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Abstract

Objective: The purpose of this study was to observe speed, power and fatigue index of under 19 year cricket players. The design of this study required participants to perform six sprints each of 35 meter. Thirty one (N=31) trained male cricketers between the ages of 15 and 19 years volunteered for this study. The mean age, height and weight of cricketers were 16.81±1.13years, 172.23±6.85cm and 61.33±8.93Kg. The mean sprint time of -1st, 2nd, 3rd, 4th, 5th and 6th of cricketers were 5.39±0.34 seconds, 5.53±0.31 seconds, 5.61±0.36 seconds, 5.85±0.26 seconds, 5.94±0.25seconds and 6.07±0.17 seconds respectively. The mean power of -1st, 2nd, 3rd, 4th, 5th and 6th sprints of cricketers was 491.00±105.90 watts, 454.90±94.81watts, 435.23±90.49 watts, 382.84±78.54watts, 364.68±78.62watts and 339.94±58.96watts respectively. The maximum power, minimum power and average power of cricketers was 511.55±94.97watts, 333.71±65.83watts, and 411.42±73.59 watts respectively. It was concluded from the results of this study that sprint time and power decline in cricketers may be due to the reduced energy production via anaerobic glycolysis and muscle acidosis.

Introduction

Due to the nature of cricket that nesessitates intermittent activities such as batting, bowling, fielding in cricket, anaerobic power and capacity is of great interest to those involved with them, as most rely heavily on players' ability to move quickly and powerfully. *Noakes & Durandt (2000)* estimated that during a one-day game, a hypothetical player scoring 100 runs, made up of 50 singles, 20 twos, 10 threes and 20 fours, would cover a distance of 3.2 km in an activity time of 8 minutes. Average running speed would be 24 km.h^{-1} with at least 110 deccelerations required *(Noakes & Durandt, 2000).* From this, it can be deduced that the physiological demands of batting in a one-day game are substantial. *Noakes & Durandt (2000)* speculate that the main cause of stress for cricket players is the stop-start nature of both sprinting between the wickets and fast bowling (during the 'run up' and delivery of the ball), contributes to early-onset fatigue indicators which, over time, results in a specific type of fatigue which negatively impacts performance and increases the risk of injury *(Christie et al., 2011b).* Sprint running times have been shown to be well correlated to peak and mean power output *(Tharp et al., 1985; Patton & Duggan, 1987).* The purpose of this study was to observe a relationship among speed, power and fatigue index of under 19 year cricket players.

Materials & Methods

Thirty one (N=31) trained male cricketers between the ages of 15 and 19 years of Punjab Cricket Academy volunteered for this study. The design of this study required participants to perform six sprints each of 35 meter. A rest of 10 second was given to the participants between each sprint. The power and fatigue index was calculated using the equations of *Draper and Whyte (1997).*

Statistical Analysis: Statistical analysis was performed with SPSS version 16.0 (free trial, SPSS Inc, Chicago). Mean, Standard Deviation and Linear correlation (Pearson's) was run between speed, power and fatigue index. The alpha level for the data analysis was determined at 0.05 levels.

Results & Discussion

Table 1. Descriptive Statistics of male cricketers

Variables	Mean	Std. Deviation
Age, year	**16.81**	**1.13**
Height, cm	**172.23**	**6.85**
Weight, kg	**61.38**	**8.93**
Sprint time-1,seconds	**5.39**	**0.34**
Sprint time-2,seconds	**5.53**	**0.31**
Sprint time-3,seconds	**5.61**	**0.36**
Sprint time-4,seconds	**5.85**	**0.26**
Sprint time-5,seconds	**5.94**	**0.25**
Sprint time-6,seconds	**6.07**	**0.17**
Power-1,watts	**491.00**	**105.90**
Power-2,watts	**454.90**	**94.81**
Power-3,watts	**435.23**	**90.49**
Power-4,watts	**382.84**	**78.54**
Power-5,watts	**364.68**	**78.62**
Power-6,watts	**339.94**	**58.96**
Maximum power, watts	**511.55**	**94.97**
Minimum power, watts	**333.71**	**65.83**
Average power, watts	**411.42**	**73.59**
Fatigue index	**5.20**	**1.92**

The mean age, height and weight of the cricketers were 16.81±1.13year, 172.23±6.85 cm and 61.33±8.93Kg respectively. The mean sprint time of 1st, 2nd, 3rd, 4th, 5th and 6th of cricketers was 5.39±0.34 seconds, 5.53±0.31 seconds, 5.61±0.36 seconds, 5.85±0.26 seconds,

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5.94±0.25seconds and 6.07±0.17 seconds respectively (Table 1). The mean power of 1st, 2nd, 3rd, 4th, 5th and 6th sprints of cricketers was 491.00±105.90 watts, 454.90±94.81watts, 435.23±90.49 watts, 382.84±78.54watts, 364.68±78.62watts and 339.94±58.96watts respectively. In addition, the maximum power, minimum power and average power of cricketer were 511.55±94.97 watts, 333.71±65.83 watts, and 411.42±73.59 watts respectively. The mean fatigue index of cricketer was 5.20 ± 1.92 (Table 1).

