

# Effects of ball recovery on top-level soccer attacking patterns of play

## *Repercussões da recuperação da posse de bola nos padrões de ataque de futebol de elite*

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**Abstract** – In soccer, ball recovery is the purpose of the defensive phase and it is also the first stage of the attack. Identifying how and where the ball is regained in elite competitions, taking in consideration the competition stage, is central to an understanding of the attacking patterns and of the diachronic order of events, and such knowledge can be used to develop specific drills in training. This study aims to characterize ball recovery patterns while taking into account the pitch zone(s) and the competition stage, and to investigate the influence of each type of ball recovery on the subsequent patterns of attacking play in matches played by the World Cup 2010 semi-finalists. Observational methodology and lag sequential analysis were applied, with the use of SoccerEye observational instrument, SoccerEye recording software and SDIS-GSEQ analytic software. Twenty-four matches were recorded from public TV broadcasts, yielding 1,619 attacks. Direct ball recovery was the most common form, with a tackle and defensive behaviour followed by a pass in the central mid-defensive zone resulting in goal attempts. Interceptions occurred mainly in the central mid-offensive zone inducing unsuccessful attacking patterns of play, while interventions by goalkeepers were most likely to occur in the central defensive zone with no significant associations with any ending of attack behaviours. Patterns of attacking play depend on the form of ball recovery. The pitch space and the form of ball recovery are similar when we compare both stages of the World Cup 2010.

**Key words:** Behavior; Observation; Psychomotor performance; Soccer; Trends.

**Resumo** – Recuperar a posse de bola é o objetivo da fase defensiva em Futebol, sendo simultaneamente o primeiro momento do ataque. A identificação do local e da forma como a bola é recuperada em competições de elite, tendo em consideração a fase da competição, revela-se fundamental para o entendimento dos padrões ofensivos e do diacronismo dos eventos, permitindo o desenvolvimento de processos de treino específicos. Pretende-se caracterizar os padrões de recuperação de posse de bola, tendo em consideração a(s) zona(s) do terreno de jogo e a fase da competição, e analisar os padrões ofensivos que resultaram de cada tipo de recuperação de bola nas equipas semifinalistas do Campeonato do Mundo 2010. Utilizou-se a Metodologia Observacional através do instrumento de observação SoccerEye, do software de registo SoccerEye e do software de análise SDIS-GSEQ. Através de transmissões públicas de televisão, registraram-se 24 jogos do Mundial 2010, tendo-se obtido 1.619 ataques. A recuperação direta da posse de bola foi a forma mais utilizada. O desarme e a ação defensiva seguida de passe na zona central média-defensiva originaram oportunidades de gols. As intercepções ocorreram na zona central média-ofensiva, resultando em ataques sem eficácia, enquanto as intervenções do goleiro ocorreram na zona central defensiva sem relações significativas com comportamentos indutores de final de ataque. A configuração dos padrões de ataque é influenciada pelo modo como a bola é recuperada. O local e a forma de recuperação da posse de bola são similares quando comparadas as duas fases do Mundial 2010.

**Palavras-chave:** Comportamento; Desempenho psicomotor; Futebol; Observação; Tendências.

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Received: 11 February 2013  
Accepted: 06 June 2013



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## INTRODUCTION

Ball recovery, the foremost aim of the defensive phase<sup>1</sup>, is a brief or even instantaneous action, and it is simultaneously the first stage of the attack. Successful ball recovery depends on good performance by defenders, although it may also result from attacking errors<sup>2</sup>. It therefore seems essential to be aware of the constraints that affect ball recovery patterns, that is, how and where the ball is regained and the influence this has on subsequent patterns of attacking play.

