

1 Examining the skill involvements of
2 under-16 rugby league players during a
3 small-sided game and match-play

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1 **ABSTRACT**

2 This study investigated the correlations between the skill demands of an ‘on-
3 side’ small-sided game (SSG) and match-play in under-16 junior rugby league
4 players. Fifteen Harold Matthews players undertook a SSG (10 vs. 10 on a 68 m
5 by 40 m playing surface for 3 min) in the week leading up to round 6 of their
6 competitive season. The frequency of skill involvements (i.e. offensive, defensive
7 and total) was manually coded using a specific criterion. The defensive and total
8 skill involvements were significantly higher per minute of play in the SSG when
9 compared to match-play. A significant, very large, positive correlation was
10 observed between offensive and total skill involvements during a SSG and
11 offensive skill involvements during a match ($r_{(s)} = 0.80, p < 0.01$; $r_{(s)} = 0.71, p <$
12 0.01 , respectively). No significant correlations were evident for defensive skill
13 involvements during SSG and match-play. Overall, it appears that the selected
14 SSG provided players with ample opportunity to practice match-specific skill. In
15 addition, the transfer of these opportunities seems confined to offensive rather
16 than defensive skills.

17 **Key words:** junior, game-based training, technical development, performance
18 analysis
19

1 INTRODUCTION

2 Rugby league is a highly demanding collision sport, with matches lasting 60 to 80
3 minutes in junior and senior competition, respectively. During a match, players
4 experience multiple offensive and defensive physical collisions (1), complete frequent
5 high intensity efforts (2) and cover distances at an intensity of $101 \text{ m}\cdot\text{min}^{-1}$ (3).
6 Importantly, players must be able to withstand the aforementioned demands whilst
7 performing a wide range of skills (4, 5). However, there is currently a lack of peer-
8 reviewed research that has investigated the skill demands of rugby league competition
9 (4, 5). Studies such as Sirotic et al. (5) have reported minimal differences in the
10 offensive and defensive skill demands between the National Rugby League (NRL) and
11 New South Wales (NSW) Premier League. While this data provides information
12 surrounding the skill demands of senior competition, little is known about junior
13 players. Without a complete understanding, it is difficult to design specific training
14 methodologies (e.g. small-sided games; SSG) that allow players to perform skills in a
15 similar capacity to competitive match-play.

16 Skill-based conditioning games are becoming increasingly popular for improving the
17 technical and tactical abilities in conjunction with physical conditioning of rugby
18 league players (6-8). These games simulate a competitive performance environment
19 by encouraging players to make game-like decisions under pressure and fatigue (9).
20 Further, they encourage players to use similar visual search behaviours (i.e. perceiving
21 environmental cues relative to the spatial and temporal relationships established by
22 opposing players) to that of competitive match-play (10, 11). If a player identifies the
23 relevant environmental information and selects an appropriate response within the
24 appropriate time frame, an effective skill is likely to be performed. Conversely, if a
25 player fails to do this, an error may occur. Accordingly, it is important to monitor the
26 skill involvements of players during SSG, to ensure that the imposed demands are
27 comparable to match-play. In doing so, coaches are able to identify which players are
28 successfully meeting the demands of the SSG and which of those may require an
29 alternative training stimulus.

30 Past research investigating SSG within rugby league has primarily focused on
31 documenting the overall skill demands of two variants; 'on-side' and 'off-side' touch.
32 It appears that SSG that include 'off-side' rules offer a greater volume of skill
33 involvements, which is most likely the result of a greater number of passing
34 opportunities (12). However, the external validity of this type of game is questionable,
35 as players are not organized according to their positional roles and are permitted to
36 pass the ball forwards and backwards. Consequently, less of a focus is placed on
37 defensive skills, with the completion of a tackle typically the result of a defending
38 player placing two-hands on an attacker. While this allows for an increased speed of
39 play, the importance of correct defensive positioning is not emphasized. As a result, it
40 is possible that 'off-side' touch SSG would lack the skill specificity that would allow
41 for competitive match-play to be replicated and a successful transfer of skill
42 performance. Therefore, the aim of the current study is to compare the skill demands
43 of an 'on-side' SSG and match-play in junior rugby league players. Further, this study
44 aims to examine if any correlations exist between the offensive, defensive and total
45 skill involvements performance during SSG and match-play.

