with practicing of three different level of physical activity for 16 weeks.

## Methodology:

### Selection of subjects:

Thirty five (35) students were selected randomly as the subject for the study. Those 40 students were taken from three groups comprising of thirteen (13) students for highly, twelve (12) students for moderate physically active groups and ten (10) students for very low active sedentary group.

Subjects selected for the study were all male students of age group between 17 to 22 years.

### Details of grouping of subjects are as follows:

Group I (HAG): Thirteen (13) fresh male students of SAI training center (soccer), Burdwan will be selected as highly physically trained group. Subjects who are undergoing a coaching program in football under SAI have to follow a vigorous conditioning schedule to improve their general as well as specific fitness followed by a coaching schedule for the development of football skills.

Group II (MAG): Twelve (12) fresh male Physical Education students of Department of Physical Education, Jadavpur University will be selected as moderate physically trained group. Student pursuing the one year program of Physical Education leading to the degree of Bachelor

of Physical Education are required to maintain a moderate level of physical fitness in order to follow different practical classes round the year.

Group III (LAG): Ten (10) first years (Arts) male students from Burdwan Raj College and Vivekananda College under Burdwan University will be selected as very low active sedentary group. They generally participate in sports program not in a regular basis and their objective of participation in such program is to have fun, enjoyment and recreation and as such it is voluntary.

Selection of variable: Packed cell volume

Experimental design:

Groups	Pre-test	Intermediate	Post-test
Highly physically trained (SAI) (N=13)	At the beginning of the session	After 8 week or 2 month of training	After 16 week or 4 month of training
Moderately physically trained (BPED) (N=12)	At the beginning of the session	After 8 week or 2 month of training	After 16 week or 4 month of training
Low physically active (GEN) (N=10)	At the beginning of the session	After 8 week or 2 month of training	After 16 week or 4 month of training

Collection of Blood Sample:

The blood samples were taken in the morning between 6.30am to 7.30am. Blood samples from subjects were taken after 12 hour hungry and having refrained from vigorous exercise for at least 24 hours. The subjects were lay down or sat on arm chair. Examination of the superficial veins of the left forearm was made to select the vein for venous puncture. About 3ml of blood was collected from each subjects and captured in the anticoagulant (EDTA) tube.

Analyzing blood sample:

All blood sample was analyzing by Sysmex XP-100 Automatic hematology analyzer (Sysmex corporation , Kobe, Japan). [Code No. BB556095, Manufactured : July 2012, Software version: 00-05 and onwards]

**Result and interpretation:**

Table :1			
Group	Status of Packed cell volume level (%) among three different physically active groups		
	1 <sup>st</sup> Test M (SD)	2 <sup>nd</sup> Test M (SD)	3 <sup>rd</sup> Test M (SD)
SAI	40.37 (3.23)	42.88 (2.10)	40.69 (3.16)
BPEd	41.06 (2.72)	41.78 (2.18)	42.52 (1.57)
General	41.601 (0.92)	41.511(0.95)	41.921 (0.64)
Normal value: 40 to 54 %			

Table : 2				
Result of Repeated Measures ANOVA for Packed cell volume (PCV) (SAI, BPEd and General students)				
Source of Variation	SS	df	MS	F
TOTAL	123.49	44	--	--
Between Subjects (A)	35.14	14	--	--
Within Subjects (B)	75.30	30	--	--
Treatments	5.773	2	2.88	1.15
Residual	70.28	28	2.51	--
* p < 0.05 ** p < 0.01				

From Table: 2 results revealed that in SAI trainees, the Packed cell volume level during 1<sup>st</sup> test, 2<sup>nd</sup> test and 3<sup>rd</sup> test were mostly similar. However, statistically differences in Packed cell volume level during 1<sup>st</sup> test, 2<sup>nd</sup> test and 3<sup>rd</sup> test were not evident for B.P.Ed. and General students ( $F=1.15$ ,  $p>0.05$ ).

- Depending upon the F-value, although there is no need for a post hoc analysis, the researcher thought to apply Newman-Kuels post hoc test to locate exact values of differences in Packed cell volume between three physically active groups.

Table : 3			
Adjusted Ordered Means in Packed cell volume (PCV) during 1 <sup>st</sup> test, 2 <sup>nd</sup> test and 3 <sup>rd</sup> test phases (SAI Group, B.P.Ed. Group & General students Group)			
	1 <sup>st</sup> test (%)	2 <sup>nd</sup> test (%)	3 <sup>rd</sup> test (%)
SAI	40.34	44.17	43.77
B.P.Ed.	40.82	43.76	44.35
General Students	41.03	41.55	41.90
1 <sup>st</sup> test = base level test, 2 <sup>nd</sup> test = after 2 <sup>nd</sup> month of respective training, 3 <sup>rd</sup> test = after 4 <sup>th</sup> month of respective training.			

From Table: 3 we found that-

- For SAI trainees, the Packed cell volume level (%) during 1<sup>st</sup> test, 2<sup>nd</sup> test and 3<sup>rd</sup> were 40.34, 44.17, and 43.77 respectively. Here, the changes in Packed cell volume level were found progressively increased, but remained in the normal range.
- For BPED trainees, the Packed cell volume level (%) during 1<sup>st</sup> test, 2<sup>nd</sup> test and 3<sup>rd</sup> test were 40.82, 43.76 and 44.35 respectively. Here, the changes in Packed cell volume level were found progressively increased, but remained in the normal range.
- For General students, the Packed cell volume level (%) during 1<sup>st</sup> test, 2<sup>nd</sup> test and 3<sup>rd</sup> were 41.03, 41.55, and 41.90 respectively, but remained in the lower side of the normal range.

