

# Effect of modifications in rules in competition on participation of male youth goalkeepers in soccer

Enrique Ortega-Toro<sup>1</sup>, Antonio García-Angulo<sup>1</sup> ,  
José-María Giménez-Egido<sup>1</sup>, Francisco J García-Angulo<sup>1</sup>  
and José Palao<sup>2</sup>

## Abstract

The purpose of this study was to assess the effect of modifications in field size, number of players, and goal size on the goalkeeper's actions in competition in male youth soccer ( $n=4$ ) (under-12). A quasi-experimental design was implemented to measure the effects of the changes in the number of players per team (8-a-side vs. 5-a-side), goal size ( $6 \times 2$  m vs.  $3 \times 2$  m), and field size ( $58 \times 38$  m vs.  $38 \times 20$  m) on the offensive and defensive technical and tactical actions of the goalkeeper. Four male under-12 goalkeepers (age =  $11.33 \pm 0.6$  years, average weekly training =  $2.45 \pm 0.3$  h, and years of experience =  $4.8 \pm 0.9$  years) were analyzed in three tournaments (8-a-side; 5-a-side; 8-a-side). The dependent variables were: defensive and offensive technical actions taken by the goalkeepers and the way their actions were carried out. The results show that in the 5-a-side soccer matches, goalkeepers carried out more defensive actions (8-a-side:  $31.2 \pm 3.8$ ; 5-a-side:  $77.75 \pm 5.0$ ; 8-a-side:  $39.5 \pm 6.0$ ;  $F_{2,6} = 111,218$ ,  $p = .000$ ,  $\eta^2 = .974$ ; ES .998) and offensive actions (8-a-side:  $58.0 \pm 7.1$ ; 5-a-side:  $84.0 \pm 13.5$ ; 8-a-side:  $58.1 \pm 9.2$ ;  $F_{2,6} = 16,257$ ,  $p = .004$ ,  $\eta^2 = .844$ ; ES .996) than in 8-a-side soccer matches. The reduction in field size, number of players, and goal size resulted in under-12 goalkeepers having more interaction and more variability in their actions. This information could help the different stakeholders to adapt or design the youth soccer competition rules in a way that allows goalkeepers to have more experiences.

## Keywords

Competition, match analysis, sport, technique, youth player

## Introduction

In the development stages, sport must be adapted to children to provide an enriching experience that allows them to develop as players and people.<sup>1–3</sup> Rule modification is commonly used in sports to adapt them to children's cognitive and physical capacities. Manipulating the game's task constraints affects the motor actions performed by the children.<sup>4–6</sup> In soccer, the use of rule adaptations, such as small-sided games, is common in training.<sup>7–9</sup> However, currently, due to the numerous aspects that affect the interactions of the players during the game, it is not completely clear what the impact of these modifications are.<sup>10–12</sup> Most of the studies that have been done have analyzed the impact of these rule modifications in senior field players, with regard to physical aspects, and in training situations.<sup>13</sup> Less information is known about the impact on technical development and on players' learning.<sup>14–16</sup> More studies are needed that analyze the impact of

rule modifications on the technical development of the players, especially goalkeepers, due to the fact that this player's role has been studied less.<sup>17</sup>

Training and competition attempt to develop the players' maximal potential. Different players' roles have different functions, positions, etc., therefore they have different demands of the game.<sup>18,19</sup> The analysis of goalkeepers shows that their characteristics are different than the characteristics of field players.<sup>20</sup> For

Reviewers: Pantelis Theodoros Nikolaidis (Exercise Physiology Laboratory, Nikaia, Greece)  
Corrado Lupo (Università di Torino, Turin, Italy)

<sup>1</sup>Department of Physical Education and Sport, Faculty of Sport Sciences, University of Murcia, Murcia, Spain

<sup>2</sup>Exercise Science & Sport Management, University of Wisconsin, Parkside, Kenosha, Wisconsin, USA

## Corresponding author:

Antonio García-Angulo, Faculty of Sport Sciences, University of Murcia, Av/ Argentina San Javier, Murcia 30720, Spain.  
Email: Aga37082@um.es

goalkeepers, studies have suggested that aspects such as experience and player anthropometry are more important than physical capacities, such as speed, agility, and endurance.<sup>21</sup> Currently, the role of the goalkeeper is critical in soccer, not only in defense, but also in offense as they start the team's attack.<sup>22,23</sup> The goalkeepers' development process should prepare them for the current and future demands of the game.<sup>24</sup> One of the goals of rule modifications in training and in competition is to create progressive steps in players' preparation. Most of the research that is available regarding the effect of rule modification has been focused on field players and on the possibilities of this type of adaptation to improve players' physical capacities. Few studies have analyzed the effect of rule modifications on goalkeepers' technical actions. In under-16 male soccer players,<sup>25</sup> the effect of a 5-a-side match on different field sizes (62 × 44 m; 50 × 35 m; 32 × 23 m) was tested. The results showed that the number of the goalkeeper's interventions did not change when the field size was reduced. However, data from other studies have shown that the presence of the goalkeeper in small-sided games affected the field players' heart rate<sup>25–27</sup> and increased the number of shots and tackles.<sup>28,29</sup>

In under-12 soccer, the available information about the modification of match rules has shown that reducing the field size and the number of players (11-a-side vs. 7-a-side) has increased the players' ball contacts and their efficacy.<sup>30,31</sup> These rule modifications also involved more offensive actions.<sup>31,32</sup> These studies did not analyze the impact of these rule modifications on the goalkeepers' actions. In theory, the reduced field size, number of players, and goal size should increase the participation of the goalkeeper in the game in both defensive and offensive actions.<sup>33</sup> This will contribute to increasing the goalkeeper's specific experience and to increasing the interactions with the rest of the teammates.<sup>34</sup> Data from this study can help coaches with the planning process of the training and development process of their goalkeepers. The purpose of this study was to assess the effect of modifying the field size, the number of players, and the goal's size on the goalkeepers' actions in competition in male youth soccer (under-12).

