

Numerically equal small-sided game effect of 2v2 and 3v3 in a decision- making task simulated in handball

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Abstract:

Introduction: In team sports, the use of small-sided games (SSG) is a common practice to achieve learning or training objectives. The most important thing is to find the most suitable SSG (FSSG) format. If all aspects of the preparation of athletes have been addressed in the SSG, the psychological field remains the least studied. Little is known about sports behavior in terms of decision-making in SSG situations. **Objective:** This study investigates the effects of numerically equal FSSG in a simulated handball decision-making task. **Methodology:** 12 expert handball players and 12 novices were studied, using a 2x2x3 factorial design of FSSG in numerical equals (2v2 or 3v3), level of expertise (expert vs novice) and types of actions (passing, keeping and shooting). The task of the participants was to make a quick decision by choosing the relevant action (keep, pass or shoot) if they were carrying the ball on static FSSG situations. **Results** The results showed that during the FSSG in numerical equal (2v2) and (3v3), the novices have equal scores to those of the experts in addition to an unexpected effect of the types of actions. **Conclusion:** These results represent a novelty in the paradigm of the study of expertise comparing experts to novices, which can be inferred to an expertise reversal effect. Important consequences are to be drawn from this study concerning the aid to the relevant decision-making of coaches in FSSG situation in terms of choice between learning and training in order to adapt the number of players present in the FSSG at different levels of expertise.

Keywords: handball; Decision-making; small-sided games; Team sports.

Introduction

The use of small-sided games (SSG) is a common practice in team sports, this averages provides coaches with an essential resource to achieve their learning or training objectives for different purposes (DANTE et al., 2019; Fernández-Espinola et al., 2020; Michailidis, 2013). If this choice of type of training is motivated by technical, tactical, physical or psychological goals or objectives to be achieved (Fernández - Espinola et al., 2020; Práxedes et al., 2018). The most important thing is to find the most appropriate SSG (FSSG) format, in terms of the choice of space, the number of players in attack or defense, the tasks and the instructions to be given or the modification of the rules, for the achievement of its objectives.

Like any team sport, handball also uses SSGs. Some studies, and particularly in football, have addressed the subject of the use of FSSGs for technical, tactical, physical or psychological purposes. according to Clemente , the psychological domain is reduced to an analysis of jouissance (F. M. Clemente, Afonso, et al., 2021). Little is known about the psychological behavior and characteristics of actors, in terms of decision-making, in handball in FSSG situations.

The aim of the present study is to analyze the FSSG effect and the level of expertise in a simulated decision-making task in handball.

According to Hill-Haas et al., SSG is played on small pitches with frequently changed rules and involving a small number of players. These SSGs are less structured than traditional training methods (Hill-Haas et al., 2011). SSGs are also characterized as playful situations involving the movements used for sports teaching/training, respecting the main principles of the game. In addition, the use of FSSGs in training scenarios to present a specific tactical problem to players of team sports. the consistent use of these games based on this type of drill induces adaptations in the technical execution and tactical behaviors of young players in team sports (Bujalance-Moreno et al., 2019; F. M. Clemente, Ramirez-Campillo, et al., 2021; THIAGO et al., 2021; Zouhal et al., 2020). So the choice of FSSG type depends on the purpose for which the SSG was chosen.

In general, changes to chosen FSSGs relate to reducing the size of the field surface and the format of the game from the point of view of the number of players present in the game situation.

This game format can be small, medium or large; or again in numerical balance (that is to say that the two teams have the same number of players), or in numerical imbalance (numerical superiority or numerical inferiority), whether in a situation of attack or defense (F. Clemente & Sarmento, 2020; Torrents et al., 2016).

The number of players involved in SSGs is a constraint often used by coaches (F. Clemente & Sarmiento, 2020), hence the need to adapt the complexity of the tasks to the skill level of the athletes to improve as much as possible their perceptual, visual and attentive abilities (Práxedes et al., 2018), since in general, the environment, teammates and opponents represent constraints to the player carrying the ball (F. Clemente et al., 2012).