Research to date has focused on a number of areas including the offensive phase of World Cup matches<sup>3</sup> and technical indicators such as the type and number of passes<sup>4</sup>, taking also into account the elapsed match time<sup>5</sup>, competition stage<sup>6</sup> and game location<sup>7,8</sup>. Ball recovery patterns have been studied to a minor extent, with a common focus on the zones where the ball is recovered and how this relates to the efficacy of any subsequent attack. Attacks starting in offensive zones of the pitch were more likely to result in a goal or a goal-scoring opportunity<sup>9,10</sup>, consequently attacking success is associated with fast recovery of the ball in offensive zones<sup>11</sup>. By contrast, some studies<sup>12,13</sup> concluded that ball recovery in offensive zones during open play rarely resulted in goals, the latter occurring primarily due to ball recovery in the mid-defensive sector. As regards the attacking configuration which follows ball recovery, research has shown that a fast shift from defence to attack, with an almost instantaneous exploitation of the ball, benefits the efficacy of the attack<sup>14</sup>. It also should be noted that analysing behaviour in soccer requires to consider the time aspect, that is, the diachronic order of the events that make up the flow of the game<sup>15</sup>. In this sense, lag sequential analysis has been used to study patterns of attacking play in World Championships<sup>5,16</sup>.

In reviewing the literature, however, we noted that scarce attention has been paid to research that considers the competition stage when analysing the relationship between different types of ball recovery, the respective pitch zone(s) and the subsequent pattern(s) of attacking play, taking in consideration the diachrony of the game.

In light of this, the aims of the present study were (1) to describe ball recovery patterns and to investigate differences between the types of ball recovery and the corresponding pitch zone(s) while taking into account the competition stages; and (2) to analyse the influence that ball recovery patterns have on attacking play, more specifically on the patterns that follow each type of ball recovery.

## METHOD

### Design

Methodological approach is based on observational methodology, which is appropriate here given that soccer is played in a habitual context<sup>15</sup>.

The observational design, in accordance with the specific taxonomy used<sup>17</sup>, is nomothetic (some teams), follow-up (continuous recording across

matches) and multidimensional (different aspects of the study topic are included in the observational instrument). This approach allowed us to identify attacks in the observed matches.

## Participants

The matches played by the semi-finalists in the 2010 FIFA World Cup (Germany, Netherlands, Spain and Uruguay) were observed and analysed. Having reached the competition semi-final round these teams were regarded as successful<sup>18</sup>.

All the observations and data recording were based on material derived from public TV broadcasts. Twenty-four matches (6 per team), from the first round of the group stage through to the play-off final round, were recorded, with the exception to the round of sixteen. Matches were observed for the regulation period (i.e. 90 min), with any attacks in which players left the camera's recording field or in which a team had ten or fewer players on the pitch excluded from the analysis. Applying these criteria, we analysed a total of 1,619 attacks ( $67.5 \pm 3.3$  per observed match) covering both stages of the competition, that is, 754 attacks ( $64.1 \pm 20.5$  per match) during the 12 group stage (GS) matches and 865 attacks ( $72.5 \pm 10.7$  per match) during the 12 play-off (PO) matches.

The Ethics Committee of the Faculty of Sport University of Porto in 10/2012, gave its institutional approval for the study (Process CEFADÉ 10/2012).

## Observational instrument

The SoccerEye observational instrument was updated from the Organizational Model of Soccer<sup>19</sup>, and the guidelines for its use have been published elsewhere<sup>5,19</sup>. This model encompasses the offensive and defensive phases of the game, and includes two types of transitions: Interphase, when indirect ball recovery is observed due to the game being interrupted; and State, when ball recovery is direct, i.e. the flow of the game is preserved.

SoccerEye includes 80 categories distributed across seven criteria, a feature that enables it to fulfil the conditions of exhaustiveness and mutual exclusivity. For the purposes of the present investigation the first five criteria were used. These criteria are: 1) Start of offensive phase/ball possession recovery, focusing exclusively on the sub-criterion referring to direct ball recovery; 2) Defence/attack Transition-State; 3) Progress of ball possession; 4) End of offensive phase; and 5) Patterns of pitch space position, used as a structural criterion (Figure 2).

## Recording instrument

The SoccerEye software (v3.0, October 2012) is designed to be used with the SoccerEye observational instrument, and it can be combined with SDIS-GSEQ analytic software<sup>20</sup>. For each attack the observer records the match status, competition stage, match time, duration of the attack and any match events.

## Procedure

In accordance with the procedure described in the literature<sup>21</sup> data quality was ensured by assessing inter-observer reliability. Specifically, Cohen's kappa index<sup>22</sup> was computed for the observations of the first half of the 2010 World Cup final. Application of SDIS-GSEQ v5.1 software<sup>20</sup> yielded values of  $0.92 < \kappa < 0.98$ , well above the cut-off ( $\kappa \geq 0.75$ ) as being indicative of high data quality<sup>23</sup>.

