

# Effect of Game Location Factors on Basketball Players' Reproductive Hormone at Home and Away Ground

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**Abstract:** Playing venue is a robust phenomenon that affects the players' physiological and psychological states. The present study aimed to compare the effect of playing venue factors and testosterone concentration levels of players at home and away playing ground. For this purpose, Nineteen-six male university basketball players with ages 18-24 years old were selected from different private and public universities of Lahore. Matches were scheduled in such a manner so that each team would play one match on home ground and one on away ground. Testosterone level was measured before and after each match. The survey response on playing venue factors was taken after the match. Elevated testosterone levels, before playing a match, as evidenced at home ground, however, a 4% decline was recorded in testosterone level at away venue, even before playing the match. Pre-match testosterone concentration and the percent change in this hormone on away playing ground was related to traveling and referee's biased decisions. In conclusion, the playing influenced hormonal responses before the commencement of basketball matches at away ground. This hormonal response was related to players' psychological state, which might contribute to players' behavior and outcomes of matches.

**Keywords:** Basketball, Player, Testosterone, Playing venue factors

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## Introduction

Sports like basketball have an intermittent team which characterizes by two main periods i.e., high-intensity activity and low-intensity recovery periods (Castagna *et al.*, 2020). High-intensity activity periods comprise high-speed running, jumping, sprinting and bodily contact while low-intensity recovery periods contain e.g., standing, walking, and jogging (van Gogh *et al.*, 2020). These performed over four quarters in a basketball match and to apply maximum energy during the match to win it (Reina *et al.*, 2020). Thus, most probably the high-intensity demands may cause worry to the immune, endocrine and muscular systems (Kirwan *et al.*, 2020). In this context, a playing venue (home advantage) is a valid tool for monitoring a player's hormonal response, aggressive and dominant behavior (Tabassum *et al.*, 2021).

The term "Home Advantage" (Playing Venue) is recognized worldwide by specialists, players, commentators and managers virtually in all team sports like basketball, ice hockey, volleyball and football (Sattar *et al.*, 2021). Regardless of the level of experience in basketball players, the players who perform at their home venue win more matches and basketball players score more baskets than the players who are participating away from their home location especially in a basketball game. Various variables have been studied to find out the cause behind this effect. Better performance is due to constant encouragement from a familiar crowd is one of the main reasons for winning (Singh, 2011). One considerable factor is that crowd density and noise increase the home advantage (Jiménez Sánchez *et al.*, 2021). Where the stadia are domed, the American baseball and football teams gain more home advantage due to their favorable noisy crowd (Hyun, 2021). Home advantage also includes the contribution of biased behavior of referees. Yearbook Opt a football, English premier ship football season 2000-2001 reveal significant referee statistics and differences in yellow cards and penalties. Sors *et al.* (2020) researched football referees' performance without the noise of home advantage. The familiarity with home location is related to the third explanation. Spatial awareness increases due to the familiar visual cues, which allows the footballer to change directions more quickly at a home location than away from a home location (Capellini and Sacchi, 2021). A significant contribution of knowledge and experience about the size and surface of a basketball court has been seen through the results of various researches (Brochado *et al.*, 2021). In a study of results over eight seasons, West *et al.* (2021) found that teams playing on artificial surfaces had a moderately inflated home advantage. Home advantage also involves the advantage of less routine disruption and fatigue caused by travel. Childs (2021) found that the basketball team faced a disadvantage for traveling more than 200 miles, as compared to those who were near to their home location. Mkutu (2021) expressed minor effects of traveling over performance, and territoriality also has gained little attention about its effects on performance, the protective response to an invasion of one's perceived territory. Various findings of research about animals show that male animals have a more agonist attitude than female animals due to a higher concentration of testosterone which is a steroid hormone (Li *et al.*, 2021). Accordingly, at the time of puberty, the concentration of testosterone hormones begins to increase and accordingly, the level of aggression also increases (Kristensen *et al.*, 2021). Aggressiveness is also influenced by the artificially raised testosterone level (Braconnier *et al.*, 2021). Territorial aggression in animals has been associated with circulating levels of testosterone, with invasion stimulating a subsequent rise in testosterone steroid hormone (Dijkstra *et al.*, 2012). When the dominance hierarchies are established, the changes in the level of testosterone are observed (Cummins, 2016).

