Assessment on Talent Identification and Development Process by Playing Position in Basketball: A Cross-Sectional Study from Adwa, Ethiopia

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ABSTRACT

Talent Identification and Development (TID) is essential for optimizing long-term athletic performance in basketball, where positional roles demand distinct physical and technical attributes. The present paper evaluates the anthropometric, physical fitness, and basketball-specific skill profiles of adolescent male players by playing position in Adwa, Ethiopia. A cross-sectional study was conducted among 50 male basketball players (aged <18 years) from Don Bosco Adwa and Kidane Mihret secondary school projects. Anthropometric (height, weight, arm span, vertical jump), physical fitness (20m sprint, T-test agility), and skill performance (ball handling, shooting, passing, dribbling using Johnson tests) variables were assessed. Data were analyzed using Pearson correlation and comparative analysis using SPSS version 23. Significant inter-positional differences were observed ($p < 0.05$). Centers were significantly taller (mean = 1.79 ± 0.03 m) and had greater arm span (188.3 ± 3.13 cm), while the Power Forwards were heavier (62.9 ± 8.22 kg). Point Guards demonstrated superior sprint speed (3.39 ± 0.15 s), whereas Shooting Guards showed better agility (10.96 ± 0.63 s) and shooting performance (3.2 ± 0.79 baskets/30 s). Small Forwards performed better in ball handling and dribbling (22.7 ± 1.83 zones/30 s). Correlation analysis revealed a strong positive relation between height and arm span ($r = 0.90$, $p < 0.001$); between height and weight ($r = 0.74$, $p < 0.001$); and a moderate positive correlation between shooting and dribbling skills ($r = 0.49$, $p < 0.05$). On the other hand, other physical performance variables showed weak and insignificant relationships ($p > 0.05$). In conclusion, anthropometric, physical fitness, and technical skill variables significantly differ across playing positions and can effectively discriminate player roles. These findings help integrate standardized, multi-dimensional assessment frameworks for evidence-based talent identification and development programs, particularly in resource-limited settings such as Ethiopia.

Keywords: Basketball, Talent Identification, Playing Position, Anthropometry, Physical Fitness, Skill Assessment.

1. INTRODUCTION

Talent Identification and development (TID) is a key element in the long-term success of athletes in competitive athletics, especially in team sports such as basketball, which requires specialized positions with unique physical and technical characteristics (Carvalho and

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Gonçalves, 2023). This requires a systematic assessment of physiological, anthropometric, technical, tactical and psychological characteristics to forecast future elite performance (Cui et al., 2019). In basketball, the elite level is highly competitive because success is identified at a young age based on the identification of players with the best physical height, fitness and skill potential (Drinkwater et al., 2008).

Basketball is an intermittent and high-intensity sport that involves a combination of speed, agility, strength and technical capability (Ferioli et al., 2018). There are five positions that players are usually grouped into: Point Guard (PG), Shooting Guard (SG), Small Forward (SF), Power Forward (PF), and Center (C), and each position has functional needs (Gál-Pottyondy et al., 2021). An example is that guards tend to be quicker and nimbler, and they handle the ball and shoot around the perimeter, whereas centers are taller and heavier and dominate the area around the basket in terms of rebounding and shot-blocking (Gryko et al., 2022). Forwards can be regarded as multi-dimensional players, namely, as offensive and defensive.

Height, weight, and arm span are anthropometric variables that have a strong predictive value of playing position and performance (Hatem et al., 2020). Research has always demonstrated that players of greater height tend to be positioned in the interior (PF and C) and the shorter ones with greater speed are placed in the guard positions (Ivanović et al., 2022). The physical fitness aspects of speed, agility and vertical jump, are also position-specific, with guards performing better on sprint and agility tests than forwards and centers (Köklü et al., 2011).

Although TID is given serious attention worldwide there is a lack of research in the sub-Saharan region, especially in developing countries like Ethiopia, on position-selected talent measurement in youth basketball. Current programs are usually based on subject grading as opposed to objective scientific assessments. This disconnect prevents the systematic cultivation of athletic potential and restricts potential talent of underrepresented talent.

Thus, a study was conducted with an objective to evaluate anthropometric, physical fitness and specific skill profiles of male basketball players based on their playing positions in Adwa, a small town in Tigray, northern Ethiopia. The results are meant to facilitate evidence-based talent identification and guide the design of the training programs in the development of youth basketball. Keeping this in view the paper addresses the following research question:

Do anthropometric characteristics, physical fitness, and technical skills significantly differ across basketball playing positions among adolescent players?

