

Opinion of handball players, trainers and referees using the handball/futsal goalpost anti-tip system “Tutigool” for a safe game: 2019 Four Nations International Handball Junior Tournament

RAFAEL BAENA-GONZÁLEZ¹, MARTA GARCÍA-TASCÓN², CARLOS CHAVARRÍA-ORTÍZ³, ISIDORO MARTÍNEZ-MARTÍN⁴ Y ANA MARÍA GALLARDO⁵

^{1,5} Faculty of Sports Science, University Católica de Murcia, Murcia, SPAIN

² University Pablo de Olavide, Seville, SPAIN

³ Escuela Universitaria de Osuna (center attached to the University of Seville), Seville, SPAIN

⁴ Department of Physical Education and Sport, University of León, León, SPAIN

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Abstract

Problem Statement: Athletes and especially children die around the world due to sports accidents. In this regard, changes in the federal sports regulations are not only aimed at favoring the game, but also to improve the safety of athletes. In handball, the goal is an essential piece of equipment and the anti-tip system used is fundamental to prevent accidents. **Purpose:** The objective of the present study was to know the opinion of different sports agents about the use of the Tutigool anti-tip system in the goals. **Methods:** The sample consisted of 60 subjects (players (51 ± 0.72), trainers (5 ± 14.01), and referees (4 ± 2.5)), of which, 96.7% were men and 3.3% women. A modified Likert-scale questionnaire was filled out (1 = strongly disagree to 7 = strongly agree) by the participants of the Four Nations International Tournament in January 2019 in the male U21 category, held in Santander (Spain). The questionnaire consisted of 18 items. **Results:** The most relevant results affirm that the system is appropriate for the handball game at the municipal and school level at 5.35 and for high level sports at 4.10. The average satisfaction with this system is 4.34. By agents, the coaches obtained 5.4, the referees 4.5 and the players 4.22. The Kruskal-Wallis test was carried out, which showed no significant differences in the mean scores ($p > 0.05$) given by players, trainers and referees in different aspects related to the anti-tip system. **Conclusions:** These results allow making a deep reflection and a change in handball regulations with the aim of adapting them and guaranteeing a safer practice, not only for athletes and amateur users, but also for sports facilities technicians who are responsible for the maintenance and handling of sports equipment.

Keywords: Handball; safety; security; goal-post; anti-tip; children

Introduction

Ensuring safety and promoting a safe environment for athletes in public and/or private sports spaces is, among others, one of the key aspects for some agents in the sports sector, such as sports managers, trainers, teachers, etc., as determined by the European Directive 2001/95/CE, of December 3rd, 2001 on product safety and protection of public safety.

The safety and causes of accidents in sports are the focus of some studies (Castro-Maqueda & Amar-Cantos, 2016; DeVivo, 1997; Engebretsen et al., 2013; Feletti & Goin, 2014; Invernizzi, Gabriele, Michielon, Padulo & Scurati, 2019). According to the European Commission, 7,000 people died due to accidents or injuries derived from sports between 2010 and 2012 (Kisser & Bauer, 2012), not referring to those caused directly by sports equipment or facilities, as there is no official record in this matter.

The data in Spain appears in secondary sources, such as published news in the media (García-Tascón, 2018a; Gavilán, 2011) or through surveys in rehabilitation and health centers (García-González, Albaladejo, Villanueva & Navarro, 2014; Mitchell, Finch & Boufous, 2010).

Safety and injury prevention is a priority for sports organizations and the equipment used is vital for this in many cases (Andrew, Chow, Knudson & Tillman, 2003; Iona et al., 2019; Karišik, S., Božić, D. & Tirić, 2018; Krauss, 2004). Specifically, for the EHF (European Handball Federation), the adaptation of equipment and facilities is a measure to prevent injuries (European Association for Injury Prevention and Safety Promotion, 2010).

Sports equipment and, in particular, the goals cause accidents and even deaths worldwide (Blond & Hansen, 1999; Centers for Disease Control and Prevention, 1994). In Spain, since 2000, 18 children have died in sports accidents (García-Tascón, 2018b), in Germany, between 1996 and 2013, six children were killed, and eight more in Central European countries (Katthage & Thiem-Hack, 2013).

