Anthropometric and physical fitness characteristics of male cricket players at the University of the Western Cape

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Abstract

Introduction: The purpose of this study was to describe the anthropometric and physical fitness characteristics of male university cricket players as a set of reference values, and to investigate possible differences between batsmen and bowlers in terms of these characteristics.

Methods: The anthropometric profiles of participants were height, weight, skinfolds, waist and hip circumferences and body composition, while the physical fitness characteristics assessed were aerobic capacity, muscular endurance, and speed. The subjects were senior male cricket players from a tertiary institution. They were classified as fast bowlers, batsmen, and spin bowlers, for comparative purposes.

Results: The three groups were found to differ significantly in terms of their height, ($p<0.05$) with fast bowlers (182.6cm) the tallest followed by batsmen (173.5cm) and spin bowlers (165.8cm) the shortest. Fast bowlers (82.0kg) were the heaviest, followed by batters (73.2kg), and spin bowlers (59.8kg) the lightest. Fast bowlers (80.9cm) had significantly longer arms than spin bowlers (74.9) ($p<0.05$) but did not differ from the batters ($p>0.05$).

Conclusion: The present study found no significant differences in the physiological characteristics of the players across all the sub-disciplines. However, the technical requirements associated with each sub-disciplines require different sets of anthropometric characteristics which could be advantages in the performance of the skills.

Keywords: Cricket, Anthropometry, physical fitness, males

INTRODUCTION

Cricket has been widely perceived as a sport that did not require a great deal of physical fitness, with many players, especially at club level, being overweight (Woolmer & Noakes, 2008). However, the rapid evolution of the game over the last two decades has brought about an increase in the number of games played at the local, regional, national and international level, with a corresponding increase in the physical demands of the game. This changed environment has compelled coaches and players to focus more on the physical aspect of the game.

Both batting and bowling require the execution of a complex sequence of actions (Cotterill, 2011). This implies that both require a high level of skill in order to be successful in either of the sub-disciplines. Recent research (MacDonald, Cronin, Mills, McGuigan & Stretch, 2013) indicates that cricketers generally rely on aerobic energy supply, and that the rates of energy expenditure in cricket are relatively low, except for fast bowlers during a bowling spell and fielders sprinting after the ball. This indicates that there is an element of both aerobic and anaerobic energy systems involved in the game. Christie (2008) has found that the main cause of stress for cricket players is the repeated eccentric muscle damage resulting from multiple decelerations that occur in batting and fast bowling. Eccentric actions alter muscle recruitment over time, resulting in the inability to store the energy of landing and recover energy for the push-off phase of the running stride which follows. The brain must then decide whether to recruit more fibers to assist in the push-off phase in order to keep the same speed of running, or reduce running speed in order to cope. As the bowling spell or batting innings progresses, the way in which the muscles are recruited will change because of the body's natural desire to protect the vital organs from catastrophic failure, referred to as the 'central governor'. This provides more evidence that players need to be properly conditioned in order to perform competitively without the risk of injury. According to Choudhary, Tiwari, Kumar and Rai (2011), there are numerous factors which are responsible for the performance of a sportsman.

Structure is strongly related to function. This means that the human structure will also affect its function, especially as relates to sport. Research into the physique of champion sports persons suggests that people with certain types of physique are more likely to succeed in certain sports (Travill & Carter, 1995). It is expected that eventually, with more detailed knowledge, it will be possible to advise people scientifically in choosing the type of sport in which they are most likely to succeed. Detailed anthropometric data on the proportions of different body compartments (muscle mass, fat mass, bone mass) is available for a number of sports, but this information is lacking in cricket (Payne, Duthie, Saunders, Petersen & Portus, 2006). Other studies about the sport include a assess

the throwing performance of elite and sub-elite cricket players at maximal throwing velocity, as well as throwing accuracy at various velocities relative to maximal throwing velocity (Freeston, Ferdinands & Rooney, 2007). According to Christie and King (2008), there are very few studies on the physical and physiological demands of the game of cricket, despite the fact that it is one of the oldest organised sports in the world. Although research in the field of sports science has evolved considerably in the last decade, not many studies have been conducted on the ideal anthropometric and physical fitness characteristics of cricket players, especially as they relate to the 'specialist' disciplines within the sport. Since cricket consists of different disciplines, it is likely that participants will display different physiques and different levels of physical fitness.

