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# EFFECT OF TRAINING PROGRAM ON PEAK EXPIRATORY FLOW RATE & HEART RATE OF TENNIS AND BADMINTON SCHOOL LEVEL PLAYERS

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**Abstract:**

The purpose of the study was to find out the effect of training programme on the peak expiratory flow and heart rate of tennis and badminton school level players. For this purpose, 100 subjects were selected by Quota sampling technique and after the pre-test, all the subjects were scattered into four equal groups i.e. experimental group and control group(n=25 in each group). The experimental group underwent twelve weeks of constructive training program whereas the control group was not given any kind of training. Pre-test and post-test were applied to get the data from both groups. The difference between groups was analysed by applying ANCOVA for the significant differences at 0.05 levels. The findings of the test showed the significant value for selected variables in the experimental group. The results were found significant. The findings of the study revealed
that the twelve weeks training program is very beneficial to Peak expiratory Flow and heart rate of tennis and badminton players.

**Keywords: Tennis , Badminton , Experimental group , Training , Peak expiratory flow Rate**

**Introduction:**

1. Badminton, a dynamic racquet sport, captivates players of all ages and skill levels. At its core, it's a game of precision and agility, where opponents, either individuals in singles or pairs in doubles, face off across a net-divided rectangular court. The objective is simple yet challenging: to use a racquet to strike a shuttlecock, often playfully called a "birdie," over the net and land it within the opponent's court boundaries. Each side is granted only a single strike before the shuttlecock must cross the net, making strategic placement and swift reflexes crucial. While professional matches unfold in meticulously designed indoor courts, the sport's accessibility shines in casual settings, from backyard games to beachside rallies. Regardless of the environment, the thrill of badminton lies in the strategic exchange, the satisfying "thwack" of the racquet, and the pursuit of scoring points by outmanoeuvring opponents. The sport's is full of tactical thinking makes it a popular choice for both

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competitive athletes and those seeking a fun and engaging pastime. The swift movements, precise shots, and strategic gameplay make badminton a sport that demands both physical fitness and mental acuity, contributing to its widespread appeal. Tennis is a racket sport in which players play with racket and a ball opposite to each other with a bouncy ball. Tennis, a sport that has captivated audiences for centuries, has undergone a remarkable transformation, evolving from a courtly amusement to a global phenomenon. As the game has spread across continents, it has experienced a gradual process of globalization, professionalization, and commercialization, as researchers have observed.

(Luitzen et al., 2015)The origins of tennis can be traced back to France, where it emerged as a popular pastime among aristocrats (Wang, 2016). However, it was the British officer Walter Wingfield who introduced an open-air version of the game, known as lawn tennis, in 1874, revolutionizing the sport's accessibility and appeal (Luitzen et al., 2015). Wingfield's innovative approach, which included developing a portable tennis set, made the game more approachable for a wider audience, including women (Luitzen et al., 2015).As lawn tennis gained popularity, it began to spread to other parts of the world, including the Netherlands, though the details of its introduction there remain elusive (Luitzen et al., 2015). The United States, in particular, embraced the sport with enthusiasm, becoming a leading centre of tennis culture and innovation.

**Methodology:**

2. The objective of the study was to see the effect of training program on the peak expiratory flow and heart rate of the badminton and tennis players. The researcher use Probability sampling technique. The various testing procedure and training program was explained to the subjects in detail before starting the training program.

3.

**2.1 Participants :** Male tennis and badminton players (N=100) were randomly elected for the purpose of this study. The age range of subjects was 12 -15 years respectively. The subjects were selected badminton and tennis groups 50 from each group and further divided in 25 as experimental group and 25 as a control group for both tennis and badminton from schools in Gurugram Haryana.

**2.2 Variables:** Based on available literature, and research findings, and keeping the specific reason for the study in mind, the following physiological and physical variables were selected for the study.