## Statistical analysis

Lag sequential analysis was used to determine the probability of there being significant associations (positive and negative) between different match events, this approach being consistent with the observational design. The strength of the relationships between behaviours, and their sequence, is determined based on the  $z$  score<sup>24</sup>. Statistical significance was set at  $p \leq 0.01$ ,  $z \geq |2.58|$ , and all analyses were performed with SDIS-GSEQ v5.1. Specifically, we investigated the associations between each type of ball recovery and the pitch zone in which it occurred, using a prospective perspective of the five lags following the ball recovery event in order to determine the subsequent pattern(s) of attacking play.

## RESULTS

### Ball recovery by intervention of the goalkeeper contrasted with the other types of direct ball recovery

Ball recovery by interception (BRi) frequently occurred in the central mid-offensive and mid-defensive zones ( $z=6.60$  and  $z=3.43$ , respectively), and it was also observed in the left strip of the mid-defensive sector ( $z=3.15$ ). A similar trend was observed for ball recovery by tackle (BRt) and for a defensive behaviour followed by a pass (BRp), both of which showed a positive association with zone 5 ( $z=2.95$ ;  $z=7.70$ , respectively). Conversely, these three kinds of direct ball recovery were negatively associated with the central defensive zone (BRi:  $z=-9.42$ ; BRp:  $z=-6.39$ ; BRt:  $z=-6.23$ ) (Figure 1).

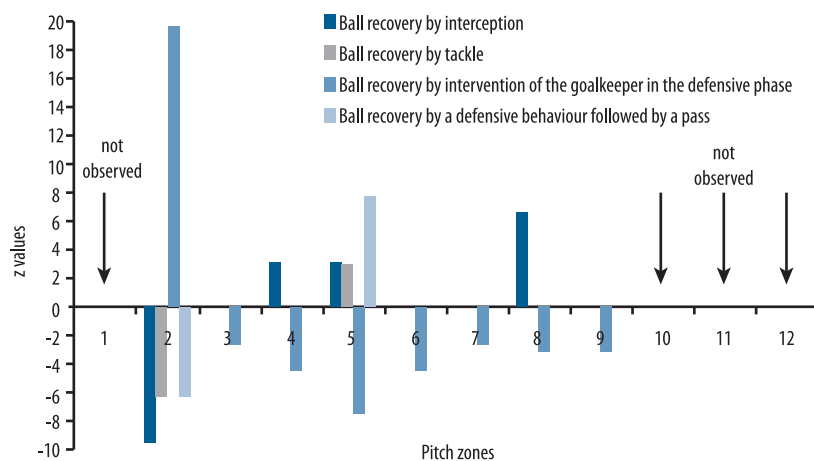
A contrasting pattern was observed in relation to ball recovery by intervention of the goalkeeper in the defensive phase (BRgk). Unsurprisingly, there was a strong association between goalkeeper interventions and zone 2 ( $z=19.72$ ), whereas BRgk showed negative relationships with the other pitch zones (3:  $z=-2.66$ ; 4:  $z=-4.46$ ; 5:  $z=-7.59$ ; 6:  $z=-4.36$ ; 7:  $z=-2.64$ ; 8:  $z=-3.16$ ; 9:  $z=-2.66$ ) (Figure 1).

The offensive sector zones (10, 11 and 12) and the lateral defensive strips (1 and 3) were not associated with any specific type of ball recovery, illustrating that the semi-finalists in World Cup 2010 normally regained possession in midfield sectors, particularly in the central strip (Figure 1).

