Anthropometric and physical fitness characteristics of male university cricket club players in accordance to player position and height categories [version 1; peer review: 1 approved with reservations]"}

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Abstract

Background: The scientific research into the varied factors that influence cricket performance has become a focal area for overall improved performance. Although there has been documented evidence for both anthropometry and physical fitness among elite cricketers, there is a paucity of evidence among the club cricket cohort. This pilot study aims to evaluate the anthropometric and fitness measurements among a pilot sample of university club cricketers (n = 17; 9 batsmen and 8 bowlers) in South Africa.

Methods: Retrospective data were collected from the university’s male first cricket team of the 2019/2020 season. The data included both anthropometric (height, body mass, and body mass index) and physical fitness (explosive power, strength, Yo-Yo, speed and agility) parameters. The results exhibited for every parameter were presented according to height categories and player positions (batsman and bowler). Student t-tests were performed to determine the differences between fitness and anthropometric variables among both height categories and player positions. All data were analysed using SPSS (Version 26, IBM). The level of significance was set at p<0.05.

Results: The results indicated significant differences for height categories with regards to stature (p = 0.000) and agility (p = 0.03). Significant differences were also evident for different player positions with regards to body fat percentage (p = 0.02) and vertical jump distance (p = 0.03).

Conclusions: The findings of this pilot study indicated that cricketers who are shorter in stature are less superior with regards to anthropometric and fitness capabilities than their taller counterparts. In addition to being aware of the variances that exist for anthropometry, stature and fitness among cricketers at any level; this study provides implications for both coaches and sports scientists at
the club level (under-researched level) in terms of how this can translate to player performances in accordance to height categories and player positions.

**Keywords**
Anthropometry, physical fitness, height categories, player positions, cricket

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**Author roles:**

Noorbhai H: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Project Administration, Software, Supervision, Validation, Writing – Original Draft Preparation, Writing – Review & Editing;

Khumalo A: Formal Analysis, Methodology, Project Administration, Resources, Software, Validation, Writing – Original Draft Preparation

**Competing interests:** No competing interests were disclosed.

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Introduction
Cricket performance is influenced by many underlying factors which can further determine the success of cricketers in various distinct levels of experience and game formats (Noorbhai, 2015). The role played by batsmen and bowlers is evident in all game formats which can place various demands on athletes (Scanlan et al., 2016). Stretch et al. (2000) discusses some of the crucial demands in cricket, which include physiological, perception and action (motor skills), biomechanics and psychological factors. For the purpose of this research, focus will be placed on the physiological aspect, which includes anthropometric and fitness profiles, and its impact on performance. In a study by Nazeer et al. (2018), it was concluded that stronger anthropometric and physical fitness characteristics elicit optimal performance at various competition levels.

Anthropometry
Koley (2011) defines anthropometry as the study of measurement of physical properties of the human body in terms of dimensions such as size and shape. Anthropometric profiles of athletes enable the establishment of whether an athlete will perform better in a certain sport and how they can meet the demands of the tasks involved (Stuelcken, Pyne and Sinclair, 2007; Koley, 2011).

In studies conducted by Stretch et al. (2000) and Koley (2011), they used the same methods to acquire anthropometric profiles of elite and university batsmen and found that batsmen tend to be shorter, with lesser body mass and with a greater body fat percentage than other cricketers. In addition, having a smaller size might be a selective advantage, especially for batting (Noakes, 2000). Having excess body mass could have a negative impact on the performance of cricketers, as it reduces the ground reaction forces for batsmen when making runs and for bowlers, at the point of delivery (Tanner and Gore, 2012).

Even though there are limited research findings on anthropometry for batsmen (Noorbhai, 2017), Johnstone and Ford (2010) looked at the overall physiological profiles of professional cricketers. Various anthropometric tools were used for physical assessment tests and some of these assessments used were commonly performed resulting in valid and reliable data. Stuelcken et al. (2007) adds that the gathering of information on anthropometric profiles helps in determining the potential for athletes to be successful.

Physical fitness
Another crucial aspect of cricket performance is physical fitness, which includes components such as physical strength, speed, aerobic capacity, and agility. Physical fitness is considered a measure of the body’s ability to function efficiently and effectively in work and leisure activities (Javali and Koppad, 2017). According to Nazeer et al. (2018), running and the swinging of the bat are the movements that make up the batting skill. Hence, the development of physical fitness characteristics is paramount to meet the physical demands of cricket batting performance.

