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## **EFFECTS OF COMBINED SHORT-TERM EXERCISE AND VITAMIN E SUPPLEMENTATION ON DEVELOPMENT OF THE RELATIONSHIP BETWEEN ANAEROBIC CAPACITY AND KINESTHETIC PERCEPTION OF MALE VOLLEYBALL PLAYERS**

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### **ABSTRACT**

**Objective:** To identify the effects of combined short-term exercise and vitamin E supplementation on development of the relationship between anaerobic capacity and kinesthetic perception of male volleyball players. **Method:** The players were divided into four groups and all of the experiments were carried out according to the standard protocols. **Results:** The data of this study showed that vitamin E supplementation to the volleyball players along with short-term exercise can improve anaerobic capacity and kinesthetic perception of the male volleyball players. **Conclusion:** Administration of vitamin E supplementation and short-term exercise develops the relationship between anaerobic capacity and kinesthetic perception of male volleyball players.

## INTRODUCTION

Research in performance analysis focused on volleyball (VB) has been increasing in recent years with the purpose to provide relevant information on features, patterns, and specificities of teams' behaviors within competitive contexts, providing valuable data for guiding practice and research alike. Volleyball is characterized as an intermittent sport, with frequent high-intensity actions, involving explosive bursts, short body displacements and numerous jumps<sup>1</sup>. It is that type of game which required high kinesthetic sensation in order to alignment of body quickly in accordance to the movement of balls. At the same time it is very important for a player to possess high anaerobic capacity as well as strong kinesthetic perception to optimize maximum performances. Intake of various food substances along with physical exercise is also essential to improve the performances of volleyball players.

Vitamins are essential nutrients that have a wide variety of functions. The lipid soluble vitamin E plays an important role as an antioxidant. Vitamin E may have important implications for exercise or work capacity. The administration of Vitamin E, *in vivo*, might have similar effects on skeletal and cardiac muscle of mice. Vitamin E deficiency enhances the susceptibility to exercise-induced muscle damage in male rats more than in female rats<sup>2</sup>. Muscle wasting or dystrophic muscles have also been noted in vitamin E-deficient animals<sup>3</sup>. Vitamin E intake among athletes is considered to be more than sufficient<sup>4, 5</sup>. High vitamin E intakes were routinely used by athletes in the Mexico City and Munich Olympic Games<sup>4</sup>. Acute exercise has been shown to affect blood levels of tocopherol. Pincemail et al. (1988) found that plasma tocopherol levels were significantly increased in nine men during intense cycle ergometer exercise<sup>6</sup>. The authors suggested that tocopherol was mobilized from adipose tissue into the blood and distributed to exercising muscles. At the muscle level, tocopherol could act to prevent lipid peroxidation induced by the exercise. Nagawa et al. (1968) reported that supplementation of 300 mg per day for at least 4 to 5 weeks had a moderate effect on several exercise tests, including cycle ergometry exercise and running sprints, performed at altitudes of 2700 and 2900 m<sup>7</sup>. Using a better controlled design, Kobayashi (1974) examined the effect of vitamin E supplementation of 1200 IU daily for 6 weeks on sub-maximal cycle ergometry exercise<sup>8</sup>.

Our earlier studies showed that the combined Vitamin E and treadmill exercise supplementation improved the leg strength, maximum exercise oxygen uptake and power of leg (explosive strength) and vitamin E supplementation can boost up the performance level of

hill land football players<sup>9, 10</sup>. But there is no report till date about the effects of combined short-term exercise and vitamin E supplementation on the development of the relationship between anaerobic capacity and kinesthetic perception of male volleyball players.

Therefore, in the present study an attempt has been made to observe the effect of combined short-term exercise and vitamin E supplementation on development of the relationship between anaerobic capacity and kinesthetic perception of male volleyball players.

## **METHODS AND SUBJECTS**

### **The subject**

The totals of 250 male volleyball players were taken as the subject for the study who represented at Inter College level competition. The age of the subjects ranged from 18-22 years. The subject was selected from Sukanta Mahavidyalaya, of Jalpaiguri district.

Those subjects were selected only on the basis of following criteria:-

- i) The selected subjects were not of very high level elite athletes
- ii) They have not any sports achievement
- iii) All of the students were from a course which is purely residential receiving more or less same type of diet.
- iv) They were regularly engaged in moderate physical activity (as per there course requirement).

