

Small-sided games in the development of technical demands for young hockey goalkeepers.

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Abstract:

Introduction: Rink hockey motor learning and control needs deeply study to promote specific motor skills acquisition and knowledge about the game interaction. The complexity of the game suggest the fragmentation to increase the opportunities of interaction among young athletes. **Problem Statement and Approach:** The objective of this study was to analyse which game model allows for young goalkeepers to have more interventions with the ball and, consequently, a greater number of interactions on the game. **Material and Methods:** Our study consisted of 24 games analysed, divided in: 8 games in the 3x3 model; 8 games in the 4x4 model and 8 games in the 5x5 model. The 24 matches were equally divided in the levels of under 8 and under 10 years of age, with a total sample of 88 children. For data collection instrument we used the deferred observation method where we proceeded to a descriptive analysis of the data to find the means, standard deviation and totals of Goalkeeper's Interventions (GKI). Comparisons were made between game models and athlete's levels, using the Mann-Whitney and Kruskal -Wallis tests. **Results:** The results showed that, after the analysis of the total game actions, the 3x3 game model obtained a total of 168 GI actions ($21\pm 3,5$; $p=0,021$), the 4x4 model obtained 132 ($16,50\pm 5,18$; $p=0,020$) and the 5x5 game model obtained 123 GI actions ($11\pm 2,61$; $p=0,083$). **Discussion:** According to the results, it was verified that there are statistically significant differences between the 3x3 game and the 5x5 game in the "Under 8" and when compared the small-sided game 4x4 to the formal game 5x5 in the "Under 10 level" in the games analysed we perceive that the small-sided game brings more actions to the game, namely in the actions that the goalkeepers show. **Conclusions:** The 3x3 game model obtained the highest number of goalkeeper's actions in both under and under 10, suggesting benefits for improving the technical demands of these young rink hockey goalkeepers.

Keywords: - Rink Hockey; Small-sided games; Training Levels; Goalkeepers.

Introduction

Literature

Small-sided games

For a healthy body development to play a proper role in the integral education of the human being, it is important to encourage the participation of children, young and adolescents in the practice of physical activity to establish it as a habit and a good lifestyle (China, 2011). Pires (2007) refers that sport is a human activity that addresses five components: game, movement, agonistics, institution and project. Elements that together determine a better definition of sport. In this sense, sport is increasingly becoming a matter of public interest. Pires (2007) states also that we should promote sport among youth as a relevant factor in their education and health.

For Clemente (2016), coaches have used small-sided games (SSG) as part of their training process, because through these games, they develop better players and their team will improve sports performance and/or improve technical specificities. Thus, the use of this small-sided games arouses the interest of the scientific community, highlighting the effect that small-sided and conditioned games have on these aspects inherent to the game (Silva, 2017; Sannicandro, Cofano & Rosa, 2016). Bayer (1994) considers that the beginning of the differentiation of action rules in team sports and the specificities of these actions, arise with the specific technical gestures of each sport, in which the basis of these technical gestures are common elements among the SSG, insofar as there is a demand for common skills, which later become specific techniques for each sport (Chung, Carvalho, Casanova & Silva, 2019). The SSG, in addition to all their characteristics that have in their internal logic oriented by the rules of each game, they can be modified in non-professional contexts of their practice, which is indicated in the sports initiation of athletes, so it can be adapted to gain basic and specific skills in the beginning, aiming towards its

