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Assessment of respiratory indices of female pace bowlers and spin bowlers

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Abstract
The purpose of present study was to assess the respiratory indices of female pace bowlers and spin bowlers. A group of thirty (N = 30) female bowlers were selected for this study. Their mean height, weight, and age were (mean ± SD: age 20.86 ± 2.03years, height 159.2±2.45 cm, and body mass 57.93± 3.64 kg). Further the subjects were divided into two groups, pace bowlers (n= 15) and spin bowlers (n=15). The age of subjects ranged between 18 to 25 years. The difference in the mean of each group for selected variable was tested by "t" test. The level of significance was set at 0.05. Analysis of data revealed that there were significant differences of Vital Capacity (p **=** 0.0001), forced vital capacity (p =0.0027**)** tidal volume (p = 0.0839)expiratory reserve volume (p = 0.0449)and Inspiratory capacity (p=0.0236)between female pace bowlers and spin bowlers, since the calculated value of t for all the variables i.e., Vital Capacity (6.8591), forced vital capacity (3.2841**)** tidal volume (1.900) expiratory reserve volume (2.0999)and Inspiratory capacity (2.3933)is higher than the tabulated value of t (1.701) for 28 degree of freedom. Thus it may be concluded that the group difference between pace bowlers and spin bowlers in regards to Vital Capacity, forced vital capacity, tidal volume, expiratory reserve volume and Inspiratory capacity found to be statistically significant. Whereas insignificant differences of Inspiratory reserve volume (p = 0.3935**)** between pace bowlers and spin bowlers, since the calculated value of t for Inspiratory reserve volume (t=0.8666) is smaller than the tabulated value of t (1.701) for 28 degree of. Thus it may be concluded that the group difference between pace bowlers and spin bowlers in regards to Vital Capacity, forced vital capacity, tidal volume, expiratory reserve volume and Inspiratory capacity found to be statistically significant. Whereas insignificant differences of Inspiratory reserve volume found.

Keywords: respiratory indices, pace bowlers and spin bowlers

Introduction

Cricket is the most popular sport in commonwealth countries and one of the most popular sports in the world. The performance of cricketers is enhancing day by day, old records are broken and new records are forming; scores are reaching new heights, it is due to high intensity training of the players which help them to perform well.

Traditionally, Cricket has been perceived as a relatively mild s port from a physiological point of view. The intermittent natur e of the game with its long rest intervals provides plenty of rec overy time between any short spells of higher intensity activit y. However, the demands of cricket may be underestimated(N oakes & Durandt, 2000) [10]. High level of performance of a Cricketer mightbe dependent upon his physiological make up and it is recognized that physiological fitness is much needed for high level performance. It has numerous parameters such as aerobic capacity, anaerobic capacity, pulse, vital capacity, blood pressure, breath holding time and etcetera. Certain physiological variables play important role in Cricket. Most of physiological variables can be tested only in laboratory. Foster *et al*. (1986) opines thatf ast bowling is predominantly an anaerobic activity which requires an aerobic base. In one study of the 1999 South African World Cup side, a number of physiological tests for explosive power and aerobic endurance capacity showed they were as 'fit' as the South African national rugby side. The physiological demands of cricket are relatively mild, except in fast bowlers during prolonged bowling spells in warm conditions. However, the physiological demands of cricket may be underestimated because of the intermittent nature of the activity and the generally inadequate understanding of the physiological demands of intermittent activity. Every sport requires a specific fitness or Physiological status, the game of badminton requires different physiological status than a long distance runner or a basketball player. Some games need different fitness for different places like in football and hockey, Physiological requirement of player playing at different positions are different. And in some games like cricket every skill requires a different physiological status; the batsmen may have different physiological status than a pace bowler or wicketkeeper. For batsmen, and bowlers, the primary energy system utilized during competition is the anaerobic lactic processes. In the acts of bowling, and batting, the intervals of activity requiring energy generation to power the athlete's muscles will almost certainly be fewer than 40 seconds. The Cricket is among the top in this sports. Therefore, there is need to analyse all these factors which can helps in developing the better cricket players and we have to change the old concept and have used to the now concept if we have to attain high level of performance. As all players in cricket are at some stage of a match called on to bat and field, much basic fitness training will be common to all players. Thus study will

