Journal of Research in Medical and Dental Science
2021, Volume 9, Issue 1, Page No: 1-7

Available Online at: www.jrmds.in
eISSN No. 2347-2367: pISSN No. 2347-2545

A Study to Identify the Most Common Exercises Used in Cricket for Improving Speed in Medium Fast Bowlers in India-A Mail Survey

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ABSTRACT

Background: Cricket is one of the world's major team sports in terms of regular international games. Bowling action is a highly skilled activity acquired over years of fine tuning. Despite the popularity of cricket, there is a relative lack of strength and conditioning research into position- specific roles. In cricket, pace bowlers use their bowling speed, accuracy, and consistency to assist in dismissing a batsman. The faster a bowler can deliver the ball, the less time a batsman must react and play an appropriate shot. A ball delivered at 44.4 m.s-1 reaches the batsman in ≈ 0.44 s. If fast bowlers maintain their bowling speed for long periods (consistency), then batsmen do not get an opportunity to settle into their innings by taking advantage of a drop in pace. The main objective of this survey was to find out the most common exercises used for medium fast bowlers for improving speed.

Methods: The researcher had sent email of questionnaire in Google form to professionals working in different cricket associations in India and the response from them was recorded and analysed.

Results: 26 responses were received from all the professionals and out of 26 exercises, 6 of them were the most common exercises selected by the expertise to improve the speed of medium fast bowlers.

Conclusion: From the responses received it was concluded that Front Squat, Hip Thrust, Box Jump, Rotational Medicine Ball Throw, 40 m Sprint and Plank were the most common exercises suggested by expertise working in cricket associations in India.

Key words: Survey, Questionnaire, Medium Fast Bowler, Exercises

HOW TO CITE THIS ARTICLE: Avinash Kumar Boyat, Priyanshu V Rathod, A Study to Identify the Most Common Exercises Used in Cricket for Improving Speed in Medium Fast Bowlers in India-A Mail Survey, J Res Med Dent Sci, 2021, 9 (1): 1-7.

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Received: 24/10/2020

Accepted: 08/12/2020

INTRODUCTION

Cricket is a global sport that is played in over 100 countries [1]. There are 3 established formats of the game such as twenty-twenty, one day, and multiday [2,3]. It must be remembered that surprise is a big element in bowling, and bowlers will often shun these common tactical approaches in the hope of simply confusing the batsman into playing the wrong shot [4]. In the game of cricket, bowling is the process of prompt the ball towards the stumps safeguarded or secured by the batsman. A player proficient at bowling is called a bowler. The main task of the bowler is to bowl at the right line and length, thereby preventing the batsman from scoring runs and to get him out. Accurate quantitative measurement of cricketer's abilities has never been made, especially in the literature of physical education and sports sciences. In addition to subjective evaluation, a player's ability is often judged by comparing his batting and bowling averages to those of other players [5].

In cricket, pace bowlers use their bowling speed, accuracy, and consistency to assist in dismissing a batsman. The faster a bowler can deliver the ball, the less time a batsman must react and play an appropriate shot [6]. A ball delivered at 44.4 $m.s^{-1}$ reaches the batsman in ≈0.44 s [7]. If fast bowlers maintain their bowling speed for long periods (consistency), then batsmen do not get an opportunity to settle into their innings by

taking advantage of a drop in pace. Although it is imperative for fast bowlers to bowl quickly, they must also bowl accurately, as batsmen can use the pace to assist with run scoring if a ball is inaccurate. Moreover, accurate bowling places pressure on batsmen to score runs; forcing them to play more deliveries. However, the ability to maintain accuracy for long periods (consistency) is imperative for enforcing pressure, taking wickets, and not allowing a batsman to control the match [8].

The fast bowling action can be classified as side-on, front-on, semi–front-on or mixed depending on the orientation of the shoulder ± hip axes and back foot alignment during delivery. Bowlers who use the side-on and front-on techniques are not at as much risk of injury as those who use the mixed technique. The semi-front-on action is a new technique that is based on the same principles as the two `safe actions', where the alignment of the shoulders and hips are in the same direction. The mixed action features a realignment of the shoulders in the transverse plane during the delivery stride, which causes an increase in lumbar spine axial rotation, extension-flexion, and lateral flexion. All these features occur cumulatively in a noticeably short time when ground reaction forces are high. A combination of these factors has been linked to an increased incidence of radiological features in the thoracolumbar spine, including spondylolysis, intervertebral disc degeneration and spondylolisthesis [9].

