

# Effects of Two Different Intensities of Bench Step Training on Plasma Inorganic Phosphate and Urine Inorganic Phosphate Variables of College Men Players

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## Abstract

The purpose of the study was to investigate the effects of two different intensities of Bench Step Training on Plasma and Urine Inorganic Phosphate variables of college men Players. Forty-five college men Players were selected at random and divided into three equal groups. Pre-test was conducted for all three groups on selected variables. The Experimental Groups participated in their respective bench step training for a period of eight weeks on alternate days. Post-test was conducted on the above mentioned dependent variables after training. The following results were drawn from the study, 1. The two types of intensities of Bench Step training adopted in this study, on the whole, brought significantly positive changes in the Experimental groups. 2. The results were observed and there was significant improvement in both variables under this study namely Plasma and Urine Inorganic Phosphate. The following conclusions were drawn: 1. Plasma and Urine Inorganic Phosphate were improved due to the influence of two different Intensities of Bench Step Training. 2. Thirty cadences per minute showed significantly greater improvement on Plasma Inorganic Phosphate than that of 23 Cadence per minute of Bench step training. 3. Twenty three Cadences per minute showed greater reduction in Urine Inorganic Phosphate than 30 Cadence per minute of bench step training.

**Keywords:** Bench step, Cadence, Intensity, Inorganic Phosphate

## Introduction

### Meaning of Bench Step Training

Bench stepping is simply stepping up and down on a bench. Step training is a great exercise to burn fat and improves the condition of the heart and lungs. Two kinds of step training exist, step aerobics and bench stepping.

### Effects of Bench Step Training on Plasma Inorganic Phosphate

#### 1. Enhance Metabolic Regulation

Phosphate is the major anion of the intra cellular fluid and the proportion of intercellular phosphate available for energy metabolism depend upon the extra cellular concentration. Phosphorous bind reversibly with a number of coenzyme systems and other compounds involved in metabolism.

#### 2. Enhancing ATP and Pcr Synthesis

Phosphate is integrally involved in the formation of pureness and primitives and thereby DNA and RNA synthesis. The 3 phospharalyation potential, given as ratio as (ATP) to (ADP + pi) is an index for energy status of the cell and is dependent upon the concentration of Pi.

### 3. Enhanced 2, 3-Diphosphoglycerate Syntheses

2, 3- diphosphoglycerate is a high anionic phosphate, which binds to hemoglobin in the erythrocyte. 2,3-DPG serves to lower the oxygen affinity of oxygen by factor of 26 thereby facilitating the release of oxygen to the tissue. Several studies have shown that there is increase 2,3-DPG levels in the adaptation top hypoxia at altitude.

### 4. Enhanced Cardiovascular to Exercise

Phosphate affects myocardial function at rest and during exercise. In this regard, hypophosphate is associated with depressed myocardial contractility and cardiac output.

### 5. Enhanced Buffering Capacity

Phosphate is an active participant in much Physiological buffer system and is involved in acid base balance within the plasma and in the cells.

### Purpose and Need of the Study

This study would be very much useful and suitable for College level Players. The findings of the study would enrich the physical education professional with better insight into methods to enhance Physiological, Hematological and Biochemical changes of college men Players. It was scientifically accepted that the Bench Step training not only develops, the performance of the athlete but also develops internal organs like respiratory system, nervous system, circulatory system, excretory system and muscular system.

### Statement of the Problem

The purpose of the study was to investigate the effects of two different intensities such as 30 Cadence per minute and 23 Cadence per minute of bench step training on selected Physiological and Biochemical variables of college men Players.

### Hypotheses

1. It was hypothesised that there would be a significant improvement in selected Physiological and Biochemical variables, due to the influence of 30 Cadence and 23 Cadence per minute of bench step training of college men Players
2. It was hypothesised that 30 Cadence per minute would have greater significant effect on selected Physiological and Biochemical variables than that of 23 Cadence per minute of college men Players.

### Dependent Variables

1. Plasma Inorganic Phosphate
2. Urine Inorganic Phosphate

### Independent Variables

- 1). 30 Cadence per minute,
- 2). 23 Cadence per minute,
- 3). Control Group

## **Review of Related Study**

### **Studies on Plasma Inorganic Phosphate**

Yoshida and Watari (1994) investigated the splitting of the inorganic phosphate (Pi) peak during exercise and recovery. These findings suggest that our method <sup>31</sup>P-MRS provides a simple approach for studying the kinetics of the Pi peak and intramuscular pH during exercise and recovery.

