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Abstract

Women's international football is growing in terms of popularity, but to date there is limited published research in women's football and even less that describes effective attacking strategies and the creation of goal scoring opportunities (GSO). The purpose of this research was to investigate and assess the factors related to the creation of GSO at the Canada Women's World Cup 2015. Video footage of each match (n = 52) from the Women's World Cup (Canada 2015) was analysed using SportsCode Software. The results revealed that the middle third of the pitch was the most effective area for gaining possession and creating GSO. The average time taken to create a GSO was under twelve seconds. The findings of the study can be used by coaches to design training sessions and interventions to successfully create GSO in women's football. The data from the research may influence the tactical set up of women's international football teams and help to evolve the game in the same way that research into the men's game has.

Introduction

Women's football is growing in terms of popularity and is becoming an internationally competitive sport. With this growth in popularity, research into the women's game has begun to emerge in the scientific literature (Alcock, 2010; Mara, Wheeler, & Lyons, 2012; Mujika, Santisteban, Impellizzeri, & Castagna, 2009; Zubillaga et al., 2014). To date however, there is very little published research in women's football that describes effective attacking strategies leading to the creation of Goal Scoring Opportunities (GSO's) that sometimes leads to goals being scored.

Previous research in men's football has identified the ability to attack through central areas of the field of play as one of the major components of successful attacking strategies and the creation of GSO's and goals (Carling, Williams and Reilly 2005; Taylor, Ensum, and Williams M. 2002). Research by Mitrotasios and Armatas (2014) reported that during the 2012 European Championship, the central zone (a channel that is the width of the 18 yard box for the full length of the pitch) of the field accounted for 52.6% of the goals created of the 31 games they reviewed. Similar to the findings by Tenga and Sigmund-Stat (2011) in professional football in Norway regarding goals scored, Wright et al. (2011) found that, for club-based football in the United Kingdom, most attacks leading to GSO started in the attacking mid third and front mid third of the pitch.

Smith and Lyons (2017) examined where the ball was regained by a defending team before beginning their own attack. They found that the most successful teams for four World Cups (2002 to 2014) regaining possession of the ball in the middle third of the pitch consistently providing the highest number of possession regains leading to goals. While most of the

previous research in men's football has examined where the attacking play stems from, very little research has investigated how the ball was recovered, the ball recovery strategies. To our knowledge, the only reported published paper that has investigated ball recovery strategies was conducted by Almeda, Ferreira, and Boscovich (2014) in the context of 2011 and 2012 United European Football Association (UEFA) Champions league. They found that teams that were more successful (that is, advanced further into the competition) recovered the ball more by interception, tackle, goalkeeper save, set play, or turnover than the teams that were eliminated from the competition.

Research supports the view that the quicker the transition to attack (that is, regaining possession and then attacking), the greater the chance of scoring. Hughes and Churchill (2005) found that, at the 2001 Copa America, the majority of shots made (43%) stemmed from phases of possession lasting between 0 and 4 seconds in duration, 72% of all shots resulted from phases no more than 9 seconds and 66% of goals scored resulted from possessions equal to or less than 9 seconds. In contrast, another study found that the majority of goals in football occur in the context of a longer time in possession. For example, analyis of the 2006 World Cup by Acar et al. (2009) revealed that approximately 40% of all goals scored were a result of possessions lasting less than 5 seconds; and 61% were a result of possessions lasting 10 seconds.

The type of final pass before a goal is scored has also been of interest to researchers. Smith and Lyons (2017) found that, in comparison to crosses and other methods of attempting to score, the most frequent last phase of play leading to a goal in four World Cups (2002-2014) was a pass where the ball was played in the area behind the opponent. This pass was such that an attacking player could run onto the ball or when the pass was made to an attacking player,

level with the last defender and in a position where they can threaten to score a goal. In the only study examining attacking strategies in woman's football, Mara, Wheeler, & Lyons (2012) found that, for all regular season games of the 2010/2011 W-League football competition, more goals were scored from crosses compared to conventional passes, free kicks, and corner kicks; and that crosses distributed into attackers at a mid-section height were most effective.