The combination of these two factors, that is to say the decision-making with external constraint including changes of FSSG in number of players present in the situation, would it be likely to modify the decision-making behaviors of the players in situation? of numerical balance ?

Otherwise, do novices make decisions, as relevant and quick during FSSGs in a situation of numerical equality as their expert counterparts? The answer to this question could make it possible to better understand the effect of FSSGs on decision-making and contribute to the development of new strategies for managing FSSG situations that are more relevant to the achievement of the objectives assigned to learning or in training. The lack of consistency in the results and the discrepancies are even greater in the methodologies of previous studies. (FM Clemente et al., 2020).

The aim of this study is therefore to analyze the effect of FSSGs and expertise on decision-making in a 2v2 and 3v3 numerical equal situation among handball players.

Method

Attendees

Twenty-four adult male gamers, aged 18 to 34 (M age = 25 years, SD = 2.90), participated in this study. They belonged to two different groups: experts and novices. The panel of experts was composed of 12 players (M age, = 31.5, SD = 5.12; M years of experience = 13.3, SD = 4.02) and practicing for more than 10 years in the second division of the Algerian national handball championship. Participants in the novice group had (M age = 23.3, SD = 6.35) and had never practiced team sports in a club. The study was approved by the local ethics committee and was conducted in accordance with the Declaration of Helsinki. All participants volunteered their time and gave their consent before the testing sessions. None of them have participated in this type of experience before.

Equipment

Forty-eight handball game situations in the form of images from a match of the Algerian national championship of handball division one. Game situation images, taken from videos of the team in possession of the ball in attack, have been processed to be able to determine the number of players present in the situation as a numerical equal: attackers against defenders either (2v2) or (3v3) and by the type of action that is optimal for the ball carrier (keeping, passing and shooting). After processing, the game situation images were assessed independently by three expert coaches. The latter designated the most relevant action for each type of game situation. Majority agreement was taken into account, there was no game situation where the experts were completely different.

Procedure

Each participant, seated in front of an individual laptop computer, followed the two SSG formats in numerical equality, presented successively (reduced game situations with 4 players or 6 players: 2v2 or 3v3) including 12 warm-up situations. The task of the participant is to respond as quickly and as relevantly as possible to the appearance of the game situation, and to say what action he would choose (keep, pass or shoot) if he were the ball carrier, to give his answer, the subject must press with one of the three fingers on one of the three keys of the keyboard associated with the answer (K for the Pass action, L for Keep and M for shoot).

Each test proceeds as follows (see Image 1): a preparation signal (!) of 2500ms indicates to the subject that an image will appear, this signal is followed by the presentation of the image of the game situation and remained on the screen until the subject's response. Once the subject responds, the signal (!) reappeared for 2500ms on the corresponding screen between two attempts. During this study, the 48 game situations are randomly distributed, to test the effect of small-sided game with numerical equals (2v2 and 3v3) in a simulated decision-making task in handball in terms of "Relevance of response" (PR) and "Response time" (TR).

The performance metrics used were Response Relevance and Response Time. Response Relevancy was measured by comparing participants' responses with expert coaches' assessments of game situations. Response Time was measured in milliseconds