It is hypothesized that:

(1) Anthropometric and physical fitness variables will significantly vary by playing position; and

(2) Guards will demonstrate superior speed and agility, while centers and forwards will exhibit greater body size and strength-related attributes.

2. METHODS

2.1. Area of Study and Study Design

The study was a cross-sectional study carried out in March-April 2024 in Donbosco Adwa and Kidane Mihret Secondary School basketball projects in Adwa, Tigray Region, Ethiopia (Fig 1). Adwa has a longitude and latitude of 14°10′N 38°54′E, and an elevation of 1907 meters. The tests were conducted in the months of March and April 2024. The study design is given in figure 2.

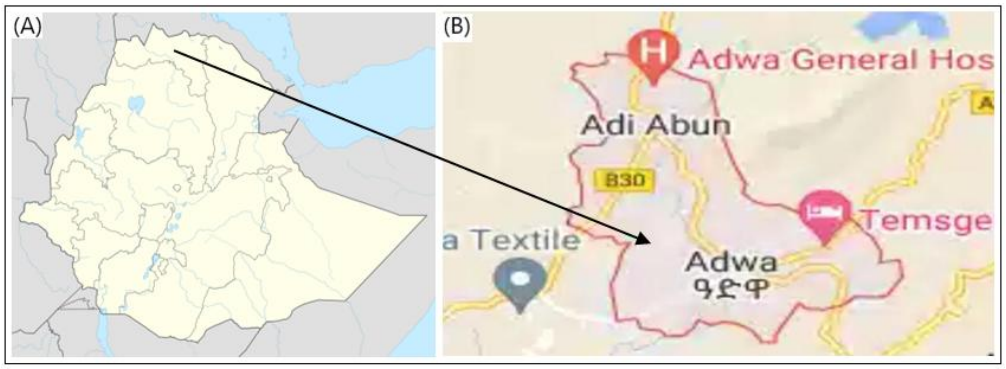


Figure 1. Map of Ethiopia (A), and the study area Adwa (B).

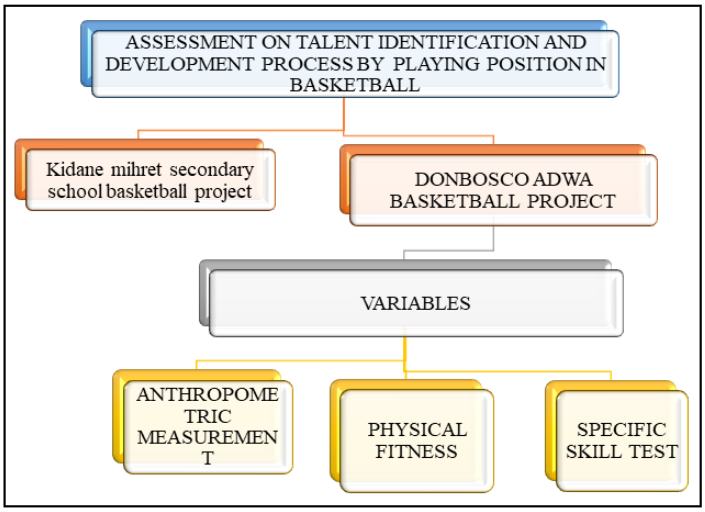


Figure 2. Flow chart on sample selection procedure.

2.2. Participants

The study involved 50 male basketball players who were below the age of 18 years. Each institution had 25 players in the sample. A census approach was used to include all registered players, achieving complete population coverage.

2.3. Inclusion Criteria

- ✓ Basketball players who are above 18 years of age and are males.
- ✓ Active participants in the respective school basketball programs.
- ✓ No history of major musculoskeletal injury in the past six months.

All available players met these criteria and were included in the study.

2.4. Variables and Measurement Tools

The experiment measured three variables, which included anthropometric, physical fitness and specific skill variables.

2.5. Anthropometric Variables

Height (m): The height was measured with the help of a stadiometer (Seca 213).

Weight (kg): Measured with a digital scale (Seca 813).

Arm Span (cm): Measured between fingertips with the arms being fully extended.

Vertical Jump (cm): Squat jump measured by a Vertec device; = jump height-standing reach.

2.6. Physical Fitness Variables Speed (20m Sprint)

Time measured with handheld stopwatches (Casio HS-3V) on a flat surface 20m long.

Agility (T-Test): The participants did a T-shaped shuttle run that included forward sprint, lateral shuffles and backward run. Time was recorded in seconds.

2.7. Certain Skill Tests (Johnson Basketball Skill Tests)

Ball Handling and Dribbling: The players were asked to dribble around four hurdles in a zig-zag fashion for 30 seconds. Score = number of covered zones.

