Original Article

Perception of safety in the game by teen handball players from a gender perspective using a novel anti-tip system

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Abstract

Problem Statement: In the perception of safety and risk, studies show that there is a difference between genders. Sports equipment and specially the goalpost have caused accidents and deaths around the world. Changes in the federal regulations not only seek to increase the practice of the game itself but also to improve safety. Similarly, technological innovations in sports facilities and equipment improve the training and competition conditions of athletes and facilitate the work of sports facility technicians. Tutigool is a new goalpost's anti-tip system that guarantees the safety of this equipment in any part of the field without the need to attach the goalpost to the ground or to the wall behind. **Purpose:** The study analyses the opinions of the agents involved in the game of handball from the point of view of gender at the 2019 International Nations Cup Tournament in Lübeck (Germany) about an innovative goals anti-tip system called Tutigool. **Methods:** The sample was composed of 120 subjects, 56.7% men and 43.3% women, including players (95 ± 79.2), coaches (9 ± 7.5), and referees (16 ± 13.3). A modified questionnaire with 18 items was administered. **Results:** The men and women participating in the study showed positive general satisfaction with the Tutigool anti-tip system (4.76 ± 1.42 out of 7) with no significant differences. In several aspects evaluated in the study there were differences in the agents analysed: players, referees and coaches show significantly higher evaluations than their opposite-gender counterparts. **Conclusions:** It is evident that there is a gender difference in the perception of safety with the use of the Tutigool anti-tip system.

Keywords: safety; security; goal-post; anti-tip; children, gender

Introduction

In the perception of safety and risk (Gustafsson, 1998; Hulse, Xie & Galea, 2018; Kerr & Mackenzie, 2012; Reid & Konrad, 2004;), as well as in accidents and injuries resulting from sports activity (Dick, 2009; Premelč, Vučković, James & Dimitriou, 2019; Theberge, 2012), studies show that there are significant differences according to gender.

Changes in sports federation regulations develop the game and increase the safety of its practitioners (Arias, Argudo & Alonso, 2011; Faulhaber et al., 2020; Timpka, Ekstrand & Svanström, 2006). Specifically, the International Handball Federation (IHF) publishes new Guidelines and Interpretations of the Laws of the Game every year, which currently affect 209 countries (IHF, 2019a). On July 1st 2019, with the aim of preventing accidents, it included among these new guidelines the modification of article 1:2, which refers to the anti-tip system for goalposts (IHF, 2019b), i.e., an adaptation of the regulations approved in March of the same year, at the meeting of the Commission on the Laws of the Game and Refereeing of the aforementioned international body. Referees must therefore apply this new independent rule to both men's and women's handball (Souchon, Cabagno, Traclet & Dosseville, 2010; Souchon et al., 2009).

Similarly, technological innovations in sports facilities and equipment increase the possibilities of their use (Hallmann, Wicker, Christoph & Schönherr, 2012; Koper, 2016; Shan, 2008) and facilitate both access to and participation in sport in society (Lera-López & Rapún-Gárate, 2007; Lim et al., 2011; Limstrand, & Reher, 2008). At the same time, they facilitate the work of private and public technical managers, who must guarantee safety in the appropriate spaces for carrying out physical activity (Culley & Pascoe, 2009; Lindkvist & Elmualim, 2009; Paramio, Beotas, Campos & Muñoz, 2010).

With regard to gender, some studies show that there are no significant differences in sports injuries (Kelm et al., 2004; Sallis, Jones, Sunshine, Smith & Simon, 2001). In this regard, Harmon and Ireland (2000) indicate that most injuries are caused by the specific characteristics of the sport modality.

In any case, there is no official and updated register of sports injuries or accidents; the data published on this subject have been obtained through internet searches (García-Tascón, 2018a; Katthage & Thieme-Hack, 2013), as

well as in a few studies carried out in health centres (Centers for Disease Control and Prevention, 1994 ; Blond & Hansen, 1999), and through surveys in rehabilitation and health centres (García-González, Albaladejo, Villanueva & Navarro, 2014).