During the bowling action's acceleration phase, the external rotators are contracted eccentrically to decelerate, and control arm and any external shoulder rotation weakness could contribute to impingement syndrome. The presence of an imbalance between the agonist and antagonist groups is one of the major risk factors for developing shoulder injuries such as dislocation and impingement, with a deficiency in the external rotator strength possibly resulting in an injury. In addition to the technical skills required to perform, cricketers also need to possess a high level of fitness, thus making them susceptible to overuse injuries because of repetitive training [10].

The upper extremities account for 25% and 22% of injuries in schoolboy and provincial cricket players, respectively. Further, during a match many bowlers are placed to field, thus tending to develop "thrower's arm" and other injuries. A three-dimensional inverse-dynamics analysis of the fast bowling action has the potential to provide a more thorough understanding of the mechanics of fast bowling, in addition to the effect of technique on ground reaction forces and loading in the lower back. This will allow current coaching practices to be better informed and help identify those bowlers who are likely to have higher forces in their back and may be at higher risk of injury [10].

It has been shown by Karppinen et al. that the basic principles of plyometric state that the stretch shortening cycle, when applied properly, will facilitate maximum power output in a minimal amount of time. "Ballistic Six" plyometric training is given to improve the effectiveness of throwing activity in baseball players, strengthen the rotator cuff muscles to prevent the shoulder injury due to overhead throwing activity. "Ballistic Six" plyometric training includes six upper extremity plyometric exercises formed with quick, powerful movements required for activating the stretch shortening cycle [11,12].

It consists of three phases, Eccentric phase: Consisting rapid eccentric contraction that evokes a stretch reflex resulting in more powerful concentric contraction in the opposite direction. Amortization phase: Is the amount of time between the eccentric contraction and the initiation of a concentric force. Stretch-shortening cycle relies heavily on the rate of stretch rather than the length of the stretch. Concentric phase: Is the final phase wherein the athlete concentrates on the effect of exercise and prepares for initiation of the second repetition. It enhances concentric contraction as shown by Pretz et al. [11]. Over the past one decade the amount of cricket being played has increased many-folds at the global plane. Though the game of cricket relishes the history of 400-Odd years, no standardized test is available in literature till date to measure the skill level (accuracy) of bowlers in cricket [13].

In the game of cricket, bowling is the process of prompt the ball towards the stumps safeguarded or secured by the batsman. A player proficient at bowling is called a bowler. Accurate quantitative measurement of cricketer's abilities has never been made, especially in the literature of physical

education and sports sciences. In addition to subjective evaluation, a player's ability is often judged by comparing his batting and bowling averages to those of other players [14].

Bowling in cricket comprises two forms: spin and pace. Spin bowlers deceive batsmen by causing the cricket-ball to deviate off the pitch, following the bounce. These types of bowlers aim to impart many revolutions on the ball, which due to the Magnus Effect; can cause the ball to “drift” or “drop” in the air, to ultimately mislead the batsman. Pace bowlers, however, primarily use their bowling speed to dismiss batsmen. Pace bowlers too, can “swing” the ball in the air, and affect a lateral deviation after bounce (seam), to deceive the batsman. Pace bowlers can be classed by their speed as: slow, medium, medium-fast, fast-medium, fast, and express [15].

Given the lack of consensus as to the important determinants of ball release speed from research that has been limited to measuring kinematics only, the motivation for investigating the relationship between joint kinetics and ball release speed is warranted. The few studies that have investigated these relationships have done so by measuring concentric and eccentric isokinetic strength [16].

Neither of these studies found a relationship between lower limb strength and ball release speed and only Ferdinands et al. have reported that lower body strength is an important contributor to ball release speed. It is plausible that measuring these strength variables in this manner may not be representative of the forces that are produced during the delivery action. Measured joint kinetics to describe the dynamic interaction between segments in cricket bowling but was restricted to the trunk and upper arms. Measuring joint kinetics of the lower body during the delivery action may shed more light on the important biomechanical determinants of ball release speed [17]. Although several factors influence the ability to bowler fast (e.g. technique, physical fitness, psychological skills, social factors), the National Cricket Association (NCA) regard technique as the most important [18].