**Variables**

- Peak expiratory flow Rate
- Heart rate

**2.3 Data collection : The Peak Expiratory Flow Rate**

Peak flow rate is the maximum amount of air that is exhaled during forced expiration. A peak flow metre, a tiny, handheld device used to track a person's capacity to exhale air, can be used to measure a person's highest rate of expiration, or peak expiratory flow rate. It gauges how much air gets through the bronchi and, consequently, how blocked the airways are.

**Procedure**

A human being's lung capacity can be measured with a peak flow metre, a portable, handheld device. One blows into it to use it, then looks at the readout.

**Scoring**

- Make sure it is at zero.
- Assure that the participants are standing and inhaling deeply.
- Instruct the individuals to blow into the device as quickly and clearly as is sensible.
- Note the number (referred to as a perusing) that the meter reads.
- Do this three times and then record the most amazing number that was ever recorded (not the typical).

**2.3 Heart rate**

The number of heartbeats that the body experiences in a minute while at total rest is known as the heart rate.

**Procedure**

Place the middle and index fingers on the carotid artery in your neck or the radial artery on your wrist. After determining the location of your pulse, multiply the number of beats per 20 seconds by 3.

**2.4 Data Analysis**

The researchers employed a rigorous statistical approach to analyse their collected data, utilizing IBM SPSS Statistics software, specifically version 20.0.0. This robust tool facilitated a comprehensive examination of the dataset concerning peak expiratory flow (PEF) among control and

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experimental groups. To ensure the reliability of subsequent analyses, preliminary tests were conducted. The M Box test was employed to assess the normality of the data distribution, a crucial step for verifying that the data aligns with the assumptions of parametric statistical tests. Additionally, Levene's test for equality of variances was performed to determine if the variances of PEF scores were similar across the groups, a prerequisite for certain comparative analyses.The analysis further involved generating descriptive statistics, providing a summary of the central tendency and dispersion of PEF scores within both control and experimental groups. Subsequently, pairwise comparisons were conducted to pinpoint specific differences in PEF between these groups. These comparisons aimed to identify the extent to which the experimental intervention influenced PEF, thereby providing insights into the effectiveness of the training program.

**Table 4.1**
**Levene's Test of Equality of variances**

| | F | df1 | df2 | Sig. (p-value) |
|---|---|---|---|---|
| **Pre** | 1.724 | 3 | 96 | 0.309 |
| **Post** | 0.130 | 3 | 96 | 0.761 |

Table 4.1 shows the analysis of the assumption - equality of variances for the peak expiratory flow performance test, tested by Levene's test. The p-value is more than 0.05 (p = 0.309 & p = 0.761); hence, Levene's Test is not significant. The insignificance of Levene's test means the assumption holds true. This table presents the results of Levene's test, which is used to check whether the variances (how spread out the data is) of the Peak Expiratory Flow are equal across different groups.

**Table 4.2**
**Descriptive Statistics peak expiratory flow control and experimental groups**

| Group | Mean | Std. Deviation | N |
|---|---|---|---|
| **Badminton Control** | 174.7200 | 13.04965 | 25 |
| **Badminton Experimental** | 182.0800 | 9.55650 | 25 |
| **Tennis Control** | 175.8400 | 11.87322 | 25 |
| **Tennis Experimental** | 178.0000 | 12.35246 | 25 |

Table 4.2 shows the descriptive data i.e. mean and standard deviation of peak expiratory flow control and experimental groups. This table summarizes the key characteristics of the Peak Expiratory Flow data for four different groups: Badminton Control: This group consists of 25 individuals who did not

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receive any special training and participated in badminton. Badminton Experimental: This group also has 25 individuals who participated in badminton but also received a specific training program. Tennis Control: This group includes 25 individuals who did not receive any special training and played tennis. Tennis Experimental: This group comprises 25 individuals who played tennis and also underwent the same special training program as the Badminton Experimental group.

