Effect of Playing Venue on Pre-Competition Cortisol Level and Competitive State Anxiety in University Basketball Players

Yasmeen Tabassum\textsuperscript{1}, Sumera Sattar\textsuperscript{2}, Muhammad Amir Iqbal\textsuperscript{3}, Muhammad Zafar Iqbal Butt\textsuperscript{1}, Muhammad Abdul Jabar Adnan\textsuperscript{1} and Nabila Roohi\textsuperscript{3}

\textsuperscript{1}Department of Sport Sciences and Physical Education, University of the Punjab, Lahore, Pakistan. \\ \textsuperscript{2}Health and Physical Education Department, Lahore College for Women University, Lahore, Pakistan. \\ \textsuperscript{3}Physiology / Endocrinology Laboratory, Department of Zoology, University of the Punjab, Lahore, Pakistan.

Authors’ contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The main aim of this study was to investigate the effect of playing venue for pre-competition cortisol and state anxiety in university male basketball players. Ninety six players from public and private universities of Lahore have evaluated during eight competitive matches played at home (n=4) and away (n=4) venues. Blood samples were collected to analyze the cortisol concentrations by the ELISA assay and state anxiety was assessed using the CSAI-2 questionnaire. All the data collection took place before the pre-match warm-up. Data was analyzed by using paired sample t test. Results showed that cortisol was significantly (p=0.002) elevated on away ground, whereas, somatic state anxiety was markedly (p=0.001) increased on an opponents home ground. In conclusion, it is suggested that playing venue affects cortisol response and anxiety score values on away ground that results in psychological interventions for players to deal with all threats and stressful stimuli of playing venue factors affecting the players performance on an opponents home ground.

*Corresponding author: E-mail: yasmeentabassum111@gmail.com;
1. INTRODUCTION

The home advantage concept is a factor that should be taken into account in team sports competitions like basketball, rugby, football, ice hockey and baseball [1,2]. The teams that play in their home ground, win 50% of matches; it is described by a term, called Home Advantage [3]. Some playing venue contemplations have been proposed to highlight the home advantage marvel, for example, tactics of games, traveling, crowd and familiarity with sports facilities [4]. The apparent advantage of playing at home can be connected to the possibility of territoriality and incomparability, mirroring a feeling of proprietorship rights over an actual region [5]. In many animals, single or group members defend their region from others intruders, is considered as defensive activity [6]. Athletes often exhibit similar territorial behavior to animals in the sense of professional sports, marked by a rise in steroid hormones [7] and aggressive behavior [7]. Indeed, a competitive environment has been associated with some steroid hormones, such as cortisol [8]. Cortisol is viewed as a clinical marker for the activation of the hypothalamic-pituitary-adrenal hub (HPA). Increases in activation of the HPA axis have been correlated with major psychological or physiological stress in sports settings, leading to high concentrations of cortisol [9]. Compared to simulated games or training sessions, a rise in cortisol concentration has been noticed before official games [8]; and earlier games played at home compared to away playing venues [10]. Although, psychological responses contribute to the outcome of the game but competitive state anxiety also has a significant role on the overall result of the game.

The Competitive State Anxiety Inventory-2 (CSAI-2) is considered to examine the players mental, physiological and behavioral symptoms before the match [11]. Previously, an increase in cognitive and somatic distress was also identified in training sessions of official games [12].

Studies have demonstrated greater cognitive and somatic anxiety pre-match in players when they play on the home field of their rival. Whereas, their self-confidence score was evaluated high before-match at their home ground venue. Despite the aforementioned findings, some studies did not discover any influence of game role in some team sports or found opposite effects on hormonal and psychological pre-competition responses [7,13].

So, the current research was endeavored to analyze the effect of playing venue on pre-competition cortisol level and competitive state anxiety in inter-university male basketball players, during the eight competitive double league matches on a home and opponents home playing ground. In light of the findings previously mentioned and following the concept of territoriality, it was hypothesized that a higher level of cortisol, cognitive anxiety and somatic anxiety scores would be seen when playing at the opponents home ground.

2. METHODS

2.1 Sample Selection

In this study ninety-six, university basketball players having an age range between 18 to 24 years from eight public and private universities situated in Lahore city were selected. As per HEC sports competition rules, 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. These were professionally trained and mature players representing their universities in competitions on different playing venues. Consent was taken from each of the players as well as from their director sports and team management before the commencement of the study.