In particular, the falling or tipping over of goalposts has led to deaths in many countries, mostly of male athletes. In Spain, 18 minors have died since 2000 (García-Tascón, 2018b), six children died in Germany between 1996 and 2013, and eight more died in Central European countries (Katthage&Thieme-Hack, 2013).

The goalpost is essential equipment for playing handball, which is a sport that is practised in multi-sport facilities, which are shared by different training groups and genders at the same time (Aguilar, Botelho, Lago, Maças& Sampaio, 2012; Iversen, 2015; Ramchandani & Taylor, 2011). Both the goals and other equipment are moved as needed, and in the case of Mini Handball, the dimensions of the field are reduced to adapt them to boys and girls (IHF, 2019c; Ilieva, &Doncheva, 2015; Phillips, Hannon & Molina, 2015). The anti-tip system is the mechanism that provides stability and prevents sports equipment from tipping over (Baena-González, Lozano, Gallardo, Chavarria-Ortiz & García-Tascón, 2020a; Baena-González, García-Tascón, Chavarria-Ortiz, Martínez-Martín & Gallardo, 2020b). It is considered a fundamental element in preventing accidents, and its absence, condition and use is evaluated in studies concerning the risks present in sports facilities (Del Campo&Piriz, 2016; García-Tascón, Gallardo, Luengo, Martínez-López, González, 2014;Latorre, Mejía, Gallego, Muñoz& Santos, 2012; Montalvo, Felipe, Gallardo, Burillo& García-Tascón, 2020; Herrador-Sánchez & García-Tascón, 2016). According to rule 1:2 of the regulation (before July 1st): the goals must be firmly attached to the floor or the walls behind them, which is not always possible, sincethe floor of the facilityis not suitablefor this (Ramchandani &Taylor, 2011; Baena-González et al., 2020a, Baena-González et al., 2020b). Therefore, the federal change has been fundamental to enable the use of different anti-tip systems in the goals and, in its current version,such regulation adds: "or provided with an overturn system. This new provision is approved with the aimof preventing accidents" (IHF, 2019b).

Numerous studies in handball haveconsidered the gender of the participants to analyse aspects such as physical abilities (Roland & Jan, 2012), motivation and team climate (Gómez-López, Ruiz-Sánchez &Granero-Gallegos, 2019), the personality of the players (Abrahamsen, Roberts &Pensgaard, 2008; König-Görögh et al., 2019), their opinion on the reason for their injuries (Hatzimanouil, Giatsis, Kanioglou&Kolkas, 2015), the way referees act (Souchon et al., 2009; Souchon et al., 2010), and the perception of sport practice (Baugh, 2018;Brown, Verhagen, Mechelen, Lambert & Draper, 2016;Latorre, Cámara& Pantoja, 2015;Montalbetti &Chamarro, 2010), among others. Young people, in general, have relatively low levels of risk perception, underestimate the possibility of certain risks, do not perceive them holistically, detect them more slowly and tend to overestimate their skills (Little &Wyver, 2010; López &Osca, 2007; Prati et al., 2019;Schnell, Mayer, Diehl, Zipfel & Thiel, 2014;Zeuwts, Vansteenkiste, Deconinck, Cardon & Lenoir, 2017). In this way, Hillier and Morrongiello (1998) found that boys showed lower perceived risk than girls, and that 6-year-olds saw fewer risks and were slower than 10-year-olds. According to Kontos (2004), these high levels of risk taking, low levels of perceived risk and skill estimation are some risk factors for injury.

However,there are no studies aboutthe influence of gender on the perception of risk and safety withthe anti-tip system for handball goals. Regarding the Tutigool anti-tip system, several studies in international handball tournaments have been conducted. Specifically, there are two previous studies, developed in international handball tournaments, where the Tutigool anti-tip system was used in the goals (Baena-González et al., 2020a; Baena-González et al., 2020b; Blanco, Diaz-Cabrera, Torres-Pinazo, Carmona-Álamos & García-Tascón). The participants presented their degree of satisfaction with this system, whose average values, corresponding to men and women, were 5.66 and 4.34 points, respectively, on a 1-7 measurement scale. Both studies contributed to the change in the 1:2 rule of the official handball regulations.