evolution (Paes, 2001). Rampinini, Coutts, Castagna, Sassi & Impellizzeri (2007) refer that games in a smaller dimension context allows more time for interaction with the ball. However, for these interactions to be more constant and frequent, it is equally important to reduce the number of players for this purpose. The authors also state that games in smaller dimensions are a method used by coaches for technical and tactical development that can promote an improvement in physical fitness. Currently, small-sided games in team sports are presented as a frequently resource used by coaches in the structure of modern training in several variables and ages to improve performance levels of its players (Badari, Machado, Moniz, Fontes & Teoldo, (2021). Hill-Haas et al. (2011) suggest that in competitive contexts, the SSG are used as an alternative and effective way of physical preparation. However, these assessments will depend on the game model, which requires a good understanding of the variables that influence movement and intensity patterns as technical executions, so that they can make a transition to the competitive aspect reflecting later in a competitive game, decreasing the volume and training load applied to players. The game in a smaller field has been used by the coaches in several sports such as football, providing gains in the technical, tactical and physical components (Flanagan and Merrick, 2002; Oliveira, Clemente and Martins, 2015). Helgerud, Engen, Wisloff and Hoff (2001) also understand that this type of intervention is important and effective for a good performance, making training for the players much more motivating (Nagy, Holienka and Babic, 2020).

Rink Hockey

Rink hockey motor learning and control needs deeply study to promote specific motor skills acquisition and knowledge about the game interaction. The complexity of the game suggests the fragmentation to increase the opportunities of interaction among young athletes. According to Honório, Batista, Paulo, Serrano, Martins and Mesquita (2017) rink hockey promotes greater technical-tactical actions in the under 8 and under 10 levels, with greater interaction with the ball, thus becoming an excellent stage of teaching-learning for the 5x5 formal game on fields of official dimensions. Ferreira (2012) according to the game approach made previously considers the beginning of the official game in 5x5, could be premature in athlete's that are in the beginning of their practice. In this sense, he proposes that the introduction in the game should be carried out through the gradual increase of the difficulty, from simple situations to others more demanding in promoting the child's adaptability to the game.

Ferreira (2012) proposes that the game structure for a training model in this sport, consists of a progressive format for game situations, namely:

- Simplified rules for a better understanding of the game;
- Modification and adjustment of the playing field considering its dimensions and number of players depending on its specific actions.

Small-sided games for goalkeepers (GK).

Amorim (2008) mentions that the goalkeeper's performance and its importance in a hockey team, is one of the most relevant, if not in countless times plays a decisive role. In hockey, the choice for the goalkeeper's requirements profile is crucial. Goalkeepers with larger and taller anthropometric measures have some advantages over those of shorter stature because they can occupy a larger surface of the goal angles. Honório and Manaças (1994) understand that bigger goalkeepers are, in some cases, less agile and versatile than the shorter ones with more difficulty in coordinating their actions.

Amorim (2008, p. 7), further states that "if we want to combine all the physical qualities of the goalkeeper into one, we will no longer have to define anything else, albeit with certain restrictions, the resulting physical quality, would be "Agility", defined by the author as the ability to move the body quickly in the three planes of the occupied space. And if we add to this definition the maximum amplitude, we are completing the definition with a primordial and determinant physical quality in the technical-tactical actions of the goalkeeper, the flexibility. If we want to extend this context, we will segment the goalkeeper's scope of action, even if reduced, another physical quality, the "strength".

Domingos (2013) concluded that the inclusion of the goalkeeper in the small-sided games influences the technical and tactical behaviours of the players on these younger levels. The presence of goalkeepers stimulates the interaction between players of the same team and the non-presence enhances individual behaviours centered on the player/ball binomial. The number of players influences the technical and tactical behaviour of the players in this category. When games are played with a smaller number of players, it has been found that more passes were made, more successful shots, more duels between players and more recoveries of ball possession. It was also found that the "game area" influenced the technical and tactical behaviours of players of these ages, since the field increase also allowed an increase in the occurrence of ball driving, and in a smaller field, less loss of the ball. Smaller field areas enhance shooting and ball intercepting, while larger field areas facilitate ball handling.