## Methods

Four male under-12 goalkeepers were studied. A total of 989 actions taken by the goalkeepers (nine matches per goalkeeper) were analyzed. Matches were played by four under-12 teams from a local club competition at the end of the competitive season. All the studied goalkeepers played the entire match. The goalkeepers had the following characteristics: age =  $11.33 \pm 0.6$  years, average weekly training =  $2.45 \pm 0.3$  h, and

years of experience =  $4.8 \pm 0.9$  years. Players' parents or guardians were informed of the study, and they provided their written consent. The study was approved by the Ethics Committee of the principal researcher's university.

An A-B-A design was implemented to measure the effect of changing the game rules. The goalkeepers studied played the tournaments with their own teams (quasi-experimental study). The sequence of experimental conditions moves from no change in rules (situation A, official rules), changes in the rules (situation B, modified rules), and back to no change in the rules (situation A, official rules). This type of design is characterized by two untreated situations (the first and third phase) and one experimental situation (the second phase). The use of a third untreated situation (as a control) gives the study a higher degree of internal validity than an A-B design (using a single control).<sup>35</sup> The independent variable was the game format. There were two levels: official rules and modified rules. The difference between the official and the modified rules were the following: field size (58 × 38 m vs. 38 × 20 m), number of players per team (8-a-side vs. 5-a-side), and goal size (6 × 2 m vs. 3 × 2 m). The first and third tournaments were played with official state rules for under-12 soccer set by the soccer federation (8-a-side). The second tournament was played with a modification of the under-12 official rules (5-a-side). Table 1 shows the rules of both competition formats. The dependent variables were: defensive technical actions carried out by the goalkeeper to prevent an opponent goal (save, parry, clear out, deflection, open palm, fly, and other actions); offensive actions taken by the goalkeeper

**Table 1.** Description of the rules implemented in the tournaments (8-a-side and 5-a-side).

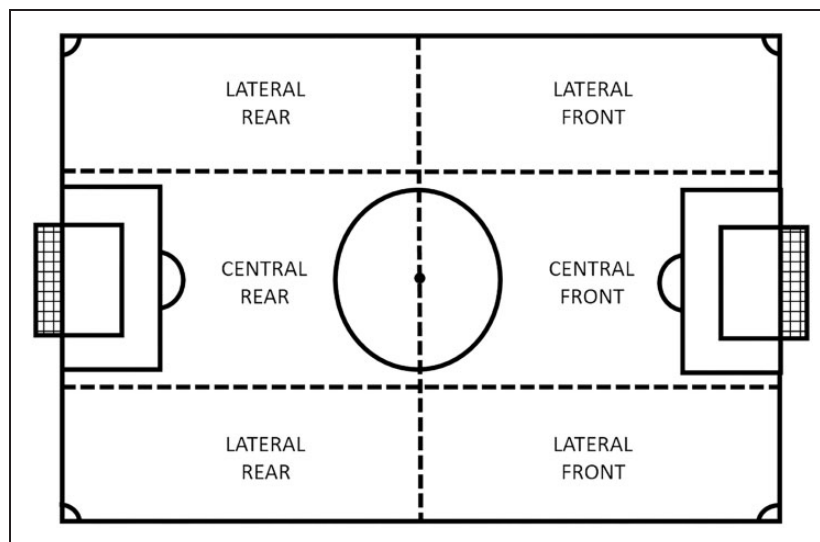
Rules	Official rules (8-a-side)	Modified rules (5-a-side)
Number of players	7 field players + 1 goalkeeper	4 field players + 1 goalkeeper
Number of players (team)	15	7
Field size (m)	58 × 38 m	38 × 20 m
Goal size (m)	6 × 2 m	3 × 2 m
Penalty area size (m)	24 × 9 m	12 × 6 m
Goal area size (m)	12 × 3 m	None used
Ratio of m <sup>2</sup> per field player	314 m <sup>2</sup>	190 m <sup>2</sup>
m <sup>2</sup> of the goal	12 m <sup>2</sup>	6 m <sup>2</sup>
Ball size (n)	4	4
Substitutions	Unlimited	Unlimited
Time (minutes)	2 × 20	2 × 20

(goal kick, foot pass during the play, hand pass, volley foot pass, kick to goal, and other actions); height to which the ball was sent (field-level, between ankle and hip, and above the hip); zone from which the ball was sent (Figure 1); area of contact used by the goalkeeper (foot, hands, or other); zone where the goalkeeper handled the ball (Figure 2); number of opponents and teammates surrounding the goalkeeper in the defensive and offensive actions (four meter ratio); number of defensive lines of players passed by the goalkeeper with his action; existence of support to the goalkeeper, when the goalkeeper had an unopposed teammate within four meters; and zone where the teammate received the goalkeeper's pass (Figure 1).