When comparing the two stages of World Cup 2010 we observed that while interceptions were likely to occur in the central mid-defensive zone, this was especially the case in the play-off stage ( $z=2.73$ ). However, this behaviour also showed a higher probability of occurrence in the central

mid-offensive zone in both stages of the tournament (GS:  $z=3.15$ , PO:  $z=3.76$ ) (Figure 2). Ball recovery by tackle was positively associated with the central mid-defensive and mid-offensive zones (5:  $z=3.01$  and 8:  $z=3.00$ ) during the group stage, but no such relationship was observed in the play-off rounds. It appears that during the play-off stage, tackles occurred in a wider variety of zones, the exception to this trend being the results for the central defensive zone (PO:  $z=-2.59$ ; GS:  $z=-4.96$ ). There were differences between the group and play-off stages as regards BRp. In the group stage this kind of ball recovery occurred predominantly in central mid-defensive zone (BRp:  $z=8.37$ ), whereas in the play-off rounds the right mid-defensive zone was the most common location, albeit with a weaker association (BRp:  $z=2.63$ ). BRgk was most likely to occur in the central defensive zone regardless of the competition stage (Figure 2), it being negatively associated with the mid-defensive zones.

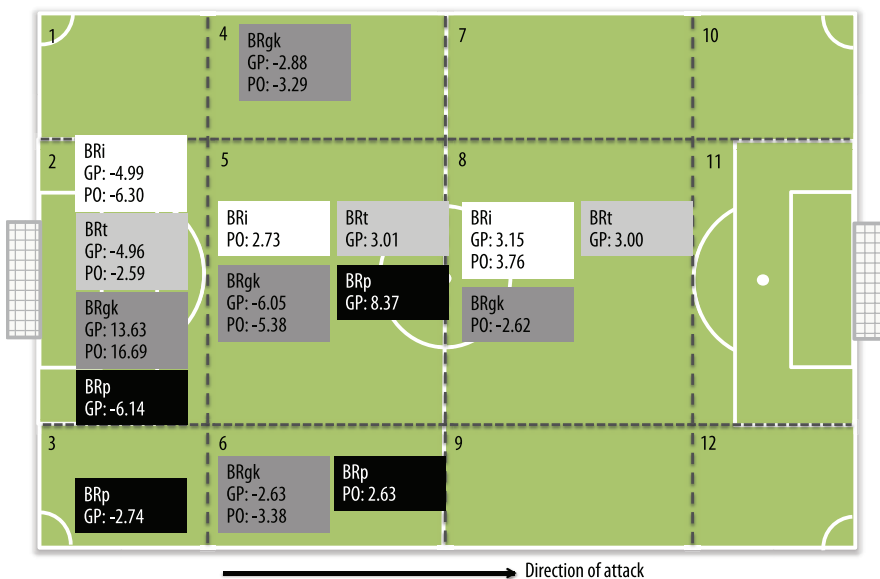
Overall, the association between the zones in which the ball was recovered and each type of ball recovery showed few differences regarding the competition stages of World Cup 2010.



**Figure 1.** Significant associations between the direct types of ball recovery and the pitch zones (from 1 to 12). Values are adjusted residuals ( $z$ ), applying a  $p$  value  $\leq 0.01$  and according to a prospective perspective.

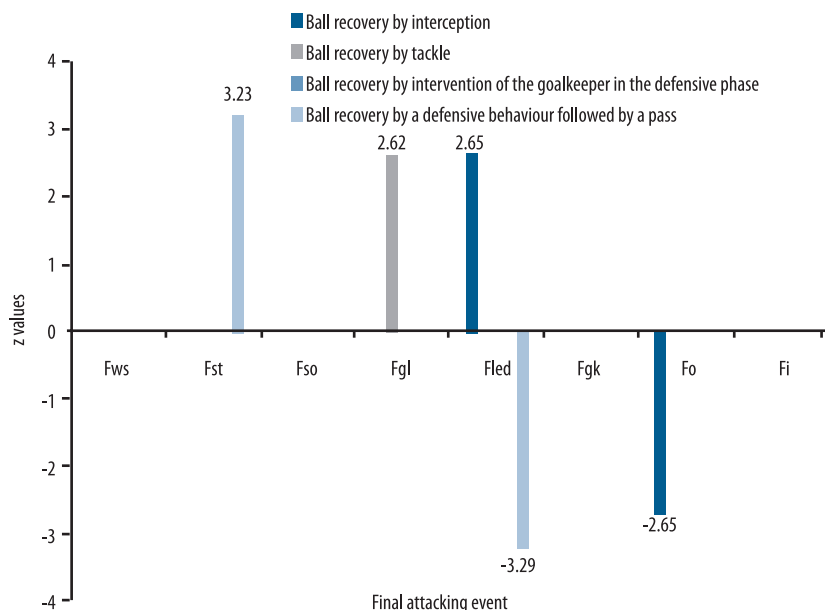
### Ball recovery by tackle and by a defensive behaviour followed by a pass resulted in goal attempts