### **Experimental design**

The 250 (n=250) subjects were distributed into four groups- (1) control group, (2) short-term exercise group, (3) only Vitamin E supplementary group [double positive], (4) short-term exercise and Vitamin E supplementary group. Short-term exercise for four weeks (6 days per week with one day rest) was applied for the group no. 2 and 4. Vitamin E were supplemented in the form of capsules (Evion<sup>®</sup> 200 of Merck Serono, India division which was selected by consultation with medical professional) at the dose one capsule for every day (as per Takanami et al., 2000) after lunch for 5 days per week for six weeks duration for group no 3 and 4 and only for control group no exercise or supplementation were given<sup>11</sup>. Data were taken for all of the four groups as mentioned above.

### **Instruments and facilities taken**

For collecting the data the following instruments and facilities were taken from Human Performance Laboratory of Department of Physical Education of Kalyani University.

### Criterion measures

Different Kinesthetic perception components of the subjects were taken as the criteria for the present study<sup>12</sup>.

### Measurement of upper limb kinesthetic discrimination ability (Backward medicine ball throw test)

**Facilities and equipments** - A medicine ball and a 5 meter field area.

**Court marking** -A restraining was mark which one meter in length. A circle was mark which eight meter in diameter and it mark five meter away from the restraining line. Four circle was mark under the one another circle and each circle distance two meter apart from the another circle.

**Procedure** -Participants performed a two-hand overhead throw backwards with a medicine ball. The target had a eight, six, four and two meter in diameter. After a training throw, participants performed four consecutive trials. The points were assigned for each centered target. Scores of 3, 2, 1 and 0 were assigned with increasing distance of the contact point of the ball from the target (Figure 1).

**Scoring** - The sum of the score of four trials was computed as the total score of the subject.



**Figure 1: Backward ball throw test for measurement of Upper limb kinesthetic discrimination ability**

### Lower limb kinesthetic discrimination ability (Low jump test)

**Facilities and Equipments** -A bench and a one meter field area.

**Court marking:-**A bench set in fix position which height 50 cm. After that one line was mark two meter distance from the bench. Four lines were mark which 50cm distance from one another. Each lines have specific point according to the distance 0,1,2,3.

**Procedure** - Participants jumped with legs together from a plinth to a long jump pit. They were instructed to land with the heels on the long jump pit. The test was performed five times and the distance of each heel from the marking was measured in meters for each trial. Distance values were collapsed across heels (Figure 2).

**Scoring** - The score of the subject is the mean value of the obtained score by two trials.



**Figure 2: Depth perception jump test for measurement of Lower limb kinesthetic discrimination ability.**

#### **Upper limb response orientation ability (Hanging target throw test)**

**Facilities and Equipments** -A hoop of 80 centimeter diameter with a 5 meter field area.

**Procedure** - One of the investigators of the study was in front of the participant, 5 meter apart, swinging a hoop of 80 cm. diameter. Participant tried to throw a tennis ball through the swinging hoop during its backswing. After one training throw, participants performed five consecutive trials. The points assigned were 2, 1 or 0 points, respectively, if the ball passed through, touched or passed outside the hoop (Figure 3).

**Scoring** - The sum of the score was computed as the total score of the subject.



**Figure 3: Hanging target through test for measurement of Upper limb response orientation ability**

**Lower limb response orientation ability (Orientation shuttle run test)**

**Facilities and Equipments** -Five tennis balls and a field area of 10 meter diameter.

**Procedure** - The participant was instructed to run 6 times, as quickly as possible, from a start marker toward one of the five numbered goal markers located behind him/her. The goal markers were 5 meter apart from the starting line and 3 meter apart from another on a hypothetical circumference arc. The sequence of goal markings to be reached was not known previously. The next marking number was announced when the participant returned to the start ball and touched it for the next run to begin without pausing. After demonstration by an experimenter, participants performed the test that was scored in seconds (Figure 4).