Thus, the aim of this research was to explore the opinions of the participants in the 2019 Nations Cup International Handball Tournament, in order to assess whether there are gender-differentiated patterns in the perception of safe handball practice using the Tutigool type of anti-tip system with goal weights.

Materials and Methods

Participants

The selected sample was composed of 120 participants aged between 15 and 65 years (21.17 ± 7.91), of whom 56.7% (68) were men aged between 16 and 65 years (22.37 ± 9.47) and 43.3% (52) were women aged between 15 and 34 years (19.60 ± 4.85). The mean age of the males was significantly higher than the mean age of the female participants, according to U-Mann Whitney non-parametric test for independent samples ($p < 0.05$) (Table 1).

Table 1 <i>Mean age and standard deviation by gender</i>			
Gender	N	Mean	SD
Male	65	22.37	9.47
Female	47	19.60	4.85
Total	120	21.17	7.91

Mann-Whitney U = 1125, Z=-3.457, p (bilateral asymptotic) = 0.001

Both sexes are well represented in the groups according to the profile of the participants (players, coaches and referees). According to the test χ^2 ($p > 0.05$), there was no significant relationship between the sex of the respondent and the group to which he or she belonged (Table 2).

Table 2 Cross table Gender*Player/Coach/Referee						
Sex			Player/Coach/Referee			Total
			Player	Coach	Referee	
Male	N		54	6	8	68
	% of the total		45.0%	5.0%	6.7%	56.7%
Female	N		41	3	8	52
	% of the total		34.2%	2.5%	6.7%	43.3%
Total	N		95	9	16	120
	% of the total		79.2%	7.5%	13.3%	100.0%

$\chi^2 = 0.657$, Asymptotic significance (bilateral) = 0.720

According to the profile of the participants, 95 were players (79.16%), 9 were coaches (7.5%) and 16 were referees (13.33%). By teams, the sample consisted of four male teams in the U19 category, which were Germany (14.17%), Iceland (15%), Norway (13.33%) and Israel (5%), and three female teams in the U17 category: Germany (15.83%), Norway (15%) and the Harislee club (8.33%) (Table 3).

Table 3 Classification of study participants								
			Men			Women		
			Player	Coach	Referee	Player	Coach	Referee
Team	Germany M	N	17					17
		%	14.17					14.17
	Island	N	15	3				18
		%	12.50	2.50				15.00
	Israel	N	6					6
		%	5.00					5.00
	Norway M	N	16					16
		%	13.33					13.33
	Germany F	N		2		16	1	19
		%		1.67		13.33	0.83	15.83
Referees		N		1		15	2	18
		%		0.83		12.50	1.67	15.00
Total		N				10		10
		%				8.33		8.33
Referees		N			8			8
		%			6.67			6.67
Total		N	54	6	8	41	3	8
		%	45.00	5.00	6.67	34.16	2.50	6.67

Instrument

The instrument used in this study was based on the questionnaire developed by Blanco et al. (2017), extended and used by Baena-González et al. (2020b), in the 2019 International 4-Nation Junior Tournament, held in Spain and organized by the International Handball Federation (IHF).

The questionnaire is composed of 3 sections, with 4 items that analyse the socio-demographic data, 17 items about the sports equipment (Tutigoolanti-tip system) and 1 item about the accidents/hits witnessed against goals. Regarding the type of response, 13 items are based on a Likert scale (1 = totally disagree; 7 = totally agree), 4 items have a dichotomous response format (YES/NO), 1 item has an ordinal scale response format of 1-6 [1: Many (>21) / 2: Quite a few (16-20) / 3: Not many (11-15) / 4: Few (6-10) / 5: Very few (1-5) / 6: None], and the socio-demographic data (4 items) must be filled in.

Procedure

Firstly, the IHF and the German Handball Federation (DHB) were contacted to obtain permission to use the Tutigoolanti-tip system in the tournament goals. Once permission was obtained, the participating teams and referees were informed. Then, the collaboration of the sports facility managers was requested for the reception and installation of the anti-tip system in the goals.