Table : 4		
Newman-Kuels post hoc test difference in Packed cell volume (PCV) level during 1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup> test Phases		
SAI Group	2 <sup>nd</sup> test	1 <sup>st</sup> test
3 <sup>rd</sup> test	0.45	1.58
2 <sup>nd</sup> test	--	1.79

B.P.Ed. Group		
3 <sup>rd</sup> test	0.56	1.64
2 <sup>nd</sup> test	--	1.95
General Students		
3 <sup>rd</sup> test	0.30	0.29
2 <sup>nd</sup> test	--	0.32
* p<0.05, ** p<0.01		
1 <sup>st</sup> test = base level test, 2 <sup>nd</sup> test = after 2 <sup>nd</sup> month of respective training, 3 <sup>rd</sup> test = after 4 <sup>th</sup> month of respective training.		

From Table: 4 we can say that-

**For SAI group:**

- No significant change in Packed cell volume was evident after 2<sup>nd</sup> month (q=1.79, p>0.05) and 4<sup>th</sup> month of training (q= 0.45, p>0.05).

**For B.P.Ed. group:**

- No significant improvement in Packed cell volume was seen after 2<sup>nd</sup> month (q=1.95, p<0.05), however, such improvement was maintained on 4<sup>th</sup> month of training (q= 0.56, p>0.05).

**For General students group:**

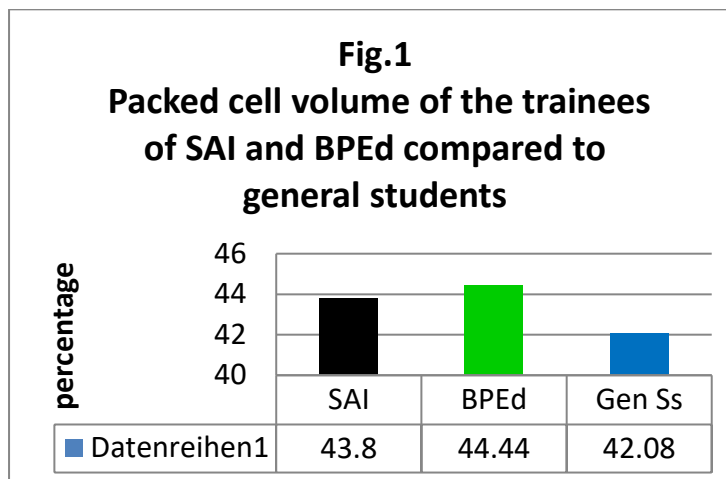
- No significant change in Packed cell volume was evident after 2<sup>nd</sup> month (q=0.32, p>0.05) and 4<sup>th</sup> month of training (q= 0.30, p>0.05).

Table : 5		
Newman-Kuels post hoc test indicating difference in Packed cell volume (PCV) level between three physically active groups		
Group	B	A
C	1.64	1.76
B	--	1.34
* p<0.05, ** p<0.01		
A = SAI group, B = B.P.Ed. group, C = General students group		

From the statistics of Table: 5 we can also say that, no significant difference in Packed cell volume was evident between SAI vs B.P.Ed groups (q=1.34, p>0.05), BPED vs General students (q= 1.64, p>0.05); Similarly, no statistical difference in Packed cell volume level was evident between SAI vs General students (q= 1.76, p>0.05). Thus, although no statistically significant difference in Packed cell volume was evident, a progressive trend in improvement was seen among the trainees of SAI and BPED.

## Major Findings:

Although, the Packed cell volume of SAI, BPED and General student were at normal level; however, a progressive trend in improvement was seen among the trainees of SAI and BPED was evident (Fig-1)



## Discussion:

There was no significant alteration found in elite Olympic distance tri-athletes over a period of 3 years by Rietjens et al. (2002). Whilst Mayr et al. (2006) did not observe significant differences in HCT between 14 and 18-year-old elite speed skaters and age-matched non-athletes. In our study the result also revealed that the highly physically trained group (SAI), moderate physically trained group (BPED) and general students groups could not show significant change in Packed cell volume level during 2<sup>nd</sup> and 4<sup>th</sup> months respectively, but progressive trend in improvement was seen among the trainees of SAI and BPED.

When literature was scanned about HCT parameters, Boyalı et al. (2006) found a significant increase at HCT values and Mashiko et al. (2004) reported those 20 days intensive exercise did not cause any changes at HCT levels. While an increase at RBC levels in the other studies, a significant increase could not be found at HGB, HCT and PLT levels (Cinar et al., 2010). The reason of increase in hematocrit volume can be explained as depending on hemoconcentration and transferring of high volume hematocrit from splenic circulation to circular circulation (Guyton, 2000). There significant difference shown on hemoglobin values between before and after training program. In this study it was shown that the Packed cell volume of SAI, BPED and General student were at normal level; however, a progressive trend in improvement was seen among the trainees of highly physically trained group (SAI) and moderate physically trained group (BPED).



## Conclusion:

From this study the Packed cell volume of the SAI, BPED and general students groups could not show significant change during 2<sup>nd</sup> and 4<sup>th</sup> months respectively, but progressive trend in improvement was seen among the trainees of SAI and BPED.

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