Table 2 shows the relationship among sprint times, powers & fatigue index. There was a significant negative correlation observed between different sprint times and power. There was a significant negative correlation between fatigue index and sprint time-1st & 2nd (r = -0.75 p<.01), sprint time-1st (r = -0.75 p<.01) and sprint time-3rd (r = -0.57 p<.01). A similar trend of significant negative correlation was found between average power and sprinttime-1st (r = -0.47 p<.01), sprinttime-2nd (r = -0.50 p<.01), sprinttime-3rd (r = -0.48 p<.01), sprinttime-4th (r = -0.58 p<.01), sprinttime-5th (r = -.054 p<.01), and sprinttime-6th (r = -0.45 p<.01). A significant negative correlation was also found between maximum power and sprinttime-1st (r = -0.64 p<.01), sprinttime-2nd (r = -0.63 p<.01), sprinttime-3rd (r = -0.57 p<.01), sprinttime-4th (r = -0.44 p<.01) and sprinttime-5th (r = -0.38 p<.05).

Table 2. Correlations among sprint time, power & fatigue index

Variable(s)	Power-1	Power-2	Power-3	Power-4	Power-5	Power-6	Maximum power	Minimum power	Average power	Fatigue index
Sprint time-1	-.79**	-.49**	-.41*	-.28	-.11	-.13	-.64**	-.23	-.47**	-.75**
Sprint time-2	-.57**	-.77**	-.56**	-.31	-.11	-.10	-.63**	-.21	-.50**	-.75**
Sprint time-3	-.46**	-.49**	-.78**	-.36*	-.17	-.11	-.57**	-.32	-.48**	-.57**
Sprint time-4	-.45*	-.38*	-.51**	-.75**	-.53**	-.45*	-.44*	-.53**	-.58**	-.17
Sprint time-5	-.34	-.25	-.39*	-.65**	-.75**	-.53**	-.38*	-.55**	-.54**	-.06
Sprint time-6	-.34	-.18	-.25	-.57**	-.51**	-.62**	-.33	-.53**	-.45**	.01

** significant at p<0.01, * significant at p<0.05

Table 3 shows the relationship among power & fatigue index. A significant positive correlation was found between fatigue index and power-1st (r = 0.67; p<.01), power-2nd (r = 0.63; p<.01) and power-3rd (r = 0.52; p<.01). A significant positive correlation was also found between maximum power and power-1st (r = 0.91 p<.01), power-2nd (r = 0.87; p<.01), power-3rd (r = 0.84; p<.01), power-4th (r = 0.71; p<.01), power-5th (r = 0.65; p<.01) and power-6th (r = 0.69; p<.01). A similar trend of significant positive correlation was also found between minimum power and power-1st (r = 0.69; p<.01), power-2nd (r = 0.67; p<.01), power-3rd (r = 0.74; p<.01), power-4th (r = 0.92; p<.01), power-5th (r = 0.88; p<.01) and power-6th (r = 0.95p<.01). A significant positive correlation was also found between average power and power-1st (r = 0.86; p<.01), power-2nd (r = 0.87; p<.01), power-3rd (r = 0.85; p<.01), power-4th (r = 0.91; p<.01), power-5th (r = 0.84; p<.01) and power-6th (r = 0.86;p<.01).

Table 3. Correlations among power & fatigue index

Variable(s)	Maximum power	Minimum power	Average power	Fatigue index
Power-1	**.91****	**.69****	**.86****	**.67****
Power-2	**.87****	**.67****	**.87****	**.63****
Power-3	**.84****	**.74****	**.85****	**.52****
Power-4	**.71****	**.92****	**.91****	**.16**
Power-5	**.65****	**.88****	**.84****	**.08**
Power-6	**.69****	**.95****	**.86****	**.07**

**** significant at p<0.01, * significant at p<0.05**

Table 4 shows the relationship among the various powers during different sprint run. A significant positive correlation was found between power-6th and power-1st (r = 0.64; p<.01), power-2 (r = 0.62; p<.01), power-3 (r = 0.62; p<.01), power-4(r = .88 p<.01) and power-5(r = .89; p<.01). A similar trend of significant positive correlation was also found between power-1 and power-2 (r = .72; p<.01), power-3 (r = 0.68; p<.01), power-4(r = 0.968; p<.01) and power-5(r = 0.58; p<.01) (Table 4).