Attacking efficacy was related with ball recoveries by tackle and by pass following a defensive behaviour. Specifically, the use of tackle induced the scoring of goals ( $z=2.62$ ), while the pass after a defensive behaviour was positively associated with shots on target ( $z=3.23$ ). The loss of the ball by error of the ball carrier/defender's intervention (Fled) was inhibited by ball recoveries by passes after defensive behaviours ( $z=-3.29$ ), contrary to interceptions ( $z=2.65$ ) that inhibited the throwing of the ball out of the pitch ( $z=-2.65$ ) permitting to preserve the dynamic of the game (Figure 3).



**Figure 2.** Patterns of pitch space position divided into twelve zones<sup>19</sup> and including the significant associations between the types of ball recovery and the pitch zones in which they occurred at the point the ball is recovered, comparing the group and play-off stages of 2010 FIFA World Cup. Values are adjusted residuals (z), applying a p value  $\leq 0.01$  and according to a prospective perspective.

Legend. BRI: Ball recovery by interception; BRT: Ball recovery by tackle; BRgk: Ball recovery by intervention of the goalkeeper in the defensive phase; BRp: Ball recovery by a defensive behaviour followed by a pass; GS: Group stage; PO: Play-off stage.



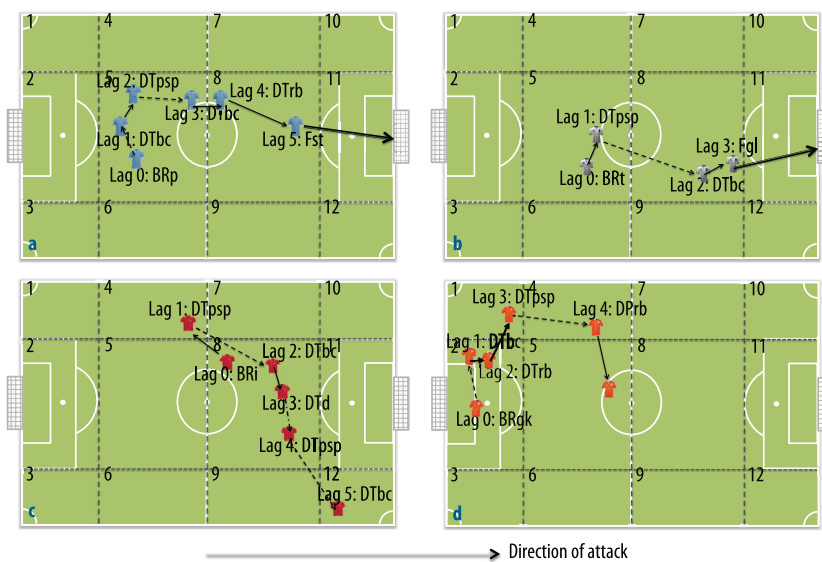
**Figure 3.** Significant associations between the direct types of ball recovery and the final attacking events in the following lag the ball is recovered, i.e. lag 1. Results refer to 2010 FIFA World Cup. Values are adjusted residuals (z), applying a p value  $\leq 0.01$  and according to a prospective perspective.

Legend. Fws: Wide shot. Fst: Shot on target. Fso: Shot stopped, with no continuation of ball possession. Fgl: Goal. Fled: Loss of ball possession by error of the ball carrier/defender's intervention. Fgk: Loss of ball possession by intervention of the opponent's goalkeeper. Fo: Throwing the ball out of the pitch. Fi: Violation of the laws of the game.

