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Correlation between technical parameters and stature of African women basketball
Corrélation entre la stature et les paramètres techniques chez les basketteuses africaines.

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Abstract : The performance of male and female basketball players is constantly being questioned in terms of results. Multiple criteria are associated with the game, including player ‘s stature, which has emerged as a major factor in team performance. Our objective is to determine the influence of stature on the performance of African teams, as well as the study of a height range related to performance. The statistical study focuses on the stature, technical parameters and final ranking of a population of 141 female basketball players from the 12 teams that participated in the 24th edition of the AFROBASKET 2015 in Cameroon.

keywords : Correlation, Technical Parameters, AFROBASKET Height.

1. Introduction :

In basketball, the specific determinants related to the performance of high-level basketball players continue to question and challenge specialists. Already in the 1970s and 1980s, Bouchard (1984), Astrand (1980), Cazorla (2012) and Weineck (1982) identified several factors that affect performance, including morphological factors. Multiple criteria are associated with this game, including player stature, which according to Norton and Olds (2001), appears to play an important role in the selection process. These variations in stature have been the subject of much relevant analysis among American professional athletes in the National Basketball Association (NBA); this increase in height and mass has had an impact on the performance of athletes. The ranking of finalist teams at major sporting events such as the Olympic Games and World Championships is often closely related to the height of individuals, as Gerard et al (2010) found.

Women's basketball at the highest level has not been so thoroughly investigated in this respect. The latest statistics from the International Federation of Amateur Basketball (FIBA) World show that the evolution of player size has also followed the same course. According to the USA BASKET BALL website, from 1976 to 2012, women's teams have gained an average of 10 cm.

The study undertaken in 2009 by B.Ismet, B.Mikic and H.Pojskic (2009) on the morphological characteristics of Bosnian women basketball players in the first division confirmed the existence of a correlation between anthropometric characteristics and functional capacities in relation to playing positions. In a population of 43 players aged 19 to 24 years, pivots occupying position 5 have a clear tendency to have the highest values for mass and body dimensions (diameters and lengths) indices. This study showed that this kind of morphological profile participates in an increase in the efficiency of shooting close to the basket as well as in the gain of offensive rebounds in attack and attempts to counter shots and rebounds in defense. In basketball, stature is one of the most important references in sports selection, with numerous studies showing that the average height values of basketball players increase as the sports qualification increases (Kuznetsov, 1976). This correlation between average height and results in basketball players is mentioned by Koldakov (1971) and Outkina (1968), revealing a clear tendency to increase, which allows us to understand this positive influence between height and shooting efficiency. According to F. Kwame and M. Sonnenschein (2012), there is a positive correlation between height and longevity of basketball players in the NBA ; individually, height and the number of awards obtained have a positive effect on the length of the player's career.

Stature has often been the subject of studies correlated with game indices such as defensive (ball gains, defensive rebounds) and offensive (shooting, assists, and offensive rebounds) activities and team rankings for men's teams. African teams have been quick to understand the importance of superior size in their rosters. Since the advent of the African Women's Championships, the size of players has continued to improve. For example, Senegal, DR Congo, Angola and Nigeria have won almost every edition of the African Championships. These teams have impressive average heights compared to other teams.

Algeria has also understood the importance of the size factor. In recent years, the women's national team has had a fairly high average height, but has not been able to reach the podium. In this sense, the essential problem facing Algerian technicians is to know whether size alone influences performance or whether it influences certain parameters of the game to the detriment of others. It is in this perspective that this research will be oriented towards the determination through principal component analysis (PCA) which should allow us to search for existing relationships between the different parameters evaluated and to detect possible redundancies between the characters of the same group.

2. Methodology : The focus of this study will be on the last African Women's Nations Championships which took place in September 2015 in CAMEROON. The sample is composed of 141 female basketball players from the 12 teams that participated in the 24th edition of the AFROBASKET, which took place from 24 September to 03 October 2015 in Yaoundé, Cameroon. The characteristics of our population are presented in the following table; the teams having been arranged according to ranking.