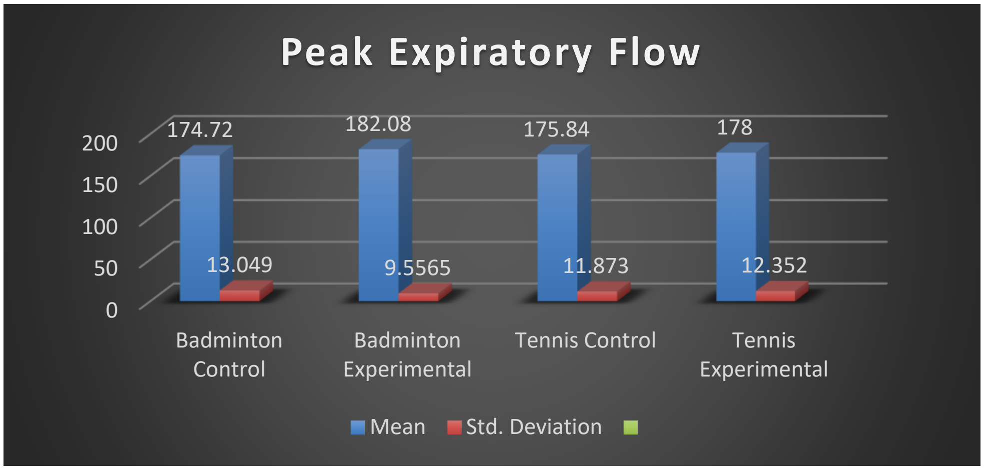


**Table 4.3**

**Pairwise comparison of peak expiratory flow between control and experimental groups**

| (I) Group | (J) Group | Mean Difference (I-J) | Std. Error | Sig.[b] | 95% Confidence Interval for Difference[b] | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| BDC | BDE | -8.419* | 1.195 | **.000** | -11.638 | -5.200 |
| | TEC | -.679 | 1.194 | 1.000 | -3.896 | 2.539 |
| | TEE | -5.280* | 1.197 | **.000** | -8.504 | -2.056 |
| BDE | BDC | 8.419* | 1.195 | **.000** | 5.200 | 11.638 |
| | TEC | 7.740* | 1.195 | **.000** | 4.519 | 10.961 |
| | TEE | 3.139 | 1.195 | .060 | -.080 | 6.357 |
| TEC | BDC | .679 | 1.194 | 1.000 | -2.539 | 3.896 |
| | BDE | -7.740* | 1.195 | **.000** | -10.961 | -4.519 |
| | TEE | -4.601* | 1.198 | **.001** | -7.829 | -1.374 |
| TEE | BDC | 5.280* | 1.197 | **.000** | 2.056 | 8.504 |
| | BDE | -3.139 | 1.195 | .060 | -6.357 | .080 |
| | TEC | 4.601* | 1.198 | **.001** | 1.374 | 7.829 |

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

*BDC- Badminton Control BEC- Badminton experimental TEC- Tennis Control TEE- Tennis Experimental

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Table 4.3 shows the post-hoc analysis using Bonferroni. The pairwise comparison showed that there is significant difference of BDC with BDE(p = 0.000), and TEE(p = 0.000); BDE with BDC (p = 0.000) & TEC(p = 0.000); TEC with BDE (p = 0.000) & TEE(p = 0.001); TEE with BDC(p = 0.000) & TEC(p = 0.001).

This table presents the results of pairwise comparisons conducted to identify which specific groups differ significantly in terms of Peak Expiratory Flow. These comparisons are typically performed after an ANCOVA (like the one in Table 4.2) has indicated that overall differences exist between the groups.

**Table 4.4**

**Levene's Test of Equality of variances**

| | F | df1 | df2 | Sig. (p-value) |
|---|---|---|---|---|
| **Pre** | 0.432 | 3 | 96 | 0.956 |
| **Post** | 0. 811 | 3 | 96 | 0.619 |

Table 4.4 shows the analysis of the assumption - equality of variances for the Heart rate test, tested by Levene's test. The p-value is more than 0.05 (p = 0.956 & p = 0.619); hence, Levene's Test is not significant. The insignificance of Levene's test means the assumption holds true.