Although four disciplines are generally recognised, namely batting, bowling, wicket keeping and fielding, the current study will focus on batting and bowling. The results of this study will reveal a set of reference values which are useful in investigations on player selection, talent identification, and training programme development (Stuelcken, Pyne & Sinclair, 2007). The purpose of this study was therefore to describe the anthropometric and physical fitness characteristics of male university cricket players as a set of reference values, and to investigate possible differences between batsmen and bowlers in terms of these characteristics.

MATERIALS AND METHODS

This study employed a cross-sectional approach in describing and comparing the anthropometric and physical fitness characteristics of male university cricket players as assessed at a specific point in time. The participants were male cricket players from the a university cricket club and were classified as fast bowlers, batsmen and spin bowlers for comparative purposes.

Anthropometric Assessments

Thirteen anthropometric measurements were taken in accordance with the standard procedures of the International Society for the Advancement of Kinanthropometry (Marfell-Jones, Olds, Stew & Carter, 2006). Technical errors of measurement were within the acceptable standards (Norton & Olds, 1996). The anthropometric measurements taken were height, weight, arm length, waist circumference, hip circumference, chest, thigh, abdomen, suprailiac, subscapular, calf, triceps and biceps skinfolds. To determine waist-to-hip ratio, the waist circumference was divided by the hip circumference. Body fat percentage was determined using the ExRx fitness calculator and all the assessments took place in the University of the Western Cape Biokinetics clinic.

Physical Fitness Assessments

Aerobic capacity was tested using the Bleep test or 20 metre shuttle run test (Léger, Mercier, Gadoury & Lambert, 1988). Players were instructed to make sure they crossed the barrier completely before commencing with the next

shuttle for accuracy reasons. Players were given two warnings; if they failed to adhere to the instruction and upon the third occurrence, they were eliminated from the test. For muscular endurance, the one-minute push-up, two-minute sit-up and static plank were used. In the push-up test, players were asked to start in an upright position, with hands a shoulder-width apart. A fist was placed on the floor beneath the player's chest, counting the repetitions only when the chest touched the fist. The player was instructed to complete as many repetitions as possible consecutively and without rest during one minute. If the participant needed to rest due to fatigue, he had to do it in a standing position. If at any point the player's knees or chest touched the ground, the test was terminated.

With sit-ups, players were asked to lie on their backs with their knees bent at ninety degrees and hands placed across their chests. The sit-up was performed when the elbow reached the knee caps and the trunk was elevated to a thirty degree position. The feet were not held for support. The player was instructed to complete as many repetitions as possible consecutively and without rest during two minutes. If the participant needed to rest due to fatigue, he had to do it in a standing position. If the players rested on their backs, the test was terminated.

Using the static plank, players were asked to lie on their fronts supported by their elbows. Upon commencement of the test, the players were instructed to raise their bodies off the ground, only being supported by their feet and elbows while maintaining an adjacent position to the ground. Players were instructed to maintain that position for as long as possible. All the muscular endurance measurements were recorded in units of time (seconds, minutes).

For speed, the 40 metre sprint test was used. The player was asked to stand in a slightly bent standing position at the start of a marked area spaced at 40 metres. The player was then instructed to sprint at maximal effort over the 40 metre distance. It was evaluated by recording the time taken for the player to sprint at full speed from the start to the end of the 40 metre test zone. The distance run was recorded in seconds. The physical fitness measurements were conducted at the University of the Western Cape's cricket oval. Data was collected using a hard copy system by physically writing down each measurement and test score. Once all the data had been collected, it was transferred to a soft copy database using a Microsoft excel spread sheet.

Data Analysis

Data analyses which include descriptive and comparative statistics were done using SPSS V22. A one-way ANOVA was conducted to test for differences between the batters, fast bowlers and spin bowlers in terms of their anthropometry and physical fitness. A post-hoc Tukey test was done to establish which means were significantly different from each other.

RESULTS

Anthropometry

Descriptive and comparative statistics of the anthropometric characteristics of the batters,

fast bowlers and spin bowlers are presented in Table 1. Skinfold patterns of the three groups are illustrated in Figure 1.