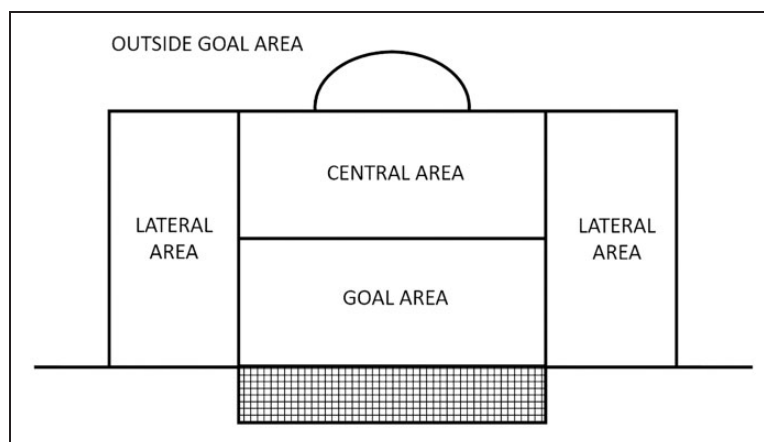
The measurements were taken in three tournaments over a period of three weeks, after the teams' competitive season. The tournaments were played on the

weekends. All the tournaments were played at the same time of day and in similar weather conditions. The tournaments were played using a round robin system. Matches had two 20-min periods. The order of the teams' confrontations was the same in the different tournaments. The goalkeepers' actions were recorded with two digital cameras from a posterior, elevated view. Data were collected using an ad hoc observation instrument, which was a combination of a field format and a category system.<sup>36,37</sup> Goalkeepers' actions were analyzed by two trained observers. The observers' reliability was tested before and after the observation. The lowest inter-observer reliability level was 0.83 and the lowest intra-observer reliability level was 0.92 (Kappa index).

Descriptive (means and standard deviation) and inferential statistics of the data were calculated. To



**Figure 1.** Division of the field used to establish the zone from which the ball was sent.



**Figure 2.** Division of the goal area used to establish the zone where the goalkeeper handled the ball.

measure the difference between the different tournaments, an analysis of variance for repeated measures was calculated. Mauchly's test of sphericity and Pillai's trace were used. Bonferroni post hoc analysis was used. The level of significance was set at  $p < .05$ . The following classification to measure the magnitude of the effect size was used:<sup>38</sup> no effect ( $d < 0.41$ ), minimum effect ( $0.41 \leq d < 1.15$ ), moderate effect ( $1.15 \leq d < 2.70$ ), and strong effect ( $d \geq 2.70$ ). The following classification was used to assess the eta square<sup>38</sup>: no effect ( $\eta^2 < 0.04$ ), minimum effect ( $0.04 \leq \eta^2 < 0.25$ ), moderate effect ( $0.25 \leq \eta^2 < 0.64$ ), and strong effect ( $\eta^2 \geq 0.64$ ). The statistical analysis was completed with SPSS software (version 21.0).

## Results

For these goalkeepers, 5-a-side soccer involved a significantly higher total number of defensive actions ( $F_{2,6} = 111,218$ ,  $p = .000$ ,  $\eta^2 = .974$ ) and offensive actions ( $F_{2,6} = 16,257$ ,  $p = .004$ ,  $\eta^2 = .844$ ) (Figure 3). These differences were found between tournament 1 and tournament 2 and between tournament 2 and tournament 3 (Table 2). No significant differences were found between tournament 1 and tournament 3 ( $p = .477$ ). By type of action, a significantly higher number of saves ( $F_{2,6} = 196,030$ ,  $p = .000$ ,  $\eta^2 = .985$ ), parries ( $F_{2,6} = 7,085$ ,  $p = .026$ ,  $\eta^2 = .703$ ), deflections ( $F_{2,2} = 33.857$ ,  $p = .029$ ,  $\eta^2 = .971$ ), open palms ( $F_{1,3} = 9.000$ ,  $p = .05$ ,  $\eta^2 = .750$ ), other defensive actions ( $F_{2,6} = 18,616$ ,  $p = .003$ ,  $\eta^2 = .861$ ), goal kicks ( $F_{2,6} = 16,593$ ,  $p = .004$ ,  $\eta^2 = .847$ ), and volley passes

( $F_{2,6} = 43,534$ ,  $p = .000$ ,  $\eta^2 = .936$ ) were found in tournament 2. No significant differences were found in clear outs ( $F_{2,6} = 2,070$ ,  $p = .207$ ,  $\eta^2 = .408$ ), flies ( $F_{2,6} = 0.000$ ,  $p = 1.000$ ,  $\eta^2 = 1.000$ ), passes with the foot ( $F_{2,6} = 3,083$ ,  $p = .120$ ,  $\eta^2 = .507$ ), passes with the hand ( $F_{2,6} = 1,943$ ,  $p = .224$ ,  $\eta^2 = .393$ ), kicks to goal ( $F_{2,6} = 2,408$ ,  $p = .171$ ,  $\eta^2 = .445$ ), or other offensive actions ( $F_{2,2} = 3,288$ ,  $p = .233$ ,  $\eta^2 = .767$ ).