Baldi, Silva & Faria (2017) found in their study that the 4x4 game model was more effective than the 5x5 model for the development of technical and tactical objectives. However, with the coach's intervention, including modifications in these small-sided games, it allowed a more homogeneous exercise among the players, including a greater number of interactions by the goalkeepers. According to Dawid, Muracki, Wolański, Sebastian & Ciałowicz (2016) small-sided games are often used in the training process. A group of training exercises allows to develop and domain several skills, and the changing of behaviours related to specific situations during a

game. This study aimed to assess the intensity of exercise during a 1x1 game model for goalkeepers. The 1x1 game model was the one that evidenced more intensive game actions, as well as the average exercise intensity was similar to the scoring opportunity situations and conditions of a standard match.

In a study by Jara, Ortega, Miguel-Ángel & Sainz de Baranda (2018) the small-sided games can be an excellent training method for goalkeepers. The main objective was to analyse how the field size variation affected the tactical actions executed by the goalkeeper. The results showed that the presence or absence of different behaviours may vary depending on the field size, as well as the areas of action and the level of security in handling the ball by the goalkeepers.

Mendo and Argilaga (2000), carried out a study with 66 hockey players with the objective of defining an observation system for knowledge about the players' action patterns. The games observed were divided into 4 categories: Shoots Actions, technical and tactical actions, goalkeeper interventions and warnings/penalties. The technical and tactical actions demonstrate a more intense game patterns in small-sided games.

Methods

Participants and games observed

The games observed consisted in 24, from 4 different teams, with the team's levels divided into: 8 games in the 3x3 game model; 8 games in the 4x4 game model and 8 games in the 5x5 game model. The 24 games were equally divided between the levels of "Under 8" and "Under 10" of 4 clubs with a total of 88 participating athletes. The 3x3 and 4x4 game models were played in half-field, measured between the midfield line and the bottom-line board, with the game being played between the side boards. The 5x5 games are held in the context of a formal game occupying the entire field. After the acceptance of the proposal by the clubs, we proceed to deliver requests for informed consent to the parents of the players to record the games. We resorted to filming several games and then recorded the number of interventions by the goalkeepers themselves, in each training levels. All the games analysed had a duration of eight minutes. As previously mentioned for the 3x3 and 4x4 game models, the field measurements used were in half-field (20m x 20m), and in the 5x5 game model the field measurement used was the entire field (40m x 20m).

Statistical procedures

For the inter-observer evaluation, an excerpt of the first 3 minutes of a predefined game was analysed, to know what percentage of agreement between the observers using the Bellack formula presented and described below: % of Agreements = (number of agreements) / (number of agreements + number of disagreements) X 100. The reliability of the observation can be attested by the high percentage of registered agreements, which is at least 85%, only with values equal to or greater than the agreements, both in the intra-observer and inter-observer modality, as we can see in the following table:

Table 1- Bellack indices agreements intra and inter observer.

| Observed variable | intra-Observer agreements | inter-observer agreements |
|---------------------------|---------------------------|---------------------------|
| Goalkeepers interventions | 100% | 100% |

For statistical purposes, the version of SPSS 20 statistic program was used, with means and standard deviation values presented. According to the games observed, less than or equal to 30 (sample = 24), it is appropriate to use non-parametric tests (Almeida & Freire, 2000). Therefore, we used the Mann-Whitney test to compare two independent samples, the Kruskal-Wallis test to compare three or more independent samples, as well as the Spearman correlation test.

Objective of the study

To identify the game model that allows goalkeepers to obtain a greater number of interventions with the ball, in hockey, in the "Under 8" and "Under 10" initiating levels.

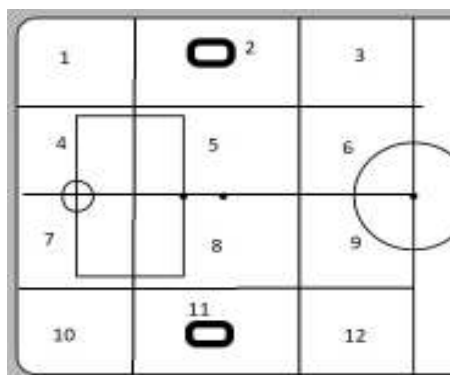


Figure 1- Field-diagram for the small-sided games (adapted from Garganta, 1997)

Goalkeeper Interventions (GKI): We have considered goalkeeper interventions, the following actions: Every time they defended a ball directed at goal, makes any kind of tackles on the opponent, passes the ball to a teammate and situations in which the goalkeeper moves and/or stand up to perform any other action on the ball.