The three groups were found to differ significantly in terms of their height (Table 1), ($p<0.05$). Fast bowlers (182.6cm) were found to be the tallest players while spin bowlers (165.8cm) were the shortest. The weight of the three groups also differed significantly (p0.05). These differences could, however, be the result of differences in their absolute heights. Fast bowlers (82.0kg) were the heaviest players, followed by batters (73.2kg), and spin bowlers (59.8kg) being the lightest. Fast bowlers (80.9cm) had significantly longer arms than spin bowlers (74.9) ($p<0.05$) but did not differ from the batters ($p>0.05$). The spin bowlers displayed bigger hip and waist circumferences compared to fast bowlers ($p<0.05$). However, no differences were found in the waist-hip ratios of any of the groups ($p>0.05$)

The three groups had similar skinfolds for the eight sites measured (Figure 1) and also did not differ in terms of their BMIs ($p>0.05$). They further displayed a similar percentage of body fat ($p>0.05$) which ranged from 10.2% to 11.8%.

Physical Fitness

Table 2 depicts the descriptive and comparative statistics of the physical fitness characteristics of the batters, fast bowlers and spin bowlers. Although the batters achieved better physical fitness scores on all but the VO2max test, none of the differences were found to be significant. The mean values of VO2 max for batsmen, fast bowlers and spin bowlers were 11.413, 11.100 and 12.475 respectively. The slowest sprinting speed was displayed by the spin bowlers, being 5.57 seconds as compared to the 5.48 and 5.49 seconds of the batters and fast bowlers respectively. The push-up and sit-up scores of the batters were higher than those of both the bowling groups.

DISCUSSION

Various studies (Landers, Blanksby, Ackland & Smith, 2000) have shown that the anthropometric characteristics of athletes are major determinants of their potential for success in their chosen sports.

The aim of this study was to describe the anthropometric and physical fitness characteristics of the batters, fast bowlers and spin bowlers of a leading university cricket team. Analysis of these characteristics provides useful references for investigations focusing on player selection, talent identification and athlete development (Stuelcken, Pyne & Sinclair, 2007).

This study found anthropometric and physical fitness differences between batters, fast bowlers and spin bowlers. However, the only significant differences found were for height, weight and arm length between all groups and hip and waist girth between the fast and spin bowlers. Height and weight are related anthropometric characteristics. Noakes and Durandt (2000) and Christie (2008) also found bowlers were heavier than batsmen. The weight differences found in the present study were mainly a result of the reported height differences as no differences

were reported in body composition. The anthropometric differences found in the present study are consistent with results reported by Choudhary (2012) which indicated that morphological differences exist between the various playing positions in cricket, such as batsmen, bowlers and all-rounders.

Height was found to one of the main distinguishing features between the three groups. Fast bowlers were found to be significantly taller than spin bowlers, with the gap between fast bowlers and batsmen being considerably smaller. Stuelcken, Pyne and Sinclair (2007) are of the opinion that the height of male fast bowlers has increased out of proportion with other players in the sport. This is consistent with the present study which also found fast bowlers to be significantly taller than both batters and spin bowlers.

Koley's (2011) research, which profiled the anthropometric characteristics of Indian inter-university male cricketers, showed no significant difference between height and body composition among batsmen, bowlers and all-rounders. These findings are contradictory to the results reported in the present study.

The differences in arm length coincide with the differences in the other anthropometric characteristics. Fast bowlers had significantly longer arms than spin bowlers. Reasons for this could be the demands of the discipline specifically, with fast bowling requiring greater speeds than spin bowling. The notion that arm length influences bowling speed is supported by Stuelcken, Pyne and Sinclair (2007) who found that assuming the sequence and coordination of the bowling action is maintained, the length of the bowling arm should influence bowling speed because for any given angular velocity, the linear speed of a segment's endpoint is proportional to the length of its radius. However Portus et al. (2000), investigating cricket fast bowling performance and technique and the influence of selected physical factors during an eight-over spell, found that general body physical factors, as opposed to the upper body alone, play a role in ball speed.

Regarding aerobic capacity, spin bowlers produced the highest mean value for VO2 max followed by batsmen and fast bowlers. This result agrees in part with Noakes and Durandt (2000) who found that batsmen have a greater VO2 max values than bowlers. For muscular endurance, batsmen were shown to be superior in terms of push-ups, sit-ups and plank indicating higher values, followed by fast bowlers and spin bowlers. For plank however, fast bowlers produced the lowest mean value. All players irrespective of their cricket responsibilities as batsmen or bowlers, have to fulfill the physical requirements of fielding; this can last up to three-and-a-half hours. The body has to be well conditioned and trained in order to prevent injuries and to be most effective on the field. This is a main contributing factor to the similarities found in skinfold patterns and body composition of all categories of players, and is particularly noticeable in batsmen and fast bowlers.