46 METHOD

47 PARTICIPANTS

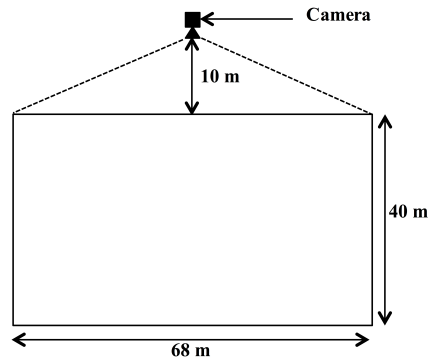
1 Data was collected from junior rugby league players (median [IQR]; $n = 15$, age = 15.9
2 [15.7-16.1] yr) participating in the Harold Matthews under-16 representative
3 competition (NSW Country Rugby League, Australia). All players were members of the
4 same NRL club and were classified as competing under the guidance of a high
5 performance talent identification program. Prior to the commencement of the study,
6 all players were informed of the aims and requirements of the research, and
7 parental/guardian informed consent was obtained. The Institutional Human Ethics
8 Committee approved all research and experimental procedures.

9 **SMALL-SIDED GAME**

10 The present study was conducted during week 6 of the competitive season. Players
11 completed a training session consisting of a standardized warm up (i.e. mobility and
12 activation drills, running builds at a pre-set intensity), one 'on-side' SSG, followed by
13 the team's normal training regime. To minimize the influence of external factors from
14 the previous week's match (i.e. neuromuscular fatigue, delayed on-set of muscle
15 soreness etc.), a rest period of 48 hours was allocated prior to completing the SSG.
16 'On-side' rules were selected to closely mimic the positional skill demands of match-
17 play. Players were permitted six 'plays' while in possession of the ball. When
18 defending, once players made 'front-on' body contact (i.e. upright tackle without
19 ground wrestling) with an attacking player in possession of the ball, the tackle was
20 classified as completed. The SSG was undertaken on a 68 m long by 40 m wide
21 playing surface, with players divided into two teams of ten. Throughout the duration of
22 the drill (3 minutes), coach encouragement was provided to ensure maximal effort.

23 **SKILL ANALYSIS PROCEDURES**

24 Players were filmed during the SSG using a video camera (HDR-JP10E, Digital HD
25 Video Camera Recorder, Sony, Japan) positioned 10 m above the playing surface on
26 the halfway line (Figure 1). Video footage of the competition match corresponding to
27 the week in which the SSG was completed were obtained from the NRL and passed
28 on to the research team by the club where the participants were recruited. Using
29 these video recordings, the skill involvements were coded according to a SSG (Table
30 1) or match (Table 2) specific criterion. The skill involvements were then divided into
31 three categories: (1) offensive (i.e. sum of ball carries, support runs, line breaks and
32 line break assists), (2) defensive (i.e. total number of 'front-on' body contacts or
33 completed tackles) and (3) total (i.e. sum of all skill involvements). All skill involvements
34 were presented per minute of play.



35
36 Figure 1. Camera positioning used to record the skill involvements of under-16 rugby
37 leagues players during a small-sided game

1 Table 1. Criteria used to code the skill involvements of the under-16 rugby league
 2 players during the small-sided game

Skill	Criteria
Offensive involvement	
Ball carry	An attacking player makes a genuine run with the ball in hand
Support run	An attacking player runs in support of the ball carrier and pushes through the defensive line
Line break	An attacking player with the ball breaks through the defensive line
Line break assist	An attacking player moves a defending player away from a support runner and delivers a timed pass that results in a line break
Defensive involvement	
Body in front	The defending player(s) make 'front-on' physical contact with ball carrier halting their progress

3 Table 2. Criteria used to code the skill involvements of the under-16 rugby league
 4 players during match-play

Skill	Criteria
Offensive involvement	
Ball carry	An attacking player makes a genuine run with the ball in hand
Support run	An attacking player runs in support of the ball carrier and pushes through the defensive line
Line break	An attacking player with the ball breaks through the defensive line
Line break assist	An attacking player moves a defending player away from a support runner and delivers a timed pass that results in a line break
Defensive involvement	
Completed Tackle	The defending player(s) makes physical contact with a ball carrier halting their progress