Census sampling was used to choose the participants as it was based only on those universities which were situated in Lahore City. There were eight universities whose basketball teams participated in HEC Intervarsity sports competitions. A basketball team consists of 12 players but 5 players play from one side in a basketball game in a match. Participants were guided about competitions at different venues, blood sampling (before and after matches) and giving their responses to the questionnaire.

2.2 Research Design

In this study, pre-test and post-test experimental research design were used to evaluate the hormonal responses of players through blood
sampling 60 minutes before and 15 minutes after matches on the home venue and away playing venues. Following blood sampling, psychological state (before competition) psychometric response on playing venue were measured. All the matches were conducted early in the morning with the time-lapse of one match every three days. All participants were bound to take an eight-hour normal sleep before blood sampling and data evaluations [14]. Standard local breakfast (omelette, paratha and tea) was offered to each player, having basic macro and micronutrients to manage the Hormonal response of the players at a standardized level.

2.3 The Procedure of the Study

After the identification of potential participants of the study, permission was obtained from all the director sports of allocated universities to get access to their basketball team players. The objectives and significance of the study were shared with players by visiting all universities on a stipulated date and time. Written consent was obtained from all of the players of basketball teams through the consent form. To fulfill the objectives of the study, we organized matches of both games in such a way that every team found the chance to play one match on their home ground and one match on away ground (double league match competition).

2.4 Competition Schedule

To manage matches HEC ranked teams were settled in such a manner that only consecutive ranked teams played matches with each other. Like the HEC winner team played with the HEC runner-up team, similarly, the number three team played with number four and so on. This schedule was set just to ensure that each team played with a team having similar fitness and skill levels.

2.5 Blood Sampling Procedure

A blood sampling practice was conducted in the dressing room of players 60 minutes before the commencement of the match. A professionally trained registered technician from a patent pathology laboratory, under the supervision of a qualified medical practitioner, drew the pre-test blood samples from all of the players keeping in view all the ethical aspects which includes use of Ultra Disposable hypodermic syringes 5cc, using intravenous rout of arm part of the body [15]. Then players moved to the court for the match and 15 minutes after the match again medical staff took a blood sample for post-test analysis. The same practice was repeated on all 8 basketball matches. Every time after taking the blood samples, serum was separated and stored at – 80°C for hormonal analysis. All of the serum samples were analyzed for cortisol by Enzyme-linked immunosorbert assay (ELISA).

2.6 The Procedure of Psychometric Assessment

Participants were advised to arrive at the playing venue 90 minutes before the starting time of the match and a psychometric assessment was taken 30 minutes before the start of a match. Both teams were preceded by warm-up, light coordination exercises, show ball drills and stretching of the major muscle groups. Each player was asked to perform in his normal psychological mode with no extra pressure. Psychological data was measured using the Competitive State Anxiety Inventory 2 (CSAI-2) [16]. This assessment tool (rating-scale) has been extensively used in the sport psychology literature and assesses each players pre-game cognitive anxiety, somatic anxiety levels as well as pre-game state of self-confidence. The Illinois Competition Test or CSAI-2 consists of 27 items, with 9 items for each of the subscales, named cognitive anxiety, somatic anxiety and self-confidence. All items were rated on a 4-point Likert-type scale, signifying with 1 at not at all, 2 at somewhat, 3 at moderately so and 4 at very much so.

2.7 Competition Result

The total no. of 4 matches were played at home ground, only one match was lost by the home team against the opponent team whereas, the home team played total no. of 4 matches on their opponents home ground and they lost all 4 matches playing against on an opponents home ground.

2.8 Statistical Analysis

Results were analyzed, statistically by paired sample t test using the latest version of SPSS (22) officially named IBM SPSS statistics [17], to work out the significant variations amongst the parameters of the study, in comparable groups. Secondly, descriptive statistics were applied to evaluate the psychological state of players.
3. RESULTS

3.1 Cortisol Level (μg/dL) of Basketball Players

Fig. 1 demonstrates a pre-test vs pre-test comparison of cortisol level of basketball players, while, playing on the home and away playing venues, respectively. Cortisol pre-test home venue was estimated to be 9.01 ± 0.39 μg/dL which increased by 16 % in away pre-test estimation. The level of cortisol in away pre-test analysis was 10.42 ± 0.9 μg/dL (Table 1).