Recent scientific research has focused on the incidence and pathology of debilitating thoracolumbar spinal and intervertebral disc injuries. Although certain physiological and kinanthropometric characteristics have been suggested to relate to back injury, only biomechanical factors have been statistically linked to an increased incidence of injury. As many biomechanical activities are involved in different types of bowling, combination of these factors has been linked to an increased incidence of radiological features in the thoracolumbar spine, including spondylolysis, intervertebral disc degeneration and spondylolisthesis [19].

Spondylolisthesis was reported in 50% of A-grade fast bowlers over a period of 5 years and has been found to represent 45% of bony abnormalities reported by retired, elite fast bowlers [20]. Although injury will be discussed briefly later, the emphasis of this paper is on technique and optimal ball release speed.

A key theoretical principle that has yet to be fully explored in fast-medium bowling, but which is integral to many overhead throwing activities, is thekinetic chain’ [21]. This phenomenon is defined as a proximal-to-distal linkage system through which energy and momentum are transferred sequentially, achieving maximum magnitude in the terminal segment [22].

The acceleration of the segments with large moments of inertia facilitates eccentric contractions of the musculature surrounding the distal segments just before they contract concentrically [23]. Because of the work done by the proximal muscle groups, the distal muscles will contract over joints with increased strain energy, creating maximum possible forces in the distal muscles [24]. There is agreement among researchers as to the importance of ball release speed in fast bowling, but no consensus exists in the scientific literature on the elements of the bowling technique that contribute most [25]. In cricket, the ball release speed of a fast bowler is widely acknowledged as an important performance characteristic, as it can reduce the decision-making and stroke execution time of the opposing batsman [26].

Previous studies comparing single-performance trials gathered across multiple bowlers (between-bowlers methodologies) examined the relationship between bowling technique and release speed. Front knee angle at ball release [27], extension of the front knee between front

foot contact and ball release shoulder forward rotation [28] alignment of the shoulders at ball release ,and the timing of the maximum hip–shoulder separation angle28 have all been shown to be weakly correlated with a bowler's ball release speed.

It has also been reported that fast bowlers adopting a front-on bowling technique generate ball release speed in a different way to fast bowlers adopting a side-on bowling technique. Theoretically, a primary issue for the identification of technique relationships from the collation of single-performance trials as used in between-bowlers' methodologies is the inability to control factors external to the bowling technique that could influence ball release speed. Glazier et al. and Portus, et al. found associations between selected anthropometric variables and ball release speed, while Foster and John et al reported a relationship between upper body strength and ball release speed [28-32]. As fast bowling is a high-intensity activity, anaerobic capacity, flexibility and increased numbers of type II muscle fibres could also be associated with ball release speed.30,32 The inability to control these physical attributes when using a between-bowlers methodology means that the internal validity of the technique relationships currently reported can be questioned.

In other sports, within-participant methodologies have been found to reject relationships derived from between participant methodologies [33]. Dufek et al. reported that relationships formed using between-participant models were not representative of any individual making up the group's performance. Such findings could be attributed to variations in parameters external to those the study investigated and suggest that between-participant methodologies describe a ''mythical'' performance [34]. In a review of the biomechanics of fast bowling in men's cricket, Bartlett et al. suggested that within-bowler analyses would allow between-bowlers differences in anthropometric, physical, and physiological parameters to be excluded [25]. Although this suggestion was made in 1996, such a methodology has yet to be adopted when investigating cricket fast bowling performance.

Mullineaux et al. reported that the same outcome measure can be achieved by an individual adopting many different techniques. Thus the primary aim of this study was to determine the effectiveness of the within-bowler methodology in the study of fast bowling [35]. As Bates reported that statistical techniques used for group or between-participants analysis are equally applicable in within-participant analysis, the effectiveness of the within-bowler methodology can be determined by the ability to logically understand the statistical findings [25].