The vertical jump test, which is an indicator of lower body strength and explosive power, is a key physiological component of cricket skills for various cricket positions (Tanner and Gore, 2012). Furthermore, it is important to note that there are field based methods to measure lower body strength and power, which is the static vertical jump and the counter movement vertical jump. Another component is upper body strength, which was found to be positively correlated with superior batting performance, using the one-repetition maximum of a bench press (Taliep et al., 2010). Furthermore, it was acknowledged that upper strength alone cannot be used as a predictor of overall batting performance.

The fitness component of speed in relation to cricket performance has not been well documented. In an article by Dana et al. (2014), speed was explored in terms of comparison between batsmen and bowlers, to determine who is the fastest using the 40m sprint test. It was discovered that batsmen are faster than bowlers and speed is directly proportional to power. As a result, muscular power is the force resulting from the sum of movements involving both strength and velocity factors (Wang et al., 2017). Both muscular strength and power are crucial physical fitness components for explosive, short duration movements in sports.

Lastly, agility is a physical component commonly used by cricket batsmen for optimal performance. It is defined as the ability to efficiently change the body’s direction, decelerate, and explosively accelerate again while maintaining body control and using a combination of coordinating skills (Srivastava et al., 2017). According to Dana et al. (2014), batsmen were found to have faster running times as well as turning times than bowlers, which translates into agility.

The majority of anthropometric characteristics and physical fitness components have shown a strong relationship with body composition and performance test variables as experimented by Koley et al. (2011). However, further research is required that needs to be conducted in terms of measuring the anthropometric profiles of cricketers. Scientific research
into the varied factors that influence cricket performance has become a focal area for overall improved performance. Although there has been documented evidence for both anthropometry and physical fitness among elite cricketers, there is a paucity of evidence among the club cricket cohort and in particular, the university cricket club cohort. This is imperative for investigation, as most cricketers in such a cohort have finished their growth spurt after being involved in adolescent cricket (Noorbhai and Noakes, 2016). This research study aims to address this gap and provide insight into the physiological attributes of university club cricketers and how this influences their success in accordance to their player position and height categories.

Methods

Study design

This pilot study employed a cross-sectional research design in which analytical methods were employed. Anthropometric and physical fitness characteristics of male university cricket players were assessed at a specific point in time. The participants were male cricket players (n = 17) and were classified as bowlers and batsmen for comparative purposes.

Data collection

Retrospective data was collected and recorded from University of Johannesburg’s first cricket team (n = 17) for the 2019/2020 season in which consent was obtained with the understanding that their data will be kept confidential and anonymised. The data included both fitness (explosive power, strength, aerobic capacity, speed, and agility) and anthropometric (body mass index (BMI) and skinfolds) parameters (Noorbhai, 2021). All anthropometric and fitness measurements were conducted in accordance to the guidelines and procedures by Miller (2012), and Howley and Faigenbaum (2016), respectively.

Due to the limited studies conducted on the role of anthropometric and physical fitness capabilities in performance among the club cricket cohort, this study will focus on parameters specific to cricket such as height, body mass, body fat percentage, explosive body power in the lower and upper body extremities, speed, aerobic capacity and agility. These will also be in relation to player height categories (short or tall) and player positions (batsman or bowler).

Data analysis

Parametric statistical tests were used to analyse data, whereby the population from which the sample was drawn was normally distributed on the variables of interest. Samples drawn from the population had the same variance (i.e. batsmen) and the observations were independent. Student t-tests were performed to determine the differences between fitness and anthropometric variables among both height categories and player positions. All data was analysed using SPSS (Version 26, IBM). The level of significance was set at p < 0.05.

Ethical considerations

Ethical approval for the study was granted by the Faculty of Health Sciences Research Ethics Committee at the University of Johannesburg (REC: 503-2020). Secondary data permission was also sought from the Research Ethics Committee. This research study also conforms to the World Medical Association Declaration of Helsinki on Ethical Principles for Research Involving Human Subjects.

Results

Descriptive results including stature, body mass and body fat percentage for the total group sample are shown below for both the two height categories (Table 1) and player position (Table 2). The two height categories were short (below 1.7m in height) and tall (above 1.7 m in height).

There were no significant differences for body mass and body fat percentage between the two height categories (short and tall) (Table 1). There was no significant difference for stature and body mass between batsmen and bowlers. However, there was a significant difference for body fat percentage between batsmen and bowlers (p = 0.02) (Table 2).