In order for a handball goal to be safe, it must comply not only with IHF federal regulations but also with European regulations UNE-EN 749: 2004/AC: 2005 of handball goals, safety, functional requirements, and test methods. In addition, new European regulation UNE-EN 16579: 2018 for portable and fixed goals, functional requirements, safety and test methods (www.une.org) must be adhered to.

Therefore, the IHF (2019) states in its rule 1: 2: “The goals must be firmly attached to the floor or to the walls behind them”. On the other hand, European standard EN-749 differentiates between type 1 goals, whose posts are inserted in the ground, and type 2 freestanding goals, which must be used with anti-tip systems (at least one on each side (EN- 749, 2006: 8)), using the floor-anchoring system as an example. According to Latorre et al. (2012, p. 4), “the current legal framework for sports facilities and materials is subject to extensive and disparate community, national, regional and local regulations, as well as the specific rules of each sports federation”. It is advisable to conduct a comprehensive review of the sports law because of the lack of harmony of terms and legal obligations (Wang, Chen & Zhang, 2010).

Handball and other sports modalities are practiced mostly in multi-sports facilities, where the field is divided into several spaces for the training of different groups at the same time (Hallman, Wicker, Breuer & Schönherr, 2012; Martínez, Gallardo, García-Tascón & Segarra, 2018; Phillips, Hannon & Molina, 2015), the goals are placed in different parts of the field and the anchor systems cannot always be used because the floor or the wall of the field is not suitable for it. Therefore, the goals are not always firmly fixed as indicated by federal regulations.

The anti-tip system is the mechanism to provide stability and prevent the overturning of sports equipment and it is considered a fundamental element to avoid accidents (Sánchez & García-Tascón, 2016, Latorre et al., 2012; del Campo & Piriz, 2016; Montalvo, Felipe, Gallardo, Burillo & García-Tascón, 2010; García-Tascón, Gallardo, Blanco, Martínez-López & González, 2014).

There are few studies on alternative anti-tip systems in handball goals, as federal regulations do not allow it. Specifically, the 2016 University World Handball Championship was played using the Tutigool Anti-Tip system and the players were asked to give their opinion on this system in the game, obtaining average values of 5.66 out of 7.

There are few studies that consider rule changes or how the sports equipment influences the sports (Andrew, Chow, Knudson & Tillman, 2003; Dosseville, 2007; Giatsis, Papadopoulou, Dimitrov & Likesas, 2003; Koptev et al., 2017; O'Donoghue, 2012, Ortega, Castro & Laporte, 2008; Ronglan & Grydeland, 2006; Williams, Hughes & O'Donoghue, 2005). All these studies on regulatory modifications propose specific amendments after a purely conceptual review (Ortega, Piñar, Salgado, Palao & Gómez, 2012).

Likewise, there are few investigations that take into account the opinion of coaches and experts on these possible modifications (Ortega, Piñar, Salado, Palao & Gómez, 2012; Tarodo, Belmonte, Toro & Ruano, 2011; Toro, Egido, Andrés & de Barranda, 2008; Vizcaíno, Sáenz-Lopez, Rebollo & Conde, 2014) and, to a much lesser extent, the opinion of athletes or referees is taken into account to make such modifications (Castro-Maqueda & Amar-Cantos, 2019; Coleclough, 2013; Francis & Jones, 2014; Toro, Angulo & Moreno, 2015). Therefore, the objective of this study was to know the opinion of players, coaches and referees participating in the 2019 Four Nations International Handball Junior Tournament on the influence of the anti-tip system with counterweights called Tutigool on the safe practice of handball.

Methods

Participants

The study sample consisted of 60 subjects, 96.7% of whom were men and 3.3% were women. The tournament was contested by four teams, showing different participation in the filled-out questionnaires, with 21 respondents from Spain (37.5%), 17 from Germany (30.4%), 16 from Portugal (28.6%) and 2 from France (3.6%); 85% were players, 8.3% coaches and 6.7% referees. Table 1 shows the average age and standard deviation of the sample subjects.