Stodden et al. demonstrated that there was sufficient variation in the predictor and dependent variables for multiple regression analysis to be used when assessing within-participant techniques in throwing [36]. As throwing is a skill dynamically similar to fast bowling, the hypothesis that logical technique relationships will be identified using a within-bowler strategy is supported. For comparison, technique relationships will also be explored using a controlled between-bowlers methodology.

Traditionally, high ball release speeds have been a defining characteristic for a successful fast bowler. Therefore, this has often been the focus for coaching and support staff, as well as research [37]. An increase in ball release speed limits the time available for a batsman to perceive or anticipate ball flight information and execute a shot [38]. The ability to accurately place the ball on a specific area on the pitch is potentially of equal importance. It allows the bowler to deliver the ball in areas that make it hard to play attacking or run scoring strokes. The lack of scoring allows the bowler to build pressure and create uncertainty in the batter's mind. Previous studies have been able to distinguish between bowlers of different skill levels using a cricket specific skill-based accuracy test. Research has reported that national representatives showed requisite levels of adaptive variability to bowl a range of lengths to different pitch locations. This highlights the importance of accuracy as a skill for elite fast bowlers [39].

Additionally, increasing the steepness of the ball post bounce is another strategy generally employed by fast bowlers as it again creates uncertainty for the batsman and at times fear especially when coupled with speed and accuracy. While this ability is often linked to ball release height within the coaching literature, it has not been scientifically investigated [40].

Categorization of fast bowling

It is possible for a bowler to concentrate solely on speed, especially when young, but as fast bowlers' nature they pick up new skills and tend to rely more on swing bowling or seam bowling techniques. Most fast bowlers will specialize in one of these two areas and will sometimes be categorized as strike, swing, or seam bowler. However, this classification is not satisfactory because the categories are not mutually exclusive and a skilled bowler will usually bowl a mixture of fast, swinging, seaming and also cutting balls, even if he prefers one style to the others (Table 1).

Objective of the survey

The main objective of the Survey was to find out the most common exercises used for medium fast bowlers for improving speed and accuracy.

METHODS

The researcher had done a mail survey by sending the Google form to professionals working in BCCI, State Cricket Association, District Cricket Association, Hospitals, Gym, Physiotherapy Colleges, Cricket Coaching Centres as physiotherapist, orthopaedic surgeon, strength and conditioning coach, cricket coach and gym trainers. From Questionnaire send to professionals working in different fields 26 responses got from all them and Out of 26 exercises 6 exercises were the most common exercises selected from expertise to improve the speed of medium fast bowlers.

RESULTS

26 responses got from all professionals and Out of 26 exercises 6 exercises were the most common exercises selected from expertise to improve the speed of medium fast bowlers. Graph 1.1 shows the 26 exercises and percentage of each of those exercise which were commonly used. Out of those 26, Front Squat and Hip Thrust accounted for 50% usage. Box Jump was used by >50% of the bowlers, Rotational Medicine Ball Throw was used by >40%, 40 m Sprint and Plank accounted for >50% and >40% respectively (Figure 1).

Table 1: Classification of bowlers.

Type	mph	Km/h
Fast	90+	145+
Fast-Medium	80 to 89	129 to 145
Medium-Fast	70 to 79	113 to 129
Medium	60 to 69	97 to 113
Medium-Slow	50 to 59	80 to 97
Slow-Medium	40 to 49	64 to 80
Slow	below 40	below 64

