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Epidemiology of injuries in young Spanish soccer players according to the playing positions
Epidemiología de las lesiones en futbolistas jóvenes españoles según la demarcación

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Abstract. Soccer is a complex sport that involves relatively high risks of injury. The high participation rates in soccer has increased the soccer-related injuries among the youth population. There are different physiological demands between playing positions, however a limited amount of studies about the incidence of injuries in soccer players of differing ages and playing position has been published. The aim of this study was to identify the incidence, type, location and severity of injuries in young Spanish soccer players according to playing position in different age groups. There were 431 participants who were male soccer players between the ages of 7 and 23 and they were studied for a full season. All players were classified according to individual playing position: goalkeepers, external defenders, central defenders, central midfielders, external midfielders and forwards; and according to age groups: younger than or equal to 9 years, younger than or equal to 11 years, younger than or equal to 13 years, younger than or equal to 15 years, younger than or equal to 18 years, and younger than or equal to 23 years. Incidence of the typology, location and severity of injuries according to playing position for each to the age groups was different. Injury incidence demonstrated a growth trend according to age. Forwards sustained an incidence of injuries significantly greater compared with goalkeepers, central defenders, external defenders and external midfielders. In conclusion, injuries constitute a health threat. Knowledge of the epidemiology of injuries in young soccer players is very important in order to be able to develop appropriate preventive measures according to age groups and playing positions.
Key words: Soccer, incidence, injury, rate of injuries, youth soccer, role position.

Resumen. El fútbol es un deporte complejo que implica relativamente un alto riesgo de lesión. La alta tasa de participación en el fútbol ha aumentado el número de lesiones entre la población juvenil. Existen diferencias en las demandas fisiológicas según la demarcación de los jugadores sobre el terreno de juego, sin embargo, se ha publicado una cantidad limitada de estudios sobre la incidencia de lesiones en jugadores de fútbol de diferentes edades y la demarcación. El objetivo de este estudio fue identificar la incidencia, la tipología, la localización y la severidad de las lesiones en futbolistas españoles jóvenes atendiendo a la demarcación sobre el terreno de juego en los diferentes grupos de edad. Participaron 431 futbolistas masculinos entre las edades de 7 y 23 años, los cuales fueron estudiados durante una temporada completa. Todos los jugadores fueron clasificados según su demarcación sobre el juego: porteros, defensas laterales, defensas centrales, mediocentros, centrocampistas externos y delanteros; y según grupos de edad: menores de 9 años, menores de 11 años, menores de 13 años, menores de 15 años, menores de 18 años, y menor de 23 años. La incidencia de la tipología, localización y severidad de las lesiones según la demarcación de los jugadores en cada grupo de edad fue diferente. Los delanteros sufrieron una incidencia de lesiones significativamente mayor en comparación con los porteros, defensas centrales, defensas laterales y centrocampistas externos. En conclusión, las lesiones constituyen una amenaza para la salud. El conocimiento de la epidemiología de las lesiones en futbolistas jóvenes es muy importante para poder desarrollar medidas preventivas apropiadas de acuerdo con las diferentes edades y según la demarcación sobre el terreno de juego.
Palabras clave: fútbol, incidencia, lesiones, tasa de lesiones, fútbol juvenil, demarcación.

Introduction

An increase in the physical activity of individuals has many health benefits, but a drawback of this increase is the risk of related injuries (Collard, Verhagen, Chin, Paw & van Mechelen, 2008). Soccer is considered the most popular sport in the world and his practice covers different social strata and age groups, including children and adolescents, due mainly to the perception on the part of parents that the sport is safe (Bastos, Vanderlei, Vanderlei, Júnior & Pastre, 2013; Chena, Rodríguez, Bores & Ramos-Campos, 2019; Van Beijsterveldt, van der Horst, van de Port & Backx, 2013). However, the high participation rates in soccer has increased the soccer-related injuries among the youth population (Kakavelakis, Vlazakis, Vlahakis & Charissis, 2003; Froholdt, Olsen & Bahr, 2009) causing an increase in global health care systems worldwide (Brito, Malina, Seabra, Massada, Soares, Krustrup & Rebelo, 2012).

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Soccer is a complex contact sport that involves relatively high risks and rates of injury. Constant exposure to repetitive actions places the integrity of bodily structures at risk, especially in cases in which growth and maturation are not yet completely developed, such as in childhood and adolescence. However, most investigators studying exposure-related injuries have focused on adult male professional soccer players (Bastos et al., 2013), where it is considered a high-risk sport (Chena et al., 2019) causing great economic losses worldwide (Brito, Malina, Seabra, Massada, Soares, Krustrup & Rebelo, 2012). In addition to age and maturity, there are other risk factors such as gender, exercise load, previous injuries, physical fitness levels, level of play and standard of training that are associated with soccer injuries (Brito et al., 2012; Pfirrmann, Herbst, Ingelfinger, Simon & Tug, 2016).