The objectives of the study are to find fluctuating testosterone concentrations of basketball players depending on the match location. This research examines relationships between testosterone level and playing venue factors. To address these objectives, the present study was conducted for this purpose.

### **Material and Methods**

In this study ninety-six, university volleyball players having an age range between 18 to 25 years from eight public and private universities situated in Lahore city were recruited. All physically fit players who had participated in the Higher Education Commission (HEC) inter-university sports competition 2016-17 representing their university were recruited for the present analysis. Players were involved in their routine training schedule. Consent was taken from each of the players as well as their directors and team

management before the commencement of the study. To collect the data of both home venue and away venue competition, basketball matches were organized in such a way that every team got a chance to play one match on her home ground and one match on away venue with the same team. Blood sampling was conducted before sixty minutes of the commencement of match time. A registered medical technician from a patent pathology laboratory, under the supervision of a qualified medical practitioner, was hired for the blood samples of recruited players for pre-test analysis, keeping in view all the ethical aspects. Then, players were allowed to play the match and fifteen minutes after the match, again medical staff took a blood sample for the post-test analysis (Arruda *et al.*, 2014). The same practice was repeated in all eight basketball matches with the time-lapse of one match after every three days early in the morning after getting an eight-hour normal sleep on average and a standard local breakfast having basic macro and micronutrients. Every time after taking the blood samples medical staff shifts those samples to the pathological laboratory for assessment of Testosterone level in the blood, before and after matches. Testosterone assessment was done by Enzyme-Linked Immunosorbent Assay (ELISA).

#### **Procedure of Playing Venue Factors Assessment**

The psychometric response of players on playing venue factors was taken 40 minutes after the match on home and away grounds through a questionnaire (Annexure E), which was based on 6 factors (tactics, territoriality, familiarity, referee bias, crowd support, travel) and each factor contained 10 statements, rating on five point-point Likert Scale (1=Never; 2=Seldom; 3=Sometimes; 4= Often; 5= Always).

#### **Statistical Analysis**

Results were analyzed, statistically by paired sample “t” test using the latest version of SPSS (22) officially named IBM SPSS statistics (Carré *et al.*, 2006), to work out the significant variations amongst the parameters of the study, in comparable groups. Secondly, descriptive statistics were applied to measure playing venue factors of players.

#### **Results**

A significant reduction ( $P < 0.001$ ) of 11% in post-test testosterone levels was evidenced at the home ground when compared with pre-test levels. Prominent reduction ( $P < 0.001$ ) of 16% in the post-test testosterone level was noticed at away ground as compared to pre-test testosterone levels. A mild difference was present in testosterone level in pre-test *vs* pre-test comparison of basketball players while, playing on a home and away playing venues, respectively. Obvious reduction ( $P < 0.001$ ) of 19% was present in post-test testosterone level at away ground, as compared to pre-test levels on the home ground venue. Non-significant variation was present in post-test *vs* pre-test comparison of testosterone level of basketball players, while, playing on a home and away playing venues, respectively. Marked ( $P < 0.05$ ) reduction of 9% was evidenced in post-test testosterone level on away ground, as compared to the post-test analysis of testosterone at home ground (Fig1, Table 1).

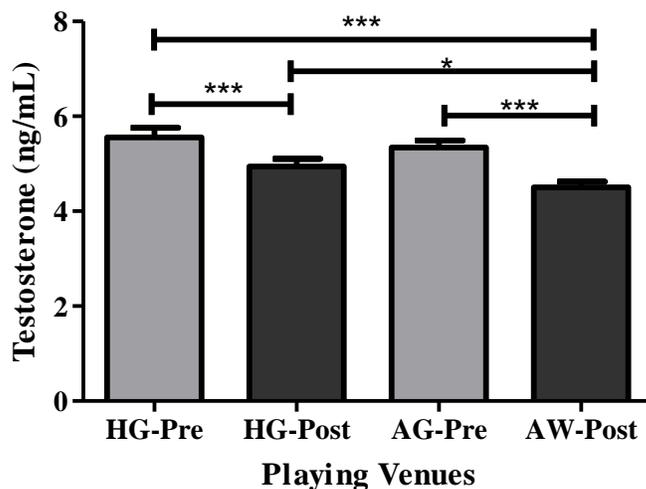


Fig. 1: Average Level (ng/mL) of Testosterone at different venues

HG Pre B: Home Ground Pre-test Basketball, HG Post B: Home Ground Post-test Basketball, AG Pre B: Away Ground Pre-test Basketball, AG Post B: Away Ground Post-test Basketball

\*,\*\*\* indicate significance at  $P < 0.05$ ,  $0.001$

Table 1 Average level of Testosterone (ng/mL) on comparable groups.