In terms of speed, batsmen produced the lowest mean value indicating the fastest time, followed by fast bowlers and spin bowlers. This supports Noakes and Durandt (2000) who found that batsmen had faster running times as well as turning times than bowlers. It can be observed that bowlers do not need to stop and turn and run again at full speed, as do batsman when they are running between the pitch. Most bowlers stand still before they start their run up. Noakes and Durandt (2000) found bowlers worked at a heart rate of between 154 and 158 beats per minute during a six-over spell for their fast bowlers. This means they are working at a maximal heart rate of 73% to 77%.

CONCLUSION

The various sub-disciplines of cricket have differing physiological and morphological requirements. The sub-discipline differences in the physiological requirements are largely negated by the fact that all players fulfill the demanding role of fielding and are subjected to the same rigorous training routines. The present study found no significant differences in the physiological characteristics of the players across all the sub-disciplines. However, the technical requirements associated with each of the sub-disciplines require different sets of anthropometric characteristics which could be advantageous in the performance of the skills. This is especially true for fast bowlers where height and arm length give the bowler a biomechanical advantage in generating bowling speed. The fast bowlers in this study were taller and had longer arm lengths than participants in the other two groups. The results of this study are useful to coaches and sport scientists and should be used in talent identification programmes, player selection and training programmes. The generalisability of the results of this study is limited by the small sample of subjects.

REFERENCES

Choudhary, R., Tiwari, S., Kumar, S. & Rai, V. (2011), Comparison of Selected Anthropometric Measurements and Body Composition of Fast and Spin Bowlers of Uttar Pradesh U-19 Cricket. Indian Journal of Movement Education and Exercises Sciences. II (1).

Christie, C.J. & King, G.A. (2008). Heart rate and perceived strain during batting in a warm and cool environment. International Journal of Fitness. 4, 33-38.

Cotterill, S. (2011). Experiences of developing pre-performance routines with elite cricket players. Journal of Sport Psychology in Action. 2, 81–91.

Freeston, J., Ferdinands, R. & Rooney, K. (2007). Throwing velocity and accuracy in elite and sub-elite cricket players, European Journal of Sport Science. 7(4): 231-237.

Koley, S. (2011). A study of anthropometric profile of Indian inter-university male cricketers. Journal of Human Sport and Exercise. 6(2), 42-435.

Landers, G.J., Blanksby, B.A., Ackland, T.R., & Smith, D. (2000). Morphology and performance of world championship triathletes. Annals of Human Biology. 27(4). 387-400.

Léger, L.A. Mercier, D. Gadoury, C. & Lambert, J. (1988). The multistage 20 metre shuttle run test for aerobic fitness. Journal of Sports Science. 6 (2): 93–101.

MacDonald, D., Cronin, J., Mills. J., McGuigan, M., & Stretch, R. (2013). A review of cricket fielding requirements. South African Journal of Sports Medicine. 25(3), 87-92.

Marfell-Jones, M., Olds, T., Stew, A. & Carter, L. (2006). International standards for anthropometric assessment. Australia: The International Society for the Advancement of Kinanthropometry.

Noakes, T.D. & Durandt, J.J. (2000). Physiological requirements of cricket, Journal of Sports Sciences. 18, 919-929.

Norton, K. & Olds, T. Anthropometrica. Sydney, Australia: University of New South Wales Press. 1996.

Payne, D., Duthie, G., Saunders, P., Petersen, C. & Portus, M. (2006). Anthropometric and strength correlates of fast bowling speed in junior and senior cricketers, Journal of Strength and Conditioning Research. 20(3), 620–626.

Portus, M.R., Sinclair, P.J., Burke, S.T., Moore, D.J.A. & Farhart, P.J. (2000). Cricket fast bowling performance and technique and the influence of selected physical factors during an 8-over spell. Journal of Sports Sciences, 2000, 18, 999-1011.

Stuelcken, M., Pyne, D. & Sinclair, F. (2007). Anthropometric characteristics of elite fast bowlers. Journal of Sport Sciences. 25(14):1587-97.

Travill, A.L. & Carter, J.E.L. (1995). Somatotypes of male Olympic high, long and triple jumpers. South African Journal for Research in Sport, Physical Education and Recreation. 18(1), 67-75.

Woolmer, B. & Noakes, T.D. (2008). Art and Science of Cricket. Cape Town: Struik Publishers.