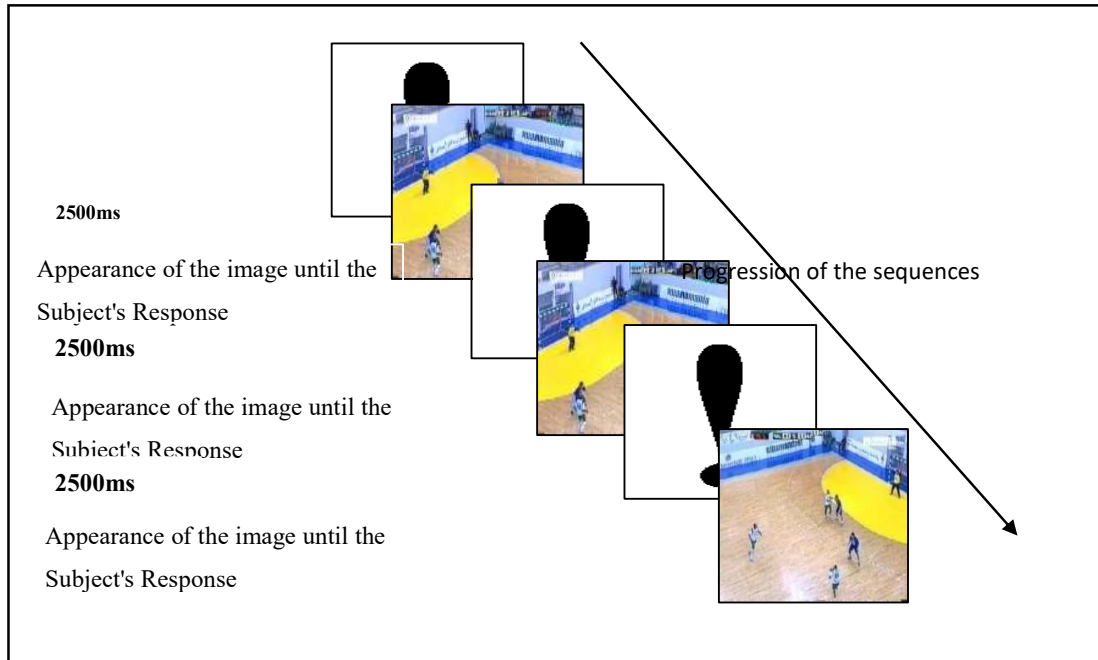


Image 1. Represents the progress of the FSSGs during the test.

Data analysis

Individual averages and standard deviations were calculated for each dependent variable. Levene's test for homoscedasticity and the Kolmogorov-Smirnov test for normal distribution were used to make the assumptions necessary to confirm the non-violation of the parametric tests. A repeated measures analysis of variance (ANOVA) was used to examine the effect of FSSG in 2v2 or 3v3 and expertise (expert vs novice) for the dependent variables and the decision in terms of Relevance of response and the Response time for the three types of action (pass, keep and shoot). The level of significance (α) was set at 0.05 for all analyses. Whenever necessary, a posteriori comparisons have been used by Tukey's test of significant difference to determine the nature of important effects. Effect sizes were expressed as the partial Eta squared (η^2).

To analyze the results of the relevance of the decision, an initial group 2 (expert, novice), 2 types of situations (2v2 and 3v3) and the type of action (pass, keep and shoot) to analyze the effect that the different types of FSSG in equal numerical had on response relevance for both groups.

The decision time was analyzed using an initial group 2 (expert, novice), 2 types of situations (2v2 and 3v3) and the type of action (pass, keep and shoot) to study the effect that the different types of situations in numerical equality had on the response time for two groups.

Results

Table 1 shows the average scores and standard deviations of the dependent variables for all conditions. A $2(\text{FSSG}) \times 2(\text{expertise})$ and the dependent variable of response relevance for action type (pass, hold, and shoot).

Average scores (standard deviations) for response relevance and response time, for each experimental condition and level of expertise **Table 1**

	Relevance of Decision		Decision Time	
	FSSG		FSSG	
	2v2	3v3	2v2	3v3
Expert	0.49 (0.03)	0.63 (0.05)	5174 (317.36)	5050 (389.54)
Novice	0.51 (0.09)	0.64 (0.08)	5723 (450.55)	5704 (524.37)

Relevance of decision

The results show a main effect of FSSG situations $F(1.22) = 8.53$; $p < 0.008$ $\eta^2 = 0.56$ and a typical action effect $F(2.44) = 3.860$; $p < 0.02$ and $\eta^2 = 0.149$, on the other hand, there was no main group effect or significant interaction effects between the different variables.

Post hoc tests revealed that in both types of situations, the expert group was more relevant than the novice group in FSSG (2v2) ($p = .002$) and ($p = .003$) for situations in FSSG (3v3). For the FSSG type and action type interaction, post hoc tests revealed that in FSSG (2v2) situations the expert group was more relevant than the novice group successively for the pass action ($p = .04$), keep ($p = .02$) and pull action ($p = .001$). In FSSG (3v3) situations, the scores of the expert group were higher than those of the novice group only in guard action ($p < 0.05$). (As shown in Figure 1).