render remarkable contribution to the field by searching out physiological potentialities of cricket players in different level of competitions and different aspects of cricket like batting bowling fielding and wicket keeping. Besides, it will be matter of inquisitiveness to excavation out the physiological variables of cricket players. Today all over the world physical educators and coaches are facing their greatest challenge in handling problems are in scientific way that is to give their sports persons proper and progressive guidelines based on scientific approach which leads to desired results. Sciences physical, physiological and psychological have been recognized as one of the best means of under lying sportsman's performance and of helping in producing better performance. The successful sports persons however, not only possess the apparently ideal physique but also certain physical, physiological and psychological traits developed by the specific events, he is competing in different motor abilities, play decisive role in various sports discipline. The purpose of present study was to assess the respiratory indices of female pace bowlers and spin bowlers. The following respiratory indices were measured with the use of a wet spirometer; Forced vital capacity (FVC), Tidal volume (Vt), Expiratory reserve volume (ERV), Vital capacity (VC), Inspiratory reserve volume (IRV) and Inspiratory capacities (IC).

Materials and Methods

Samples

A group of thirty (N = 30) female bowlers were selected for this study from Guru Nanak Dev university, Amritsar (Punjab), India. Their mean height, weight, and age were (mean ± SD: age 20.86 ± 2.03years, height 159.2±2.45 cm, body mass 57.93± 3.64 kg. The purposive sampling technique was used to attain the objectives of the study. The study was approved by the Ethics Committee of Directorate of Sport in Guru Nanak Dev University, Amritsar, India. All the subjects, after having been informed about the objective and protocol of the study, gave their consent and volunteered to participate in this study. They were further divided into two groups N = 15 each (N1=15, pace bowlers and N_2=15, spin bowlers).

Table 1: Subjects' Demographics.

S. No	Pace bowler	Spin bowler	Total sample
1.	N_1=15	N_2=15	N=30

Procedure

The following respiratory indices were measured 3 times with the use of a wet spirometer, the respective average values being used in the analysis:

- **Forced vital capacity (FVC):** The subject was asked to exhale forcibly after full inspiration;
- **Tidal volume (Vt):** The subject was asked to inhale a normal breath and then to place the mouthpiece of the spirometer between the lips and exhale normally into the spirometer;
- **Expiratory reserve volume (ERV):** After exhaling normally and placing the mouthpiece between the lips, the subject exhaled forcefully all the additional air possible;
- **Vital capacity (VC):** Following a maximum inspiration, all the air possible was forcibly exhaled through the mouthpiece;
- **Inspiratory reserve volume (IRV):** Following a maximum inspiration, the mouthpiece was placed and the air exhaled normally. The recorded value was subtracted from Vt producing the IRV value;
- **Inspiratory capacities (IC):** After exhaling normally, breathe in as deeply as possible, place the mouthpiece and exhale normally.

Statistical Analysis

Student's t-test for independent data was used to assess the between-group differences. The level of $p \leq 0.05$ was considered significant.

Results

The results of respiratory indices in female pace bowlers and spin bowlers are presented in the following tables:

Table 2: Mean, Standard Deviation (SD), Standard Error of Mean (SEM) of Vital Capacity of female pace bowlers and spin bowlers.

Group	Number	Mean	SD	SEM	t-Value	p-value
Pace bowlers	15	3.747	0.290	0.075	6.8591	0.0001
Spin bowlers	15	3.193	0.116	0.030		

Significant at .05 level of significance

$t_{.05}$ (28) =1.701

Table-2 shows that the mean value of female pace bowlers and spin bowlers vital capacity was3.747and 3.193 respectively, whereas the standard deviation (SD) was0.290 and 0.116. The critical value of t at 95% probability level is much lower (1.701) than the observed value of t (6.8591*). The data does suggest that the differences between female pace bowlers and spin bowlers vital capacity are significant.