Yoshida and Watari (1993) assessed the rates of change in muscle metabolites such as Phosphocreatine (PCr) and inorganic phosphate (Pi) during repeated exercise sessions with rest periods. The Pi, PCr ratio during exercise increased linearly with exercise; and Pi, PCr during recovery was smaller in the long-distance runners than in the control subjects ( $P < 0.05$ ). It is suggested that these were attributable to a greater oxidative capacity of muscles in the long-distance runners.

### **Studies on Urine Inorganic Phosphate**

Heaton and Hodgkinson (1963) concluded that the effect of exercise on urine flow and food intake on the renal excretion of calcium, magnesium, water, sodium, potassium, phosphate and creatinine was observed in normal adults. The excretion of calcium and magnesium was reduced during moderate exercise but the excretion of sodium, potassium, creatinine, and inorganic phosphate was unaffected

Benjamin Buemann et.al (2000) examined the D-tagatose, which is a stereoisomer of D-fructose, is phosphorylated to D-tagatose-1-phosphate by fructokinase in the liver. These results suggest that a moderate intake of D-tagatose may affect liver metabolism by phosphate trapping despite the fact that the sugar may only be incompletely absorbed in the gut.

## **Methodology**

### **Experimental Design**

The study was formulated as a true random group design consisting of a Pre test and post test. For this purpose, forty-five college men Players were selected at random and assigned to three equal groups and their age group were 20-24 years. The groups were assigned as 30 Cadence per minute, 23 Cadence per minute and Control Group. Pre test were conducted for all three groups on selected Physiological and Biochemical variables. The Cadence per minute participated in their respective bench step training for a period of eight weeks on alternate days. Post tests were conducted on the above mentioned dependent variables after eight weeks of the training period. Analysis of Covariance statistical technique was used, to test the significant difference among the treatment groups. If the adjusted post-test results were significant, the scheffe's post hoc test was used to determine the paired mean significant difference.

### **Bench Step Training Workout Programme**

#### **30 Cadence Per Minute Workout**

The bench step training for this Group consists of 30 Cadence per minute (120 Tempo / BPM), during the evening hours between 4:30 to 5:30 p.m for three days per week. The training bench height is 40 cm. The duration for the training will be raised by about 15 seconds (eight repetitions) every week.

### 23 Cadence Per Minute Workout

The bench step training for this Group consists of 23 Cadence per minute (94 Tempo / BPM), during the evening hours between 4:30 to 5:30 p.m for three days per week. The training bench height is 40 cm .The duration for the training will be raised by about 15 seconds (six repetitions) every week.

Control Group: No training was given to this group during the training period.

Measuring Procedures of Plasma Inorganic Phosphate

Direct UV Method without Reduction

### Intended Use

This reagent is intended for the invitro quantitative determination of inorganic phosphate in human plasma, and urine.

### Results, Findings and Discussion

Computation of Analysis of Covariance of Plasma Inorganic Phosphate

The following tables illustrate the statistical results of the Effects of Two Different Intensities of Bench Step Training on Plasma Inorganic phosphate of college men Players and ordered adjusted means and the difference between the means of the groups under study.

**Table - I**  
**Computation of Analysis of Covariance of Plasma Inorganic Phosphate**  
(Scores in mg /dl)

Means	Control group	30 Cadence / minute	23 Cadence / minute	S.V	S.S	D.F	M.S	O. F
Pre test means	3.02	3.06	3.02	B	0.016	2	0.00	0.02
				W	12.44	42	0.30	
Post test mean	2.94	2.40	2.68	B	2.18	2	1.09	6.50*
				W	6.90	42	0.16	
Adjusted Post test mean	2.94	2.38	2.68	B	0.02	2	1.16	10.35*
				W	12.44	41	0.11	
Mean gain	0.08	0.66	0.34	*significant				

Table F-ratio at 0.05 level of confidence for 2 and 42 (df) =3.23 and 41 (df) = 3.23



**Table - I (a)**  
**Computation of Scheffe's Post Hoc Test Ordered Adjusted Final Mean Difference of Plasma Inorganic Phosphate (Scores in mg /dl)**

Control group	23 Cadence / minute	30 Cadence / minute	M.D	O.F	T.F
2.94	2.68	-	0.26	6.15	3.23
2.94	-	2.38	0.56	27.87	3.23
-	2.68	2.38	0.3	8.87	3.23

### Results of Plasma Inorganic Phosphate

Table I shows the analyzed data on Plasma Inorganic phosphate, The Pre test means of Plasma Inorganic phosphate were 3.06 for 30 Cadence per minute, 3.02 for 23 Cadence per minute and 3.02 for Control Group. The obtained 'F' ratio of 0.02 was lesser than the table 'F' ratio of 3.23. Hence, the Pre test was not significant at 0.05 level.