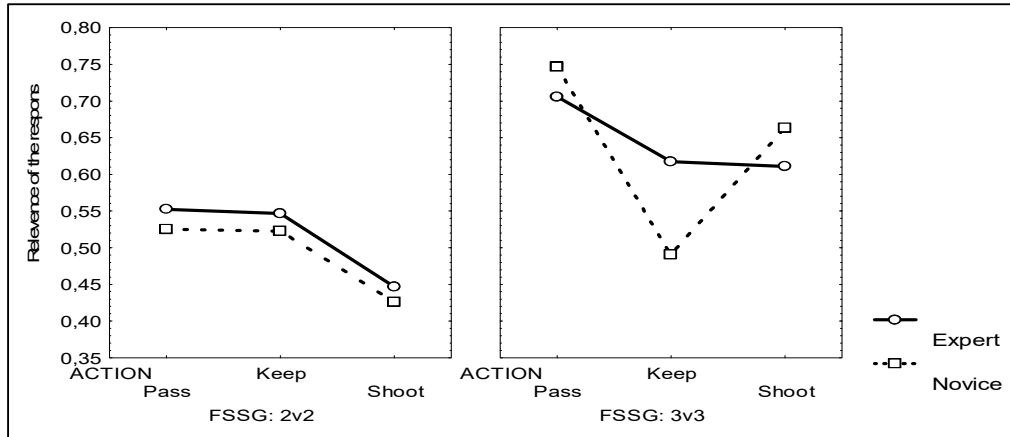
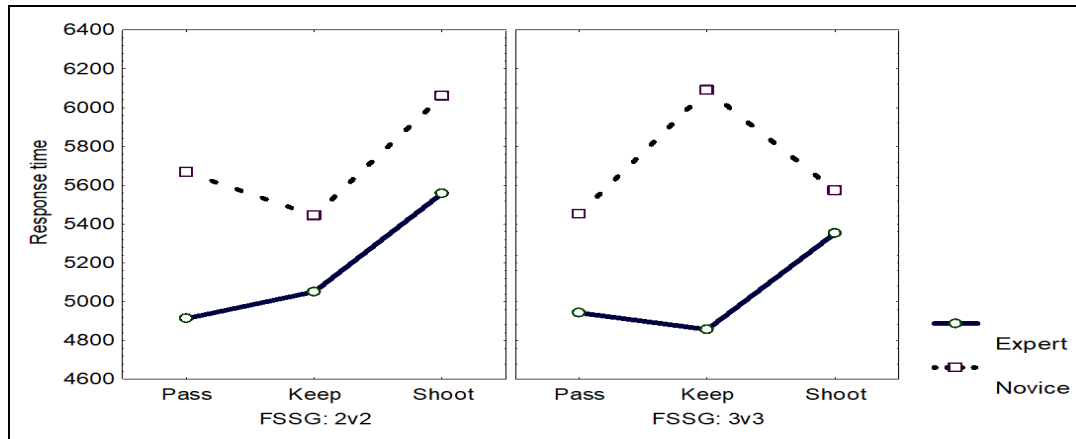


Fig 1. Average rate of correct decisions, for each group according to the FSSG (2v2) and (3v3) and the type of action.

Response time

The results show action-type main effect $(2.44) = 3.86$; $p < 0.029$ $\eta^2 = 0.149$ on the other hand there was no main group effect or FSSG situations as well as no significant interaction effects between the different variables.



Post hoc tests revealed that in all forms of FSSG situations the expert group had better scores than the novice group successively in FSSG situations (2v2) for the types of action: passing ($p = .03$), keeping ($p = .002$) and the shoot action ($p = .001$), and in FSSG (3v3) situations only for the keep action ($p = .03$) (as illustrated in fig 2).

Fig 2. Average response time, in ms, for each group according to the FSSG (2v2) and (3v3) and the type of action.