Table 4. Correlations among various powers during different sprint run

Variable(s)	Power-2	Power-3	Power-4	Power-5	Power-6
Power-1	**.78****	**.68****	**.68****	**.58****	**.64****
Power-2	-	**.77****	**.69****	**.57****	**.62****
Power-3		-	**.72****	**.61****	**.62****
Power-4			-	**.88****	**.88****
Power-5				-	**.89****

**** significant at p<0.01, * significant at p<0.05**

Results of this study show a trend of increase in time of sprint from sprint-1st to sprint-6th. However, there was a trend of decrease in power during the different sprints from power -1st to power-6th and this may be due to the production and subsequent accumulation of lactic acid during the six sprints. It was also observed that higher sprint time (sprinttime-1st vs. sprinttime-6th) is associated with lower power (power-1st vs. power-6th) response as sprint time showed mean relative increase as compared to mean relative decrease of power. It can be seen that there is a significant difference in relative sprint time increase between sprint-1 to sprint-6.There was a significant positive correlation between fatigue index and various powers. However, there was a significant negative correlation between various sprint times and different powers. Similarly, there was a significant negative correlation between fatigue index and various sprint times.

Discussion: The principal findings of the present study were, first, the best 35 m sprint time was related to the maximum power (r = -0.64,p<.01) and power during the first sprint test (r = -0.79,p<.01) involving 6x35 m sprints. Second, the best 35 m sprint time was related to the fatigue index that occurs during the 6x35 m test. *Dawson et al., (1993)* also found sprinting time to be significantly correlated with three measures of anaerobic power. A strong correlation was also found between the best 35 m sprint time and maximum power (r = -0.64, p<.01), average power (r = -0.47, p<.01) and fatigue index (r = -0.45,p<.01), indicating that subjects with better sprint times had higher levels of fatigue. *Hirvonenet al. (1987)* found runners of higher sprinting ability were able to deplete a greater proportion of CP stores when compared with runners of lower sprinting ability. *Kumar & Kathayat (2014)* reported that a repeated sprint protocol of crickter playersproducing the highest peak power output during repeated sprinting efforts had the greatest decreases in mean power output. A similar result was also reported on football players *(Kumar & Singh, 2014).Holmyard et al. (1988)* found individuals producing the highest peak power output during repeated 6s sprinting efforts on a non-motorised treadmill had the greatest decreases in mean power output. Therefore, subjects who can produce higher peak power outputs and better sprint times are probably able to do so due to their ability to utilise a greater proportion of their CP stores. With short recovery periods, these subjects would have lower CP stores prior to the next sprint and are therefore likely to fatigue more over a series of repeated sprints. The present study also involves shorter recovery periods which are less than the half life of CP resynthesis *(Harris et al., 1976)*. The CP stores will not be adequately replenished during the RSA test and a progressive decline in CP stores and a slowing of the 35 m sprint times will ensue. Even though anaerobic glycolysis provides a significant contribution to the initial stages of the sprint test, its contribution appears to diminish over the latter stages of a repeated sprint test. *Gaitanos et al. (1993)* measured the change in muscle CP, ATP, lactate and pyruvate during 10×6 s maximal sprints on a cycle ergometer. They estimated that during the first sprint, anaerobic glycolysis was contributing approximatel 50% to anaerobic ATP However, by the last sprint, anaerobic glycolysis was only contributing approximately 20 % to anaerobic ATP production. Based on these findings, *Gaitanos et al. (1993)* also suggested that it was likely aerobic metabolism increased its contribution during these last sprints. These studies suggest that the phosphagen system is the major anaerobic energy system during 3 - 5s of maximal sprinting and its importance appears to increase over the latter stages of a series of repeated sprinting efforts.

Conclusion: A significant negative correlation was found between different sprint times (speed) and power and fatigue index. Results, of this study suggested that the phosphagen (CP) system may be the major anaerobic energy system during the first sprint of repeated sprint test and in the last sprints aerobic metabolism may likely increased its contribution. Thus, it was concluded that cricketer had run a good sprint (i.e. taken less sprint time)as they had generated more power during the sprint running and this may be due to their training programme.Further, the sprint time (i.e. speed) and power decline in repeated sprint tests of cricketer may be due to reduced energy production via anaerobic glycolysis and muscle acidosis.

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