Results

Table 2 – Statistic data (means) from the Under 8 player’s level

| Number of players | GKI* |
|-------------------|-------|
| 3 | 21.25 |
| 4 | 14.75 |
| 5 | 10.00 |

*GKI – goalkeepers interventions

Upon a first analysis its observable differences between the 3 games models in the “Under 8” level, with a greater difference a mean value for the 3x3 model game. When the formal game is played (5x 5), with the increase in the number of players, the players must use a more collective dynamic, since the field becomes bigger, with not so many individual interventions per player, which consequently decreases the number of GKI interventions.

Table 3 – Statistic data (means) from the Under 10 player’s level

| Number of players | GKI* |
|-------------------|-------|
| 3 | 20.75 |
| 4 | 18.25 |
| 5 | 12.00 |

*GKI – goalkeepers interventions

After analysing the “under 10” level, the 3x3 game model also presents more situations of intervention by the goalkeepers. The same trend is also confirmed in the formal 5x5 game since the dimensions of the field are larger.

Table4–Total values of GKI, means and standard deviation of the different game models

| | 3x3 | 3x3 | 3x3 | 4x4 | 4x4 | 4x4 | 5x5 | 5x5 | 5x5 |
|----------------------------------|-------|------|-----|-------|-------|------|-------|------|------|
| | Total | Mean | SD | Total | Mean | SD | Total | Mean | SD |
| Goalkeepers Interventions | 168 | 21 | 3.5 | 132 | 16.50 | 5.18 | 123 | 11 | 2.61 |

The 3x3 game model has demonstrated the greatest number of interventions by the goalkeeper (t = 168; X= 21 ± 3.5). In the 5x5 games, however, the same trend of lower GR actions continues, whenever it is played in a formal (standard) game situation.

Table5–Comparison between 3x3 and 4x4 game models in both levels (under 8 and under 10)

| Level | GKI* |
|----------|-------|
| Under 8 | 0.149 |
| Under 10 | 0.554 |

*GKI – goalkeepers interventions

Sig $\alpha \leq 0.05$

According to the Mann-Whitney non-parametric test, we used a brief statistical analysis of the 3x3 and 4x4 game models within the Under 8 level and later in the Under 10 level and its presented that in none of the games studied in both levels analysed, no significant differences between these game models were found.

Table 6–Statistical comparison between 3x3 and 5x5 game model in the Under 8 level

| Level | GKI* |
|---------|--------|
| Under 8 | 0.021* |

*GKI – goalkeepers interventions

* Sig $\alpha \leq 0.05$

Using the same test (Mann-Whitney) but analysing the 3x3 game model with the formal 5x5 game model, within the Under 8 level, we found that there are statistically significant differences ($p \leq 0.05$) in favour of the 3x3 game model in the number of times that the goalkeeper intervenes in the game ($p = 0.021$).

Table 7–Statistical comparison between 3x3 and 5x5 game model in the Under 10 level

| Level | GKI* |
|----------|--------|
| Under 10 | 0.020* |

*GKI – goalkeepers interventions

* Sig $\alpha \leq 0.05$

After analysed the 3x3 game model with the formal game 5x5, within the Under 10 level, we found that there are significant differences ($p \leq 0.05$), also, in favour of the 3x3 game model in terms of the number of times that the goalkeeper intervenes in the game ($p = 0.020$).

Table 8 - Statistical comparison between 4x4 and 5x5 game models in the Under 8 and Under 10 levels.

| Level | GKI |
|----------|-------|
| Under 8 | 0.149 |
| Under 10 | 0.083 |

* Sig $\alpha \leq 0.05$

Comparing the 4x4 and 5x5 game model between these levels, we can see that there are no statistically significant differences ($p \leq 0.05$) between levels in this variable.

