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ABSTRACT

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

Key words: junior, game-based training, technical development, performance analysis

INTRODUCTION

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

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

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

METHOD

PARTICIPANTS

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

SMALL-SIDED GAME

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

SKILL ANALYSIS PROCEDURES

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

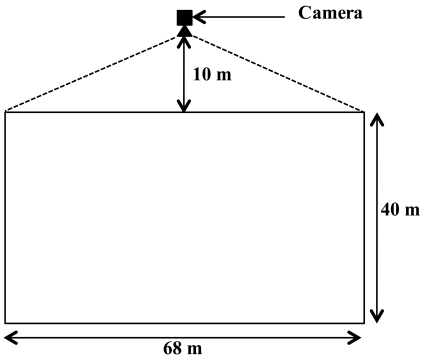

Figure 1. Camera positioning used to record the skill involvements of under-16 rugby leagues players during a small-sided game

Table 1. Criteria used to code the skill involvements of the under-16 rugby league 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

Table 2. Criteria used to code the skill involvements of the under-16 rugby league 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

DATA ANALYSIS

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

RESULTS

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

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

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

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

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

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

	Match-Play		
SSG	**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)

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

DISCUSSION

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

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

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

PRACTICAL APPLICATIONS

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

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

LIMITATIONS

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

CONCLUSION

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

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