**Scoring** - The best score out of the three trials was taken as the score of the subject.



**Figure 4: Orientation shuttle run test for measurement of Lower limb response orientation ability**

**Rapid anaerobic sprint test for measurement of anaerobic power-**

**Facilities and equipments**-7 cones, lime dust, whistle stopwatch, etc.

**Procedure**-The participant has given the instruction to run 30 meter but in different style. The 7cones were set up in a 5 meter distance within the marked 30<sup>th</sup>meter. The participants were instructed to run on whistle from 1<sup>st</sup> cone to 7<sup>th</sup> cone, and then came back to 2<sup>nd</sup> cone and again to 6<sup>th</sup> cone. Gradually he had stop at middle cone. Stopwatch started with whistle and stop when participant reach the middle cone (Figure 5)<sup>13</sup>.

**Scoring** -Time had been taken 1/10<sup>th</sup> of second.



**Figure 5: Rapid Anaerobic Sprint Test for measurement of anaerobic power.**

### **ANALYTICAL PROCEDURE**

The personal and kinesthetic sensation data were collected by using appropriate tools and instruments. For statistical analysis standard procedure was adopted Mean and SD was first computed then test data was analyzed by Pearson product moment co relation method. All the statically calculation was performed by SPSS version19.0 (IBM)

I. Mean( $X$ ) =  $\sum X/N$  , (Where,  $X$ = sum of all score,  $N$ = no. of subject)

II. Standard deviation (SD or  $\sigma$ ) =  $\sqrt{\sum x^2 / N-1}$

(Where,  $X$ = sum of the square deviation of all scores taken from mean,  
 $N$ = no. of subjects)

III. The Co-efficient of correlation was computed by following formula-

$$r = \frac{\sum XY - NM_X M_Y}{\sqrt{[\sum X^2 - NM_X^2][\sum Y^2 - NM_Y^2]}}$$

Where,  $X$  and  $Y$  are obtained scores,  $M_x$  and  $M_y$  are the means of the  $X$  and  $Y$  series, respectively.

$\sum X^2$  and  $\sum Y^2$  are the sums of the squared  $X$  and  $Y$  values  $N$  is the number of cases..

### **Statistical analysis**

Analysis of covariance (ANCOVA) was used to determine the differences, among the adjusted post test means on selected criterion variables separately. The level of significance was fixed at .05 level of confidence to test the 'F' ratio obtained by analysis of covariance. Percentage changes in Mean value of each of the three parameters before and after test were measured. All the statistical analysis was done by using MICROCAL ORIGIN PRO 7 version. All the data were analyzed by applying Pearson product moment correlation to find out the significant difference, if any between the groups.

## RESULTS

Personal data of subjects were measured and these have been shown in table 1.

**TABLE 1: PERSONAL DATA OF THE VOLLEYBALL PLAYERS**

Personal data	Control	Short-term exercise	Vitamin E	Short-term exercise +Vitamin E
Age (Year)	19.24±1.32	19.33±2.01	19.73±1.43	19.06±1.81
Height (cm)	168.76±3.56	167.32±2.87	168.33±3.91	168.77±1.02
Weight (kg)	52.09±4.22	52.18±1.65	53.44±1.91	52.21±1.52

Values are expressed as Mean± SD for all of the four groups.

Table 2 depicts the Pearson product moment correlation value between lower limb response orientation ability and anaerobic power as the computed value is found to be higher even the critical value at 0.01 level hence null hypothesis is rejected and there is a significant co relation between the variables.

**TABLE 2: LOWER LIMB RESPONSE ORIENTATION ABILITY**

Variables	Control	Short-term exercise	Vitamin E	Short-term exercise + Vitamin E
Lower limb response orientation ability	16.55±0.62	19.02±0.01	16.99±0.13	26.06±0.51
Anaerobic power	23.54± 0.62	27.29±0.27	23.83±0.24	38.67±0.02
r- value	0.81	0.77	0.84	0.92
P level	P<0.01	P<0.01	P<0.01	P<0.01

Values are expressed as Mean± SD for all of the four groups.

Table 3 depicts Pearson product moment Correlation value between upper limb response orientation ability and anaerobic power as the computed value is found to be higher even the critical value at 0.01 level hence null hypothesis is rejected and there is a significant co relation between the variables.

**TABLE 3: UPPER LIMB RESPONSE ORIENTATION ABILITY**

Variables	Control	Short-term exercise	Vitamin E	Short-term exercise + Vitamin E
Upper limb response orientation ability	7.73±1.03	10.35±0.21	8.04±0.63	13.66±0.12
Anaerobic power	23.54± 0.62	23.29±0.06	23.83±0.24	38.67±0.02
r- value	0.85	0.82	0.81	0.88
P level	P<0.01	P<0.01	P<0.01	P<0.01

Values are expressed as Mean± SD for all of the four groups.

