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Does bowling with a fierce pace determines a bowler's wicket-taking abilities: A brief review

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Abstract
Keeping in mind the research question "does bowling fast really accomplish the very purpose of bowling i.e., getting wickets?", a study was conducted to reach to a conclusion and factors associated with fast bowling. With the help of online data available on reliable platforms such as cricbuzz.com and ESPN CricInfo, bowlers who have bowled the fastest deliveries were selected. Some delimitations were applied to refine the data. Bowlers' records including overall wickets taken, matches played, and bowling strike rate were considered for the study. These records were compared against the records of the most successful bowlers in international cricket. Further, a few recommendations for future studies were outlined.

Keywords: Cricket, fast bowling, wicket-taking abilities, strike rate

Introduction

Cricket is a widely played sport in modern times. The fascinating nature of this game has attracted the attention of spectators all around the world. The game of Cricket is played between two teams that consist of eleven players each. It is a bat and ball game. As per ICC's laws, it is played with a wooden bat and leather ball. Skill-wise there are four major departments in cricket namely- batting, bowling, fielding, and wicket-keeping. This study focuses on bowling. As per Bob Woolmer's book "Bob Woolmer's art and science of cricket", various methods and suggestions are made for different types of bowlers i.e., fast bowlers and spin bowlers. Here it is concluded that there are two distinct approaches in cricket bowling i.e., pace (fast) bowling and spin bowling (Ahamed *et al*., 2014; Woolmer *et al*., 2008) [1, 20]. The investigator specifically wants to study pace bowling.

In today's globalised game of cricket, all levels of competition aspire to produce fast bowlers with quick ball releases. The success of cricket teams is largely attributed to the bowlers' capacity for high ball release speeds (R. Portus *et al*., 2000) [15]. Researchers generally agree that the effectiveness of any bowling side is greatly influenced by fast bowling (Bartlett *et al*., 1996; Elliott *et al*., 1986; Hanley *et al*., 2005; Portus *et al*., 2004; S. Glazier *et al*., 2000; Salter *et al*., 2007; Stockill & Bartlett, 1994) [2, 5, 10, 13, 16, 17, 19].

The very purpose of bowling is to get the wickets of the opponents (Woolmer *et al*., 2008) [20] regardless of the techniques and tactics a bowler applies until and unless it comes under the regulation of ICC laws. Now the question arises "does bowling fast really accomplish the very purpose of bowling i.e., getting wickets"? The investigator studied facts and statistics available online related to fast-bowling statistics and tried to reach a conclusion.

Methodology and Sampling

The sampling of the data was done level-wise, and as the level increased, more delimitations were applied to reach the refined list.

Level 1 sampling
▪ Only male bowlers were considered.
▪ The bowler must have represented his nation in at least one international match (Test,

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ODI, or T20i).

Outcome: The first search results showed 36 bowlers to have get their names in the Table 1.

Table 1: Level 1 sampling

Sr. No.	Bowler name	Country	Fastest ball
1.	Shoaib Akhtar	Pak	161.3
2.	Brett Lee	Aus	161.1
3.	Shaun Tait	Aus	161.1
4.	Jeffrey Thompson	Aus	160.6
5.	Mitchell Starc	Aus	160.4
6.	Andy Roberts	WI	159.5
7.	Fidel Edwards	WI	157.7
8.	Lockie Ferguson	NZ	157.3
9.	Umran Malik	Ind	157
10.	Mitchell Johnson	Aus	156.8
11.	Mohd. Sami	Pak	156.4
12.	Shane Bond	NZ	156.4
13.	Dale Steyn	SA	156.2
14.	Anrich Nortje	SA	156.2
15.	Mark Wood	Eng	156.1
16.	Lasith Malinga	SL	155.7
17.	Mohd. Hasnain	Pak	155.1
18.	Jofra Archer	Eng	154.6
19.	Wahab Riaz	Pak	154.5
20.	Nantie Hayward	SA	154.5
21.	Kagiso Rabada	SA	154.2
22.	Irfan Pathan	Ind	153.7
23.	Mohd. Shami	Ind	153.3
24.	Adam Milne	NZ	153.2
25.	Jasprit Bumrah	Ind	153.2
26.	Allan Donald	SA	152.9
27.	Waqar Younis	Pak	152.6
28.	Ishant Sharma	Ind	152.6
29.	Umesh Yadav	Ind	152.5
30.	Varun Aaron	Ind	152.5
31.	Mohd. Amir	Pak	151.9
32.	Makhaya Ntini	SA	151.4
33.	Pat Cummins	Aus	151
34.	Jason Gillespie	Aus	151
35.	Darren Gough	Eng	151
36.	Michael Holding	WI	150.6