Table I. Mean and standard deviation of the ages of the participants

Profile	N	Mean	SD
Player	51	19.63	0.72
Trainer	5	48	14.018
Referee	4	24.33	2.517
Total	60	22.27	8.812

Instrument

The questionnaire by Blanco et al. (2017) has been previously used in the World University Handball Championship in 2016 (Spain), which was organized by the International University Sports Federation (FISU). A small modification was made to it, which consisted in the addition of an item regarding the number of witnessed accidents associated with goalposts. In a first stage, a bibliographic review was carried out, finding the pilot

study taken as a reference; then the modified questionnaire was valued by a group of 8 experts consisting of 4 coaches, 3 players and a referee, all in the handball modality. These were first-division professional players and coaches with international experience and a referee with more than ten years of experience and responsibility at the national level in different arbitration committees. After the expert assessment of the content, the questionnaire was adapted.

The final version of this questionnaire consists of 5 variables, which analyze sociodemographic data, 17 items on the use of sports equipment (Tutigool anti-tip system), and 1 item on witnessed accidents/hits related to goalposts. Thirteen of these items have a Likert-type response format (1 = totally disagree or very bad; 7 = totally agree or very well), 4 items have a dichotomous response (YES/NO), and 1 item has an ordinal-scale response format (Many/Some/Not Many/Few/Very Few/None).

To carry out the present study, the goals with the Tutigool anti-tip system were used. This is a new system created in Spain for the elimination/reduction of accidents. This system even improves the existing UNE-EN 749:2004/AC:2006 regulation "Playing Field Teams. Handball goalposts". It uses a permanent anti-tip system, which guarantees the stability of the goalposts in any part of the field or track and the safety of the users at all times, favoring the absorption of impacts during the game due to the fact that the goals are not anchored.

Procedure

The Federations of the participating teams (Germany, Spain, France and Portugal) were contacted to report about the research study, as well as the IHF, to obtain authorization to use the Tutigool anti-tip system in the tournament. Subsequently, the collaboration of those responsible for the sports facility was requested for the reception and installation of the anti-tip system in the goalposts.

The next step was to deliver the survey to players, trainers and referees, who were then asked to fill out the survey after having the experience of using this anti-tip system (3 matches per team).

Data analysis

The data were analyzed using the statistical program SPSS version 22 for Windows. An analysis of averages, standard deviation, and minimum and maximum values was carried out and the percentages of each item are shown in tables 2 and 3. The Kolmogorov-Smirnov normality test carried out on each group of segmented data, based on the classification of the respondents, shows the presence of variables that significantly depart from the normal distribution, for which nonparametric comparison methods were selected. To compare the variances, the Levene test was used, as well as the Tamhane test to compare the groups (post-hoc). Similarly, the Kruskal-Wallis test and the contingency coefficient of Kendall's Tau-c were carried out to determine whether the differences in the responses were significant.

Results

The results of the analysis carried out in three different sections are presented below.

1. About the knowledge and design of the Tutigool Anti-Tip System

As can be observed in Table 2, the results show that only 18.3% of the respondents knew about the Tutigool Anti-Tip System and 27% indicated that it existed in their country of origin. Specifically, 21.56% of the players knew the system and 31% of them indicated that it existed in their country of origin. Neither coaches nor referees knew the system or that it even existed. Regarding the design of the system, it appealed to 49% of the players, 60% of the trainers and 25% of the referees. Furthermore, none of the respondents had had previous experience with the Tutigool Anti-Tip system.

Table II. Knowledge, existence and design of the Tutigool Anti-Tip System

Player Referee	Trainer	I know about this anti-tip system (no=0 or yes=1)	It exists in my home country (no=0 or yes=1)	The design appeals to me (no=0 or yes=1)
	N	51	51	51
	Mean	0.22	0.31	0.49
Player	SD	0.415	0.469	0.505
	N	5	5	5
	Mean	0	0	0.6
Trainer	SD	0	0	0.548
	N	4	4	4
	Mean	0	0	0.25
Referee	SD	0	0	0.5
	N	60	60	60
	Mean	0.18	0.27	0.48
Total	SD	0.39	0.446	0.504