Table: 3 Mean, standard deviation (SD), standard error of mean (SEM) of forced vital capacity of female pace bowlers and spin bowlers.

Group	Number	Mean	SD	SEM	t-Value	p-value
Pace bowlers	15	3.687	0.242	0.062	3.2841	0.0027
Spin bowlers	15	3.413	0.213	0.055		

Significant at .05 level of significance

$t_{.05}$ (28) =1.701

Table-3 shows that the mean value of female pace bowlers and spin bowlers forced vital capacity was 3.687 and 3.413

respectively, whereas the standard deviation (SD) was0.242 and 0.213. The critical value of t at 95% probability level is much lower (1.701) than the observed value of t (3.2841*). The data does suggest that the differences between female pace bowlers and spin bowlers forced vital capacity are significant.

Table: 4 Mean, standard deviation (SD), standard error of mean (SEM) of tidal volume of female pace bowlers and spin bowlers.

Group	Number	Mean	SD	SEM	t- Value	p-value
Pace bowlers	15	389.333	44.27	12.78	1.900*	0.0839
Spin bowlers	15	366.416	28.20	8.14		

Significant at .05 level of significance
$t_{.05}$ (28) =1.701

Table-4 shows that the mean value of female pace bowlers and spin bowlers tidal volume was 389.333and 366.416 respectively, whereas the standard deviation (SD) was 44.27 and 8.14. The critical value of t at 95% probability level is much lower (1.701) than the observed value of t (1.900*). The data does suggest that the differences between female pace bowlers and spin bowlers tidal volume are significant.

Table: 5 Mean, standard deviation (SD), standard error of mean (SEM) of expiratory reserve volume of female pace bowlers and spin bowlers.

Group	Number	Mean	SD	SEM	t- value	p-value
Pace bowlers	15	1.0153	0.0986	0.0255	2.0999	0.0449
Spin bowlers	15	0.9440	0.0871	0.0225		

Significant at .05 level of significance
$t_{.05}$ (28) =1.701

Table-5 shows that the mean value of female pace bowlers and spin bowlers expiratory reserve volume was 1.0153 and 0.9440 respectively, whereas the standard deviation (SD) was 0.0986 and0.0871. The critical value of t at 95% probability level is much lower (1.701) than the observed value of t (2.0999*). The data does suggest that the differences between female pace bowlers and spin bowlers expiratory reserve volume are significant.

Table 6: Mean, standard deviation (SD), standard error of mean (SEM) of Inspiratory reserve volume of female pace bowlers and spin bowlers.

Group	Number	Mean	Sd	Sem	T- value	p-value
Pace bowlers	15	2.573	0.361	0.093	0.8666	0.3935
Spin bowlers	15	2.453	0.396	0.102		

Significant at .05 level of significance
$t_{.05}$ (28) =1.701

Table-6 shows that the mean value of female pace bowlers and spin bowlers Inspiratory reserve volume was 2.573 and 2.453 respectively, whereas the standard deviation (SD) was0.361 and0.396. The critical value of t at 95% probability level is much higher (1.701) than the observed value of t (0.8666). The data does suggest that the differences between female pace bowlers and spin bowlers Inspiratory reserve volume are insignificant.

Table 7: Mean, standard deviation (SD), standard error of mean (SEM) of Inspiratory capacity of female pace bowlers and spin bowlers.

Group	Number	Mean	SD	SEM	t- Value	p-value
Pace bowlers	15	2.947	0.325	0.084	2.3933	0.0236
Spin bowlers	15	2.653	0.346	0.089		

Significant at .05 level of significance
$t_{.05}$ (28) =1.701

Table-7 shows that the mean value of female pace bowlers and spin bowlers Inspiratory capacity was 2.947 and 2.653 respectively, whereas the standard deviation (SD) was0.325 and 0.346. The critical value of t at 95% probability level is much lower (1.701) than the observed value of t (2.3933*). The data does suggest that the differences between female pace bowlers and spin bowlers Inspiratory capacity are significant.