The patterns of attacking play related to BRp (Figure 4a) and to BRT (Figure 4b) were globally similar. These figures show the trend in the structure of attacks, there being frequent ball recoveries in the central mid-defensive zone and with the attack ending in central mid-offensive and

offensive zones. There was a predominance of fast attacks, which were more likely to lead to goal attempts. The pattern following BRt finished with a goal scored (Fgl:  $z=2.62$ ) in lag 3 (Figure 4b), while the pattern subsequent to BRp ended with a shot on target in lag 5 (Fst:  $z=3.23$ ) (Figure 4a). Thus, the patterns of attacking play that followed the abovementioned defensive behaviours mostly occurred in the defence/attack Transition-State, and were likely to lead to goal attempts.

Ball recovery by interception (Figure 4c) tended to occur in the central mid-offensive zone, and the subsequent patterns of attacking play reflected the tendency to use positional attack as the offensive method. Thus, teams normally used the whole width of the pitch to mount an attack, with use of the lateral strips (4:  $z=2.59$ ; and 12:  $z=2.79$ ) and the central strip (8:  $z=3.03$ ) during the five lags leading to the successful creation of attempts on goal. When the goalkeeper recovered the ball (Figure 4d), short types of attacking behaviours were preferentially used to shift the centre of play into zones with no pressure from the opposing team. Thus, the centre of play remained in the defensive midfield zones (2:  $z=10.40$ , lag 1; 2:  $z=3.88$ , lag 2; 5:  $z=2.91$ , lag 5) during the five lags considered, there being negative associations with offensive midfield zones (7:  $z=-2.66$  and 8:  $z=-2.74$ , lag 1; 7:  $z=-2.66$ , lag 2; 8:  $z=-3.60$ , lag 3). More specifically, BRgk was associated with behaviours involving ball control ( $z=9.21$ , lag 1), running with the ball ( $z=6.73$ , lag 2) and positive short passing in the defence/attack Transition-State ( $z=3.60$ , lag 3), and running with the ball during the progress of ball possession ( $z=2.62$ , lag 4) (Figure 4d).



**Figure 4.** Ball recovery (a) by a defensive behaviour followed by a pass; (b) by tackle; (c) by interception; and (d) by intervention of the goalkeeper in the defensive phase. Each part of the figure 4 shows the resulting pattern of attacking play according to a prospective perspective of the five lags following the ball recovery event. Results refer to 2010 FIFA World Cup.

Legend. BRp: Ball recovery by a defensive behaviour followed by a pass; BRt: Ball recovery by tackle; BRI: Ball recovery by interception; BRgk: Ball recovery by intervention of the goalkeeper in the defensive phase; DTbc: Development of defence/attack Transition-State by ball control; DTpsp: Development of defence/attack Transition-State by positive short passing; DTTrb: Development of defence/attack Transition-State by running with the ball; DTd: Development of defence/attack Transition-State by dribble (1x1); DPrb: Progress of ball possession by running with the ball; Fst: Shot on target. Fgl: Goal.



## DISCUSSION

As regards the ball recovery zones our results show that the semi-finalists in World Cup 2010 did not often recover the ball in the attacking sector of the pitch. More specifically, the teams tended to recover the ball directly in the central mid-defensive zone, and less frequently in the defensive and mid-offensive zones, which corroborates the findings of a study in the Euro 2008<sup>19</sup>. A similar trend was reported by the analysis of Portuguese and European teams<sup>9</sup>, it being found that ball possession was most often regained in the central strip of the midfield sector. In relation to findings such as these, a study suggested that elite teams conventionally regard recovery of the ball in mid-defensive zones as fundamental as it enables the ideal defensive organization to be preserved<sup>25</sup>.

Regarding the efficacy of the attack in relation to ball recovery zones, our findings suggest that direct ball recovery was more efficient in mid-defensive central zones, thereby confirming the results of World Cup 1998 study<sup>13</sup>. However, our findings are not consistent with certain other studies. For example, around 60% of attacks leading to scoring opportunities followed ball recovery in mid-offensive pitch zones<sup>26</sup>, and in top European teams was found that most of the attacks resulting in a goal started in the offensive third of the pitch<sup>9</sup>, a finding corroborated by the analyses of World Cup competitions<sup>16,27</sup>. In these, respectively, 51% and 58% of the goals scored followed ball recovery in the offensive third of the pitch. Similarly, in the 1998 World Cup was found 49.6% of ball possessions that led to a shot began in the offensive third of the pitch, 34.9% began in the middle third and 15.8% began in the defensive third<sup>28</sup>. Also, in Norwegian men's professional league 2004 investigation, 2.9% ( $n=55$ ) of attacks started in the pitch offensive third, 45.5% ( $n=860$ ) in the middle third and 51.6% ( $n=976$ ) in the first third, leading to 32.7%, 11.7% and 8.6% of goals, respectively<sup>29</sup>.