Table 1: Anthropometric characteristics of male batters (Bat), fast bowlers (FB) and spin bowlers (SB)

Variable	Batsmen Mean	Fast Bowlers Mean	Spin Bowlers Mean	F-value	p-value
Height(cm)	**173.5^{FB,SB}**	**182.6^{SB,Bat}**	**165.750^{FB,Bat}**	**17.886**	**0.000***
Weight(kg)	**73.2^{FB,SB}**	**82.0^{SB,Bat}**	**59.0^{FB,Bat}**	**9.381**	**0.001***
BMI(kg/m2)	23.9	24.0	20.8	2.392	0.111
Body Fat%	10.4	11.8	10.2	0.263	0.771
W/H Ratio (cm)	.825	.832	.825	0.222	0.802
Arm Length(cm)	78.2	**80.9^{SB}**	**74.9^{FB}**	**6.469**	**0.005***

*Significant at 0.05 level
Superscripts identify the differing groups

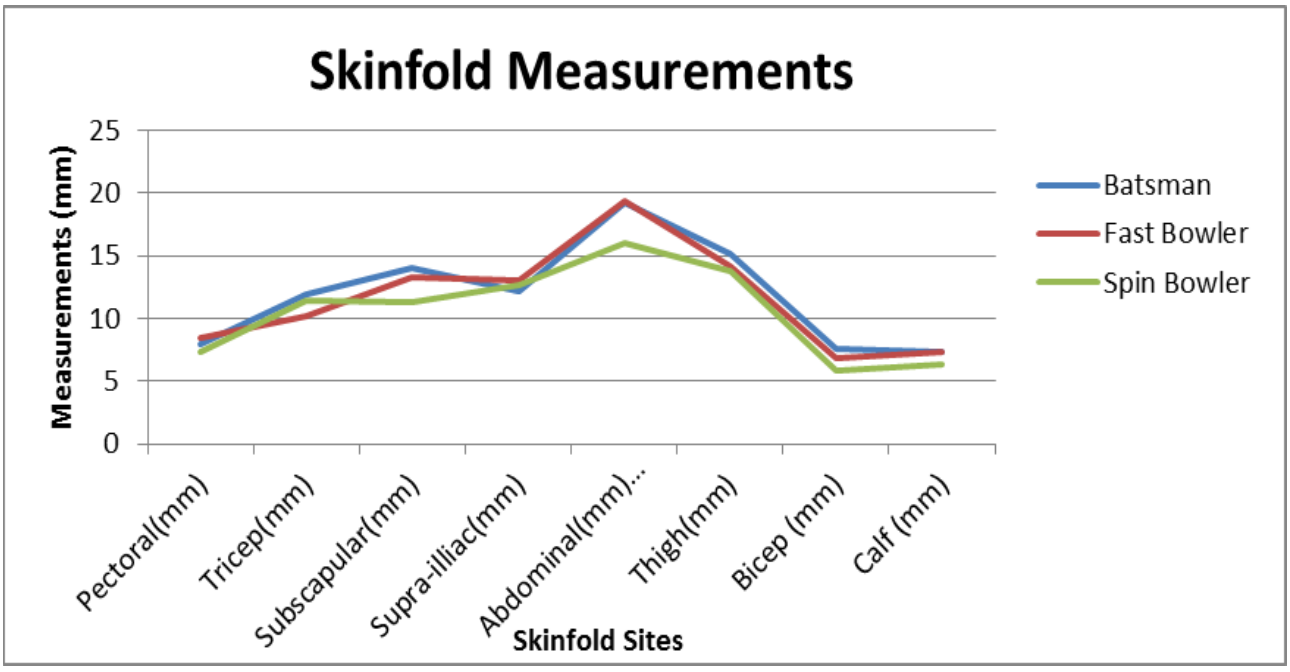

Figure 1: Skinfolds of male batters, fast bowlers and spin bowlers

Table 2: Physical fitness characteristics of male batters, fast bowlers and spin bowlers

Variable	Batsmen Mean	Fast Bowlers Mean	Spin Bowlers Mean	F-value	p-value
Bleep test VO2max (ml•kg-1•min-1)	11.413	11.100	12.475	1.753	0.192
Push-ups (rpm)	51.400	47.091	46.750	0.567	0.574
Sit-ups (rpmx20)	79.067	77.636	76.500	0.140	0.870
Plank (min·sec)	4.4767	3.8682	4.2725	0.267	0.768
Speed (sec)	5.4893	5.4964	5.5725	0.232	0.795

Significant at 0.05 level