The above table shows the list of the bowlers who were considered as per the Level 1 sampling delimitations. However there was a dilemma whether to include the records before 1999 as the speed radar gun was first used in 1999 to calculate the bowling speed (Singh, 2018) [18], and before 1999 the bowlers' speed was calculated using cameras under laboratory conditions which might not be considered reliable as the real match situation differs than that of laboratory conditions. Hence it was discarded in level 2 sampling.

Level 2 sampling
▪ The bowler's record must be beyond 1999.

Outcome: This resulted in exclusion of 4 bowlers from the Table 1 i.e., Jeffrey Thompson (Aus), Andy Roberts (WI), Nantie Hayward (SA), and Michael Holding (WI).
Now, more precisely number of matches and strike rate of the bowler was to be considered in order to reach a refined list of bowlers. A strike rate (in bowling) is a parameter to assess the effectiveness of the bowler. A strike rate tells how much deliveries on an average does a bowler take to get a wicket. The formula to calculate the strike rate is dividing the number of balls bowled by the bowler by the number of wickets taken. The lesser the strike rate, the better a bowler is considered.

▪ The bowler must have at least bowled a single delivery clocked at 150 kmph+.

Since the newcomers at international level possess extraordinary strike rate (because a smaller number of matches' record cannot be a predictor for a similar success in future), few more delimitations were applied in Level 3 sampling.

Level 3 sampling
▪ Appeared in 100+ matches.
▪ Strike rate below 45.0
▪ Taken 250+ wickets.

Outcome: Finally, there were 17 entries left after applying Level 3 delimitations, which are enlisted below:

Table 2: Level 3 sampling

Sr. No.	Bowler name	Country	Fastest ball	Matches	Wickets	S/R
1.	Shoaib Akhtar	Pak	161.3	224	444	36.5
2.	Brett Lee	Aus	161.1	322	718	39.3
3.	Mitchell Starc	Aus	160.4	237	575	37.2
4.	Mitchell Johnson	Aus	156.8	256	590	40.9
5.	Shane Bond	NZ	156.4	120	259	31.3
6.	Dale Steyn	SA	156.2	265	699	37
7.	Lasith Malinga	SL	155.7	340	546	32.8
8.	Kagiso Rabada	SA	154.2	196	448	35.6
9.	Irfan Pathan	Ind	153.7	173	301	40.5
10.	Mohd. Shami	Ind	153.3	165	392	39.5
11.	Jasprit Bumrah	Ind	153.2	162	319	35.6
12.	Allan Donald	SA	152.9	236	602	40
13.	Waqar Younis	Pak	152.6	349	789	36.6
14.	Umesh Yadav	Ind	152.5	136	276	43.3
15.	Makhaya Ntini	SA	151.4	284	662	44.8
16.	Pat Cummins	Aus	151	169	381	38.2
17.	Darren Gough	Eng	151	219	467	43.5

In the above table, it is to be noted that all the bowlers included in the list have (or had) been delivering 150 kmph+ balls on a regular basis and not just once or twice.

Results
Now, a list of highest wicket-takers across all formats of International Cricket was compared against the Level 3 sampling (Table 2), and it was found out that only 1 bowler (from Table 2) made it to the Top 10 wicket-taker of all times, 3 in Top 15 and 4 in Top 20. Providing the list of Top 10 highest wicket-takers in international cricket below:

Table 3: Top 10 highest wicket takers in international cricket

Sr. No.	Bowler name	Country	Matches	Wickets	S/R
1.	Muttiah Murlidaran	SL	495	1347	46.8
2.	Shane Warne	Aus	339	1001	51.2
3.	James Anderson	Eng	389	959	49.8
4.	Anil Kumble	Ind	403	956	57.8
5.	Glenn McGrath	Aus	376	949	44.5
6.	Wasim Akram	Pak	460	916	44.5
7.	Shaun Pollock	SA	423	829	48.6
8.	Stuart Broad	Eng	336	809	48.5
9.	Waqar Younis	Pak	349	789	36.6
10.	Chaminda Vaas	SL	439	761	51.7