Table 4 depicts Pearson product moment Correlation value between lower limb kinesthetic discrimination ability and anaerobic power as the computed value is found to be higher even the critical value at 0.001 level hence null hypothesis is rejected and there is a significant co relation between the variables.

**TABLE 4: LOWER LIMB KINESTHETIC DISCRIMINATION ABILITY**

Variables	Control	Short-term exercise	Vitamin E	Short-term exercise + Vitamin E
<b>Lower limb kinesthetic discrimination ability</b>	1.10 ± 0.34	2.55±0.13	1.64±0.93	7.81±0.82
<b>Anaerobic power</b>	20.74± 0.12	24.29±0.56	20.83±0.24	33.3 7±0.32
<b>r- value</b>	0.83	0.82	0.89	0.84
<b>P level</b>	P<0.01	P<0.01	P<0.01	P<0.01

Values are expressed as Mean± SD for all of the four groups.

Table 5 depicts Pearson product moment correlation value between upper limb kinesthetic discrimination ability and anaerobic power as the computed value is found to be higher even the critical value at 0.001 level hence null hypothesis is rejected and there is a significant co relation between the variables.

**TABLE 5: UPPER LIMB KINESTHETIC DISCRIMINATION ABILITY**

Variables	Control	Short-term exercise	Vitamin E	Short-term exercise + Vitamin E
<b>Upper limb kinesthetic discrimination ability</b>	16.82±0.91	18.95±0.03	16.64±0.44	27.11±0.02
<b>Anaerobic power</b>	23.54± 0.62	25.29±1.56	23.03±0.84	34.37±0.42
<b>r- value</b>	0.91	0.92	0.83	0.94
<b>P level</b>	P<0.01	P<0.01	P<0.01	P<0.01

Values are expressed as Mean± SD for all of the four groups.

Table 6 depicts the correlation matrix of each of the variables of temporal and physical characteristics of the interuniversity volleyball players. It is to be noted that all the physical characteristics are significantly co related with duration of set reflecting the level of proficiency of the players whereas rest time and work time has no significant relation with that of physical variables. Duration of rallies depends upon the number of hits and jumps and efficiency of blocker and defenders as well as smasher, here it has been observed that this parameter of temporal variables are significantly correlated with all the physical variables positively so does the rest time between rallies. Interesting to note that numbers of rallies are negatively correlated with hits and jumps done by blocks which correlates with our previous results.

**TABLE 6: CORRELATION MATRIX OF EACH OF THE VARIABLES OF TEMPORAL AND PHYSICAL CHARACTERISTICS OF THE INTERUNIVERSITY VOLLEYBALL PLAYERS.**

Variables	Physical Temporal	Number of jumps done by defender	Number of jumps done by blocker	Total number of jumps	Number of hits done by defender	Number of hits done by Blocker
1	Duration of set (min:sec)	0.85* <sup>a</sup>	0.32* <sup>a</sup>	0.87* <sup>a</sup>	0.88* <sup>a</sup>	0.82* <sup>b</sup>
2	Total rest time	0.40	0.32	0.10	0.54	0.56
3	Total work time	0.21	0.32	0.35	0.21	0.21
4	Duration of rallies(min:sec)	0.54* <sup>a</sup>	0.65* <sup>a</sup>	0.39* <sup>b</sup>	0.89* <sup>b</sup>	0.95* <sup>b</sup>
5	Rest time between the rallies	0.87* <sup>a</sup>	0.48* <sup>b</sup>	0.45* <sup>a</sup>	0.87* <sup>a</sup>	0.81* <sup>a</sup>
6	Number of rallies	0.78* <sup>a</sup>	-0.10* <sup>a</sup>	0.21	0.32	-0.56* <sup>a</sup>

\* refers to the significant value a: P<0.001 and b: P<0.01 level of significance.

Table 7 depicts the correlation matrix of each of the variables of temporal and physical characteristics of the intercollegiate volleyball players.