Game	#	Venue comparison	Test type	Testosterone (ng/mL) Mean ± SEM	Percentage Difference	P-value
Basketball n=96	A	Home vs Home	Pre Post	5.55 ± 0.20 4.94 ± 0.15	11↓***	< 0.0001
	B	Away vs Away	Pre Post	5.34 ± 0.14 4.50 ± 0.11	16↓***	< 0.0001
	C	Home vs Away	Pre Pre	5.55 ± 0.20 5.34 ± 0.14	4↓	0.4
	D	Home vs Away	Pre Post	5.55 ± 0.20 4.50 ± 0.11	19↓***	< 0.0001
	E	Home vs Away	Post Pre	4.94 ± 0.15 5.34 ± 0.14	8↑	0.0667
	F	Home vs Away	Post Post	4.94 ± 0.15 4.50 ± 0.11	9↓*	0.0253

\*,\*\*\* indicate significance at  $P < 0.05$ ,  $0.001$ , respectively.

Playing Venue Factors of Basketball

**Table 2: Playing Venue Score of basketball Players**

Venue factors	Venue	N	Mean $\pm$ SEM	<i>P</i> value
Tactics	Home Ground	96	3.20 $\pm$ 0.04	0.000*
	Away Ground		3.11 $\pm$ 0.35	
Territoriality	Home Ground		3.28 $\pm$ 0.08	0.124
	Away Ground		3.20 $\pm$ 0.08	
Familiarity	Home Ground		3.05 $\pm$ 0.01	0.000*
	Away Ground		3.02 $\pm$ 0.01	
Referee Bias	Home Ground		3.76 $\pm$ 0.04	0.000*
	Away Ground		3.66 $\pm$ 0.05	
Crowd Support	Home Ground		3.23 $\pm$ 0.02	0.273
	Away Ground		3.18 $\pm$ 0.02	
Travel	Home Ground	3.40 $\pm$ 0.05	0.206	
	Away Ground	3.45 $\pm$ 0.05		

\* $P < 0.05$  is considered as significant variation

Table 2 presents the effects of match tactics on home and away ground. There was a significant difference between match tactics on home and away ground. The average score of match tactics was  $3.20 \pm 0.04$  on home ground, which decreased by 3% on away ground. The average level of match tactics on away ground  $3.11 \pm 0.03$ .

Table 2 presents the effects of territoriality on home and away ground. A significant difference between territoriality on home and away ground was evidenced. The average level of territoriality on home ground was  $3.28 \pm 0.08$ , which decreased by 2.4% on away ground. The average score of territoriality was  $3.20 \pm 0.08$  on away grounds.

Table 2 presents the effect of familiarity with match conditions on home and away ground. The obtained value indicates a significant difference in familiarity with match conditions between home and away ground. The average score of familiarity with match conditions was  $3.05 \pm 0.01$ , which decreased by 1% in away ground. While the average level of familiarity with match conditions was  $3.02 \pm 0.01$  on away grounds.

Table 2 presents the effect of referee biases on home and away ground. The value indicates that there is a significant difference in referee biases concerning the players' home and away ground. The average level of referee biases was  $3.76 \pm 0.04$  which decreased by 2.6% on away ground. The average level of referee biases on players' performance was  $3.66 \pm 0.05$  on away ground which reflects that players do feel more comfortable, while, playing on home ground.

Table 2 also presents the effect of crowd support on home and away ground. The resultant value indicates that there is a significant difference in crowd support on home and away ground. The average

score of crowd support was  $3.23 \pm 0.02$  which decreased by 1.5% on away ground. While crowd support value was estimated to be  $3.18 \pm 0.02$  on away grounds.