Table 1: Statures of the African teams that participated in the 24th edition of the AFROBASKET: Source: FIBA Africa24th edition of the AFROBASKET, 24 September to 03 October 2015 Yaoundé Cameroon

N°	Country	Number	Stature	Country	Number	Stature
1	Senegal	12	184	Gabon	12	176
3	Cameroon	12	181	Egypt	12	180
3	Nigeria	12	180	Guinea	12	180
4	Angola	12	179	Uganda	12	178
5	Mozambique	12	1175	Algeria	12	180

6	Mali	12	180

The parameters collected and which will be studied during our research are:

- The individual and collective stature (cm) of the 12 teams participating in AFROBASKET 2015.

- Game time (min).

- Successful shooting, 2-point, 3-point and 1-point free throws.

- Offensive and defensive rebounds.

- Shots.

- Ball losses.

- Ball gains.

- Counter-attacks.

- Evaluation of individual and team performance.

Results:

Determination of team stature and collective performance per team

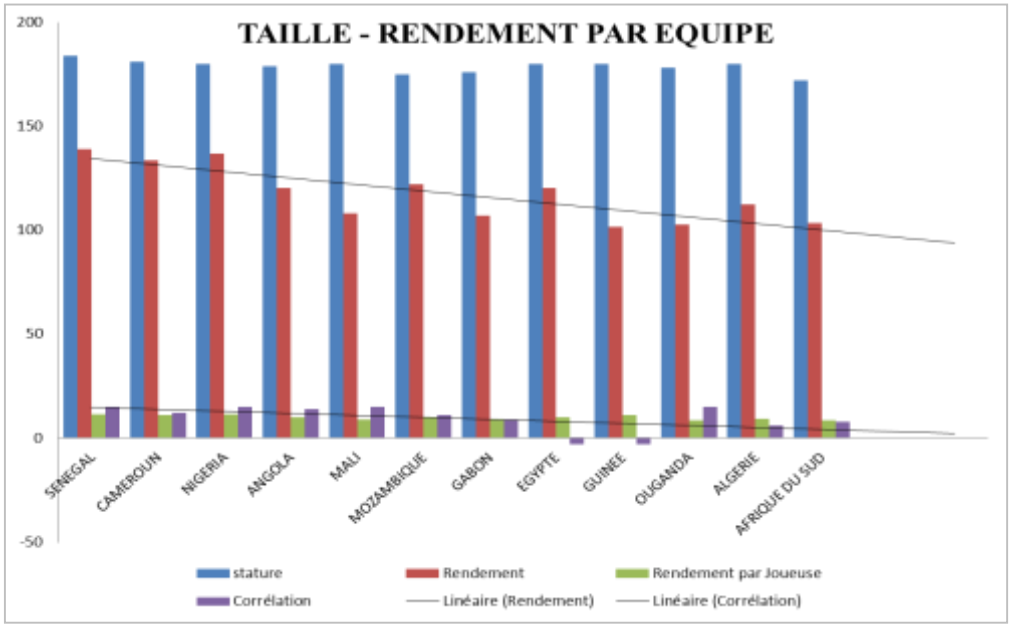
The study of the total stature and technical parameters of the 12 participating teams at the AFROBASKET 2015, allows us to calculate the collective performance, in order to determine the correlations between stature and performance in relation to each team.

Stature:

The average stature value recorded for all participating teams is 179 cm; the average stature for the podium teams is 182 cm. Algeria, with an average height of 180 cm is ranked 3rd with Nigeria, Mali, Egypt and Guinea. The overall performance value in this competition is 117.2. The 3 teams on the podium, Senegal, Cameroon and Nigeria, totaled an average of 136.36, with the highest performance of the competition in favor of the Senegalese team with a value of 138.8. Algeria, on the other hand, recorded an overall performance of 112.24. The stature-performance correlation indicates a highly significant correlation of 0.313** for all participating teams. For the podium teams the correlation is significant with a value of 0.686*. On the other hand, for the Algerian team, the correlation between stature and performance is not

significant. Note that the significant correlation in favor of the Ugandan team with a value of 0.541*, and South Africa with a value of 0.611*, with a lower performance and stature, expresses the existing dependence between low performance and low stature for the Ugandan and South African players (* : Significant correlation at level (α = 0.05) - ** : Very significant correlation at level (α = 0.01).

