



Playing match venue does not affect resting salivary steroids in elite Futsal players



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HIGHLIGHTS

- Cortisol (C) and testosterone (T) concentrations were significantly elevated after the matches.
- Pre-hormone values were not affected by playing venue.
- Higher post-match C concentration was observed for playing home.
- Greater C post-home match suggests that players may be more concerned of gaining social status playing at their own facility.

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ABSTRACT

This study examined the influence of competition playing venue on the hormonal responses in elite Futsal players. Twenty-one males (age, 19.3 ± 0.7 years; height, 174.2 ± 4.1 cm; body mass, 71.8 ± 7.9 kg) from two Futsal teams were monitored during two competitive matches that were played against each other on a home and away basis. Saliva sampling was conducted before (pre) and after (post) each match. The concentration of salivary steroids (testosterone [T] and cortisol [C]) was assessed by ELISA. Resting concentration of salivary steroid (T and C) hormones was not affected by playing venue (home and away). Both Futsal matches promoted a significant increase in T and C from pre - to post-matches ($p < 0.05$), with a higher post-C concentration for playing at home ($p < 0.05$). No effect of playing venue on T was observed. In conclusion, the findings of this study indicate that the playing venue did not elicit a significant change in resting concentration of salivary steroid hormones. However, playing home induced a greater post-match C response, suggesting that the pressure for positive results in front of supporters, families and friends may impose a higher level of stress on the players at their own facility.

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1. Introduction

The home advantage is a phenomenon that has been widely documented in team sports competition such as Baseball, Football, Ice Hockey, Rugby, and Basketball [1–3]. It describes the perceived advantage of a team playing at home over the visiting team. Evidence for the existence of home advantage has been demonstrated by the winning percentage of teams playing in their domains (at home) taken into account a value above 50% [1,2].

For instance, McGuire et al. [4] demonstrated a winning percentage of 58.3% for playing at home in Hockey; indeed, values of 61% for Rugby [5], 64.1% for Soccer [6], and 66.8% for Basketball [7] have been

presented to support the existence of home advantage in team sports. Despite these findings, the main reasons for explaining this perceived advantage of playing at home are still under debate.

Among others, the concept of territoriality and its association with dominance, aggressiveness, and status emerges as a possible candidate to explain the advantage of competing at home venue in team sports [8, 9]. Territoriality is prevalent within many animal species displaying agonistic behaviors. For instance, it has been proposed that animals attack with greater vigor when trying to defend their own home territory [10]. Indeed, there are also reports on increased aggression or arousal state playing at home in team sport athletes such as Ice Hockey [4] and Rugby Union [11].

Agonistic behavior is thought to be reciprocally related to endogenous testosterone (T) [9]. A higher pre-match T concentration has been reported on team sport athletes playing at their own home stadium, rather than at the opponent's venue [12–14]. Moreover, T has

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been linked to aggressive behavior [15,16] and higher vigor [17,18], as well as related to an improvement in strength and power sports performance [19,20].

Furthermore, Mazur and Booth [9] pointed out that the increment in T level would be associated with the individual attitude of maintaining or gaining social status during a status contest, like team sports competition. Additionally, Carré [21] demonstrated that the home victory was associated with a significant larger increment in salivary testosterone concentration relative to the away victory in non-elite hockey players. Although the factors responsible for the different testosterone responses are still unknown, this possible greater rise in testosterone concentration observed during the playing home might be attributed to the fact that winning at home is a more rewarding result related to social status, notably, in front of the home crowd. Therefore, a higher pre-T level might favor behaviors, as assertiveness and competitiveness, which could influence the performance and the likelihood of success, and an elevated T level might be expected when playing home, particularly, after a home victory.

Cortisol (C) response also appears to be associated with competition environment. For example, a marked increment in C level has been verified prior to real or official events compared to simulated in Weightlifting [22], Brazilian Jiu-Jitsu [23], Soccer [24] and Basketball matches [25,26].

The salivary steroid (T and C) hormone responses and their association with territoriality are still unclear in team sports context. Addressing both T and C responses for playing venue in order to better understand the associations between endocrine responses, territoriality, and home advantage would be useful to add to literature new insights and evidence concerning this issue. Thus, the main purpose of this study was to verify the effect of playing venue in T and C responses, in accordance with the challenge hypothesis and territoriality phenomenon [10]. Based on the above findings and presented background and theories, it was hypothesized that a higher resting concentration of T and C would be observed when playing at home (versus away venue) and that a higher T response would be also observed at home. To test these hypotheses, two Futsal teams were monitored during two official matches playing against each other on a home and away basis.