Table 3 shows the way the goalkeepers' defensive actions were carried out. Differences were found between the different tournaments regarding the heights to which the ball was sent ( $F_{2,6} = .13,858$ ,  $p = .006$ ,  $\eta^2 = .822$ ), the balls sent to the lateral front area ( $F_{2,6} = 51,083$ ,  $p = .000$ ,  $\eta^2 = .945$ ) and to the rear center area ( $F_{2,6} = 27,262$ ,  $p = .001$ ,  $\eta^2 = .901$ ), the goalkeeper's different areas of contact ( $F_{2,6} = 5,171$ ,  $p = .049$ ,  $\eta^2 = .633$ ), the zones where the goalkeepers handled the ball ( $F_{2,6} = 69,552$ ,  $p = .000$ ,  $\eta^2 = .959$ ), and the types of numerical situations regarding the opponent and teammates in which the goalkeeper participated ( $F_{2,6} = 129,00$ ,  $p = .000$ ,  $\eta^2 = .977$ ).

Table 4 shows the way the goalkeepers' offensive actions were carried out. Differences were found between the different tournaments regarding: (a) the use of the foot to start the team's offensive actions ( $F_{2,6} = 6.790$ ,  $p = .029$ ,  $\eta^2 = .694$ ), the ground-level passes ( $F_{2,6} = 9.476$ ,  $p = .039$ ,  $\eta^2 = .737$ ), medium-height passes ( $F_{2,6} = 15.652$ ,  $p = .004$ ,  $\eta^2 = .839$ ), and high passes ( $F_{2,2} = 45.585^a$ ,  $p = .021$ ,  $\eta^2 = .979$ ); (b) the number of defensive lines of players passed by the goalkeeper when he started the team's offense: none ( $F_{2,6} = 8.858$ ,  $p = .016$ ,  $\eta^2 = .747$ ), three ( $F_{2,6} = 7.858$ ,

**Table 2.** Offensive and defensive actions taken by the goalkeepers in the tournaments.

Goalkeepers' actions	8-a-side	5-a-side	8-a-side	Post hoc significance	Effect size
Defensive actions	31.2 ± 3.8	77.75 ± 5.0	39.5 ± 6.0	T1 = T3 < T2	.998
Save	21.5 ± 6.1	50.0 ± 7.1	26.7 ± 7.9	T1 = T3 < T2	.998
Parry	2.2 ± 0.5	7.2 ± 4.1	1.7 ± 1.2	T1 = T3 < T2.	.750
Clear out	5.7 ± 3.4	7.5 ± 2.3	6.2 ± 3.9	$p > .05$	–
Deflection	0.5 ± 1.0	3.7 ± 3.0	1.2 ± 0.5	T1 = T3 < T2	.712
Open palm	0.0 ± 0.0	0.7 ± 0.5	0.0 ± 0.0	T1 = T3 < T2	.648
Fly	2.5 ± 0.5	2.5 ± 0.5	2.5 ± 0.5	$p > .05$	–
Other	1.0 ± 1.1	8.2 ± 2.8	0.2 ± 0.5	T1 = T3 < T2	.931
Offensive actions	58.0 ± 7.1	84.0 ± 13.5	58.1 ± 9.2	T1 = T3 < T2	.996
Goal kick	14.2 ± 10.2	31.2 ± 3.3	14.2 ± 9.2	T1 = T3 < T2	.909
Pass (foot)	16.7 ± 9.6	22.2 ± 11.5	8.5 ± 7.5	$p > .05$	–
Throw	4.0 ± 5.4	9.2 ± 4.9	7.5 ± 4.8	$p > .05$	–
Volley (foot)	19.2 ± 0.9	7.0 ± 1.4	22.5 ± 4.5	T1 = T3 > T2	.998
Kick to goal	1.2 ± 0.2	1.0 ± 0.7	3.0 ± 0.9	$p > .05$	–
Other	2.5 ± 0.3	13.5 ± 4.2	2.2 ± 0.2	$p > .05$	–

T1: tournament 1 (8-a-side); T2: tournament 2 (5-a-side); T3: tournament 3 (8-a-side).