3.2 Psychological State of Basketball Players at Playing Venue

Table 2 shows the psychological state of basketball players on home and away grounds regarding state anxiety and self-confidence. The psychological state of basketball players on home and away grounds regarding cognitive state anxiety shows that players feel more cognitive anxiety on away grounds as compared to their home grounds. The average cognitive state anxiety score on home ground was 2.15 ± 0.04 which was mildly increased by 14%, while, playing on an away venue. The cognitive state anxiety score on away ground was estimated as 2.46 ± 0.04.

Table 2 also shows that players feel more somatic anxiety on away grounds as compared to their home grounds. The average somatic state anxiety score on home ground was 2.57 ± 0.04 which was increased significantly by 5%, while, playing on an away venue. The somatic state anxiety on away ground was estimated as 2.71 ± 0.03.

Table 2 also shows that players feel more confident on their home grounds as compared to away ground. The average self-confidence score on home ground was 2.14 ± 0.06, which was declined non significantly by 3%, while, playing on an away venue. The self-confidence on away ground was estimated as 2.07 ± 0.06 (Fig. 2).

![Fig. 1. Average Level of Cortisol (μg/dL) in HG Pre B vs AG Pre B analysis](image)

HG Pre B: Home Ground Pre-test Basketball; AG Pre B: Away Ground Pre-test Basketball

**Significance at p< 0.01

Table 1. The average level of Cortisol (μg/dL)

| Game            | Venue comparison | Test type | Cortisol level (μg/dL) Mean ± SEM | Percentage Difference | t-value | P-value |
|-----------------|------------------|-----------|----------------------------------|-----------------------|---------|---------|
| Basketball      | n=96             | Pre       | 9.01 ± 0.39                      |                       |         |         |
|                 |                  | Pre       | 10.42 ± 0.19                     | 16% **                | 3.14    | 0.002   |

** indicate significance at p< 0.01

Table 2. Psychological State score of basketball players using paired sample t test

| Psychological Components | Venue       | N  | Mean ± SEM | p-value |
|--------------------------|-------------|----|------------|---------|
| Cognitive State Anxiety  | Home Ground | 96 | 2.15 ± 0.04| 0.584   |
|                          | Away Ground |    | 2.46 ± 0.04|         |
| Somatic State Anxiety    | Home Ground | 96 | 2.57 ± 0.04| 0.001*  |
|                          | Away Ground |    | 2.71 ± 0.03|         |
| Self-Confidence           | Home Ground | 96 | 2.14 ± 0.06| 0.712   |
|                          | Away Ground |    | 2.07 ± 0.06|         |

**p< 0.01 is considered a significant variation
4. DISCUSSION

The present study was conducted on inter-university male basketball players to evaluate the pre cortisol and anxiety score of players on a home ground and an opponents home ground. As the home playing venue phenomenon is considered a crucial factor on overall performance of the players.

In our findings, the pre-competition cortisol level and anxiety score of players were recorded higher on an opponents home ground before the start of a match. The results of the current study show that as players changed their home playing venue and moved on the opponents home ground their cortisol and anxiety score was increased due to unfavorable playing venue conditions. Opposite to the concept of territoriality, their assertive behaviour was turned into fear and an apprehension state due to which they lose their matches on the opponents home ground.

In the present study, the basketball players seem to perceive more stressful and threatening situations playing on away ground than home ground, demonstrated by a moderate and clear effect of playing venue on cortisol and state anxiety.

Whenever, any sign of disturbance is observed, HPA response through cortisol biosynthesis acts as an indicator of stress condition (van Dalfsen and Markus, 2018). In response to the unstable and stressful conditions, Cortisol (C) begins to rise. For example, in a competitive state, a player encounters several psychological stimulators and stressors, perpetuating the rising of C that results in altered glucose level, cardiovascular activation and anti-inflammatory responses to tackle the overwhelming stress [18].

In an investigation by Arruda, Aoki, Paludo & Moreira [8] conducted on pre and post-match conditions, a significant change in the concentration of cortisol due to an increased level of anxiety and match tension was evidenced. It was observed in a meta-analysis study, the psychological stressors were studied in the laboratory. The researchers artificially created stress stimulators in the laboratory to assess the change in cortisol production. They observed an increased level of C due to the occurrence of unstable and social evaluative elements especially when they occur for longer periods.