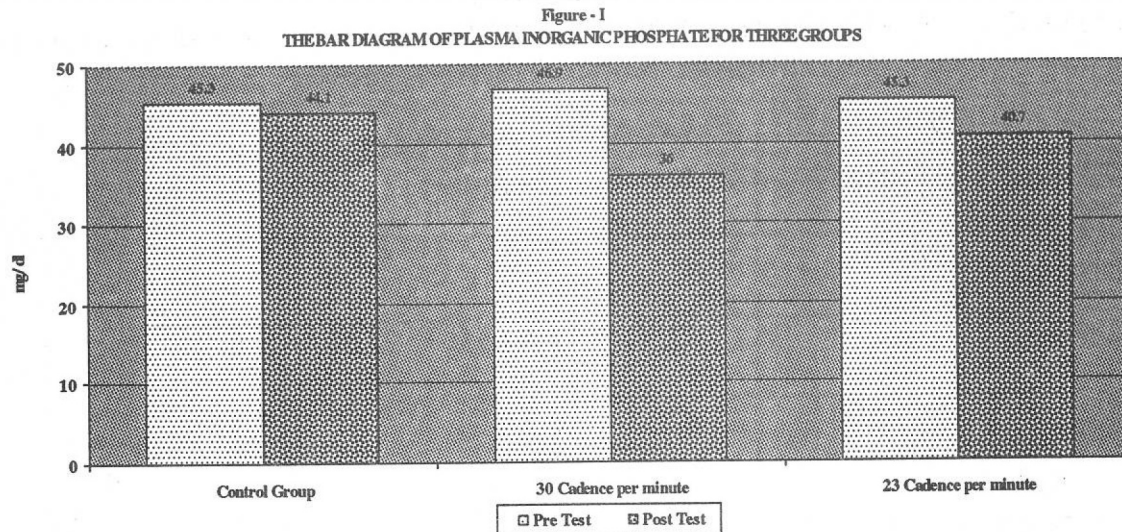
The Post test means were 2.40 for 30 Cadence per minute, 2.68 for 23 Cadence per minute and 2.94 for Control Group. The obtained 'F' ratio 6.50 was higher than the table 'F' ratio of 3.23. Hence, the Post test was significant at 0.05 levels. The adjusted Post test means were 2.38 for 30 Cadence per minute, 2.68 for 23 Cadence per minute and 2.94 for Control Group. The obtained 'F' ratio 10.35 was higher than the table 'F' ratio 3.23. Hence, the Post test was significant at 0.05 level.

Table I (a) shows the Scheffe's post hoc test of ordered adjusted final mean difference of Plasma Inorganic phosphate of different groups. The difference between 30 Cadence per minute and 23 Cadence per minute was 0.3, 30 Cadence per minute and Control Group was 0.56, and 23 Cadence per minute and Control Group was 0.26. The obtained 'F' ratios of the above comparison were 8.87, 27.87, and 6.15 respectively. The table 'F' ratio was 3.23 at 0.05 levels. Hence, all three comparisons were significant.

### Discussion on Findings of Plasma Inorganic Phosphate

Two different Cadences per minute with the inclusion of bench step training were analyzed in this work for the covariance of Plasma Inorganic phosphate. Another group called the Control Group was analyzed for the same without the inclusion of any training. The results obtained from the Cadence per minute were found to have a significant improvement in the Plasma Inorganic phosphate level when compared with the one from the control group.

It is interesting to note that the inclusion of bench step training in the analysis on Cadence per minute clearly stabilizes the Plasma Inorganic phosphate level. Moreover, 30 Cadence per minute play an important role in the Plasma Inorganic phosphate level when compared with 23 Cadence per minute. This is attributed to the nature in the intensity levels in the Cadence per minute.