<table>
<thead>
<tr>
<th>Anthropometric variables</th>
<th>Total group participants (n = 17)</th>
<th>Short (n = 7)</th>
<th>Tall (n = 10)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stature (m)</td>
<td>1.79 ± 0.09</td>
<td>1.71 ± 0.05</td>
<td>1.84 ± 0.06</td>
<td>0.000</td>
</tr>
<tr>
<td>Body mass (kg)</td>
<td>76.78 ± 18.5</td>
<td>82.85 ± 25.45</td>
<td>72.5 ± 11.36</td>
<td>0.27</td>
</tr>
<tr>
<td>Body fat (%)</td>
<td>10.14 ± 3.60</td>
<td>10.54 ± 3.63</td>
<td>9.87 ± 3.74</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Presented as mean ± SD; m = metres; kg = kilograms; % = percentage; n = sample; * = p < 0.05.
Table 3 outlines the fitness parameters which includes explosive leg power, explosive upper body power, speed, aerobic capacity and agility for the total group sample by the two height categories.

There are no significant differences for explosive power (lower and upper body), speed and aerobic capacity between the height categories (short and tall). However, there is a significant difference for agility (both right and left) between the height categories (short and tall) (p = 0.03) (Table 3).

Table 4 outlines the fitness parameters of explosive leg power, explosive upper body power, speed, aerobic capacity and agility for the total group sample according to player positions.
There are no significant differences for explosive power (upper body), speed, aerobic capacity and agility between batsmen and bowlers. However, there is a significant difference for explosive power (lower body) between batsmen and bowlers (p = 0.03) (Table 4).

This section presented the results in terms of mean scores with their corresponding standard deviations for the anthropometric and fitness parameters of height categories and different playing positions. The results indicated significant differences for the height categories with regards to stature and agility. The tall group showed a significantly higher stature than the short group. For agility time scores, the tall group showed faster times for both sides (right and left) than the short group.

Two significant differences were also evident for the different cricket positions with regards to body fat percentage and vertical jump distance. The batsmen showed the highest body fat percentage compared to bowlers. In terms of vertical jump distance, bowlers showed the highest mean score than batsmen.

Discussion

Anthropometric characteristics and physical fitness components have been shown to have a considerable influence on the potential success of cricketers (Koley et al., 2017; Srivastava et al. 2017; Wang et al. 2017; Talib et al., 2010). This pilot study aimed to evaluate the anthropometric and fitness variables among cricketers and to determine whether cricketers who are shorter in stature perform better than their taller counterparts. The different cricket positions were also evaluated in terms of anthropometric and fitness measurements among university club level cricketers.

This study found anthropometric and physical fitness differences between short and tall cricketers. However, significant differences were only found in stature and agility between the short and tall group. Similarly, the findings documented by Koley (2011) which evaluated anthropometric profiles of Indian inter-university male cricketers, found that the tall group had a higher mean score for stature than the total group mean, while the short group had a lower mean score for stature than the total group mean. This is also in accordance with Noakes and Durandt (2000), who found that most batsmen were shorter than the other cricket positions. However, it is crucial to note the paucity in research on fitness parameters with regards to height categories. As a result, reference was made to normative data for physically active adults by Tanner and Gore (2012).

With reference to normative data, both the short and tall groups fell below the norms for vertical jump distance, whereas the tall group performed better. In terms of speed, both short and tall cricketers performed significantly better compared to the normative data, with the tall group obtaining faster times. The short and tall groups were slightly below the norms for the Yo-Yo Intermittent Recovery Test, with the short group being slightly better than the tall group. With regards to agility, both the short and tall groups obtained excellent ratings, whilst the tall group obtained faster times than their counterparts.

The current study found interesting results across the cricket positions (batsmen and bowlers) for anthropometric and fitness tests. According to Johnstone and Ford (2010), bowlers are heavier and taller than batsmen, which contradicts the current findings in which bowlers were taller but lighter than batsmen. Body fat percentage and vertical jump distance between the batsmen and bowlers also showed a significant difference. Batsmen were found to have a higher body fat percentage than bowlers, which corresponds with the research conducted by Stretch et al. (2000) and Koley et al. (2011). This current study supports the findings by Dana et al. (2014) which found that bowlers are significantly taller than batsmen. With regards to stature and body composition (body mass), a significant difference among batsmen and bowlers regarding body fat percentage was evident. Hence, these findings partly support findings by Koley (2011), who found no significant difference for bowlers and batsmen in height and body composition. Johnstone and Ford (2010) found insignificant differences between batsmen and bowlers with regards to the vertical jump test, which contrast with the findings of this study, as the results highlighted a significant difference.