Table 9- Statistical comparison between Under 8 and Under 10 levels in the 3x3, 4x4 and 5x5 game models.

| Game model | GKI |
|------------|-------|
| 3x3 | 1.000 |
| 4x4 | 0.386 |
| 5x5 | 0.309 |

* Sig $\alpha \leq 0.05$

Table 9 presents that there are no statistically significant differences ($p \leq 0.05$) when comparing both levels in the 3 game models.

Discussion

According to the results, it was verified that there are statistically significant differences between the 3x3 game and the 5x5 game in the “Under 8” level in our study which agrees with the study by Musch and Mertens (1991), since in the small-sided game there are more present interactions on the ball, complying a greater number of interventions by the goalkeepers. In the study by Flanagan and Merric (2002) the small-sided game is used to provide gains in the technical, tactical and physical component, which is verified in these results because when compared the small-sided game 4x4 to the formal game 5x5 in the “Under 10 level” in the games analysed we perceive that the small-sided game brings more actions to the game, namely in the actions that the goalkeepers show.

We also emphasize Carvalho, Scaglia and Costa (2013), in which the tactical behaviours showed significant differences between the results of the small-sided games, both in the offensive and the defensive level. Our study also points to a more dynamic format due to the number of interactions with the ball and technical-tactical principles, with no agglomeration of players around the ball, so there is more contact with the ball and consequently more solicitations from goalkeepers. According to the literature, we refer to the study by Mendo and Argilaga (2000), where it was found that the small-sided game improved the interaction with the ball between the players and in particular the interventions made by the goalkeepers. In this study, the same type of behaviour was found in which, as smaller was the number of players, more interventions there were with the goalkeeper during the game, as shown among the game models analysed in this study, namely in the situation of 3x3.

The same situation is verified in the investigation by Jara et al. (2018), where, according to the size of the field and the number of players, the goalkeeper's interventions diverge, in this case with results identical to ours in which the smaller size of the field leads the players to make shorter distances within the field, with more changes of direction and more actions close to the goal and consequently more demands from the goalkeepers. Baldi et al. (2017) found, in the comparison between the 4x4 and 5x5 game models, that the smaller number of players allowed greater interaction between players and more consistency in fulfilling the proposed objectives as well as a greater and more intense participation of goalkeepers during the periods of game. In our analysis, and between these two game models, there were more actions by goalkeepers in the 4x4 model.

As previously described by Domingos (2013) the presence of goalkeepers stimulates the interaction between players of the same team as well as increases the competitiveness between two teams due a faster search for the goal. The non-presence enhances more individual behaviours. The author concluded that smaller fields enhance

shots and ball interceptions, which resulted in an increasing number of balls directed towards the goal and thus more actions by the goalkeepers, in line with our results.

Conclusions

Considering the objectives described in the present study, in this analysis we can refer that the game model where more finishing actions were carried out was in the 3x3 model where 168 Goalkeeper interventions were counted. We can also observe that within the small-sided game models, the 4x4 situation in a smaller field allowed the athletes more actions and more experiences, on the other hand the Goalkeepers always had more influence in the 3x3 game model and as the number of players increases, the influence of the goalkeeper is lower which will not be so interesting to its evolution, in these levels. These small-sided games allows to goalkeepers that shorter distances to be overcome by field players, compel the goalkeeper to have a more specific attention capacity because the ball is closer to the goal more often, that factor leads to technical skills closer to game situations, favoring the speed of reaction, faster displacement in movements execution and faster changes of direction, qualities that are important in these players.

For the development of the player in the goalkeeper position, the small-sided games should be, among other factors, a part of the training moments in these levels of practice. By this, it is understood as a valid instrument for learning in team sports, in this specific case, in hockey, corresponding to the development process of the athlete in a training process.

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