2. Material and methods

2.1. Participants

Twenty four male Futsal players were recruited for this study. Participants were all elite Futsal players who belong to two under-20 teams competing in the State Futsal Championship (São Paulo, Brazil). Data of 21 players (mean \pm SD: age, 19.3 \pm 0.7 years; height, 174.2 \pm 4.1 cm; body mass, 71.8 \pm 7.9 kg; Futsal training experience, 9 \pm 3 years) were retained for analysis, based on the participation of the players in two assessed official matches. Therefore, it can be assumed that the 21 assessed players were all free of injury or illness that could influence the baseline hormonal concentration as well as the hormonal responses to the matches. Both teams had similar competitive level, but the teams were ranked third (team B) and sixth (team A) (there were 14 teams participating in the championship) in the U20 State championship during the monitoring period (regular season). Both teams advanced to the final phases (play-offs). After the play-offs phase, the team B becomes the U20 State champion. The assessed players were used to participating in eight to ten training sessions (60–120 min per session) and one official match per week. The training sessions usually consisted of Futsal drills, tactics, sprints, intermittent running exercises, and specific conditioning work, as well as weight training and plyometrics exercises. The typical weekly training schedule for a seven-day between-match microcycle is shown in Table 1. This typical microcycle training illustrates the habitual schedule of the assessed teams during the period of the investigation. As the assessed matches occurred seven weeks apart, coaches reported that this typical training content

is an appropriate illustration of the usual training schedule performed within the period of the investigation. All athletes gave informed consent following full disclosure of procedures. All procedures received University Ethics Committee approval.

2.2. Experimental design

To test the effect of playing venue on the salivary concentration of T and C, two official matches involving the same two elite Futsal teams were investigated. Both matches occurred during the regular competitive season (seven weeks apart). The first match was performed at Team “B” facility and the second match at Team “A” facility. The Team B won both assessed matches. The first (4–2) was played at home and the second match (5–0) was played at away venue. Players arrived at the playing venue approximately 90 min before the beginning of the matches. Both matches were preceded by a 30-min warm-up comprising of light aerobic exercise, Futsal drills, and stretching of the major muscle groups. Saliva samples were collected by passive drool before the warm-up procedures (pre) and within 15 min after the end of each match (post). Players were instructed to have their last meal at least 1.5 h before the first saliva collection to reduce the effect of food intake on salivary hormone concentration [27] and were encouraged to drink water during the breaks of the matches to maintain hydration levels. Both games were played at a same time of day (between 18:00 and 20:00). Thus, it was possible to control for diurnal hormones variations. Players maintained their normal training schedule in the week leading up to each match, which remained relatively stable in terms of training mode, frequency, and volume across the period of the study. The training schedule preceding the assessed matches followed that typical weekly training schedule illustrated in table 1. Additionally, it was recorded 91 matches' outcomes from other teams that were participating in the championship to verify whether the “home advantage” phenomenon was actually present within this particular competition.

2.3. Hormonal assessments

Players provided a saliva sample before the pre-game warm-up (PRE), and approximately 15 min after the end of each match (POST). The unstimulated saliva sample was collected in a pre-weighted sterile 15-ml centrifuge tube over a five-minute period and stored at -80°C until assay. After thawing and centrifugation (10,000 g for ten minutes at 4°C), the samples were tested for free concentration of C and T, using enzyme-linked immunosorbent assays (ELISA, Salimetrics™ expanded range kit) and the manufacturer's recommendations, and in accordance with previous studies [28]. The average intra-assay coefficient of variation for the C and T assays were 3.9% and 4.3%, respectively. The minimum detection limit for the T assay was 21 $\mu\text{mol L}^{-1}$ and 0.33 $\eta\text{mol L}^{-1}$ for C assay.

2.4. Statistical analyses

All data was reported as mean and standard deviation (SD) and 95% CI. The normality of data was analyzed by the Shapiro–Wilk test and the Levene's test was performed to test the homoscedasticity. In order to verify whether hormonal responses would be affected by winning or losing match and therefore influence the results, a one way-analysis of variance (ANOVA) with repeated measures was performed with “teams” as the independent variable (winning team, = Team B, and losing team = Team A) and hormonal concentrations (T and C) pre and post-match, as the dependent variables. As no differences were found for any time-points (pre-post) or hormones (C and T), an ANOVA with repeated measures was performed on the pooled data with venue (home or away) as the independent variable and hormonal concentrations (T and C) pre and post-match, as the dependent variables. Therefore, both teams were analyzed as a single group ($n = 21$) for home and away outcomes comparison. Bonferroni test was used as *post hoc*

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