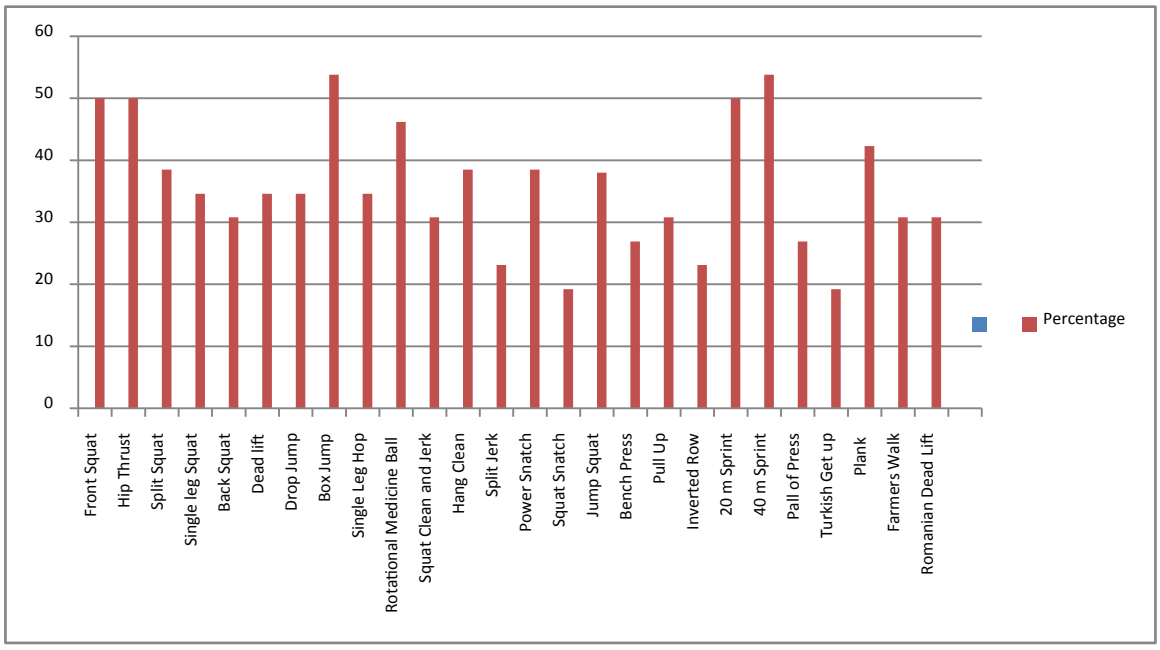

Figure 1: Different exercises.

DISCUSSION

The main task of the bowler is to bowl at the right line and length, thereby preventing the batsman from scoring runs and to get him out. Accurate quantitative measurement of cricketer's abilities has never been made, especially in the literature of physical education & sports sciences [5]. The faster a bowler can deliver the ball, the less time a batsman must react and play an appropriate shot [6].

The present study was done to identify the common exercise which can improve the bowling speed of the medium fast bowlers. A mail survey was carried out for the same purpose. 26 exercise were used for the survey purpose out of which 6 exercises were commonly used for improving the speed in medium fast bowlers which has been shown in figure 1.

During bowling in cricket, the internal rotators of the shoulder are involved in the acceleration phase of the arm through concentric contractions, whereas the external rotators are involved during the deceleration phase. Any imbalance in the action of these muscles lead to injuries of shoulder.10 Many studies have been done to see the role of lower limb strength in improving the bowling speed but neither of them found a relationship between lower limb strength and ball release speed. Ferdinands et al. have reported that lower body strength is an important contributor to ball release speed [17].

Additionally, no study to date has tried to quantify the influence of various anthropometric variables on ball release speed. Thus, the main aim of this study was to identify significant relationships between selected anthropometric and kinematic variables and ball release speed [25]. Burden et al reported an association between lower run-up speeds and ball release speed [27]. As fast bowling is a high-intensity activity, anaerobic capacity, flexibility and increased numbers of type II muscle fibers could also be associated with ball release speed [30,32].

Run-up speed was positively correlated with ball release speed, as reported previously. Bowlers with a quicker run-up have a greater amount of linear momentum that can potentially be converted into ball speed. There is likely to be an optimum run-up speed, beyond which ball release speed decreases, as bowlers are unable to maintain the technique required to control the additional run-up speed [18]. Hanley et al. reported that 5 out of 74 technique parameters were associated with ball release speed: run-up velocity, trunk angular displacement, shoulder angular displacement, angle of the bowling arm, and alignment of the feet. There has been conflicting evidence among published studies regarding the relationships between some technique parameters and ball release speed. This inconsistency has questioned the validity of some of the published relationships [29]. For example, Contrary to it, Hanley et al. and Glazier et al. suggested that faster run-up speeds are associated with ball release speed [29,30].

LIMITATIONS

The study included limited number of exercises in the questionnaire and the sample size was limited.

CONCLUSIONS

From the responses received it was concluded that Front Squat, Hip Thrust, Box Jump, Rotational Medicine Ball Throw, 40 m Sprint and Plank were the most common exercises suggested by expertise working in cricket associations in India.

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