2. On the degree of satisfaction with the Tutigool Anti-Tip System

Table 3 shows the assessment of the players, coaches and referees with the Tutigool Anti-Tip System and on the questions with a Likert 1-7 response format (questions 5-17). The mean value of satisfaction was 4.34 and it was observed that the best evaluation (5.40) was given by the trainers. The best rated items were those

referring to the convenience of using the Tutigool Anti-Tip System in municipal sports centers and schools, both obtaining 5.35, with the trainers rating 7 and 6.60, respectively. The same assessment distinguished between the items on the increase of team safety in attack or defense positions (3.85 for both cases), with goalkeeper safety being clearly higher (4.77). The item referring to the continuity of the game despite the fact that the goal was not anchored was the worst valued (3.82). The novelty of the system was valued with 4.65 points, uniformity with 4.72 and the difficult alteration or manipulation of the system with 4.75.

Table III. *Opinion on the Tutigool Anti-Tip System*

Variables	Players		Trainers		Referees		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
It is innovative	4.53	1.93	5.6	1.67	5	0.81	4.65	1.86
It increases the safety of the game	4.51	1.88	5.4	2.07	5	0.81	4.62	1.84
It increases the goalpost's mobility	4.43	1.75	5.8	1.78	5.5	0.57	4.62	1.74
It increases the goalkeeper's safety	4.63	1.82	5.8	1.64	5.25	1.25	4.77	1.78
It increases the team's safety in attack	3.75	1.92	4	1.87	5	0	3.85	1.86
It increases the team's safety in defense	3.78	2.12	3.8	2.16	4.75	0.5	3.85	2.04
It facilitates the game's continuity	3.84	1.81	3.6	2.19	3.75	1.25	3.82	1.79
The structure is uniform	4.59	1.59	6.2	1.78	4.5	1.73	4.72	1.64
The structural alteration is difficult	4.65	1.74	5.8	2.16	4.75	0.5	4.75	1.73
It is suitable for municipal sports centers	5.29	1.64	7	0	4	1.15	5.35	1.64
It is suitable for schools	5.27	1.55	6.6	0.89	4.75	0.95	5.35	1.51
It is suitable for high-level competition	3.98	2.1	5	2.55	4.5	0.57	4.1	2.07
Overall opinion	4.22	1.62	5.4	1.94	4.5	0.57	4.34	1.61

In general, and according to the Kruskal-Wallis test (Table 4), no significant differences were observed in the mean scores ($p > 0.05$) given by players, trainers and referees for different aspects related to the anti-tip system (3 groups of independent variables). Only variable 10 (it is convenient for municipal sports centers) shows significant differences ($p < 0.05$).

Table IV. *Kruskal-Wallis Test*^{a,b}

	Chi-Square	Asymp. Sig.
It is innovative	1.566 (2)	0.457
It increases the safety of the game	1.336 (2)	0.513
It increases the goalpost's mobility	4.261 (2)	0.119
It increases the goalkeeper's safety	2.661 (2)	0.264
It increases the team's safety in attack	2.659 (2)	0.265
It increases the team's safety in defense	1.301 (2)	0.522
It facilitates the game's continuity	.153 (2)	0.926
The structure is uniform	4.877 (2)	0.087
The structural alteration is difficult	3.635 (2)	0.162
It is suitable for municipal sports centers	10.329 (2)	** .006
It is suitable for schools	5.269 (2)	0.072
It is suitable for high-level competition	1.317 (2)	0.518
Overall opinion	3.038 (2)	0.219

a. Kruskal-Wallis test

b. Grouping variable: Player, trainer or referee

Table 5 presents the groups of data to be compared, which show non-homogeneous variances according to the Levene test ($p < 0.05$).

Table V. *Test of Homogeneity of Variances*

Variable 10: It is suitable for municipal sports centers(1 to 7)			
Levene Statistic	df1	df2	Sig.
7.204	2	57	.002

The Tamhane test (Table 6) was performed to compare the groups (post-hoc). There were no significant differences between players and referees; however, the average rating of the trainers was significantly higher than that of the players and referees.