Finally, printed copies of the questionnaire were given to players, coaches and referees to fill them in after the tournament (3 matches for the men's teams and 2 for the women's teams), and they were also asked to comment on their experience with the Tutigoolanti-tip system.

Data analysis

The data obtained when applying the instrument to the 120 participants in the study (players, coaches and referees) were structured in a database in Microsoft Excel 2016 and analysed using IBM Statistics SPSS version 3236-----

23 for Windows. Methods of descriptive analysis of variables, construction of frequency and contingency tables, and Kolmogorov-Smirnov normality tests were applied. The normality tests applied to each group of segmented data, taking into account the classification of respondents by position occupied and gender, indicate that, in general, the data corresponding to each variable were significantly different from the normal distribution ($p < 0.05$). Non-parametric statistical tests were selected for processing: χ^2 test for analysis of independence between variables (contingency tables), calculation of Kendall's non-parametric and symmetric Tau-c correlation coefficient, and non-parametric test to compare two independent Mann-Whitney U samples.

Results

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

1. About the knowledge and design of the Tutigoolanti-tip system.

The analysis of frequencies for data segmented by gender (Table 4) shows that 16/68 men knew about this Tutigoolanti-tip system (23.50%), 15/68 men stated that it existed in their countries of origin (22.10%), and 51/68 men were surprised by it (75%). On the other hand, 10 of the 52 participating women affirmed that they knew about the system (19.20%), and only one (1.90%) indicated that it exists in their country. The design of the anti-tip system has attracted the attention of 31/52 women (59.60%). Only 5/68 men (7.40%) and 4/52 women (7.70%) had previous experience with this system. In general, 21.70% of those surveyed knew about it, 13.30% indicated that it existed in their country, and only 9/120 participants (7.50%) had previous experience with this anti-tip system. The design has attracted the attention of 68.30% of the participants. Knowing about the anti-tip system, previous experience with it and attention attracted by the design were independent of the sex of the respondent ($p > 0.05$); however, it was observed that the relative frequencies related to its existence in the country of origin the participants depended significantly on the sex of the respondent, according to Kendall's Tau-b correlation coefficient.

Table 4 Knowledge, existence, experience and design of the Tutigoolanti-tip system

Gender		I knew about this anti-tip system	It exists in my home country	Previous experience with this system	The design appeals to me
Male = 68	N	16	15	5	51
	Percentage	23.5%	22.1%	7.4%	75%
Female = 52	N	10	1	4	31
	Percentage	19.2%	1.9%	7.7%	59.6%
Total = 120	N	26	16	9	82
	Percentage	21.7%	13.3%	7.5%	68.3%
<i>Symmetrical measurements</i>					
Kendall's Tau-b		-0.052	-0.294*	0.006	-0.164
Standardised Asymptotic error		0.090	0.060	0.092	0.091
Approximate T		-0.573	-3.729	0.070	-1.788
Approximate p		0.567	0.000	0.944	0.074

* Significant correlation ($p < 0.05$)

2. About general satisfaction with the Tutigoolanti-tip system.

Table 5 shows the 13 items included in the instrument for evaluating the level of perception about different aspects related to the Tutigoolanti-tip system (novelty, safety, structure and convenience), which were favourably evaluated by both male and female participants (4.62 ± 1.42), with ratings generally higher than the neutral level (4) on a scale of 1-7.

Table 5 Satisfaction with the Tutigool anti-tip system

Gender	Man		Woman		Total	
	Media	DE	Media	DE	Media	DE
It is innovative	4.51	1.31	5.15	1.92	4.79	1.377
It increases the safety of the game	4.91	1.358	5.35	1.44	5.1	1.405
It increases the goalpost's mobility	4.72	1.402	4.56	1.335	4.65	1.37
It increases the goalkeeper's mobility	5.29	1.294	5.79	1.242	5.51	1.29
It increases the team's safety in attack	4.47	1.569	5.04	1.692	4.72	1.641
It increases the team's safety in defence	4.43	1.459	4.38	1.728	4.41	1.574
It facilitates the game's continuity	4.56	1.365	4.63	1.534	4.59	1.435
The structure is uniform	4.66	1.167	4.56	0.826	4.62	1.03
The structural alteration is difficult	4.35	1.347	4.21	0.936	4.29	1.184
It is suitable for municipal sports centers	4.6	1.537	5.71	1.177	5.08	1.493
It is suitable for schools	4.85	1.374	5.3	1.294	5.06	1.355
It is suitable for the highest-level	4.61	1.644	5.33	1.757	4.87	1.734
Overall opinion	4.53	1.45	4.73	1.157	4.62	1.33