Figure 01: Graph of average stature, collective performance by team at AFROBASKET 2015



The curves for stature and collective performance show an increase for the top ranked teams, while the figure shows that the curve decreases for the bottom ranked teams.

Correlative study between stature and technical game parameters at the AFROBASKET 2015: Determination of the influence of stature on performance by playing position

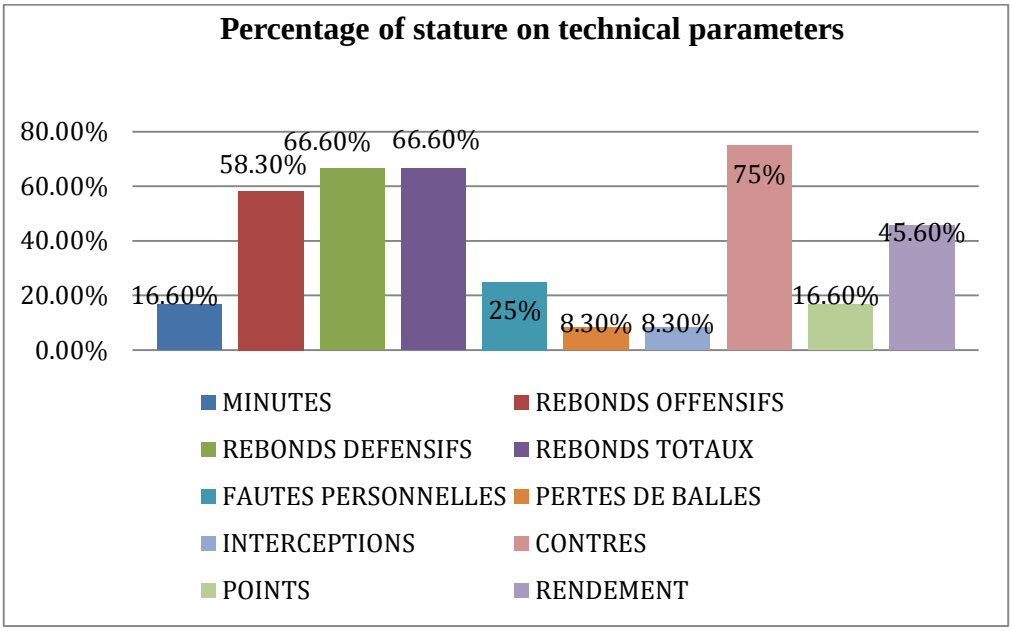
Table 02: Percentage of influence of stature on each technical parameter of the game during the AFROBASKET 2015.

	MIN	RO	RD	TOT	FP	PB	IN	C	PTS	RDM
Percent	**16,6** %	**58,3** %	**66,6** %	**66,6** %	**25** %	**8,3** %	**8,3** %	**75** %	**16,6** %	**45,6**%

MIN: Minutes - RO: Offensive rebounding - RD: Defensive rebounding - TOT: Total rebounds - FP: Personal fouls - PB: Ball losses - IN: Interceptions - C: Contracts and ball deflections - PTS: Points scored - RDM: Average performance, calculated in relation to individual performance.

Table 2 shows the percentages indicating the influence of stature on each technical parameter in this competition; calculated from the technical game parameter-stature correlations and the principal component analysis. Stature influenced mostly the counters, with an influence percentage of 75%, also the total rebounds at 66.6%. Offensive rebounds with a percentage of 58.3%, and 66.6% for defensive rebounds; also, average efficiency, with a percentage of 45.6%; followed by personal fouls with a percentage of 25%. The stature will have influenced at 16.6% the minutes of play, as well as the points scored, and that of 8.3% the steals and the losses of balls during the AFROBASKET 2015

Figure 02: Graph of the percentages of influence of stature on each technical parameter of the game during the AFROBASKET 2015.



The graph of the percentages of influence of stature on the technical parameters of the game seems to indicate that stature influences mainly offensive and defensive rebounds, total rebounds, and counters, at more than 60%, followed by individual performance at more than 40%, as well as points scored and minutes played, at 16%. Stature influences foul provocation at about 25and has an influence on ball losses at 8%, and is only involved in interceptions at 8%.