Table VI. *Multiple Comparisons*

It is suitable for municipal sports						
Tamhane						
Player	Player	Mean	Std. error	Sig.	95% Confidence interval	
Trainer	Trainer	difference (I-J)			Lowerbound	Upperbound
Referee	Referee					
Player	Trainer	-1.706*	.230	.000	-2.27	-1.14
	Referee	1.294	.621	.284	-1.15	3.74
Trainer	Player	1.706*	.230	.000	1.14	2.27
	Referee	3.000*	.577	.041	.21	5.79
Referee	Player	-1.294	.621	.284	-3.74	1.15
	Trainer	-3.000*	.577	.041	-5.79	-2.21

*. The mean difference is significant at the 0.05 level.

3. On the number of accidents/hits witnessed by the three participating agents

Regarding the number of hits and injuries that the three analyzed agents have witnessed in their lifetime, Table 7 shows that 85% of these events were observed by players, 8% by trainers and 7% by referees. It is relevant that almost 20% of the respondents, mainly players, had never witnessed any accidents/hits, 40% indicated having witnessed few or very few cases, 16.70% not many cases and 23.3% some or many cases. Kendall's Tau-c contingency coefficient indicates that there were no significant differences in witnessed accidents/hits ($p > 0.05$).

Table VII. *Cross Tabulation. Hits/accidents witnessed by players, trainers and referees*

			Player	Trainer	Referee	Total
Hits/accidents witnessed	Many(>21)	Count	1	1	0	2
		% of Total	1.70%	1.70%	0.00%	3.30%
	Some (16-20)	Count	11	0	1	12
		% of Total	18.30%	0.00%	1.70%	20.00%
	Notmany (11-15)	Count	6	1	3	10
		% of Total	10.00%	1.70%	5.00%	16.70%
	Few (6-10)	Count	10	0	0	10
		% of Total	16.70%	0.00%	0.00%	16.70%
	Very few (1-5)	Count	12	2	0	14
		% of Total	20.00%	3.30%	0.00%	23.30%
None	Count	11	1	0	12	
	% of Total	18.30%	1.70%	0.00%	20.00%	
Total	Count	51	5	4	60	
	% of Total	85.00%	8.30%	6.70%	100.00%	

Symmetric Measures

		Value	Asymp. Std. error ^a	Approx. T ^b	Approx. Sig.
Ordinal by ordinal	Kendall's tau-c	-0.089	0.076	-1.175	0.24
Valid Cases		60			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis

Discussion

The aim of this study was to analyze the opinion of the players, coaches and referees in the 2019 Four Nations International Handball Junior Tournament on the use of the Tutigool Anti-Tip System, as a preventive measure in the game.

It was observed that the Tutigool Anti-Tip System, prior to the tournament played by the surveyed subjects, was poorly known (18%). This could be due to the novelty of the system and to the fact that handball regulations did not allow the use of this type of anti-tip system, since the goals must be firmly attached to the floor or to the wall behind it (IHF, 2019). In addition to the present study, an official handball tournament has been played with unattached goalposts, which was at the University World Cup held in Antequera (Spain), where the pilot study of Blanco et al. (2016) was conducted.

Regarding the *design* of the Tutigool Anti-Tip System, it appealed to 48% of the participants, who valued its *novelty* with 4.65 points, a value lower than that shown in the previous championship played with this system, which was 5.5 (Blanco et al., 2016). The technological innovations of sports equipment and the materials that compose it produce numerous advances in the development, safety and performance of sports (Bhudolia, Perrotey & Joshi, 2015; Potts & Ratten, 2016; Ratten, 2016).

Regarding the *general satisfaction* with the Tutigool Anti-Tip System, the mean value given by the participants was 4.34, a value lower than that obtained in the study of Blanco et al. (2016), where the value obtained was 5.66. However, these authors recorded the opinion of the teams in general, whereas, in this study, the *general satisfaction* of players (4.22), trainers (5.4) and referees (4.5) was distinguished independently. The opinion of sports agents is important for making future changes in regulations, assessing those that have already been modified and preventing injuries (Brown, Verhagen, Mechelen, Lambert & Draper, 2016; Toro, López & López, 2012).