Discussion

The aim of this study was to analyze the effect of FSSGs and level of expertise on decision-making in a 2v2 and 3v3 numerical equal situation among handball players. In general, the results show that during FSSG in numerical equal (2v2) and (3v3), the novices have equal scores to those of the experts. This is inconsistent with previous studies on expertise demonstrating the superiority of expert athletes in cognitive tasks, for example, (Abernethy et al., 1994; Pinder et al., 2011). these results confirm the outcomes of other visuo-spatial and verbal

memorization tasks, in the study by Zoudji and his associates the results revealed no difference in response accuracy, nor response time between the groups of experts and novices (Zoudji et al., 2010)

In the study by Zoudji and associates, the results revealed no difference in response accuracy or response time between soccer groups of expert and novice (Zoudji et al., 2010), as well than in the SANMUGA study in field hockey where quasi-experimental results indicated no significant difference in decision-making in 5vs5 play between high-skilled and low-skilled players (SANMUGA, 2015).

We agree with Khacharem about an interaction effect called expertise inversion, where presentation of information that is effective for a novice might be ineffective for an expert and vice versa (Khacharem et al., 2015). The results of the study by Khacharem and colleagues demonstrated an expertise reversal effect for the segmentation of micro-stage and macro-stage animated soccer scenes, where novice learning outcomes were positively affected. than those of the experts, even if the latter invested less mental effort and less repetition for the recall in the two segmentation conditions (Khacharem et al., 2013).

In response relevance, the performances of the two expert and novice groups, in the post-hoc results of the type of action, are equal in both FSSG (2v2) and (3v3) except for the keep action in FSSG (3v3) . these results coincide with previous studies where an increase in the number of technical actions performed per player with smaller teams (Almeida et al., 2013; F. M. Clemente et al., 2014; Katis & Kellis, 2009; Kim et al., 2016; Owen, 2014) Almeida et al., 2013; Clemente , Wong, Martins, & Mendes, 2014; Joo et al., 2016; Katis & Kellis , 2009; Owen et al., 2014). Da Silva et al.'s study using tied FSSGs in football (3v3; 4v4; and 5v5), showed that team size does not influence the number of passes, tackles and headers , but that the number of dribbles, crosses and shots on goal increases in small games among young players. It was also observed that inexperienced players opted more often for the construction of attacks based on individual actions, while the use of ball possession was preferred by experienced players (da Silva et al., 2011).

For the Response time, regarding the post-hoc results of the type of action, the scores of the expert group are better than those of the novice group in both FSSG (2v2) and (3v3), except for the passing and shooting actions. FSSG (3v3). The results confirm findings from previous studies on the effect of short-sided plays where in a study by Mason and colleagues, in basketball, players spent more time in possession of the ball in all 3v3 formats compared to 5v5. (Mason et al., 2018). Amateurs always rely on external feedback, hence the increase in response times for novices (Gonçalves et al., 2016). Mason and associates also find that court dimensions affect basketball player activity profiles during 3v3 SSGs but have little impact on technical performance when time pressures (shot clocks) are constant (Mason et al., 2018) .

Our research was conducted in situations of FSSG in digital equal, situations with low and medium density of presence of FSSG players successively: (2v2) and (3v3). There are also other types of FSSG in extreme numerical equal (1v1) or (5v5) (Sarmiento et al., 2018) or totally in numerical superiority of different densities of players present in the situation: (2v1), (3v2) ,... (5v4), etc. Such FSSGs arguably exhibit similar differences in decision-making behavior between different levels of expertise as we have highlighted, differences that would arguably deserve to be examined more systematically.

Several lines of research open up as a result of this research. First, it would be interesting to better understand the context of strong FSSG in numerical superiority (3v2) and (4v3) than in numerically equal FSSG used with weak (2v2) and average (3v3). Our findings have important implications for handball coaches regarding relevant decision support in FSSG situations.

In conclusion, the results of the present research show that during FSSG in numerical equal (2v2) and (3v3), novices have equal scores to experts. We also found that novice participants scored higher on tactical (3v3) action types and vice versa on technical action types than experts. Finally, even if the objective of the present research was not to study the effect of the types of actions, the results of the research seem to infer this tendency.

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Conflicts of interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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