5 DATA ANALYSIS

6 Data distribution was assessed for normality using the Kolmogorov-Smirnov test and
 7 further through histogram and box plots. As player's skill involvements did not follow a
 8 normal distribution during the SSG or match-play, non-parametric statistical methods
 9 were used and median and inter-quartile range values calculated. For analysis
 10 purposes, only players who completed both the SSG and match were included.
 11 Differences between the offensive, defensive and total skill involvements during the
 12 SSG and match-play were determined using a Mann-Whitney *U*-test. To determine if a
 13 correlation existed between skills performed during SSG and those performed during
 14 match-play, a Spearman's rank-order correlation test was conducted. The strength of
 15 Spearman's rho (r_s) correlation coefficient with 95% confidence intervals was
 16 interpreted according to Hopkins (13), with ≤ 0.30 considered small; 0.31 to 0.49
 17 moderate; 0.50 to 0.69 large; 0.70 to 0.89 very large; and ≥ 0.90 near perfect. The
 18 criterion alpha level for significance was set at $p \leq 0.05$. All statistical analyses were
 19 performed using RStudio (Version 0.98.978; RStudio, Inc., Boston, USA).

1 RESULTS

2 Table 3 displays the relative skill involvements of under-16 players during a SSG and
3 match-play. A higher frequency of offensive skill involvements were recorded in the
4 SSG when compared to match-play, with this variable approaching significance ($U =$
5 $66.0, p = 0.05$). The defensive and total skill involvements were significantly higher per
6 minute of play in the SSG when compared to match-play ($U = 51.0, p = 0.01; U =$
7 $37.0, p < 0.01$, respectively).

8 Table 3. The relative skill involvements of the under-16 rugby league players during
9 the small-sided game and match-play

	SSG	Match
Offensive involvements ($n \cdot \text{min}^{-1}$)	0.67 (0.17-0.67)	0.17 (0.14-0.25)
Defensive involvements ($n \cdot \text{min}^{-1}$)	0.67 (0.33-0.84) ^a	0.22 (0.05-0.36)
Total involvements ($n \cdot \text{min}^{-1}$)	1.00 (0.67-1.50) ^a	0.41 (0.26-0.52)

10 Data is presented as median (interquartile range). SSG = small-sided game; $n \cdot \text{min}^{-1} =$
11 number per minute. ^a denotes a significant difference ($p < 0.01$) between the relative
12 number of skill involvement during SSG and match-play.

13 Table 4 presents the correlations between the SSG and match-play for the frequency
14 of offensive, defensive and total skill involvements. A significant, very large, positive
15 correlation was observed between the offensive skill involvements during the SSG and
16 match-play ($r_{(s)} = 0.80, p < 0.01$). A significant, very large, positive correlation was
17 observed between the total skill involvements during the SSG and the offensive skill
18 involvements during match-play ($r_{(s)} = 0.71, p < 0.01$). No significant correlations were
19 evident for defensive skill involvements during SSG and match-play.

20 Table 4. The correlations between the skill involvements during the small-sided game
21 and match-play for the under-16 rugby league players.

SSG	Match-Play		
	Offensive	Defensive	Total
Offensive	0.80 (0.50 to 0.93) ^a	0.02 (-0.50 to 0.52)	0.34 (-0.21 to 0.73)
Defensive	0.40 (-0.14 to 0.76)	0.25 (-0.30 to 0.68)	0.38 (-0.17 to 0.75)
Total	0.71 (0.31 to 0.90) ^a	0.19 (-0.36 to 0.64)	0.45 (-0.09 to 0.78)

22 Data are presented as Spearman's rho correlation coefficients (95% confidence
23 intervals). SSG = small-sided game. ^a denotes a significant correlation between
24 variables ($p < 0.01$).

25 DISCUSSION

26 The aim of the current study was to compare the skill demands of an 'on-side' SSG
27 and match-play in under-16 rugby league players. Further, this study examined the
28 correlation between the offensive, defensive and total skill involvements in SSG and
29 match-play. Collectively, the SSG offered a higher number of skill opportunities when
30 compared to match-play, particularly for the defensive and total involvements.
31 However, it appears that skills of an offensive nature are better associated with
32 match-play when compared to the aforementioned variables. In addition, the total skill
33 involvements during the SSG are strongly correlated with the offensive skill
34 involvements during match-play.