**Table 3.** The way the goalkeepers' technical defensive actions in each tournament were carried out.

Variable	Category	8-a-side	5-a-side	8-a-side	Post hoc significance	Effect size
Height the ball reaches the goalkeeper	Low	11.25 ± 2.3	29.0 ± 6.6	18.75 ± 7.4	T1 < T2	.958
	Medium	6.75 ± 3.5	20.0 ± 0.8	12.0 ± 5.2	T1 < T2	.984
	High	12.5 ± 2.0	27.5 ± 3.8	8.75 ± 3.1	T1 = T3 < T2	.966
Area of contact	Foot	5.75 ± 4.8	13.2 ± 4.1	7.7 ± 4.9	T1 = T3 < T2	.658
	Hand	25.0 ± 6.6	60.25 ± 7.1	30.0 ± 9.6	T1 = T3 < T2	.998
	Other	0.6 ± 1.0	2.75 ± 1.7	1.75 ± 0.9	T1 = T3 < T2	.912
Zone in which the ball originated	Lateral front	5.75 ± 2.9	1.25 ± 1.2	6.5 ± 4.5	T1 = T3 < T2	.899
	Central front	21.25 ± 9.0	30.5 ± 5.2	31.0 ± 11.7	$p > .05$	–
	Lateral rear	1.5 ± 1.7	23.25 ± 11.4	1.75 ± 1.7	T1 = T3 < T2	.877
	Central rear	2.25 ± 1.5	21.0 ± 6.4	2.25 ± 1.7	T1 = T3 < T2	.943
	Other zone	0.5 ± 1.0	2.0 ± 1.4	0.25 ± 0.5	$p > .05$	–
Zone in which the ball is received	Goal area	30.2 ± 13.4	–	35.2 ± 13.9	–	–
	Center penalty area	10.75 ± 5.0	43.75 ± 6.7	11.25 ± 4.6	T1 = T3 < T2	.996
	Lateral penalty area	3.0 ± 2.1	27.0 ± 6.2	6.5 ± 2.1	T1 = T3 < T2	.974
	Outside of penalty area	1.0 ± 0.0	6.5 ± 4.2	2.5 ± 1.3	$p > .05$	–
Defensive situation	Numerical equality	1.5 ± 1.0	3.75 ± 1.7	0.5 ± 0.5	T1 = T2 < T3	.977
	Numerical superiority	7.25 ± 3.94	0.75 ± 0.9	18.25 ± 7.5	$p > .05$	–
	Numerical inferiority	2.0 ± 1.4	5.5 ± 5.0	3.25 ± 2.5	$p > .05$	–

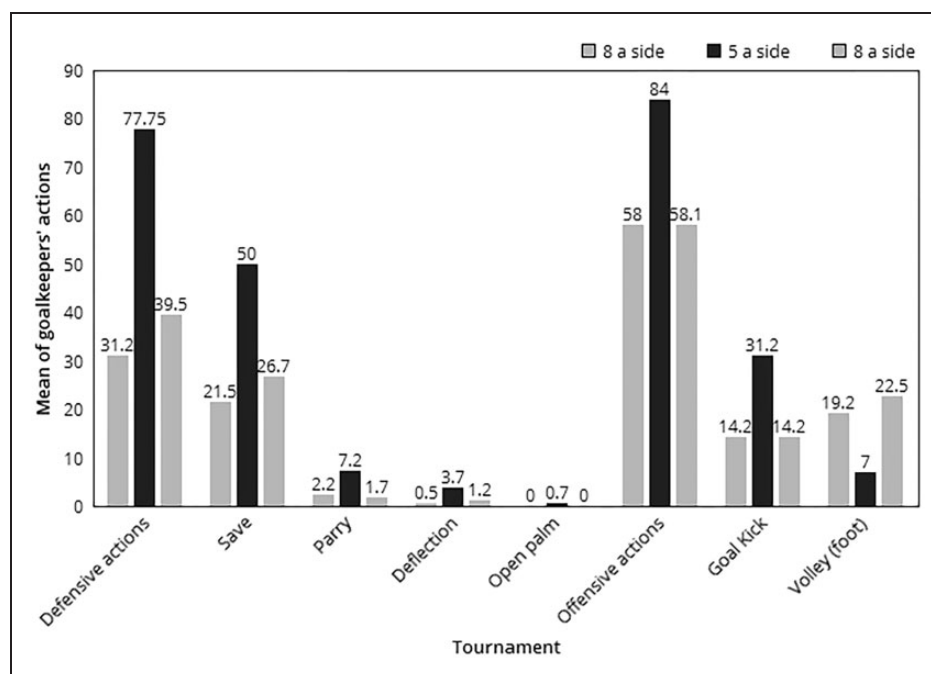
T1: tournament 1 (8-a-side); T2: tournament 2 (5-a-side); T3: tournament 3 (8-a-side).

**Table 4.** Way the goalkeepers' technical offensive actions in each tournament were carried out.

Variable	Category	8-a-side	5-a-side	8-a-side	Post hoc significance	Effect size
Contact zone	Foot	30.25 ± 15.4	48.0 ± 7.39	27.75 ± 8.3	T1 = T3 < T2	.952
	Hand	7.25 ± 4.6	12.75 ± 2.75	16.0 ± 7.1	$p > .05$	–
Height of pass	Ground-level	14.0 ± 9.4	21.5 ± 14.9	4.25 ± 3.5	T1 = T3 < T2	.696
	Medium	16.0 ± 7.7	2.5 ± 1.0	30.5 ± 12.7	T1 = T3 > T2	.870
	High	7.25 ± 1.2	37.0 ± 14.6	9.0 ± 2.5	T1 = T3 < T2	.979
Lines of defense passed by the goalkeeper's pass	None	10.25 ± 6.4	24.5 ± 12.5	6.75 ± 4.4	T1 = T3 < T2	.782
	One	13.25 ± 6.1	23.0 ± 8.7	19.0 ± 7.0	$p > .05$	–
	Two	11.0 ± 5.8	14.0 ± 6.4	13.25 ± 8.7	$p > .05$	–
	Three	2.5 ± 3.1	10.5 ± 7.9	4.5 ± 2.5	T1 = T3 < T2	.889
	Four	0.5 ± 1.0	10.25 ± 8.4	0.0 ± 0.0	T1 = T3 < T2	.671
Goalkeeper support	Yes	19.0 ± 9.6	47.75 ± 6.5	22.75 ± 9.2	T1 < T3 < T2	.953
	No	18.5 ± 6.4	35.0 ± 10.6	20.7 ± 6.5	T1 < T2	.949
Destination zone of the pass	Lateral front	2.0 ± 0.8	6.5 ± 4.6	4.5 ± 4.6	$p > .05$	–
	Central front	8.0 ± 5.3	21.0 ± 6.9	16.7 ± 8.9	T1 = T3 < T2	.949
	Lateral rear	12.75 ± 9.5	17.2 ± 8.8	7.2 ± 6.3	T1 = T3 < T2	.940
	Central rear	13.25 ± 7.6	7.75 ± 8.8	14.7 ± 4.2	$p > .05$	–
	Other zone	0.5 ± 0.5	8.5 ± 6.6	0.25 ± 0.5	$p > .05$	–
Offensive situation	Numerical equality	4.0 ± 3.5	11.75 ± 6.75	0.25 ± 0.5	T1 = T3 < T2	.843
	Numerical superiority	3.0 ± 2.1	30.75 ± 7.3	2.25 ± 2.0	T1 = T3 < T2	.955
	Numerical inferiority	8.5 ± 3.1	7.0 ± 3.55	5.75 ± 2.6	$p > .05$	–
	Only goalkeeper	16.75 ± 14.5	1.75 ± 1.25	32.5 ± 13.1	T2 < T3	.918