Moreover, responsiveness to psychological and physical stressors as well as competitive situations results in elevated C levels (Edwards & Kurlander, 2010). It also occurs in response to stressful physical activity like heavy exercise or any other physiological changes [19]. In response to the release of the C hormone the cardiovascular activity becomes faster as blood is pumped more rapidly by the heart, elevated glucose production and anti-inflammatory response becomes more enhanced [20].

It has been evaluated that the psychophysiological responses of Rugby players in pre-match on home and away playing ground, and the players demonstrated a higher cortisol concentration in pre-match at away ground as compared to home ground [21].

The researchers estimated a few factors that could be credited to this outcome, for example,
that players may see playing away from home as more undermining than playing in natural environmental factors at the home scene, taking into account that cortisol adjusts a few physiological instruments and social reactions to compromising conditions [22] just as the conceivable pressure identified with the group travel to away settings on pre-match cortisol fixation.

Other studies have demonstrated high cortisol levels in players of the pre-game condition on their home ground as compared to away due to the expectations level of spectators and match outcomes [17]. It has been proposed earlier, crowd density may play an important role in the home advantage [23] and this crowd density is likely to increase the cortisol responses in the athletes playing away.

Moreover, some studies have reported that teams traveling to their opponents venue are more likely to lose the games compared to home games due to fatigue and stress [24] however, no traveling effect was found elsewhere [25]. In the current study, the away ground matches included approximately 1-hour and fifteen minutes trips by university bus and players were observed in discomfort and distress conditions.

Another study observed that a change in somatic anxiety was expected due to evidence of a positive correlation of pre-match cortisol concentration and somatic anxiety state of players on an opponents home ground [11,8]. Moreover, increases in self-confidence in-home locations were predicted to be intensified as previously found [17], as demonstrated in the current research. Arruda, Aoki, Freitas, Drago, Oliveira, Crewther & Moreira [7] also found no difference in cognitive and somatic anxiety and self-confidence in pre-game basketball athletes played at home and away from places. The same trend was observed in current research. Also, previous studies have not found an association between cortisol and somatic and cognitive anxiety [21]. The physiological arousal level and human awareness may be the reason for a potential explanation. As speculated from previous research, when it was below higher levels, a person likely perceives physiological arousal (e.g. changes in cardiac autonomic responses and/or release of hormones). Analyzing the performance effects of somatic anxiety (Ford, Ildéfonso, Jones & Arvinen-Barrow [26]) documented about the Athletes were hypothesized to experience their physiological signs only under a high degree of somatic anxiety.

Additionally, the idea that athletes who displayed a high level of pre-game cortisol may have subjectively indicated lower somatic anxiety is highlighted because before the data collection, their short-term stress response occurred. It is also worth highlighting that although the inter-university basketball players cortisol concentration was increased in pre-game conditions. This trend cannot inherently contribute to a home benefit per se when playing at opponents place. In this study, inter-university male basketball teams won 3 matches out of 4 at home ground whereas, they lost 4 matches on away ground. However, taking into account the playing position, it is important to consider the actions of the player pre-game. It was possible to note that there were also increases in pre-match cortisol concentration in the outside area, it seems that the players of the existing study were comforted on their home ground but they could not manage their state anxiety on an opponents home ground due to which their cortisol concentration was increased and they lose all matches. Limitation of the present investigation is that the research have been conducted on males, however, no data is available about the females of Pakistan.

5. CONCLUSION

The present data suggest that the pre-match hormonal reaction and state anxiety are influenced by the playing position. Relative to their home venue, playing in the home ground of the opponent appears to induce greater neuroendocrine stress on basketball players, shown by high cortisol concentration and state anxiety score on the outside compared to the home venue. Additionally, the effect of playing venue on pre-match cortisol and state anxiety does impact negatively the match results on an opponents home ground. It is strongly suggested possible psychological interventions (imagery, goal-setting, cohesion and stress management techniques) for players to deal with a challenging situation at an away playing venue.

CONSENT

Consent was taken from each of the players as well as from their director sports and team management before the commencement of the study.
ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

This research is not funded by any company and researchers invested on this research on their own financial resources. Furthermore, there is no conflict of interest between researchers / authors and producers of the product.

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