1 The use of SSG in team sports has allowed coaches and sporting professionals to
2 replicate a competitive performance environment while promoting the practice and
3 learning of a number of match-specific skills (14). From a skill acquisition perspective,
4 it is important that the practice of these skills transpire at a higher frequency than they
5 occur during match-play (15). In doing so, players are able to experience a greater
6 number of problem-solving situations and thus promoting a self-learning through
7 discovery approach (16). In this study's selected SSG, a significantly greater
8 frequency of total skill opportunities was evident when compared to match-play.
9 Accordingly, it could be suggested that the players involved would have had ample
10 opportunities to practice match-specific skill. However, it should be noted that the
11 elevated total skill involvements observed in the SSG were only significantly correlated
12 with the frequency of offensive involvements during match-play. Therefore, it is
13 possible that the players who were more involved during the SSG were also more
14 involved offensively during a match. Nevertheless, it is important that future research
15 examines this as only one week of competition was analysed.

16 Typically, past research on rugby league specific SSG has examined skills of an
17 offensive nature (7, 12). A novel aspect of this research was that it provided an insight
18 into the defensive demands of an 'on-side' SSG. Interestingly, the findings from the
19 current study suggest that there is a greater frequency of defensive skill involvements
20 during the SSG when compared to match-play, than for offensive skills. This may have
21 been influenced by the inclusion of 'front on' body contact (upright tackle without
22 ground wrestling) to complete a tackle rather than the traditional two-handed touch.
23 Appropriately, this methodology allowed for multiple defending players to be involved
24 in the completion of a tackle whereas a two-handed touch approach favours only one.
25 Alternatively, it is also possible that the number of participating players and the field
26 dimensions restricted the offensive involvements, through a reduced amount of
27 relative space for each individual (17, 18). It is likely that by decreasing the number of
28 players involved in the selected SSG there would be an increase in the number of
29 offensive involvements. While differences in the frequencies of involvements between
30 offensive and defensive skill were evident in the SSG, it seems that offensive skills
31 displayed the strongest correlation with match-play. As a result, the players involved
32 during this SSG may have received a specific stimulus for the offensive skills.

33 PRACTICAL APPLICATIONS

34 The results from this study suggest that the inclusion of 'front-on' body contact (i.e.
35 upright tackle without ground wrestling) offers players the opportunity to practice
36 these defensive skills that typically aren't offered when a two-handed touch
37 methodology is used. However, it should be noted that while it is important to provide
38 players with an opportunity to practice defensive skills, contact loads should be
39 carefully monitored to minimize the risk of experiencing a contact related injury.

40 Offensively, a very strong correlation was observed between the skill involvements
41 during the SSG and match-play. It could be suggested that the selected SSG
42 provided a specific offensive training stimulus for the participating players. As a result
43 a transfer of skill performance to match-play is more likely. Importantly, a SSG may
44 provide a coach with the opportunity to implement specific tactical plays that are
45 commonly performed during a match while placing pressure and time-constraints on
46 those involved. This type of training methodology would be ideal during the specific
47 phases of the season (i.e. pre-competition and competition), as it would allow players
48 to practice under simulated match conditions.

1 LIMITATIONS

2 This study only examined the correlations between SSG and match-play during one
3 week of competition. It is therefore appropriate that further research examines
4 whether the observed trends extend to a large sample of SSG and matches.
5 Secondly, the players were recruited from a single NRL club. Accordingly, coaching
6 philosophies and structures may have biased the frequencies of offensive and
7 defensive involvements. A potential area of future research may involve examining the
8 correlations between SSG and match-play within different standards of junior
9 competition. This would assist coaching staff and sporting professionals in an
10 understanding of the effectiveness of a SSG within their competition standard. Finally,
11 it should be noted that the calculation of each category of involvement (i.e. offensive,
12 defensive and total) differed in the number of skills included (i.e. five offensive
13 compared to one defensive) and thus constrained the observed findings.

14 CONCLUSION

15 Small-sided games are commonly used to improve the technical and tactical abilities
16 of rugby league players by providing an environment to practice under pressure and
17 fatigue. While the skill demands have been documented in past research (12, 19), little
18 is known about these demands relative to match-play. The overall findings of this
19 study provide further insight into the use of a specific SSG in training. During the SSG
20 a significantly greater frequency of defensive and total skill involvements were
21 observed when compared to match-play. However, a significant correlation was only
22 evident between SSG and match-play for offensive rather than defensive skills.
23 Although a correlation existed, it is important that future research examines whether
24 this trend extends past one week of competition.

25 ACKNOWLEDGEMENTS

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