T1: tournament 1 (8-a-side); T2: tournament 2 (5-a-side); T3: tournament 3 (8-a-side).





**Figure 3.** Average of goalkeepers' actions in the different tournaments.

$p=.036$ ,  $\eta^2=.747$ ), and four ( $F_{2,6}=5.655$ ,  $p=.045$ ,  $\eta^2=.608$ ); (c) the existence of support for the goalkeeper ( $F_{2,6}=22.220$ ,  $p=.002$ ,  $\eta^2=.881$ ) and no support ( $F_{2,6}=14.181$ ,  $p=.005$ ,  $\eta^2=.825$ ); (d) the zone where the teammate received the pass from the goalkeeper: central front area ( $F_{2,6}=8.655$ ,  $p=.017$ ,  $\eta^2=.743$ ) and lateral rear area ( $F_{2,6}=7.725$ ,  $p=.022$ ,  $\eta^2=.720$ ); and (e) the number of opponents and teammates surrounding the goalkeeper when he participated in offensive actions: numerical equality ( $F_{2,6}=11.654$ ,  $p=.009$ ,  $\eta^2=.795$ ), superiority ( $F_{2,6}=46.498$ ,  $p=.000$ ,  $\eta^2=.939$ ), and only the goalkeeper ( $F_{2,6}=13.624$ ,  $p=.006$ ,  $\eta^2=.820$ ).

## Discussion

The results show the rule modifications involved an increase in the goalkeepers' participation (i.e. interventions and ball contacts) and in the variability of their actions. The increase in participation is the effect of the combination of the three modifications made to the rules: field size, number of players, and goal size. The higher participation of the goalkeeper is due to the rule modifications involving more attacks by the team and more interventions by the goalkeeper (contacting the ball more) in these attacks.

In this study, the reduction in field size and the number of players means that the field space per player was reduced from 314 m<sup>2</sup> (8-a-side) to 190 m<sup>2</sup> (5-a-side). The combination of these variables for the age group that was studied (i.e. under-12) allowed

teams to develop their plays and complete a higher number of attacks. Previous studies found a higher number of shots and tackles on small fields,<sup>28,29</sup> due to the proximity of the players and goals. Studies carried out with senior players have shown that an excessive reduction of the field size (e.g. less than 100 m<sup>2</sup> per player) can increase the intensity and the technical difficulty of the game for the players.<sup>15,25</sup> For under-12, the field coverage per player of 190 m<sup>2</sup> shows a positive effect on the game. Most of the previous studies have been carried out with adult players. More information is needed about the impact of field size on youth soccer players and the impact of the different ranges of sizes. The field coverage per player (m<sup>2</sup>) could serve as the criteria that allow us to compare different proposals of rule modification.

The reduction of the goal size results in a reduced space to be covered by the goalkeeper (12 m<sup>2</sup> to 6 m<sup>2</sup>). The intent of this modification was to increase the goalkeepers' defensive and offensive interventions (ball contacts). The results showed that the combination of the rule modifications involved an increase in the goalkeepers' interventions. The increase in the attacks and the defensive efficacy are behind the goalkeeper's participation in the attack. Similar proportions in the way the goalkeepers carried out their actions between 5-a-side and 8-a-side soccer, as well as data found in the literature, were found.<sup>23,32,37</sup> The saves, clear outs, and parries were the actions that the goalkeepers performed the most, and all these actions were done with their hands. These findings show that the rule modifications

allowed the goalkeepers to prepare for the future demands of the game, i.e. tendencies of elite soccer.<sup>22,23,39</sup> In offense, the rule modifications involved a higher use of the foot, long passes, and more variety of situations for the goalkeepers (e.g. situations of numerical equality, superiority, and inferiority). The rule modifications allowed the goalkeepers to be active in their team's offensive. Future studies should consider how these changes in the participation affect goalkeepers' characteristics. Previous studies showed that goalkeepers had higher muscular power but lower Vo2max, anaerobic power, and performance in repeated sprint abilities and sprint abilities than field players.<sup>40,41</sup>