According to the statistical test carried out (Tamhane test), no significant differences were observed between players and referees; however, the mean rating of the trainers was significantly higher than those corresponding to players and referees.

The items that were best-valued by the 3 different types of agents were those referring to the use of the Tutigool Anti-Tip System for *municipal sports centers* and *schools*, with 5.35 points for both, a result similar to that obtained by Blanco et al. (2016), who reported 5.57 and 5.66, respectively. Children and adolescents spend a large part of their time in schools and in municipal sports facilities, thus the access, conditions and use of these spaces is essential to prevent injuries and accidents and to guarantee safety (Limstrand & Rehner, 2008; Morrongiello & Shell, 2010; Rafoss & Troelsen, 2010; Salminen, Kurenniemi, Raback, Markkula & Lounamaa, 2014; Timpka & Ekstrand, 2006).

According to the analysis carried out (Kruskal-Wallis), no significant differences were observed in the mean scores given by the agents ($p > 0.05$), and, with respect to the variables, only the one referring to the use of the system in *municipal sports centers* showed significant differences.

Regarding the use of the anti-tip system for *high-level competition*, this item was valued with 4.10 points, which is lower than the 5.41 points reported by Blanco et al. (2016). It would be advisable to play more tournaments with the Tutigool Anti-Tip System in the goalposts to collect more opinions of the agents involved in handball (Cañadas, Ibáñez & Leite, 2015; Morris & O'Connor, 2017; Torres, Rosende, Rodríguez, González & Ivette, 2019).

With respect to whether the use of the Tutigool Anti-Tip System can *increase the goalkeeper's safety*, the mean rating was 4.77, which is below the 5.59 points given in the study of Blanco et al. (2016), while the trainers gave 5.8 points. Both studies show a higher assessment of this item with respect to the *increase in security for attackers and defenders*. In handball, neither attacking nor defending players are allowed to invade the delimited area of six meters, thus there are more possibilities for the goalkeeper to contact the goalpost (IHF, 2019). Individual tactical actions of the goalkeeper are analyzed in numerous studies (Agras, Ferragut & Abal, 2016; Baena-González, Lozano, Gallardo, Chavarría & García-Tascón, 2020; Cătălin, Ion, Gheorghe, & Julien, 2018; Costa et al., 2017; Cañadas, García-Angulo & García-Angulo, 2018; Gutierrez-Davila, Rojas, Ortega, Campos & Parraga, 2011).

Another issue to highlight is the *mobility of the goalpost* with the Tutigool Anti-Tip System, which was valued with 4.62 points, a result lower than the 5.69 points reported by Blanco et al. (2016). Currently, different sports modalities are carried out in sports facilities, e.g., Mini Handball (Vuleta, Milanović & Čačić, 2013). Trainings of several groups or teams take place at the same time, thus the track must be shared (Dello, Vigotsky, Laver & Halperin, 2019; Rafoss & Troelsen, 2010). The goals are placed according to the needs of the users and possibilities of sports facilities, although the use of anchoring systems is not always possible, so they do not remain firmly attached to the floor or to the wall behind them. The Tutigool Anti-Tip System guarantees the security of the goal in any part of the field without the need to use screws to attach the goal.

Regarding the items on the *alteration* and *uniformity of the structure*, they were given 4.75 and 4.73 points, respectively, which are lower than those observed in the study of Blanco et al. (2016), who reported values of 5.54 and 5.36, respectively. It should be noted that the Tutigool Anti-Tip System is attached to the goal structure by welding or anti-theft screws and adaptations to each model of goalposts can vary the performance of the

system and, therefore, vary the results of future studies. The characteristics and conditions of anti-tip systems in the goals are considered a fundamental factor to prevent accidents (del Campo & Píriz, 2016; García-Tascón et al., 2014; Latorre, 2008; Latorre et al., 2012; Montalvo et al., 2010; Sánchez & García-Tascón, 2016).