Determination of the technical parameters of the game influencing performance:

In order to compare the results obtained previously by the percentage of influence of stature on the technical parameters, and to relate the different parameters studied to the final ranking, we carried out a study to determine the influence of the technical parameters of the game on the performance of the teams, through the averages of each team, correlated with the final ranking of the AFROBASKET 2015, in order to verify the results obtained by the percentage of influence of stature on technical parameters, and to identify a possible concordance between the technical parameters influenced by stature, and those influenced by the ranking.

Analysis and comparison of the performance match by match between the Algerian team and the podium teams

We wanted to situate the performance of the Algerian team with the podium teams, in order to determine the performance of the Algerian national team, and to try to interpret the real differences existing between Algeria and its opponents during the AFROBASKET 2015.

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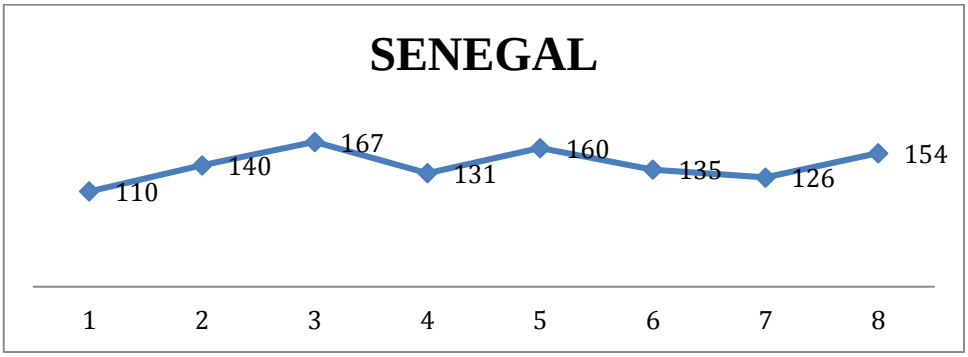
Table 03: Match by match performance of the podium teams and Algeria at AFROBASKET 2015.

SENEGAL		**CAMEROUN**		**NIGERIA**		**ALGERIE**	
VS	**RENDEMENT**	**VS**	**RENDEMENT**	**VS**	**RENDEMENT NIGERIA**	**VS**	**RENDEMENT ALGERIE**
Angola**(*)**	**110**	Mozambique	**137**	Angola **(*)**	**129**	Egypt **(*)**	**91**
Algeria	**140**	Mali	**109**	Egypt	**150**	Senegal**(*)**	**97**
Guinea	**167**	Uganda	**160**	Guinea	**162**	Angola**(*)**	**109**
Nigeria**(*)**	**131**	Gabon	**130**	Senegal	**133**	Guinea **(*)**	**117**
Egypt	**160**	South Africa	**132**	Algeria	**142**	Nigeria **(*)**	**99**
Mali	**135**	Egypt	**141**	Mozambique	**140**	Uganda **(*)**	**129**
Angola	**126**	Nigeria	**139**	Cameroon **(*)**	**134**	South Africa	**118**
Cameroon	**154**	Senegal **(*)**	**126**	Angola	**131**		

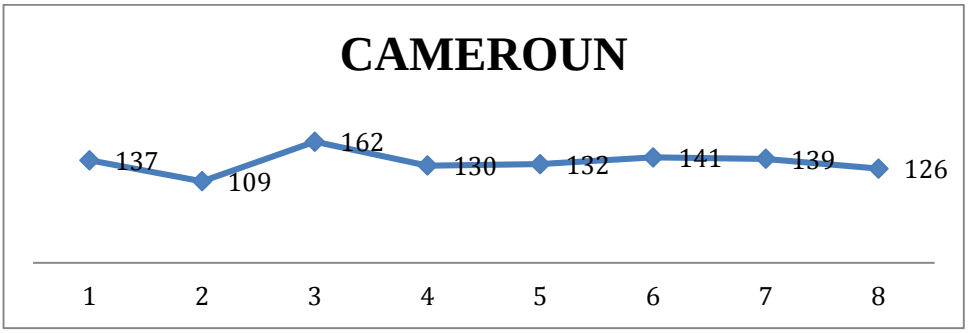
PERFORMANCE: Collective performance in each match. (*): Winner of the match.