The data from the current study, due to the sample size, cannot be generalized. However, the results provide insight about the impact of these rules changes in the goalkeeper participation. The rule modifications increased the participation of and the variability in the goalkeepers' actions, which should affect their learning.<sup>6,34,42</sup> More participation and interventions are a key aspects of skill acquisition,<sup>5,16,43</sup> which makes the rule modifications that were tested a good competition format for goalkeepers' development. Future studies should consider other aspects, such as psychological variables (e.g. level of enjoyment), physiological variables (e.g. types of physical actions), and safety (e.g. risk of injuries). The present study showed the impact of the three task constraints of the game on specific players. This information could help the different stakeholders to adapt or design the youth soccer competition rules in a way that allows goalkeepers to have more experiences. In a similar same way, the findings can show coaches of youth players the effect of field size, number of players, and goal size manipulation of youth goalkeepers and the possibilities for their technical-tactical development.

## Conclusions

The results showed that the rule modifications resulted in more specific actions by goalkeepers in defense and more variability in offense. The changes increased the amount of the goalkeepers' actions and experiences. Criteria used to set the rules in youth sports are often based on experience or trial and error, and they often only take into consideration the development of the field players. The data presented in the article provide information about the effect of modifying the space, goal size, and number of players, which can be useful for designing competition rules that enhance goalkeepers' development as well as for designing game-like situations in practice. However, more information is needed about the impact of rule modifications on youth players in training and in competition.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Ministry of Science and Innovation, Spain, under Grant DEP2010-16140. And, Project "Salvador de Madariaga", of the Ministry of Education, culture and sport (PRX16 / 00422).

## ORCID iD

Antonio García-Angulo  <http://orcid.org/0000-0002-1729-8259>

## References

1. Memmert D, Almond L, Bunker D, et al. Top 10 research questions related to teaching games for understanding. *Res Q Exerc Sport* 2015; 86: 347–359.
2. Mitchell AS and Griffin LL. *Teaching sports concepts and skills: a tactical games approach for Ages 7 to 18*, 3rd ed. Champaign, IL: Human Kinetics, 2013.
3. Santos SD, Memmert D, Sampaio J, et al. The spawns of creative behavior in team sports: a creativity developmental framework. *Front Psychol* 2016; 7: 1282.
4. Esteves PT, Silva P, Vilar L, et al. Space occupation near the basket shapes collective behaviours in youth basketball. *J Sports Sci* 2016; 34: 1557–1563.
5. Gonçalves B, Coutinho D, Santos S, et al. Exploring team passing networks and player movement dynamics in youth association football. *PLoS One* 2017; 12: e0171156.
6. Silva P, Travassos B, Vilar L, et al. Numerical relations and skill level constrain co-adaptive behaviors of agents in sports teams. *PLoS One* 2014; 9: e107112.
7. Diaz-Cidoncha J, Refoyo I, Calleja-González J, et al. Comparison of tactical offensive variables in different playing surfaces in sided games in soccer. *Int J Perform Anal Sport* 2015; 15: 297–314.
8. Jastrzebski Z and Radzimiński Ł. Individual vs general time-motion analysis and physiological response in 4 vs 4 and 5 vs 5 small-sided soccer games. *Int J Perform Anal Sport* 2015; 15: 397–410.
9. Radzimiński L, Rompa P, Barnat W, et al. A comparison of the physiological and technical effects of high-intensity running and small-sided games in young soccer players. *Int J Sports Sci Coach* 2013; 8: 455–466.
10. Aguiar M, Botelho G, Lago C, et al. A review on the effects of soccer small-sided games. *J Hum Kinet* 2012; 33: 103–113.
11. Casal CA, Losada JL and Ardá T. Role conflict and team conflict as debilitators of collective efficacy. *Rev Psicol Deporte* 2015; 24: 103–110.
12. Vales A and Blanco H. Performance profiles of winning and losing teams participating in the 2012 FIFA World