In summary, most goals are created by a defending team regaining possession in their own defensive half (Smith & Lyons, 2017). While there is some contradictory research regarding the utility of time taken to take a shot at goal (Acar et al., 2009; Hughes & Churchill, 2005; Wright et al., 2011), no study has investigated whether the time taken from regaining the ball to shooting is related to effectiveness of creating GSO's. Although the findings of Mara, Wheeler, and Lyons (2012) point to the importance of crosses for GSO's in women's football, the relative importance of crosses compared to the final phases of play identified by Smith and Lyons (2017) has yet to be conducted. Although Smith and Lyons (2017) combined the events of passing the ball behind opponents or to a player level with the last defender who could either shoot or take the ball forward / passing to a team mate who shot the ball as one category Ball Behind & Strike/Pass & Strike (BBS/PS). It is possible that the explanatory role of the BBS/PS may be more clearly understood if BBS/PS was viewed as two categories because a Ball Behind, Pass and Strike (BBPS) GSO may be not as effective for goal scoring compared to a Ball Behind and Strike (BBS) GSO because the extra ball movement associated with a BBPS may increase the likelihood that the defence can reorganise themselves compared to a BBS GSO.

While the overall findings reviewed may reflect the state of play in men's football regarding GSO creation and goal scoring, in the same way that there are differences between men and women regarding physiological aspects of football (e.g., women cover 33% less distance at high intensity when compared to their male counterparts – see Mujika, Santisteban, Impellizzeri, & Castagna, 2009), how women create chances to score in football may not be the same way as male footballers do. Thus, the purpose of this study was to investigate GSO creation and goals scoring in international women's football that occurred at the Women's World Cup in 2015. Of particular interest was where the ball was regained by the defending team, how they regained the ball, how quickly they moved from regaining the ball before shooting, and what was the most commonly observed pass before GSO or goal.

Owing to our hypothesis' and predictions based on the some of the pervious research from men's football (Smith & Lyons, 2017), it was expected that GSO's and goals would most commonly originate in the middle third of the pitch. It was also hypothesised that the most the most common last pass before a GSO or goal would be a pass where the ball was played in area behind the opponent so that an attacking player could run onto the ball or when the pass was made to an attacking player who was level with the last defender and in a position where they can threaten to score a goal.

Methods

Procedures and Measures

The study was approved by the Edith Cowan University Ethics Committee. Video footage of the 52 matches from the Women's World Cup in Canada in 2015 were analysed. For the purpose of the present study, a GSO was classified as being a shot that was determined to have been on target with a high likelihood of scoring a goal if not for the intervention of the goalkeeper or an opposing defender. When a GSO was successful, a goal was scored. An unsuccessful GSO was a GSO that was prevented by the goal keeper or a defender's intervention. Replays of GSO's during the broadcast video footage or accessed from the offical FIFA Youtube channel and website were utilised to determine whether the GSO had a high likelihood of scoring except for the intervention of the goalkeeper or opposition player. Shots that rebounded back into play after striking the goal frame, were omitted from the study. Penalty shoot-outs were also excluded from the study as they are used as a means of determining a winner at knock out stages of tournaments.

Every GSO in all 52 games were analysed in the study. Coding of the games was undertaken using SportsCode Pro V9 (Sportstec. Limited) with the pitch divided into 9-zones to record the zone where the ball was taken possession of by the attacking team (Zone of Possession Gain: ZPG). Dividing the pitch into 9 zones (see Figure 1) was chosen as it is common in football for coaches and players to refer to defensive, midfield and attacking zones. Each zone was divided into 3 sub-zones as this correlates with typical tactical formations and player positions in football. This was undertaken to provide context to the performance analysis football research as suggested by McKenzie & Cushion (2013).

Figure 1. here****

Figure 1. The 9-Zone grid system employed to record the Zone of Possession Gain.