The evaluations provided by the female participants are significantly higher according to the results of the Mann-Whitney U test ($p < 0.05$) in terms of the following statements: the proposal of this type of goal is novel (5.15 ± 1.39), it increases the goalkeeper's safety (5.79 ± 1.24), it increases the safety in attack (5.04 ± 1.69), it is suitable for municipal sports schools (5.71 ± 1.17), and it is suitable for the highest sports level (5.33 ± 1.75). No significant differences were observed in the general satisfaction with this system between men (4.53 ± 1.45) and women (4.73 ± 1.15), $p > 0.05$ (Table 6).

Table 6	<i>U-Mann-Whitney test</i>	
	Z	Sig. asymptot.
It is innovative	-2.436	0.015*
It increases the safety of the game	-1.636	0.102
It increases the goalpost's mobility	-0.835	0.404
It increases the goalkeeper's mobility	-2.101	0.036*
It increases the team's safety in attack	-2.054	0.040*
It increases the team's safety in defence	-0.062	0.950
It facilitates the game's continuity	-0.491	0.624
The structure is uniform	-0.176	0.860
The structural alteration is difficult	-0.422	0.673
It is suitable for municipal sports centers	-4.061	0.000*
It is suitable for schools	-1.912	0.056
It is suitable for the highest-level	-2.92	0.003*
Overall opinion	-0.499	0.618

Grouping variable: Gender (1-Male, 2-Female)

* Significant differences according to the gender of the respondent

According to the profile of the respondent, there are significant differences ($p < 0.05$) in the levels of perception that men and women have about a set of items presented in Table 7, according to Mann-Whitney's non-parametric U-test. Female players show significantly higher average evaluations than male players regarding the novelty of this type of goal, usefulness for improving safety when not anchored, safety for the goalkeeper, safety for the team in the attacking position, convenience for municipal sports schools and regular schools, and suitability for elitesports level.

There were no significant differences between the two groups in terms of overall satisfaction, which in both cases was favourable. The coaches showed a significantly higher evaluation regarding the convenience of this system for municipal sports schools and a significantly more favourable general opinion about the proposed system. Male referees have significantly more favourable criteria than female referees regarding the usefulness of improving security by not being anchored and increasing the security of the team in the attacking position.

Table 7	<i>Satisfaction of men and women with the Anti-Tip System according to the participant profile</i>				
	Items	Men	Women	Z	Sig. asymptot.
Players	The proposal of this type of goal is novel	4.43±1.409	5.32±1.422	-2.814*	0.005
	Can be useful to improve safety as it is not anchored	4.70±1.396	5.59±1.414	-2.904*	0.004
	Can increase the safety of the goalkeeper	5.19±1.361	5.95±1.264	-2.815*	0.005
	Can increase the safety of the team in the attack position	4.22±1.645	5.05±1.816	-2.556*	0.011
	It is suitable for municipal sports schools	4.31±1.49	5.73±1.073	-4.613*	0.000
	It is suitable for schools	4.61±1.352	5.24±1.261	-2.205*	0.027
	It is suitable for the highest sport level	4.61±1.571	5.41±1.802	-2.736*	0.006
Coaches	It is suitable for municipal sports schools	6.00±0.632	7.00±0.000	-2.060*	0.039
	Anti-tip-General opinion	5.50±1.225	7.00±0.000	-2.070*	0.038
Referees	Can be useful to improve safety as it is not anchored	5.75±0.886	4.00±0.756	-2.934*	0.003
	Can increase the safety of the team in the attack position	5.50±0.756	4.63±1.061	-2.177*	0.030

* Significant differences. Mann-Whitney U test, p (bilateral asymptotic) < 0.05

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

The number of accidents witnessed by the participants was most frequently valued between very few (1-5 hits) and quite a few (16-20 hits), i.e., 4.13 ± 1.40 on a 1-6 measurement scale. Three men (2.5% of the sample) admitted to having witnessed many accidents/hits against goals, whereas 57/68 men (83.8%) and 41/52 women (78.8%) have witnessed some accidents/hits against goals (Table 8).