Figure 1 depicts the graph of overall highest wicket takers compared against bowlers selected in our study. In this graph, Top 30 highest wicket takers across all formats' data was taken into consideration (ESPNCricInfo, 2022) [6].
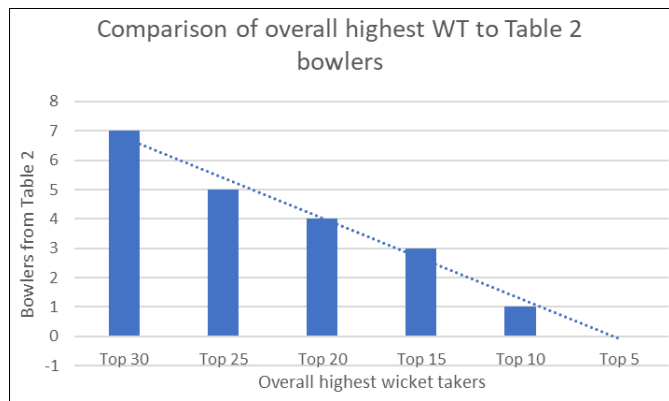
Fig 1: A graph showing the comparison.

It's quite noticeable that as the graph of wicket-takers proceeds further, the bowlers with a fiery pace decline. In Top 5 of the highest wicket takers there are only 2 pace bowlers Glenn McGrath and James Anderson, yet both were known for their swing and deceptive skills and not a fiery pace.

Discussion and Conclusion
With the data studied and taken into consideration, few of the points can be concluded:
The records portray that pace may not be a singular factor to determine the success of a pace bowler. A pace bowler must have swing, pitch reading abilities, game reading abilities, adaptation to different situations and conditions along with pace to earn a significant number of wickets on their records.
It is observed that bowlers from SENA countries have dominated the chart of fast bowling as compared to Asian subcontinent except Pakistan. However, in recent times, India has also produced some of the fastest bowlers, but except few, others are yet to make an impact in terms of wicket-taking abilities.
It is also observed that before the Level 3 sampling, the bowlers were taken out of the list for a lack of appearance in international matches, where Shaun Tait with a great no. of bowling speed as well as a great number of strike rate was discarded from the list, because he didn't appear in many matches. Reason being his injury profile.

Recommendations
Injuries have been a major concern for fast bowlers at senior level as well as junior level cricket (Dennis *et al*., 2003; Elliott, 2014; Foster *et al*., 1989; Olivier *et al*., 2016) [3, 14, 7, 12]. This study recommends further investigation of the factors associated with injuries of the fast bowlers.
There are numerous methods and techniques available in modern times to assess the career as well as injury graph of the athletes (Gogoi *et al*., 2020, 2021) [9, 8]. Those methods may be applied in assessing the injury patterns of the fast bowlers as well.
Since the surface electromyography studies provide biofeedback to the researcher about the muscle activity in a subject (Mehr, 2013) [11], the recommendations about therapeutic and rehabilitation exercises as well as programmed exercise plans can be given to the fast bowlers based on their muscle activation readings, and it may also be beneficial to detect and prevent injuries. In India electromyography is a technique available today, hence more studies related to fast bowlers pertaining to muscle activation of different muscles, myoelectrical analysis of different action fast and medium fast bowlers is recommended.
Apart from biomechanical and physiological factors, psychological factors also determine a fast bowler's performance as a whole. Along with physical, psychological, and technical qualities, early on in development, the significance of intrinsic motivation was underlined in a study (Phillips *et al*., 2014) [13].