Shooting (Field Goal Speed Test): The highest number of successful baskets in 30 seconds under the basket.

Passing Accuracy: The players made 10 overhead or hook passes to the wall target (40 feet away). Marked: 3 (inner), 2 (middle), 1 (outer rectangle).

2.8. Data Collection Procedure

Two trained researchers (BSc in Physical Education) collected the data. Before the experiment, the subjects were tested on a standardized warm-up. Each test was conducted in one session each player and following standardized procedures.

2.9. Reliability of the Study

To ensure uniformity and reliability of the testing technique, the investigator had or made number of practice sessions in the testing procedure and standard equipment was use for credible data. The study was conducted with the guidance of experts. The test reliability had ensured by test re test reliability. The measurements and trainings were taken with the help of coaches of the projects.

2.10. Data Analysis

All variables were computed using descriptive statistics (mean, standard deviation). Cross-position differences were compared with one-way ANOVA tests. Pearson correlation coefficients were determined to evaluate associations between variables. Significance was set at $p < 0.05$. The SPSS version 23.0 was applied in the analysis of data.

3. RESULTS

3.1 Statistical Analysis for Participant Characteristics

A total of 50 male participants were included in the study, with a mean age of 16.8 ± 1.2 years. The positional distribution of players was relatively balanced across the five basketball positions: small forwards (SF) accounted for 11 players (22%), centers (C) for 10 players (20%), power forwards (PF) for 10 players (20%), shooting guards (SG) for 10 players (20%), and point guards (PG) for 9 players (18%). The proportional representation of each playing position is illustrated in figure 3 using a pie chart.

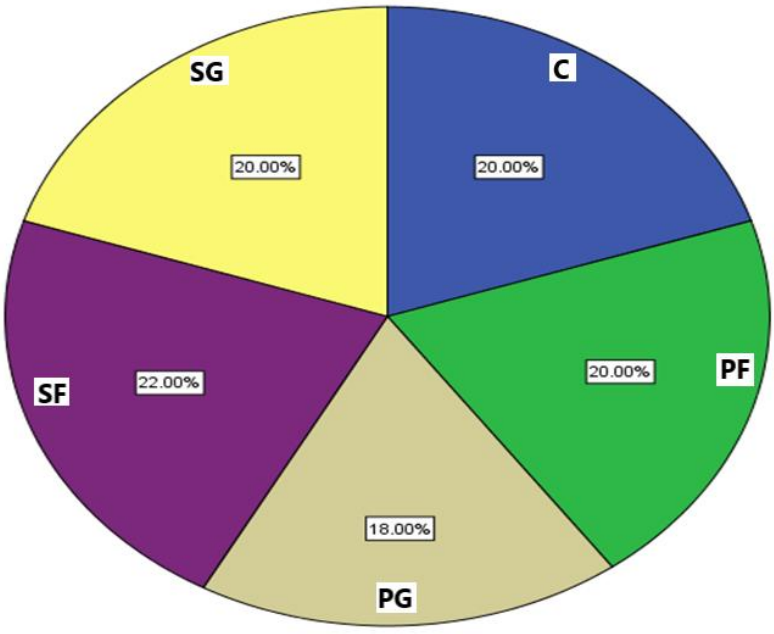


Figure 3. Pie chart of play position with the number of players (C = Centers; PF = Power forwards; PG = Point guards; SF = Small forwards; SG = Shooting guards).

Significant anthropometric differences were observed across playing positions (Table 1). Centers exhibited significantly greater stature and arm span compared with all other positions ($p < 0.01$), highlighting the positional specificity of body size in basketball. In contrast, players in the remaining positions were significantly shorter and had smaller arm spans relative to centers. With respect to body mass, power forwards were the heaviest among all positions, and this difference was statistically significant ($p < 0.05$), reflecting the greater physical demands associated with their role. These findings underscore the importance of position-specific anthropometric characteristics in youth basketball player profiling and talent identification. Table 2 indicates that the fastest were Point Guards ($p < 0.01$), and the most agile were Shooting Guards ($p < 0.05$). As it is given in table 3, small Forwards were the best in dribbling ($p < 0.05$), and Shooting Guards were the best in shooting ($p < 0.01$). The best passing accuracy was recorded by Power Forwards.

Table 1. Anthropometric characteristics of male basketball players by playing position (N = 50).