**TABLE 7: CORRELATION MATRIX OF EACH OF THE VARIABLES OF TEMPORAL AND PHYSICAL CHARACTERISTICS OF THE INTERCOLLEGIATE VOLLEYBALL PLAYERS.**

Variables	Physical Temporal	Number of jumps done by defender	Number of jumps done by blocker	Total number of jumps	Number of hits done by defender	Number of hits done by Blocker
1	Duration of set (min:sec)	0.82* <sup>a</sup>	0.32* <sup>a</sup>	0.74	0.88	0.28* <sup>b</sup>
2	Total rest time	0.20	0.34	0.08	0.41	0.56
3	Total work time	0.21	0.32	0.35	0.21	0.21
4	Duration of rallies(min:sec)	0.45* <sup>a</sup>	0.35* <sup>a</sup>	0.39* <sup>b</sup>	0.9	0.5* <sup>b</sup>
5	Rest time between the rallies	0.81	0.48* <sup>b</sup>	0.41* <sup>a</sup>	0.81* <sup>a</sup>	0.80
6	Number of rallies	0.8* <sup>a</sup>	-0.8* <sup>a</sup>	0.12	0.23	-0.51* <sup>a</sup>

\* refers to the significant value a: P<0.001 and b: P<0.01 level of significance.

## DISCUSSIONS

It has been widely reported that vitamin E shows numerous beneficial effects through and beyond its antioxidative properties; many studies related to vitamin E have been conducted originally from the point of view of its effects on physical performance. Recent studies have suggested that endurance exercise may promote free radical generation in the body, and vitamin E may play an important role in preventing the free radical damage associated with endurance exercise. However, it is proposed that as a result of exercise, vitamin E may be mobilized from store tissues and redistributed in the body to prevent oxidative damage. Research studies have already proved that vitamin E contributes to preventing exercise-induced lipid peroxidation. It has also observed that in case of strenuous endurance exercise

enhancement in the production of oxidized low density lipoprotein (LDL) could be reduced by higher vitamin E status maintenance.<sup>6</sup> Supplementation with 100 to 200mg of vitamin E daily can be recommended for all endurance athletes to prevent exercise-induced oxidative damage and to reap the full health benefits of exercise.<sup>6</sup> Anaerobic exercises is an exercise intense enough to trigger lactate formation. It is used by athletes in non-endurance sports to promote strength, speed and power and by body builders to build muscle mass. Muscle energy systems trained using anaerobic exercise develop differently compared to aerobic exercise, leading to greater performance in short duration, high intensity activities, which last from mere seconds to up to about 2 minutes. In case of running based sprinting activity it is extremely important for an athlete to generate his aerobic power at maximum threshold.

Motor co ordination and kinesthetic discrimination represents the qualitative part of psychomotor activity and is a complex and multidimensional phenomenon, in which several systems participate to assure optimal movement control and reaction to environmental variations. Volleyball is that kind of sports that require strong kinesthetic perception as well as anaerobic power to achieve quality of performance. Whenever we have compared the values of anaerobic capacity and kinesthetic perception with respect to controls we have found that all the parameters were increased after experimental time period of 6 weeks in both the short-term exercise group and short-term exercise with vitamin E supplementation in respect to control group, and it was observed that in case of combined short-term exercise and vitamin E supplementation group the increment of anaerobic capacity and kinesthetic sensation was highest. The possible explanation might be is that Vitamin E as well as short-term exercise increases muscle strength; whenever these two combined together we have found significant increment in all this two parameters. In our study we have found a significant positive co relation that exists between all four components of kinesthetic perception that includes discrimination ability and orientation ability for upper and lower part of the body with that of anaerobic power suggesting the importance of these two components. The possible explanation might be that as the game constitutes of several jumps and hits<sup>1</sup> and movement in accordance with the ball which in turn requires anaerobic power to perform high intensity activity within a short spell of time, so these two parameters have significantly correlated as kinesthetic perception which is a moving sense in dynamic condition controlled by cerebella cortical neuron whereas anaerobic power also does the same conglomerating with muscular interactions as well as bio-energetically interplay.

Therefore for volleyball players Vitamin E supplementation as well as designed short-term exercise could be a better device by which greater muscular strength and endurance can be achieved.

## CONCLUSION

It was concluded from the results of the study that the anaerobic capacity and kinesthetic perceptions of volleyball players will improved significantly after giving of combined Vitamin E supplementation and short-term exercise. A significant relationship exists between kinesthetic perceptions and anaerobic power of volleyball players. Further research will open new avenue in this field.

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