Time taken from the ZPG to the successful (when the ball crossed the line) or unsuccessful GSO (when the flight path of the ball meant that the shot could no longer be considered a GSO) was recorded from the time stamp on the official broadcast as part of the analysis of every GSO for the study so that the effect of time on the creation of a GSO.

Analysis of the Type of Possession Gain (TPG) leading to a GSO was also recorded from the sampled matches. After reviewing the GSO's and considering the role of defensive pressure as well as errors by the attacking team, three categories of TPG were developed: interception/misplaced pass (IMP: When a player in possession of the ball deliberately attempts a pass to a teammate and the pass is intercepted or when a pass is played into open space with intent for a teammate and the opposition gain possession); tackle/high pressure (THP: When possession is gained through a tackle or when an opponent forces a skill error [heavy touch] through physical contact or close proximity); and restart (R: unopposed and controlled possession from situations such as goal kick, throw in, free kick or goalkeeper in possession after a save).

The last phase of play prior to the GSO was recorded in the present study and were based on the methodology used by Smith and Lyons (2017). Smith and Lyons defined three phases of play prior to a goal and then expanded in this study to include GSO's:

Ball Behind and Strike / Pass and Strike (BBS/PS: passing the ball behind opponents or to a player level with the last defender who could either shoot or take the ball forwards; or pass to a team mate who shot the ball); Crosses (a pass into the penalty area from either side of the penalty area and from within 20 yards of the goal line, including corner kicks), and Other (Other methods of attempting to score). A separate analysis was conducted where BBS/PS was considered as two categories: Ball Behind and Strike (BBS: passing the ball behind opponents or to a player level with the last defender who could either shoot or take the ball forwards), Ball Behind Pass and Strike (BBPS: as for BBS except that the player passed to passed the ball to a team mate who had a shot on goal).

Reliability

Intra: To ensure the reliability of the coding process a test-retest reliability protocol was performed using a 20-day interval for re-analysis to avoid task familiarity. From the available video, the matches of the Top 4 Women's teams were re-reviewed by the analyst, returning a Yules Q Statistic of 1.0. A Yule's Q score of 1.0 for intra-reliability is indicative that the analyst had a 100% probability of analysing the variables repeatedly.

Inter: A Yules Q Statistic of 0.98 was returned for inter-reliability after a second analyst reviewed the Top 4 (semi-finalists) Women's Games from the Canada 2015 tournament and their results compared against the first analyst's results. The Yule's Q score of 0.98 for inter-reliability indicates there is a probability of 99% that the analyst(s) agreed in their coding. To calculate the reliability of coding of the categorical data the two categories that registered the only difference (ATT, MID) in sum total of all the categories analysed was used for the Yule's Q.

For intra/inter-reliability the Yules Q statistic (Barbour, Edenfield, & Blumenthal, 2007) was utilised for the categorical data due to its intuitiveness in measuring, the ease in which it calculates and because of applicability to the decision-making process of performance analysts.

Statistical Analysis

All statistical analysis was conducted by using SPSS version 26 (SPSS Inc., Chicago, IL, USA). A Chi Squared test of independence was used to examine if there was a difference between ZPG leading to type of GSO (a GSO, unsuccessful GSO, and goals scored or successful GSO). An independent samples t-test was conducted to determine if the time taken for an unsuccessful GSO was different to time take for goals scored. A Chi Squared test of independence was used to examine to investigate differences between TPG and type of GSO as well as phase of play and type of GSO.

Results

In the 52 matches, 390 GSO's were observed. Of the 390 GSO's, 295 of these attempts were deemed unsuccessful and 95 resulted in a goal being scored. That is, approximately one in four GSO's were successful.