Position	***Height (m)***	***Weight (kg)***	***Arm span(cm)***	***Vertical jump(cm)***
PG	1.68 ± 0.10	53.1 ± 5.3	173.2 ± 9.8	44.4 ± 2.5
SG	1.69 ± 0.08	51.9 ± 6.3	175.2 ± 5.9	43.3 ± 3.2
SF	1.68 ± 0.07	55.9 ± 5.9	174.0 ± 6.5	44.0 ± 3.0
PF	1.78 ± 0.06	62.9 ± 8.2	183.7 ± 7.5	44.6 ± 2.5
C	1.79 ± 0.03	60.8 ± 5.6	188.0 ± 3.1	46.0 ± 1.3

Table 2. Physical fitness performance of male basketball players by playing position.

Position	***20m Sprint (s)***	***T-Test Agility (s)***
PG	3.39 ± 0.15	11.07 ± 0.44
SG	3.46 ± 0.22	10.96 ± 0.63
SF	3.51 ± 0.20	11.05 ± 0.49
PF	3.46 ± 0.25	11.24 ± 0.52
C	3.63 ± 0.13	11.46 ± 0.53

Table 3. Specific skill performance of male basketball players by playing position.

Position	***Dribbling (zones/30s)***	***Shooting (baskets/30s)***	***Passing (points/10)***
PG	22.1 ± 3.0	2.6 ± 1.0	8.8
SG	20.0 ± 1.8	3.2 ± 0.8	9.2
SF	22.7 ± 1.8	2.8 ± 1.0	9.5
PF	20.8 ± 1.9	2.5 ± 1.0	9.8
C	21.2 ± 2.0	2.4 ± 0.7	9.7

The stacked bar chart in figure 4 shows the highest point was recorded by shooting guards players with 4 players score 4 points with this position. Five players from both point guard and small forward scored four points. And one player from power forward score the same four points.

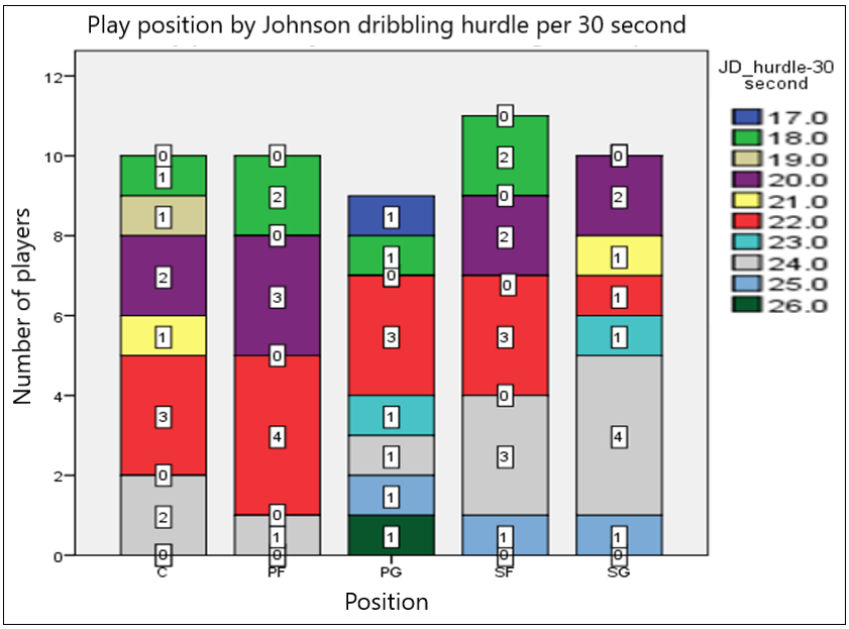


Figure 4. Stacked bar chart on play position and Johnson dribbling hurdle per 30 second (C = Centers; PF = Power forwards; PG = Point guards; SF = Small forwards; SG = Shooting guards).

This stacked bar chart also shows in power forward and center players are found average scorers. Each player scores three points. This chart shows the shooting guard players are the highest scorers in average in Johnson's basketball shooting skill test. And small forward and power forward players are best scorer than center and point guard players.

3.2. Correlation Analysis

The correlation as shown in table 4 suggests that there is a strong positive relation between weight and height (r = 0.7425) and also between arm span of the players and height of the players (r = 0.9094). Whereas, the weight and vertical jumping have positive but weak correlation (r = 0.4870). Interestingly, all anthropometric variables show positive relation.

Table 4. Test of Correlation between the anthropometric variables.

Correlation	***Height (m)***	***Weight (kg)***	***Arm span (cm)***	***Vertical jump (cm)***
Height (m)	1.0000			
Weight (kg)	0.7425	1.0000		
Arm span (cm)	0.9046	0.7113	1.0000	
Vertical jump(cm)	0.5035	0.4870	0.5976	1.0000

Correlation between agility and speed shows insignificant relation (Table 5), as the speed increases by 1 second agility increases only by 0.4323 seconds.