**Table 4.5**

**Descriptive Statistics of Heart Rate (HR) among different groups**

| Group | Mean | Std. Deviation | N |
|---|---|---|---|
| **BDC** | 70.4428 | 7.41119 | 25 |
| **BDE** | 67.4800 | 6.13813 | 25 |
| **TEC** | 70.8000 | 6.83478 | 25 |
| **TEE** | 67.3240 | 5.27267 | 25 |
| **Total** | 69.0117 | 6.56886 | 100 |

*BDC- Badminton Control BEC- Badminton experimental TEC- Tennis Control TEE- Tennis Experimental

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Table 4.5 shows the descriptive data i.e. mean and standard deviation of heart rate (HR) among different groups .This table summarizes the key characteristics of the Heart Rate data for four different groups.

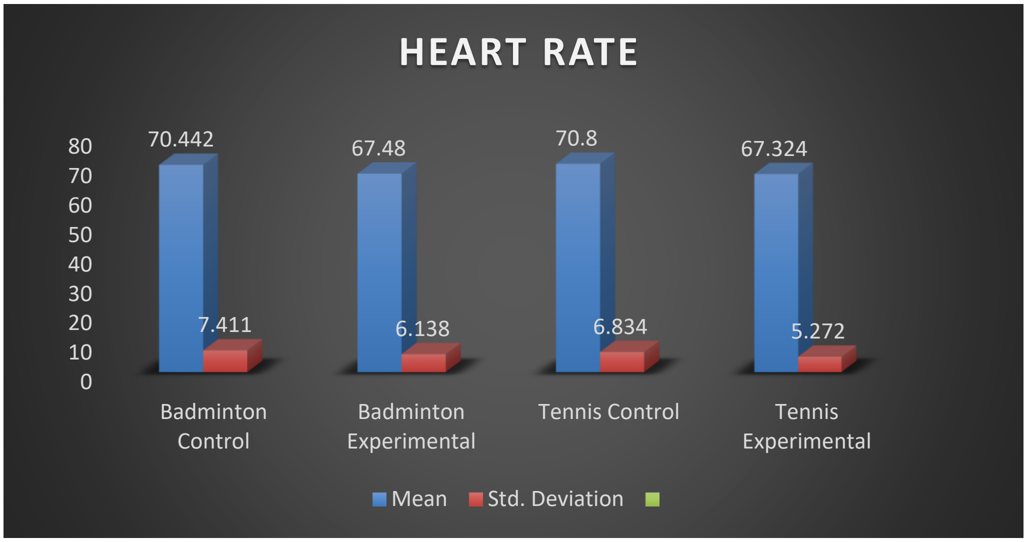


**Table 4.6**

**The pairwise comparison of heart rate among different groups**

| (I) Group | (J) Group | Mean Difference (I-J) | Std. Error | Sig.[b] | 95% Confidence Interval for Difference[b] | |
|---|---|---|---|---|---|---|
| | | | | | Lower Bound | Upper Bound |
| BDC | BDE | 3.488* | .493 | **.000** | 2.510 | 4.466 |
| | TEC | .098 | .492 | .843 | -.880 | 1.076 |
| | TEE | 3.294* | .492 | **.000** | 2.316 | 4.271 |
| BDE | BDC | -3.488* | .493 | **.000** | -4.466 | -2.510 |
| | TEC | -3.390* | .492 | **.000** | -4.367 | -2.413 |
| | TEE | -.194 | .492 | .694 | -1.172 | .784 |
| TEC | BDC | -.098 | .492 | .843 | -1.076 | .880 |
| | BDE | 3.390* | .492 | **.000** | 2.413 | 4.367 |
| | TEE | 3.196* | .492 | **.000** | 2.219 | 4.173 |
| TEE | BDC | -3.294* | .492 | **.000** | -4.271 | -2.316 |
| | BDE | .194 | .492 | .694 | -.784 | 1.172 |
| | TEC | -3.196* | .492 | **.000** | -4.173 | -2.219 |

Based on estimated marginal means
*. The mean difference is significant at the .05 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

*BDC- Badminton Control BEC- Badminton experimental TEC- Tennis Control TEE- Tennis Experimental