References
1. Ahamed NU, Sundaraj K, Ahmad B, Rahman M, Ali Md. A, Islam Md. A. Significance of the electromyographic analysis of the upper limb muscles of cricket bowlers: recommendations from studies of overhead-throwing athletes. Journal of Mechanics in Medicine and Biology. 2014;14(04):1430005. https://doi.org/10.1142/S0219519414300051
2. Bartlett RM, Stockill NP, Elliott BC, Burnett AF. The biomechanics of fast bowling in men's cricket: A review. Journal of Sports Sciences. 1996;14(5):403-424. https://doi.org/10.1080/02640419608727727 Cricbuzz.com/profiles
3. Dennis R, Farhart R, Goumas C, Orchard J. Bowling workload and the risk of injury in elite cricket fast bowlers. Journal of Science and Medicine in Sport. 2003;6(3):359-367. https://doi.org/10.1016/S1440-2440(03)80031-2
4. Elliott BC. Back injuries and the fast bowler in cricket. Journal of Sports Sciences. 2000;18(12):983-991. https://doi.org/10.1080/026404100446784
5. Elliott BC, Foster DH, Gray S. Biomechanical and physical factors influencing fast bowling. 1986;18(1):16-21.
6. ESPNCricInfo, Espnc. Most wickets in career [Cricket statistics]. Most Wickets in Career; c2022. https://stats.espncricinfo.com/ci/content/records/283980.html
7. Foster D, John D, Elliott B, Ackland T, Fitch K. Back injuries to fast bowlers in cricket: A prospective study. British Journal of Sports Medicine. 1989;23(3):150. https://doi.org/10.1136/bjsm.23.3.150
8. Gogoi H, Borah P, Gogoi L, Rajpoot YS, Minu T, Singh J, *et al*. A Statistical Model for Prediction of Lower Limb Injury of Active Sportsperson. International Journal of Human Movement and Sports Sciences. 2021;9(6):1219-1229. https://doi.org/10.13189/saj.2021.090616
9. Gogoi H, Rajpoot YS, Sajwan AS. Sports Specific Injury Pattern of Sportspersons. International Journal of Human Movement and Sports Sciences. 2020;8(5):199-210. https://doi.org/10.13189/saj.2020.080507
10. Hanley B, Lloyd R, Bissas A. Relationships between ball release velocity and kinematic variables in fast bowling in cricket. Journal of Sports Sciences. 2005;23(2):112-113. https://doi.org/10.1080/02640410512331334413
11. Mehr K. Surface electromyography in orthodontics – a literature review. Medical Science Monitor. 2013;19:416-423. https://doi.org/10.12659/MSM.883927
12. Olivier B, Taljaard T, Burger E, Brukner P, Orchard J, Gray J, *et al*. Which Extrinsic and Intrinsic Factors are Associated with Non-Contact Injuries in Adult Cricket Fast Bowlers? Sports Medicine. 2016;46(1):79-101. https://doi.org/10.1007/s40279-015-0383-y
13. Phillips E, Davids K, Renshaw I, Portus M. Acquisition of expertise in cricket fast bowling: Perceptions of expert players and coaches. Journal of Science and Medicine in Sport. 2014;17(1):85-90. https://doi.org/10.1016/j.jsams.2013.03.005
14. Portus MR, Mason BR, Elliott BC, Pfitzner MC, Done

RP. Cricket: Technique factors related to ball release speed and trunk injuries in high performance Cricket fast bowlers. Sports Biomechanics. 2004;3(2):263-284. https://doi.org/10.1080/14763140408522845

15. Portus R, Sinclair M, Burke PJ, Moore ST, Farhart PJ. Cricket fast bowling performance and technique and the influence of selected physical factors during an 8-over spell. Journal of Sports Sciences. 2000;18(12):999-1011. https://doi.org/10.1080/026404100446801

16. Glazier S, Paradisis P, Cooper SM. Anthropometric and kinematic influences on release speed in men's fast-medium bowling. Journal of Sports Sciences. 2000;18(12):1013-1021. https://doi.org/10.1080/026404100446810

17. Salter CW, Sinclair PJ, Portus MR. The associations between fast bowling technique and ball release speed: A pilot study of the within-bowler and between-bowler approaches. Journal of Sports Sciences. 2007;25(11):1279-1285. https://doi.org/10.1080/02640410601096822

18. Singh H. How Bowling Speed is calculated in Cricket Matches [General knowledge]; 2018 May. Jagranjosh.Com. https://www.jagranjosh.com/general-knowledge/how-bowling-speed-is-calculated-in-cricket-matches-1526538382-1

19. Stockill NP, Bartlett RM. An investigation into the important determinants of ball release speed in junior and senior international cricket bowlers. 1994;12:177-178.

20. Woolmer B, Noakes T, Moffett H. Bob Woolmer's art and science of cricket. Struik ; New Holland [distributor; c2008.