The peak yield recorded in the matches is 167, in favor of the Senegalese team, followed by the Nigerian team with a peak of 162, Cameroon records a peak yield of 160. The peak yield for Algeria is 129.

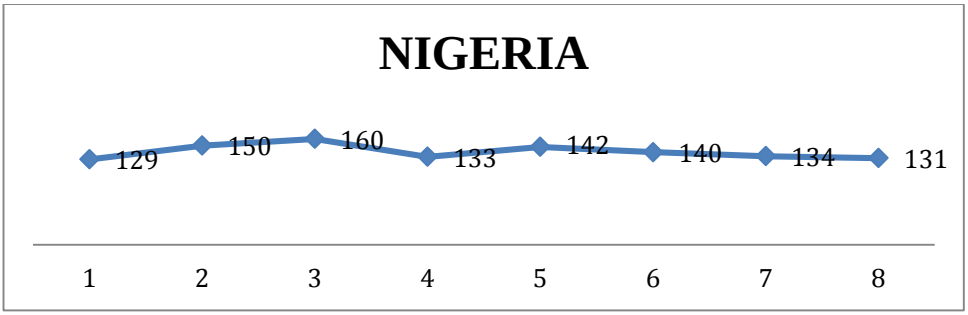
Figure 04: Graphical interpretations of match-by-match returns by team at the 2015 AFROBASKET.



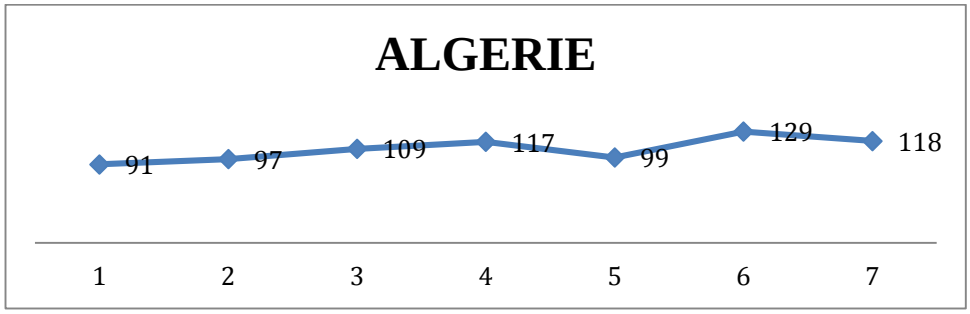
The average performance of the Senegalese team at the tournament is worth 138.8.