According to Noakes and Durandt (2000), batsmen were found to have faster running times and turning times than bowlers in relation to agility which is in contrast with the current findings. In terms of speed, current finding suggests that running speeds for batsmen and bowlers are alike, however the bowlers performed better in the sprint tests. This is similar to findings by Johnstone and Ford (2010) but in contrast to Dana et al. (2014), who discovered that batsmen were faster than bowlers. Current findings suggest that batsmen have superior aerobic fitness and these results have been linked with improved recovery and maintenance of optimal performance. With regards to upper body strength, the current findings indicate that bowlers performed better than batsmen (supported by MacDonald (2013)). However, the relevance of such results to match performance is unclear.
Strengths and limitations
This was a pilot study due to a smaller sample size and the inclusion of only male data. The data was also limited to only two cricket playing positions and can’t be generalisable. Another limitation was the absence of the 505 Agility Test (which has been identified as a more specific test for change of direction specific to running between the wickets) and somatotype of the players. In this study, only the Illinois test was available. However, the depth of tests conducted has provided adequate insights into the anthropometric and physical fitness characteristics of male university cricket club players in accordance to height categories and player position.

Conclusion
Anthropometry and physical fitness are key to ensuring success in cricket performance. This study demonstrates that cricketers who are shorter in stature are less superior with regards to anthropometric and fitness capabilities than their taller counterparts, which makes the latter group more likely to be successful in cricket. The batsmen showed the highest body fat percentage compared to bowlers. In terms of the vertical jump distance, bowlers showed a higher mean score than batsmen. This study will assist coaches in terms of team selection by providing information that is essential for determining the potential for athletes to enhance performance. Future studies should include a larger sample size and also consider female data, along with the inclusion of the various cricket playing positions and height categories. In addition to being aware of the variances that exist for anthropometry, stature and fitness among cricketers at any level, this study provides implications for both coaches and sports scientists at the club level in terms of how this can translate to player performances in accordance to height categories and player positions.

Data availability

This project contains the following underlying data:
- Dataset_Cricket_Anthro and Fitness_2020.xlsx (Anthropometric and physical fitness variables).

Data are available under the terms of the Creative Commons Attribution 4.0 International license (CC-BY 4.0).

Acknowledgements
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References
Dana K, Webster Z, Travill AL: Anthropometric and physical fitness characteristics of male cricket players at the University of the Western Cape. J Community Health Sciences. 2014; 9(1).


Abstract:
1. In the background, maybe shorten the opening statement and only include: “The scientific research into the varied factors that influence cricket performance has become a focal area for overall improved performance”. Remove the entire second statement which you can insert at the end of the introduction to address your problem and why you choose to research in this area, which will be able to clarify the rationale of the study. (Although there has been documented evidence for both anthropometry and physical fitness among elite cricketers, there is a paucity of evidence among the club cricket cohort.)

2. Include study design on the methods within the abstract. And then indicate that ‘Retrospective data were collected from the university's male first cricket team of the 2019/2020 season.’

Introduction:
1. The introduction needs to be revised: avoid headings in the introduction. Make sure your introduction flows while including all parameters of the article that was written in different headings.

2. The authors are applauded for using current literature in the introduction, however addressing the above concern will solidify the introduction.

Methods:
1. Study design - the only concern is the number of participants, which, if expanded, will surely lead to a valid result, which will represent a large cohort and address the physical fitness characteristics measured. Surely it will lead to bias results due to small sample used?

2. Data collection - The authors are commended in terms of explaining how data was collected, the method was clearly explained. However, there is missing information in terms of how the following parameters were measured ((explosive power, strength, aerobic...
capacity, speed, and agility) and anthropometric (body mass index (BMI) and skinfolds) parameters. The authors should expand in this area to give readers an idea on how these parameters were measured.

3. Statistical analysis - The statistical analysis of the study is well explained in terms of how the data will be analysed and which statistical methods was applied/done. The authors are commended in this area.

4. Results and discussion- The results of the study were well presented in tables addressing all the parameters measured and the discussion the article was in line with the findings of the study.

5. Conclusion - the authors are commended on the way they crafted the conclusion to summarize the findings of the study, finally and well capturing of the recommendations of the study.

**Is the work clearly and accurately presented and does it cite the current literature?**
Yes

**Is the study design appropriate and is the work technically sound?**
Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**
Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**
Yes

**Are all the source data underlying the results available to ensure full reproducibility?**
Yes

**Are the conclusions drawn adequately supported by the results?**
Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Physical activity, health, wellness and cardiometabolic risk factors.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.
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