Michael F et.al (2004) has shown that the PCr hydrolysis during incremental plantar flexion exercises passes into a steady state at different workload levels. The observed decrease in pH does not result in acceleration of PCr hydrolysis. Later, Andreas Greiner et.al (2005) has proved that the correlation between the degree of blood flow reduction and PCr levels in the exercising muscle groups, which are supplied by the stenosed arteries, is the first essential of using 31P magnetic resonance spectroscopy in the assessment of the effect of arterial stenoses on muscle function in claudicants.

The above results provide ample proof for the correctness of the research work under study. Hence, it is concluded that the inclusion of bench step training in the analyses on Cadence per minute reduces the Plasma Inorganic phosphate level and this energy is supplied to the body. This enhances the performance of an athlete largely since the athlete gains energy from Plasma Inorganic phosphate.

**Table - II**  
**Computation of Analysis of Covariance of Urine Inorganic Phosphate**  
**(Scores in mg /dl)**

Means	Control group	30 Cadence / minute	23 Cadence / minute	S.V	S.S	D.F	M.S	O. F
<b>Pre test mean</b>	74.59	73.53	74.66	B	12.13	2	9678.18	0.005
				W	47603.66	42	37304.80	
<b>Post test mean</b>	77.26	54.93	41.73	B	9678.18	2	4839.09	5.31*
				W	37304.80	42	909.87	
<b>Adjusted post test mean</b>	74.01	55.49	41.42	B	12.13	2	4817.90	20.75*
				W	47603.67	41	232.10	
<b>Mean gain</b>	2.67	18.6	32.93	*significant				

**Table – II A**  
**Computation of Scheffe's Post Hoc Test Ordered Adjusted Final Mean Difference of**  
**Urine Inorganic Phosphate**  
**(Scores in mg /dl)**

Control group	30 Cadence / minute	23 Cadence / minute	M.D	O.F	T.F
77.01	55.49	-	21.59	11.81	3.23
77.01	-	41.42	35.59	35.64	3.23
-	55.49	41.42	14.00	6.41	3.23

### Results of Urine Inorganic Phosphate

Table II Shows the analyzed data on Urine Inorganic Phosphate, the Pre test means of Urine Inorganic Phosphate were 73.53 for 30 Cadence per minute, 74.66 for 23 Cadence per minute and 74.59 for Control Group. The obtained 'F' ratio 0.005 was lesser than the table 'F' ratio of 3.23. Hence, the Pre test was not significant at 0.05 level.

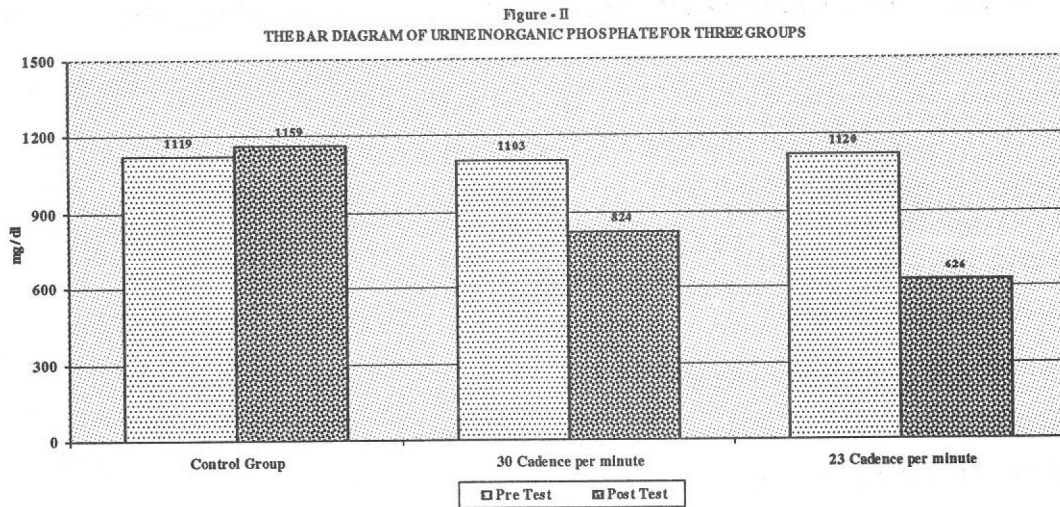
The post test means were 54.93 for 30 Cadence per minute, 41.73 for 23 Cadence per minute and 77.26 for Control Group. The obtained 'F' ratio 5.31 was higher than the table 'F' ratio of 3.23. Hence, the post test was significant at 0.05 level. The adjusted post test means were 55.49 for 30 Cadence per minute, 41.42 for 23 Cadence per minute and 74.01 for Control Group. The obtained 'F' ratio 20.75 was higher than the table 'F' ratio 3.23. Hence, the post test was significant at 0.05 level of confidence for the degrees of freedom 2 and 42. The means gain of 30 Cadence per minute, 23 Cadence per minute and Control Groups were 18.6, 32.93 and 2.67 respectively.