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The above table 4.6 shows the post-hoc analysis using Bonferroni The pairwise comparison showed that there is significant difference of BDC with BDE (p = 0.000) and TEE(p = 0.000); BDE with BDC (p = 0.000) and TEC(p = 0.000); TEC with BDE(p = 0.000) and TEE (p = 0.000); TEE with BDC(p = 0.000) & TEC(p = 0.000). The Bonferroni post-hoc analysis revealed significant differences in the measured variable between all paired group comparisons (BDC, BDE, TEC, TEE). Specifically, every group showed a statistically significant difference (p=0.000) when compared to each other group. This indicates that the experimental intervention had a distinct and measurable impact across all groups. The consistently low p-values (0.000) strongly suggest that these differences are not due to chance, but rather reflect genuine effects. Therefore, the study confirms that there were clear and significant variations among all the groups analysed.

**Conclusion**

The findings pertaining to the peak expiratory flow and heart rate of squash and tennis players revealed the following results. This study ANCOVA was conducted to evaluate the compare the variables Peak expiratory flow rate and heart rate of badminton and tennis players. The pairwise comparison showed that there is significant difference of BDC with BDE (p = 0.000) and TEE(p = 0.000); BDE with BDC (p = 0.000) and TEC(p = 0.000); TEC with BDE(p = 0.000) and TEE (p = 0.000); TEE with BDC(p = 0.000) & TEC(p = 0.000). As per the finding of physiological variables, results showed that, there was significant difference in the peak expiratory flow of of BDC with BDE group, and TEE group; BDE group with BDC group & TEC group; TEC group with BDE group & TEE group; TEE group with BDC group & TEC group; It means that peak expiratory flow improved for in different Group. Findings also shows that the peak expiratory flow changed due to training. It shows that there was difference in peak expiratory flow in pre and post time intervals. In Heart Rate (HR) variable, there was a significant difference in the resting heart rate of BDC group with BDE group and TEE group; BDE group with BDC group and TEC group; TEC group with BDE group and TEE group; TEE group with BDC group & TEC groups which means the resting heart rate changed with training effect. **Singh, (2015).,** Several factors have been identified as key determinants of peak expiratory flow.(Kaur et al., 2013)Age, height, weight, and Body Surface Area (BSA) have all been shown to influence an individual's peak expiratory flow rate. Specifically, peak expiratory flow rates tend to increase with age and height, while they generally decrease with increasing weight and body mass index. Gender has also been observed to play a role, with males typically exhibiting higher peak expiratory flow rates compared to females. **Faude, O., (2007)** Examining the physiological traits and metabolic needs of badminton single match play was the goal of the current study. An incremental treadmill test was carried out by twelve internationally rated badminton players (four men and eight women) [VO2peak = 61.8 § 5.9 ml min¡1 kg¡1 (men) and 50.3 § 4.1 ml min¡1 kg¡1 (women), respectively]. They engaged in a two-hour simulated badminton match one day while their heart rates were being monitored and their gas exchanges were done breath-by-breath. Blood lactate concentrations were also measured prior to, during, and following the match (15 minutes). In addition, the length of the rallies and the breaks between them, the score, and the quantity of shots each rally were all noted. Analysis was done on 630 rallies in total. An average of 5.1 § 3.9 shots were played throughout each rally, with mean rally and rest durations of 5.5 § 4.4 s and 11.4 § 6.0 s, respectively. During badminton matches, the average heart rate (HR), blood lactate concentration, and oxygen uptake (VO2) were 39.6 § 5.7 ml min¡1 kg¡1 (73.3% VO2peak), 169 § 9 min¡1 (89.0% HR peak), and 1.9 § 0.7 mmol l¡1, respectively. 95% confidence intervals had an average of 45.7–100.9% VO2peak and 78.3–99.8% HR peak for a single individual during match play. Anaerobic acid production and aerobic energy production are important in competitive badminton, as evidenced by the high average intensity of badminton matches and the significant fluctuation of various physiological indicators. It appears that quick recovery in between rallies or intense training sessions requires a well-developed aerobic endurance capacity.

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