Table 2 also presents the effects of traveling to reach the match venue on match results. A mild difference is noticed regarding the traveling of players reaching playing venues. The average score of traveling to the home venue was  $3.40 \pm 0.05$  which increased by 1.4% on away ground. The average score of traveling to away venue was  $3.45 \pm 0.05$  which reflects that players take stress to reach their competition venue either playing on away ground or home ground (Fig 2).

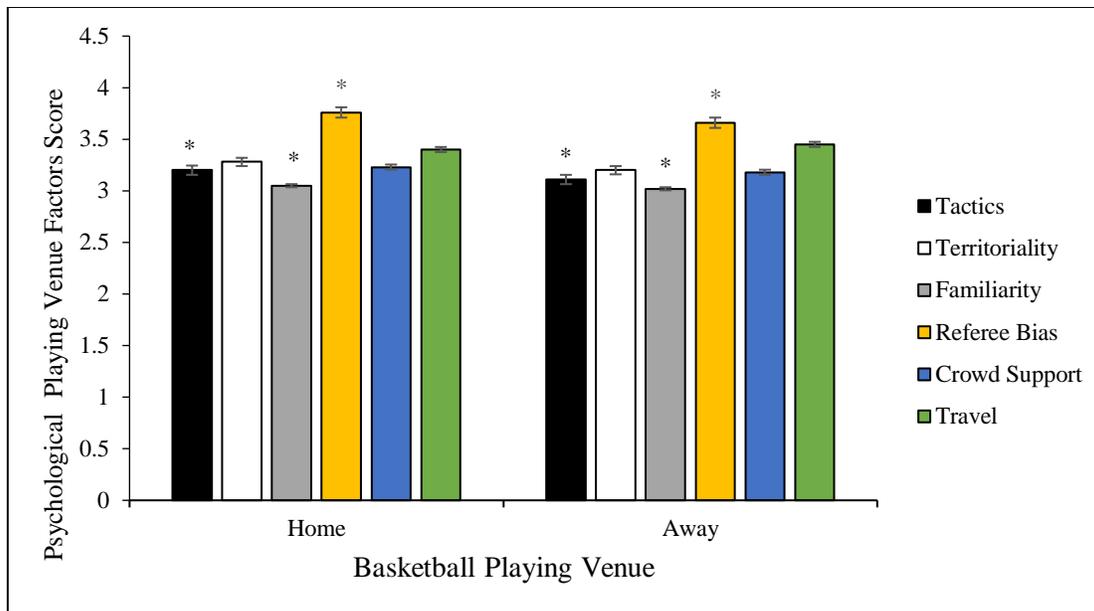


Fig. 2 Playing Venue Factors Score of Basketball Players

\* $P < 0.05$  is considered as significant variation

## Discussion

The present research has shown the game location effect on testosterone level in the blood of male university basketball players before and after the competition and secondly, players' opinion on playing venue factors after the match. There are several key findings of this study, conducted on male inter-university basketball players. It was observed that when players performed at their home playing venue, their level of testosterone was raised and they also won the matches due to increased scores of territoriality, crowd support, tactics, familiarity, and referee bias. Further, it was also documented in the current study that the testosterone level of players was declined on an opponent's playing venue even they did not play the match yet due to an increased score of traveling and referee's prejudice on away ground before and after the match.

Testosterone, particularly, among males, is an anabolic hormone that influences sports competition by increasing motivation and physical ability to compete (Cook et al., 2018). In our findings, the testosterone level was significantly elevated on the home ground and decreased on away ground. The trend of reduced testosterone levels in players was seen on away playing ground situations in comparison to the

testosterone level of the same players on their home ground, it was declined just because of the changing the playing venue. Moreover, this reduced trend of testosterone might harm away playing venues. The reduced testosterone level might halt the overall performance of game tactics and poor skill execution resulting in losing a match on grounds other than home.

Some studies found no alteration in the hormonal profile of playing at the home venue or away venue (Arruda *et al.*, 2017; Furley *et al.*, 2018 ). Whereas, some researchers found a significant difference in the hormonal profile of players who are participating in the competition, played at home venue as compared to those players who are playing away from the home ground.

Additionally, it has been documented earlier that the concentration of testosterone hormone increases after winning the competition, whether it is in the home ground or away from the home ground (Arruda *et al.*, 2014).

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