The result of the calculation of Kendall's non-parametric Tau-c contingency coefficient indicates that the number of accidents witnessed by the respondents, measured on an ordinal qualitative scale, is shown as a variable independent of gender ($p > 0.05$).

Table 8 Cross Tabulation.		Hits/Accidents witnessed by gender (M, B, NM, P, MP, N)				
			Gender			
			Man	Woman	Total	
Witnessedblows	Many	N	3	0	3	
		Gender gap	100	0.0	100.0	
		Within the gender	4.4	0.0	2.5	
	Some	N	10	4	14	
		Gender gap	71.4	28.6	100.0	
		Within the gender	14.7	7.7	11.7	
	Not many	N	17	11	28	
		Gender gap	60.7	39.3	100.0	
		Within the gender	25	21.2	23.3	
	Few	N	5	11	16	
		Gender gap	31.3	68.8	100.0	
		Within the gender	7.4	21.2	13.3	
	Very few	N	22	15	37	
		Gender gap	59.5	40.5	100.0	
		Within the gender	32.4	28.8	30.8	
	None	N	11	11	22	
		Gender gap	50	50	100.0	
		Within the gender	16.2	21.2	18.3	
Total	N	68	52	120		
	Gender gap	56.7	43.3	100.0		
	Within the gender	100.0	100.0	100.0		
Symmetricalmeasurements						
Ordinal by ordinal	Kendall's Tau-c	Value	Typical error ^{asymptotic}		T approx.	Sig. Approximate
		0.131	0.100		1.314	0.189
No. of valid cases		120				

a. The null hypothesis is not assumed

b. Using the asymptotic standard error based on the null hypothesis.

Discussion

The aim of this study was to explore, based on gender, the opinions about the Tutigoolanti-tip system, as a preventive measure in the game in the 2019 International Handball Cup Tournament (U19 male and U17 female category).

The level of *knowledge of* the Tutigoolanti-tip system prior to the tournament was low (21.7%). By gender, 23.5% of men and 19.2% of women knew about the system, which is higher than the 18% reported in the previous study [39]. This may be due to the fact that handball regulations did not allow the use of this type of system before July 1st 2019 (IHF; 2019b). The first tournament played with unanchored goals and the Tutigoolanti-tip system was the 2016 World University Championship in Antequera (Spain), where Blanco et al. (2017) conducted a pilot study.

With regard to the *design of* the Tutigoolanti-tip system, 68.3% of those surveyed participants were interested, with more men (75%) than women (59.6%). However, women gave a higher value to the *novelty of* the system, with 5.15 points compared to 4.51 points given by men. The value of the system was between those of the two previous studies for men (5.5 in the pilot study [Blanco et al, 2017] and 4.65 in the subsequent study with the anti-tip system [Baena-González et al., 2020b]), and slightly lower for women. The technological innovations in sports equipment and its materials that have led to numerous advances in sports development, safety and performance (Latorre et al., 2015; Little, H. & Wyver, 2010; López & Osca, 2007; Prati et al., 2019).

Overall satisfaction with the Tutigoolanti-tip system obtained 4.62 points, higher than the 4.34 points obtained in the previous study (Baena-González et al., 2020b) and lower than the 5.66 points obtained in the first study (Blanco et al., 2017). Depending on their gender, women rated this variable slightly higher (4.73) than men (4.53), although no significant differences were observed with the system according to gender, $p > 0.05$ (Table 6). Regardless of the gender of the participants, the opinion of sports officials is important for making future changes in the regulations, assessing those already modified to prevent injuries (Baena-González et al, 2020a; Baena-González et al, 2020b; Hillier & Morrongiello, 1998; Zeuwts et al., 2017).