Chi Square analysis indicated that there was a difference between the different zones of possession gain leading to the creation of a GSO, χ^2 (8)= 178.34, $p \le .05$, unsuccessful GSO χ^2 (8)= 119.34, $p \le .05$ and goals, χ^2 (7)= 60.54, $p \le .05$. As can be seen in Table 1, the areas where GSO's, unsuccessful GSO's, or goals most commonly began was in the three midfield

zones (midfield right 13%; midfield centre 27%, and midfield left 16%) and the attacking

centre zone.

Table 1. 9 Zones of possession gain leading to the creation of GSO, unsuccessful GSO's and

Goals scored.

ZPG	AR	AC	AL	MR	MC	ML	DR	DC	DL	Total
GSO	28	60	37	52	106	63	10	29	5	390
Unsuccessful GSO	24	40	36	38	80	40	8	24	5	295
Goals	4	20	1	14	26	23	2	5	0	95
Goal/GSO Ratio	1:7	1:3	1:37	1:3.7	1:4.1	1:2.7	1:5	1:5.8	0	1:41

Note: GSO= Goals Scoring Opportunity; ZPG= Zone of Possession Gain. AR= Attacking Right; AC=

Attacking Centre; AL= Attacking Left; MR= Midfield Right; MC= Midfield Centre; ML= Midfield

Left; DR= Defensive Right; DC= Defensive Centre; and DL= Defensive Left.

An independent samples t-test indicated that, on average, there was no difference in time

taken between goals scored and unsuccessful GSO's, $t(46)= 0.33$, $p = .74$. (see Table 2)

Table 2. Time taken to create an unsuccessful GSO and Goal for all teams at the tournament.

	Time taken (secs)	SD
Unsuccessful GSO	11.40	2.47
Goals	10.96	6.04

Chi Square analyses revealed that there was a difference for the type of possession gain

(TPG) leading to GSO's, $\chi^2 (2)= 24.97$, $p \leq .05$, unsuccessful GSO $\chi^2 (2)= 13.53$, $p \leq .05$ and

goals scored, χ^2 (2) 10.51, $p \leq .05$. As can be seen in Table 3, the most commonly observed TPG leading to a GSO or goal scored was due to an interception or misplaced pass (IMP).

Table 3. Type of possession gain leading to the creation of a GSO, unsuccessful GSO's, and goals scored for all teams at the tournament

Possession Gain	IMP	THP	R	Total
GSO	176	113	101	390
Unsuccessful GSO	130	85	80	295
Goals	46	28	21	95
Goal/GSO Ratio	1:3.82	1:4.03	1:4.8	1:41

Note: GSO = Goal Scoring Opportunity; IMP= Interception / Misplaced Pass; THP= Tackle / High Pressure; and R= Re-start.

An initial Chi Square analyses was conducted using the three categories of phases before a GSO or goal. A significant difference was observed for the last phase of play and GSO's, χ^2 (2)= 12.06, $p \leq .05$ and unsuccessful GSO χ^2 (2)= 25.05, $p \leq .05$ but not goals scored, χ^2 (2) 3.56, $p \geq .05$. As can be seen in Table 4, the most commonly observed last pass before a GSO or unsuccessful GSO was Other Methods (O).

Table 4. Final phase of play and GSO's, unsuccessful GSO's and goals for all teams at the tournament: 3 categories

Type of GSO	BBSPS	C	O	Total
GSO	110	118	162	390
Unsuccessful GSO	71	86	138	295
Goals	39	32	24	95
Goal/GSO Ratio	1:2.82	1:3.68	1:6.75	1:41

Note: GSO= Goal Scoring Opportunity; BBS/PS= Ball Behind and Strike / Pass and Strike; C= Crosses; and O= Other Methods.

When Chi Square analyses was conducted with four types of passes, a significant difference was observed for the last phase of play and GSO's, χ^2 (3)= 101.28, $p \leq$ .05, unsuccessful GSO χ^2 (3)= 112.66, $p \leq$ .05, as well as goals scored, χ^2 (3) 6.93, $p \leq$ .05. As can be seen in Table 5, the most commonly observed last pass before a GSO or unsuccessful GSO was other methods but the most commonly observed last pass before a goal was a cross. What was most apprarent from these findings was that BBPS was the least effective passing strategy before a GSO, unsuccessful GSO or goal.