According to the *accidents/hits witnessed*, the players observed 85% of the total accidents/hits, the trainers 8% and the referees 7%. This difference is due to the fact that 85% of the participants in the study are players. Similarly, Kendall's Tau-c contingency coefficient indicates that there were no significant differences in witnessed accidents/hits ($p > 0.05$). This item was included in the questionnaire with respect to the one used by Blanco et al. (2016). Sports accidents are not officially registered; therefore, it would be essential to gather this information in order to implement detection, control and prevention actions (García-González et al., 2014; García-Tascón, 2018a; Gavilán, 2011)

Some of the limitations of the study are the scarcity of the sample obtained from the French team, with only two completed questionnaires, and possible misinterpretations of the language, since the questionnaire was only conducted in English and Spanish.

Further research should focus on the application of this study to other interest groups, with the aim of expanding the study sample, as well as the correlational analysis of the variables described.

Conclusion

This study aims to show the opinion of the players, trainers and referees participating in the Four Nations International Handball Junior Tournament on the influence of the anti-tip system with counterweights for goalposts called Tutigool.

Only 18.3% of the players knew about the Tutigool Anti-Tip System, whereas both trainers and referees were unaware of it. The overall satisfaction was 4.34 out of 7 points, and there were no significant differences between players and referees; however, the average rating of the trainers was significantly higher.

Of all the variables analyzed, the best-valued were those referring to the convenience of using the Tutigool Anti-Tip system in municipal sports centers and schools, with both obtaining 5.35 out of 7 points. Significant differences were observed between the analyzed agents regarding the use of this system in municipal sports centers.

Of all participants, 23.3% had witnessed many or some accidents/hits against goals, with the players being the ones who witnessed most of these events (85%); in this sense, no significant differences were detected. Finally, the Tutigool Anti-Tip System is considered suitable for the prevention and reduction of possible injuries due to contact with the goalpost, favoring absorption in the event of an impact as it is not anchored, thus preventing it from falling.

This study sets a milestone in handball safety. The proposal was considered by the IHF with the aim of improving the safety of this sport and preventing accidents. In March 2019, the 1: 2 rule of the official regulation was modified, which currently affects 209 countries around the world.

Practical applications

The practical application of the study is to propose the use of a new anti-tip system for handball and futsal goalposts as an accident-prevention measure in handball practice and in sports facilities in general. Moreover, through the opinion of players, coaches and referees, it helps to sensitize the regional, national and international handball federations on the use of an alternative goalposts anti-tip system as a measure to reduce impacts and injuries.

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Appendix

Questionnaire	Anti-tip system "Tutigoal"						
Dichotomous-response items							
1. I already know this type of system	Yes						No
2. This kind of system exists in my country	Yes						No
3. I have previous experience playing/coaching with this system before this study/tournament	Yes						No
4. Its design appeals to me	Yes						No
Likert-response items							
I consider that ...							
	Totally agree or very well			Totally disagree or very bad			
5. ... the proposal of this type of goalpost is innovative/novel	1	2	3	4	5	6	7
6. ...can be useful to increase/boost security/safety by not being anchored during the training/game	1	2	3	4	5	6	7
7. ... might be useful to increase (speed up) movements, since it facilitates the displacement of the goalpost	1	2	3	4	5	6	7
8. ... can increase the goalkeeper's safety	1	2	3	4	5	6	7
9. ... can increase the team's safety in the attack position	1	2	3	4	5	6	7
10. ... can increase the team's safety in defensive position	1	2	3	4	5	6	7
11. ... can facilitate the game continuity in spite of not being fixed to the floor/wall	1	2	3	4	5	6	7
12. ... the structure is uniform	1	2	3	4	5	6	7
13. ... the structural alteration is difficult	1	2	3	4	5	6	7
14. ... it is suitable for municipal sports centers	1	2	3	4	5	6	7
15. ... it is suitable for students to play/train (schools)	1	2	3	4	5	6	7
16. ... it is suitable for high-level sportscompetition	1	2	3	4	5	6	7
17. Overall opinion on the proposal of using anti-tip systems	1	2	3	4	5	6	7
Scale-response items							
18. How many accidents/hits against goalposts have you witnessed?	Many			(>21)			
	Some (16-20)			No			
	Not many (11-15)			Very			
	Few (6-10)			None			
	few (1-5)						