The average performance of the Cameroon team at the tournament is worth 133.57

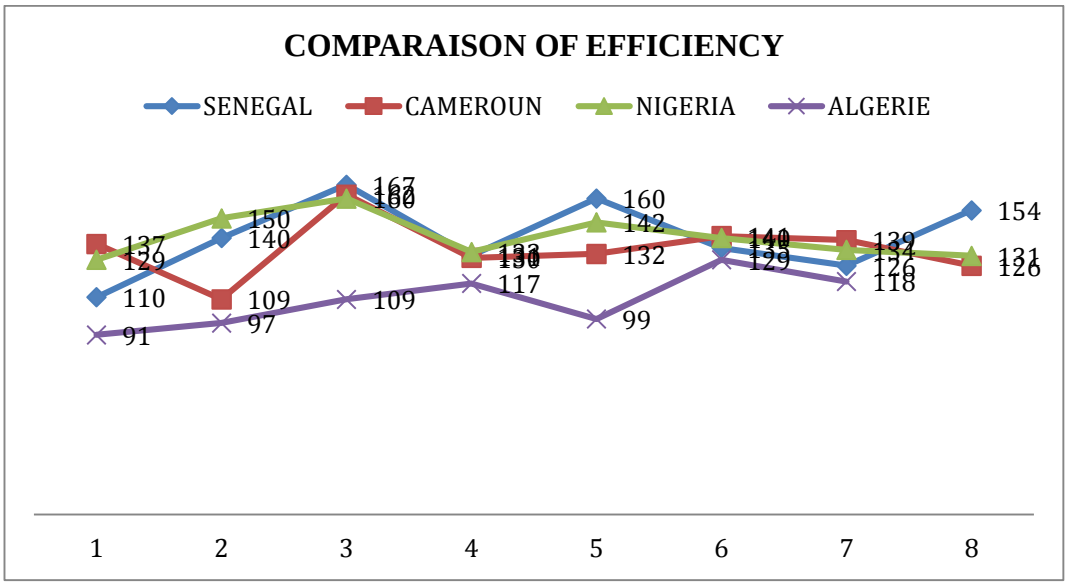


The average performance of the Nigerian team at the tournament is worth 136.72.



The average performance of the Algerian team at the tournament is worth 112.24

Figure 5 Performance graphs for the podium teams and the Algerian team



The curves reveal that Senegal, the 2015 AFROBASKET champion, has a higher performance curve than its counterparts at the tournament.

Nigeria, ranked 3rd, has a more consistent curve compared to the finalist of the competition namely Cameroon.

Cameroon's curve is slightly lower and has more pronounced extremes between its minimum and maximum recorded peaks.

Algeria's yield curve is clearly lower than that of the teams on the podium, although it does show an increase towards the end of the competition.

Table 4: Match by match performance between the podium teams and the Algerian team at the AFROBASKET 2015.

Team	Senegal	Cameroon	Nigeria	Algeria
General efficiency	**138,8**	**133,57**	**136,72**	**112,24**

The highest average performance in this competition is represented by the value of 138.8 in favor of the Senegalese team, champion of the 24th edition of AFROBASKET 2015; following the comparison of the averages, the lowest average performance is that of the Algerian team, ranked 11th out of 12 in this competition.

Discussion:

The study of the performance of the podium teams and the Algerian team, allows us to note that the higher the performance of the opponent, the higher the performance, and consequently the matches are more easily won, as the results indicate; Algeria, whose performance is clearly inferior to that of the podium teams, finds itself ranked in last position. This comparison suggests that the positive stature-performance relationship is involved in the performance of the podium teams, with a very significant value, while the value recorded is insignificant for Algeria, which could justify the low performance produced by the Algerian women at the AFROBASKET 2015. "High stature ensures better performance" OSTOJIC, MAZIC, and DIKIC, (2006). The comparative study of the optimums of size and performance and individual and collective performance, allows us to verify our previous results, where, the more the optimum of size moves away from the general interval, the less the performance is effective; Algeria thus records one of the lowest individual and collective performance. Following the comparative analysis of performance, stature and its correlations by playing position, between the Algerian national team and its opponents, essentially the podium teams, it emerges that the tall backs and pivots have strongly contributed to the performance. The results show that the inside-outside relationship is favored for the podium teams, while the Algerian team's wingers have a better performance compared to the backs and pivots, in line with the results of other investigations, which allow us to claim that the Algerian players mainly use the counter-attack. However, the results show that this form of attack is less effective than transition play and positional attack, as Remmert (2003) states: "the variety of actions with 2, 3, and 4 players increases the success of the offensive action"; This could explain the strong difference in performance

between Algeria and the podium teams, and its final ranking of 11th place in the AFROBASKET 2015

Conclusion:

The present study allowed us to address the morphological criterion, which is stature and measure its influence on the technical parameters of the game, as well as on the performance of the teams at the AFROBASKET 2015. Stature has always been a major factor in the selection and orientation of top players, and has emerged as the criterion that optimizes performance in basketball. All teams participating in major continental or world events are aligned in terms of average height. However, beyond this average height known to all, other data allow us to redefine the importance of this criterion. The results of this study clearly show that stature had a positive influence on performance in this African competition. As the stature of the players increases, we note that the performance is better, especially for the higher ranked teams, such as the podium teams.

Given the poor performance of the Algerian national team at this 24th edition of AFROBASKET 2015, and given the results obtained, we suggest a re-evaluation of the selection criteria of Algerian players participating in international competitions, also, to focus on the technical-tactical training of the latter, especially for the backs.

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