According to the profile of the participants (players, coaches and referees), and compared with the assessments in the study conducted by Baena-González et al. (2020b), the female players showed significantly higher average evaluations than the male players in terms of usefulness for improving *safety* by not being anchored (5.59 vs. 4.70, both higher than 4.51 in the previous study), *safety for the goalkeeper* (5.95 vs. 5.19, both higher than 4.63 in the previous study), and safety for the team in the *attacking position* (5.05 versus 4.22, both higher than 3.75 in the previous study), and convenience for *municipal sports schools* (5.73 versus 4.31,

similar to 5.29 in the previous study), *regular schools* (5.24 versus 4.61, both lower than 5.27 in the previous study), and for the *highest sports level* (5.41 versus 4.61, both higher than 3.98 in the previous study).

The coaches showed a significantly higher evaluation regarding the convenience of this system for *municipal sports schools* (7 versus 6, similar to 7 in the previous study), thus it is the best evaluated item in this study and in the two previous studies. Children and adolescents spend much of their time in schools and municipal sports facilities. Access, condition and use of these spaces are fundamental to preventing injuries and accidents and ensuring safety (Bhudolia, Perrotey & Joshi, 2015; Blanco et al., 2017; EN-749, 2006; Kontos, 2004; Limstrand & Reher, 2008; Potts & Ratten, 2016; Ratten, 2016; Timpka, 2006). Similarly, they have a significantly more favourable *overall opinion about* the proposed system (7 vs. 5.5, compared to 4.34 in the previous study). Male referees have significantly more favourable criteria than female referees regarding the usefulness of *improving safety* by not being anchored (5.7 vs. 4, compared to 5 in the previous study) and increasing the safety of the *team in the attacking position* (5.50 vs. 4.63, compared to 5 in the previous study).

Some of the limitations of the study are the possible language misinterpretations, since the questionnaire was only written in English.

Future lines of research will include the application of this study to other groups of interest, with the aim of expanding the population under study, as well as the correlational analysis of the variables described.

Conclusions

According to the objective of this work, and taking into account the results obtained, we present the conclusions considered most interesting regarding the influence of the type of anti-tip system with counterweights for Tutigool goals on the safe practice of handball.

Only 21.7% of the participants knew about the Tutigool anti-tip system: 23.5% of the male participants and 19.2% of the female participants. Overall satisfaction was 4.62 out of 7, with women (4.73) being slightly more satisfied than men (4.53), showing no significant differences.

The evaluations provided by the female participants are significantly higher in the following items: the proposal of this type of goal is novel (5.15 ± 1.39 vs 4.51 ± 1.31), increases the safety of the goalkeeper (5.79 ± 1.24 vs 5.29 ± 1.29), increases safety in the attacking position (5.04 ± 1.69 vs 4.47 ± 1.56), is suitable for municipal sports schools (5.71 ± 1.177 vs 4.6 ± 1.53), and is suitable for the highest sport level (5.33 ± 1.75 vs 4.61 ± 1.164).

Regarding accidents, 83.8% (57/68) of the male participants and 78.8% (41/52) of the female participants had witnessed an accident/hit against goals, showing that this variable is independent of sex.

Finally, the Tutigool anti-tip system is considered to be suitable for the prevention and reduction of possible injuries due to physical contact with the goal, favouring absorption in the event of an impact, as it is not anchored, and preventing it from falling. In this regard, women show greater appreciation of its use as a risk prevention element.

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

Practical applications

The practical application of the study is to propose the use of a new anti-tip system for handball/futsal goals as an accident prevention measure in handball practice and in sports facilities in general. Moreover, the purpose of this work is to help visualize and sensitize regional, national and international handball federations about the use of the anti-tip system for goals as a measure to reduce impacts and injuries, where it has been demonstrated that there are gender-based differences that should be addressed, such as the opinions of players, coaches and referees.

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Conflicts of interest

The authors declare that they have no conflict of interest.

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Appendix

Questionnaire		Anti-tip system "Tutigool"											
Sociodemographic													
1. Male	Female	2. Age	3. Team	4. Type agent: Player	Coach	Referee							
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 sports competition							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)					
							Not many	(11-15)					
							Few	(6-10)					
							Very few	(1-5)					
							None						