- Cup in South Africa. *Rev Psicol Deporte* 2015; 24: 111–118.
13. Malone S and Collins K. The physical and physiological demands of small-sided games: how important is winning or losing? *Int J Perform Anal Sport* 2016; 16: 422–433.
  14. McLean S, Salmon PM, Gorman AD, et al. What's in a game? A systems approach to enhancing performance analysis in football. *PLoS One* 2017; 12: e0172565.
  15. Torrents C, Ric A, Hristovski R, et al. Emergence of exploratory, technical and tactical behavior in small-sided soccer games when manipulating the number of teammates and opponents. *PLoS One* 2016; 11: e0168866.
  16. Williams AM and Hodges NJ. Practice, instruction and skill acquisition in soccer: challenging tradition. *J Sports Sci* 2005; 23: 637–650.
  17. Hill-Haas SV, Dawson B, Impellizzeri FM, et al. Physiology of small-sided games training in football. *Sports Med* 2011; 41: 199–220.
  18. Coutinho DA, Reis SG, Gonçalves BS, et al. Manipulating the number of players and targets in team sports. Small-sided games during physical education classes. *Rev Psicol Deporte* 2016; 25: 169–177.
  19. Di Salvo V, Baron R, Tschann H, et al. Performance characteristics according to playing position in elite soccer. *Int J Sports Med* 2007; 28: 222–227.
  20. Seaton M and Campos J. Distribution competence of a football clubs goalkeepers. *Int J Perform Anal Sport* 2011; 11: 314–324.
  21. Gil SM, Zabala-Lili J, Bidaurrezaga-Letona I, et al. Talent identification and selection process of outfield players and goalkeepers in a professional soccer club. *J Sports Sci* 2014; 32: 1931–1939.
  22. Liu H, Gomez MA and Lago-Peñas C. Match performance profiles of goalkeepers of elite football teams. *Int J Sports Sci Coach* 2015; 10: 669–682.
  23. Sainz de Baranda P, Ortega E and Palao JM. Analysis of goalkeepers' defence in the World Cup in Korea and Japan in 2002. *Eur J Sport Sci* 2008; 8: 127–134.
  24. Di Salvo V, Benito PJ, Calderon FJ, et al. Activity profile of elite goalkeepers during football match-play. *J Sports Med Phys Fitness* 2008; 48: 443–446.
  25. Casamichana D and Castellano J. Time-motion, heart rate, perceptual and motor behaviour demands in small-sided soccer games: effects of pitch size. *J Sports Sci* 2010; 28: 1615–1623.
  26. Mallo J and Navarro E. Physical load imposed on soccer players during small-sided training games. *J Sports Med Phys Fitness* 2008; 48: 166–171.
  27. Dellal A, Chamari K, Pintus A, et al. Heart rate responses during small-sided games and short intermittent running training in elite soccer players: a comparative study. *J Strength Cond Res* 2008; 22: 1449–1457.
  28. Kelly DM and Drust B. The effect of pitch dimensions on heart rate responses and technical demands of small-sided soccer games in elite players. *J Sci Med Sport* 2008; 12: 475–479.
  29. Owen A, Twist C and Ford P. Small-sided games: the physiological and technical effect of altering pitch size and player numbers. *Insight J* 2004; 7: 50–53.
  30. Escudero JM and Palao JM. Incidencia de la modalidad de juego (fútbol 7 y fútbol 11) sobre la utilización de medios técnicos en categorías de formación (11-12 años) [Effect of game modality (7-a-side and 11-a-side) on the use of technical actions in youth sport (11-12 years)]. *Lecturas: EF Deportes* 2004; 74, www.efdeportes.com (accessed 26 March 2018).
  31. Escudero JM and Palao JM. Incidencia de la modalidad de juego (fútbol 7 y fútbol 11) sobre la eficacia de las acciones de juego en categorías de formación (11-12 años) [Effect of game modality (7-a-side and 11-a-side) on the efficacy of technical actions in youth sport (11-12 years)]. *Lecturas: EF Deportes* 2005; 90, www.efdeportes.com (accessed 26 March 2018).
  32. Lapresa D, Arana J and Garzón B. El fútbol 9 como alternativa al fútbol 11, a partir del estudio de la utilización del espacio de juego [9-a-side as an alternative to 11-a-side, from the use of play space]. *Apunts Educ Física Deportes* 2006; 86: 34–44.
  33. Siedentop D, Hastie PA and van der Mars H. *Complete guide to sport education*, 2nd ed. Champaign, IL: Human Kinetics, 2011.
  34. Davids K, Araujo D, Correia V, et al. How small-sided and conditioned games enhance acquisition of movement and decision-making skills. *Exerc Sport Sci Rev* 2013; 41: 154–161.
  35. Barlow DH and Hersen M. Single-case experimental designs: uses in applied clinical research. *Arch Gen Psychiatr* 1973; 29: 319–325.
  36. Anguera MT. Observational methods (general). In: Fernández-Ballesteros R (ed.) *Encyclopedia of psychological assessment*. London: Sage, 2003, pp.632–637.
  37. Barreira D, Garganta J, Castellano J, et al. How elite-level soccer dynamics has evolved over the last three decades? Input from generalizability theory. *Cuadernos Psicol Deporte* 2015; 15: 51–62.
  38. Ferguson CJ. An effect size primer: a guide for clinicians and researchers. *Profess Psychol* 2009; 40: 532–538.
  39. Sainz de Baranda P, Ortega E, Novo JF, et al. Estudio de la acción y participación del portero en fútbol 7: el ataque [Study of goalkeeper's actions and participation in 7-a-side: the offense]. *Rev Entrenam Deporte* 2005; 19: 26–32.
  40. Slimani M and Nikolaidis PT. Anthropometric and physiological characteristics of male Soccer players according to their competitive level, playing position and age group: a systematic review. *J Sports Med Phys Fitness* 2017. DOI: 10.23736/S0022-4707.17.07950-6.
  41. Nikolaidis P, Ziv G, Lidor R and Arnon M. Inter-individual variability in soccer players of different age groups playing different positions. *J Hum Kinet* 2014; 40: 213–25.
  42. Szwarc A, Lipińska P and Chamera M. The Efficiency model of goalkeeper's actions in soccer. *Balt J Health Phys Act* 2010; 2: 132–138.
  43. Fernández-Ozcorta EJ, Vizcaino C, Sáenz-López P, et al. Influencia de enseñar minibasket desde las reglas en la disminución de las infracciones reglamentarias [How infractions to the rules are influenced by the teaching of minibasket from teaching its rules]. *Cuadernos Psicol Deporte* 2015; 15: 157–162.