Table 5.

Final phase of play and GSO's, unsuccessful GSO's and goals for all teams at the
tournament: 4 categories.

Type of GSO	BBS	BBPS	C	O	Total
GSO	84	26	118	162	390
Unsuccessful GSO	59	12	86	138	295
Goals	25	14	32	24	95
Goal/GSO Ratio	1:3.36	1:1.85	1:3.68	1:6.75	1:41

Note: GSO = Goal Scoring Opportunity; BBS= Ball Behind and Strike; BBPS= Ball Behind Pass and
Strike; C= Crosses; and O= Other.

Discussion

This research conducted the first complete tournament analysis of Women's international
football. Based on the findings, the following conclusions from the results can be made. Of
the nine zones defined in the present study, regaining the ball in the three midfield zones and
the central attacking zone were the most effective areas for gaining possession of the ball and
creating an opportunity to score a goal at the Women's World Cup 2015. This finding is
similar to the findings reported by Smith and Lyons (2017) who found that the middle third
of the pitch consistently providing the highest number of possession regains than the front
(final) and back third zones for football in four men's world cups between 2002 and 2014.

How the ball (or type of possession gain: TPG) was regained from the opponent also
impacted on GSO's and goals scored. Making an interception or recovering a misplaced pass
from the opposition was the most effective ball recovery strategy at Canada 2015 when it
came to creating a GSO and scoring a goal. Almada, Ferreira, and Boscovich (2014) also
found that for teams, in men's football, intercepting the ball from the opposition was linked

with team success. However, what is unique about the finding of the present study is that, for women's football at Canada 2015, intercepting the ball or regaining the ball after an errant pass was more strongly linked with GSO's or goals than tackling and creating pressure via close proximity to an attacking player carrying the ball or from a situation where the game was re-started (e.g. throw in).

No statistical differences in goal scoring effectiveness was observed when the final phase of play was a BBSPS, a cross, or Other Methods. However, there is a difference in the ratio of goals to GSO's. BBSPS has a goals to GSO ratio of 1:2.8 (39/110), Crossing has a ratio of 1:3.6 (32/118) and Other Methods has a ratio of 1:6.7 (24/162). Looking at the ratio of goals to GSO indicates the effacicy of BBSPS, getting the ball behind the oppositions defence, was the most effective way to score at Canada 2015.

The time taken to create a GSO at Canada 2015 was just under twelve seconds, highlighting the speed in which a GSO was created. However, time taken from gaining possession to shooting at goal was not linked to whether the shot on goal was successful or not.

The present study provide insight regarding where and how the ball was gained to turn defence into attack as well as the effectiveness regarding the final phase of play in the creation of GSO's and goals, However some of the findings were quite different to the results of previous research conducted in men's football, although these findings are limited to one women's world-cup tournament. The current study showed that in the 2015 Women's World Cup, more goals came from BBSPS than from any of the other types of GSO as an absolute and as a ratio, which is similar to previous research identified from the men's tournaments (Smith & Lyons, 2017). Due to the lack of research into women's football and in particular

women's international football, further research should be undertaken to not only investigate GSO where the shot was on target, but also those opportunities that due to skill error, or from a defender's intervention are off target.

At a practical level, the findings of the present study can be used to influence coaches and coach educators to design training sessions and interventions to successfully create GSO in women's football. For example, the findings can be used by coaches to develop training for women's football that reflects gaining possession of the ball in the midfield zones, and focuses on intercepting passes or forces opponents into turning over possession with misplaced passing. The findings may be used by coaches and players in their tactical preparation for competition. The lack of research into women's football was also highlighted and more research in this area needs to be undertaken, this could also include investigations into expected goals (xG) in women's football, which has come to prominence in both the football media and data analysis undertaken by clubs in the last few years.

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