Table 5. Test of Correlation between Physical Performance variables.

	Agility in second	***Speed in second***
Agility	1.0000	
Speed	0.4323	1.0000

The physical performance variables show both positive and negative relation between them but weak (Table 6). Significant positive relation exists (r = 0.4895) between shooting Johnson test (S_Johnson_30 second field goal test) and Johnson dribbling and ball handling test (Johnson dribbling hurdle per 30 second).

Table 6. Test of Correlation between Physical Performance variables.

Specific skill	***Johnson dribbling_ hurdle3~d***	***Johnson Shooting test***	***Passing test joh~3point***	***Passing test joh~2point***	***p~1point Passing test joh~1point***
Johnson dribbling_hurdle3~d	1.0				
Johnson Shooting test	0.49	1.0			
Passing test joh~3point	0.005	-0.07	1.0		
Passing test joh~2point	-0.061	-0.014	-0.074	1.0	
Passing test joh~1point	0.046	-0.046	-0.570	-0.454	1.0

4. DISCUSSION

This study examined whether anthropometric, physical fitness, and basketball-specific skill variables differ across playing positions among adolescent male basketball players in Adwa, Ethiopia. The findings demonstrated significant positional differences in height, weight, arm span, sprint speed, agility, and selected technical skills, with large effect sizes, confirming that player roles are strongly associated with distinct physical and performance profiles.

The observed anthropometric differences are consistent with previous studies, which report that taller players with greater arm span are more likely to occupy interior positions such as Centers and Power Forwards (Larkin et al., 2022). In the present study, Centers exhibited the greatest height and arm span, supporting their functional role in rebounding and shot-blocking, as also noted by Rösch et al. (2022). However, unlike some studies where Centers are typically the heaviest players, Power Forwards in this study had higher body mass. This discrepancy may reflect context-specific factors, including training level, nutritional status, or regional variation in athlete development (Sekulic et al., 2017).

In terms of physical fitness, Point Guards demonstrated superior sprint performance, aligning with their tactical role in initiating fast breaks and facilitating ball movement (Vaeyens et al., 2009). Shooting Guards showed better agility and shooting performance, which supports their role as perimeter scorers and versatile defenders. Small Forwards performed better in dribbling tasks, highlighting their hybrid role that requires both ball-handling and positional flexibility.

The correlation analysis further supports these findings. The strong relationship between height and arm span (r = 0.90, p < 0.001) indicates that these anthropometric traits

develop proportionally and are critical for positional assignment. The moderate association between shooting and dribbling ($r = 0.49$, $p < 0.01$) suggests that technical skills may co-develop, reflecting integrated performance abilities. In contrast, the generally weak correlations among most physical and skill variables indicate that these attributes are relatively independent and should be assessed separately in talent identification programs.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

The results demonstrate that anthropometric, physical fitness, and technical skill characteristics differ significantly across playing positions in adolescent basketball players. Specifically, Centers and Power Forwards are characterized by greater body size, Point Guards by superior speed, Shooting Guards by agility and shooting performance, and Small Forwards by enhanced ball-handling ability. These findings confirm that position-specific profiling is essential for effective talent identification.

5.2. Recommendations

Coaches and trainers should implement multi-dimensional, standardized assessment frameworks that integrate anthropometric, physical, and technical variables to enhance player selection and development. Training programs should also be tailored to specific playing positions, with greater emphasis on speed and agility for guards and on strength and body size for forwards and centers. In Ethiopia, schools and sports programs need to shift from subjective evaluation approaches toward evidence-based talent identification systems. For future research, longitudinal studies are recommended to monitor player development and validate predictive talent models, while larger and more diverse samples should be used to improve generalizability. Additionally, incorporating psychological, tactical, and game-performance variables would provide a more comprehensive understanding of talent development, and the use of advanced measurement tools, such as electronic timing systems, is encouraged to enhance data accuracy.

7. ACKNOWLEDGMENTS

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8. ETHICAL APPROVAL AND CONSENT TO PARTICIPATE

The study was conducted in accordance with the Declaration of Helsinki for research involving human participants. Ethical clearance for this study was obtained from the Research Ethics Review Committee of the College of Natural and Computational Sciences at Aksum University. Permission to conduct the study was also secured from the respective school administrations.

Prior to data collection, informed consent was obtained from all participants, and for those under 18 years of age, agreement was obtained from the participants alongside written informed consent from their parents or legal guardians. Participants were informed about the purpose of the study, procedures, potential risks, and their right to withdraw at any time without any consequences.

All data were collected confidentially and used solely for research purposes, ensuring anonymity and privacy of the participants throughout the study.

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