Table 8: Mean Values (±SD), Standard Error of the Mean and Test Statistic t of Vital Capacity, Forced Vital Capacity, Tidal Volume, Expiratory Reserve Volume, Inspiratory Reserve Volume, and Inspiratory Capacities **in** female pace bowlers (N = 15) and spin bowlers (N = 15).

Dimension (S)	Mean		SD		SEM		t-value
	Pace bowler	Spin bowler	Pace bowler	Spin bowler	Pace bowler	Spin bowler	
Vital Capacity	3.747	3.193	0.290	0.116	0.075	0.030	6.8591*
Forced Vital Capacity	3.687	3.413	0.242	0.213	0.062	0.055	3.2841*
Tidal Volume	389.33	366.41	44.26	28.2	12.778	8.14	1.90*

Expiratory Reserve Volume	1.0153	0.9440	0.0986	0.0871	0.0255	0.0225	2.0999*
Inspiratory Reserve Volume	2.573	2.453	0.361	0.396	0.093	0.102	0.8666
Inspiratory Capacities	2.947	2.653	0.325	0.346	0.084	0.089	2.3933*

Significant at .05 level of significance

$t_{.05}$ (28) =1.701

The results of the respiratory indices (i.e. Vital Capacity, Forced Vital Capacity, Tidal Volume, Expiratory Reserve Volume, Inspiratory Reserve Volume, and Inspiratory Capacities**.)** between female pace bowlers and spin bowlers are presented in table 8. In case of respiratory indices components significant between-group differences were found for Vital Capacity (6.8591*), Forced Vital Capacity (3.2841*), Tidal Volume (1.90*), Expiratory Reserve Volume (2.0999*), and Inspiratory Capacities (2.3933*).

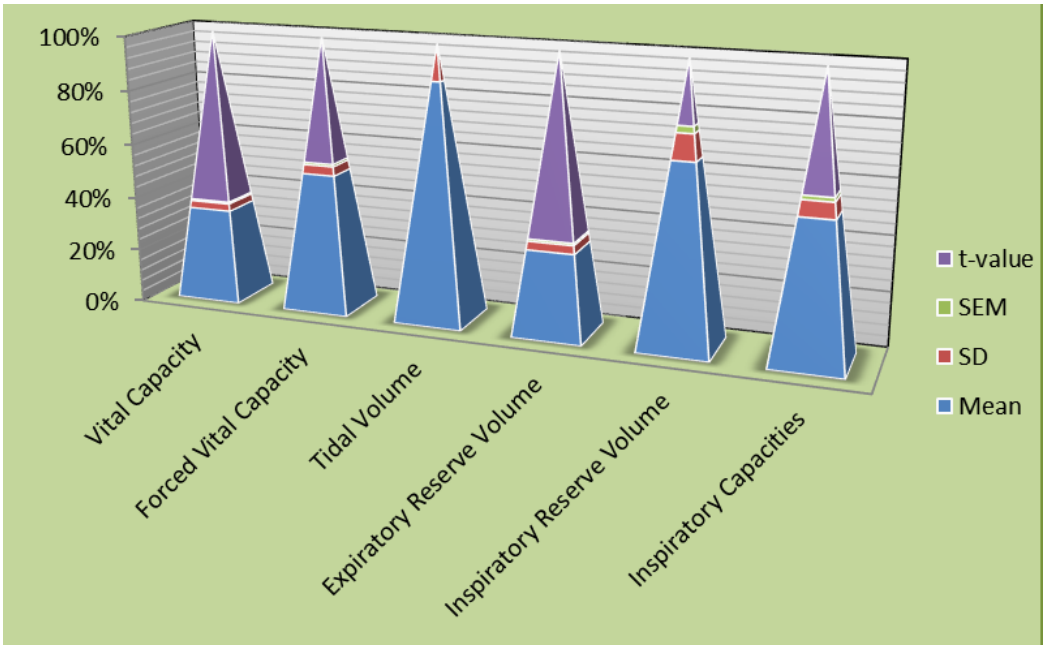

Fig 1: Mean values (±SD), standard error of the mean and test statistic t of Vital Capacity, Forced Vital Capacity, Tidal Volume, Expiratory Reserve Volume, Inspiratory Reserve Volume, and Inspiratory Capacities **in** female pace bowlers (N = 15).