Taken together, these results suggest that elite teams mostly recover the ball in mid-offensive zones, due to a more active and organized defence, and that ball recovery of this kind is associated with greater attacking success. These findings suggest that training programs should focus on collective defensive behaviours that provide, on the one hand, a fast and intense pressure in the offensive third that is likely to lead the opponent to lose the ball as a result of errors in attack building (e.g. a long and negative pass to the mid-defensive zone); and, on the other hand, the preparation of the defence/attack transition while defending, i.e., to have players with conditions to perform a fast attack immediately after recovering the ball possession. According to this argument, ball recovery in mid-defensive zones would somehow be produced by constraints in the offensive third of the pitch.

With respect to the relationship between the types of ball recovery and the zones in which they occurred during World Cup 2010, our overall results showed positive associations between the types of ball recovery and the mid-defensive central zone, thereby corroborating Euro 2008 study<sup>19</sup>.



However, interceptions were more likely to occur in the mid-offensive zone, whereas interventions by the goalkeeper were most strongly associated with the central defensive zone. Contrary to the present findings, a study concluded that the lateral defensive zones tended to be associated with ball recovery by tackle<sup>19</sup>.

In regards of the influence of ball recovery types on the form of concluding the attack and analysing the results from the five lags succeeding the ball recovery event, our results suggested that tackling and passing after a defensive behaviour were performed to a similar extent and tended to lead to a goal or a scoring opportunity, with the last referred defensive behaviour inhibiting the loss of ball possession by error of the ball carrier. This contrast with findings that reported that ball recovery by a defensive behaviour followed by a pass did not lead to a successful attack<sup>19</sup>. Contrary, the use of interception behaviour led to the use of continued attacks<sup>14</sup> with no efficacy, however permitting to maintain the ball inside the pitch and, consequently, preserving the dynamic of the game. It should be noted that this result contrast with Euro 2008 study, in which interception behaviour led to goal attempts<sup>19</sup>. Goalkeeper interventions led to short attacks in both the abovementioned competitions.

Regarding the patterns of successful teams found in this study, it might enhance our results the understanding of the influence that each national team had in the World Cup 2010 overall patterns. Moreover, notwithstanding literature<sup>30</sup> referring that both South American and European styles were recently blended into a patient passing strategy named as possession football style, it seems important the analysis of the intercontinental effect. Also, the inclusion of unsuccessful teams as participants would permit to find out if the patterns found were a characteristic of success.

## CONCLUSIONS

The offensive sector of the pitch and the lateral defensive strips do not seem to be significantly associated with ball recovery behaviours, since the World Cup 2010 semi-finalists in generally regained possession in the central mid-defensive sector. Ball recovery was also observed in the defensive sector, but exclusively as a result of the goalkeeper's intervention.

There were no significant differences between the group and play-off stages of World Cup 2010 as regards the relationship between the types of ball recovery and the zones in which they occurred.

The different kinds of ball recovery appear to have influenced the subsequent patterns of attacking play in World Cup 2010. Ball recovery by tackle and by a defensive behaviour followed by a pass tended to lead to goal attempts in Transition-State, whereas interception behaviour tended to induce the use of positional attacks as the offensive method, but with no efficacy. Ball recovery through the goalkeeper's intervention is associated with short attacking patterns, with behaviours designed to shift the centre of play into zones where there is no pressure from the opposing team.

## Acknowledgments

The lead author was supported by Fundação Portuguesa para a Ciência e a Tecnologia [Grant SFRH / BD / 48558 / 2008].

We gratefully acknowledge the support of the Spanish government project *Observación de la interacción en deporte y actividad física: Avances técnicos y metodológicos en registros automatizados cualitativos-cuantitativos* (Secretaría de Estado de Investigación, Desarrollo e Innovación del Ministerio de Educación y Ciencia) [Grant DEP2012-32124].

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