Table II (a) shows the Scheffe's post hoc test of ordered adjusted final mean difference of Urine Inorganic Phosphate of different groups. The difference between 30 Cadence per minute and 23 Cadence per minute was 14.0, 30 Cadence per minute and Control Group was 21.59, and 23 Cadence per minute and Control Group was 35.59. The obtained 'F' ratio of the above comparison was 6.41, 11.81, and 35.64 respectively. The table 'F' ratio was 3.23 at 0.05 levels. Hence, all three comparisons were significant.

### Discussion on Findings of Urine Inorganic Phosphate

The analysis of covariance of Urine Inorganic Phosphate was carried out with the inclusion of bench step training and the results indicate that the 30 Cadence per minute and 23 Cadence per minute were significantly influenced in the Urine Inorganic Phosphate.

Further findings of this study showed that, in contrast to the earlier results, the 23 Cadence per minute had more effect on the improvement of Urine Inorganic Phosphate than the 30 Cadence per minute.



The results were strengthened by the earlier work done by Terence J et.al (2005) Plasma calcium, phosphate, and albumin ( $P < 0.01$ ) was significantly lower. Urinary calcium, phosphate, sodium, and potassium excretion were lower, ( $P < 0.001$ ). Heaton and Hodgkinson (1963) stated that the excretion of calcium and magnesium was reduced during moderate exercise but the excretion of sodium, potassium, creatinine, and inorganic phosphate was unaffected.

Hence, it is concluded that the inclusion of bench step training in the analysis of covariance of Urine Inorganic Phosphate greatly reduces the expulsion of inorganic phosphate through urine. During the training period, the working muscle absorbs the energy from the un-expelled inorganic phosphate and hence, the overall performance of the athlete who underwent the bench step training were improved drastically.

### Discussion on Hypotheses

The finding of the study showed that there was a significant effect on Plasma Inorganic phosphate and Urine Inorganic Phosphate, due to the influence of 30 Cadence and 23 Cadence per minute of Bench Step training. Hence, the first hypothesis was accepted on the above said variables.

The finding of the study showed that the 30 Cadence of bench step training significantly improved on Plasma Inorganic phosphate greater than that of 23 Cadence per minute of college men Players. The result obtained from 23 Cadence significant improvements than that 30 Cadence per minute on Urine Inorganic Phosphate alone. Hence, the second hypothesis was accepted on the above said variables.

### Findings

Following results were observed after statistical analysis of covariance, significant improvement in two types of bench step training of eight weeks, were observed in Plasma Inorganic Phosphate and Urine Inorganic Phosphate

The two types of intensities of Bench Step training adopted in this study, on the whole, brought about significantly positive changes from the respective 30 Cadence per minute group and 23 Cadence per minute group.



## Conclusions

Within the limitations of the study, the following conclusions were drawn:

1. Plasma Inorganic Phosphate, Urine Inorganic Phosphate were improved due to the influence of two different Intensities of Bench Step Training of college men Players (30 Cadence per minute of Bench Step training and 23 Cadence per minute of Bench Step training).
2. Thirty cadences per minute showed significantly greater improvement on Plasma Inorganic Phosphate and Urine Creatine than that of 23 Cadence per minute of Bench step training.
3. Twenty three Cadences per minute showed greater reduction in Urine Inorganic Phosphate than 30 Cadence per minute of bench step training.
4. If the level of plasma inorganic phosphate range is high in blood / serum, the excretory system will be over loaded to filter and the excess plasma inorganic phosphate will be expelled through urine. If we adopt scientific methods in specific intensity training, the excretory system will recycle the urine inorganic phosphate for better utilization of the bioenergetics system.

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