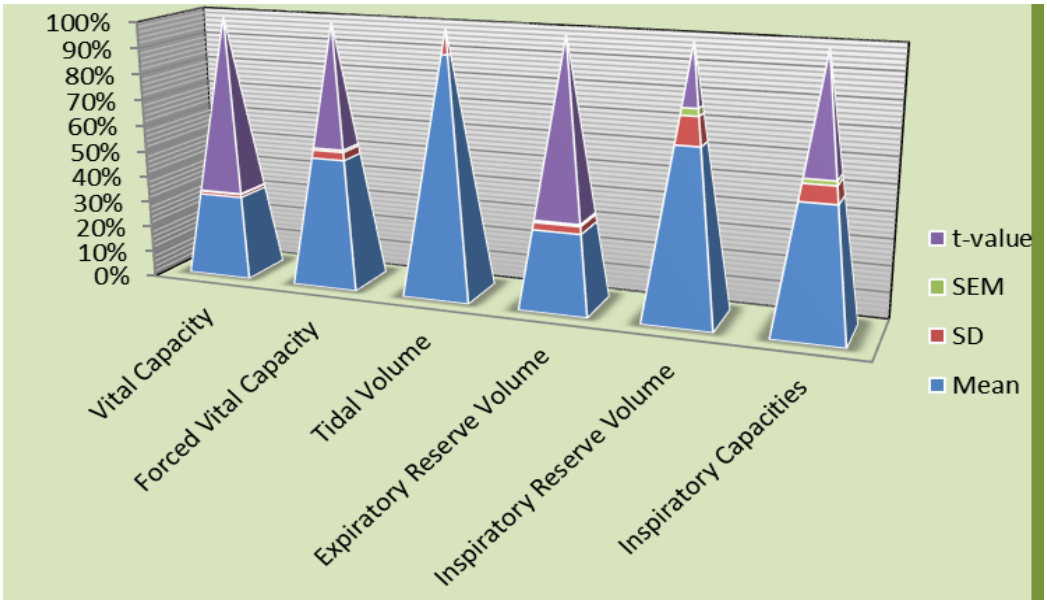

Fig 2: Mean values (±SD), standard error of the mean and test statistic t of Vital Capacity, Forced Vital Capacity, Tidal Volume, Expiratory Reserve Volume, Inspiratory Reserve Volume, and Inspiratory Capacities **in** female spin bowlers (N = 15)

Discussion

Based on statistical analysis, their critical observation and interpretation It is concluded from the above findings that there were significant differences of Vital Capacity (p = 0.0001), forced vital capacity (p =0.0027**)** tidal volume (p = 0.0839) expiratory reserve volume (p = 0.0449)and Inspiratory capacity (p=0.0236)between female pace bowlers and spin bowlers, since the calculated value of t for all the variables i.e., Vital Capacity (6.8591), forced vital capacity (3.2841**)** tidal volume (1.900) expiratory reserve volume (2.0999)and Inspiratory capacity (2.3933)is higher than the tabulated value of t (1.701) for 28 degree of freedom. Thus it may be concluded that the group difference between pace bowlers and spin bowlers in regards to Vital Capacity, forced vital capacity, tidal volume, expiratory reserve volume and Inspiratory capacity found to be statistically significant. Whereas insignificant differences of Inspiratory reserve volume (p = 0.3935**)** between pace bowlers and spin bowlers, since the calculated value of t for Inspiratory reserve volume (t=0.8666) is smaller than the tabulated value of t (1.701) for 28 degree of. Thus it may be concluded that the group difference between pace bowlers and spin bowlers in regards to Vital Capacity, forced vital capacity, tidal volume, expiratory reserve volume and Inspiratory capacity found to be statistically significant. Whereas insignificant differences of Inspiratory reserve volume found.

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