The time–motion analysis has been well analyzed during competitive match play (Bradley, Sheldon, Wooster, Olsen, Boanas & Krustrup, 2009; Di Salvo, Baron, Tschan, Calderon Montero, Bachl & Pigozzi, 2007). Soccer is a sport characterized by repeated short sprints, rapid acceleration or deceleration, turning, jumping, kicking, and tackling (Lago-Peñas, Casais, Dellal, Rey, & Dominguez, 2011). The physical

demands were also analyzed according to the different positional roles, showing activity profiles and fatigue patterns vary among playing positions (Bradley et al., 2009; Di Salvo et al., 2007). This evidence suggests that specific physiological demands exist for different playing positions (Bradley et al., 2009; Di Salvo et al., 2007; Lago-Peñas et al., 2011), however, match play demand is different in youth team categories, and therefore, the physical and physiological profiles of players differ from those of adult players (Lago-Peñas et al., 2011).

Other than the different physiological demands between playing positions, it has been reported that professional soccer players have positional differences with regard incidence of injuries (Hägglund, Waldén & Ekstrand, 2013). However, a limited amount of studies about the incidence of injuries in soccer players of differing ages and playing position has been published (Le Gall, Carling, Reilly, Vandewalle, Church & Rochcongar, 2006).

The purpose of this study was to identify the incidence, type, location and severity of injuries in young Spanish soccer players according to playing position in different age groups to generate new knowledge to develop appropriate preventive measures specific to each case.

Method

Subject

There were 431 participants who were male soccer players between the ages of 7 and 23 and they were studied for a full season. All players had been classified according to individual playing position used in studies (Lago-Peñas et al., 2011): goalkeepers (GK), external defenders (ED), central defenders (CD), central midfielders (CM), external midfielders (EM) and forwards (FW), and according to categories as specified by the Spanish Royal Soccer Federation: younger than or equal to 9 years (U9), younger than or equal to 11 years (U11), younger than or equal to 13 years (U13), younger than or equal to 15 years (U15), younger than or equal to 18 years (U18), and younger than or equal to 23 years (U23) (Table 1).

Table 1
Age and anthropometric characteristics of the players

Category	Position	n	Age	Height (m)	Weight (kg)	BMI (kg/cm^2)
			$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD	$\bar{X}$ ± SD
U9	GK	6	9.54±0.71	1.36±0.07	31.93±10.98	17.10±3.82
	ED	4	9.78±0.34	1.34±0.03	28.13±2.49	15.68±1.55
	CD	14	9.59±0.63	1.39±0.07	34.36±4.77	17.70±1.89
	CM	11	9.90±0.54	1.38±0.06	34.15±6.25	17.79±2.30
	EM	21	9.46±0.63	1.34±0.05	30.47±5.81	16.87±2.52
	FW	12	9.43±0.49	1.32±0.08	29.02±5.56	16.51±1.49
	Total	68	9.58±0.59	1.36±0.07	31.60±6.30	17.08±2.30
U11	GK	7	11.51±0.64	1.46±0.04	37.89±2.60	17.83±0.70
	ED	10	11.59±0.66	1.45±0.07	36.37±4.37	17.14±0.83
	CD	19	11.62±0.55	1.48±0.07	41.05±9.73	18.66±3.17
	CM	17	11.77±0.55	1.47±0.08	38.49±5.93	17.85±1.72
	EM	11	11.59±0.62	1.41±0.07	35.20±4.85	17.70±1.34
	FW	16	11.57±0.51	1.45±0.05	38.21±6.42	18.17±2.48
	Total	80	11.63±0.56	1.45±0.07	38.27±6.77	18.00±2.15
U13	GK	11	13.42±0.67	1.64±0.08	52.95±9.26	19.77±3.75
	ED	22	13.43±0.51	1.53±0.08	43.79±7.78	18.61±2.60
	CD	20	13.43±0.56	1.65±0.11	54.07±10.39	19.72±2.10
	CM	20	13.24±0.60	1.56±0.05	47.44±7.53	19.34±2.55
	EM	17	13.59±0.59	1.58±0.10	44.29±7.27	17.74±1.54
	FW	24	13.41±0.60	1.56±0.09	44.08±7.72	17.90±1.98
	Total	114	13.41±0.58	1.58±0.09	47.25±9.13	18.77±2.47
U15	GK	6	15.52±0.59	1.78±0.04	72.77±12.43	22.96±3.43
	ED	11	15.69±0.79	1.67±0.05	54.92±6.45	19.60±1.70
	CD	11	15.84±0.53	1.74±0.07	62.16±7.96	20.54±1.63
	CM	15	15.73±0.57	1.72±0.09	63.39±9.31	21.34±2.51
	EM	11	15.28±0.65	1.60±0.07	50.55±6.89	19.63±2.17
	FW	17	15.45±0.65	1.69±0.10	54.76±9.62	18.97±1.50
	Total	71	15.59±0.64	1.70±0.09	58.62±10.55	20.25±2.34
U18	GK	6	17.64±1.14	1.76±0.03	74.12±6.62	23.98±2.76
	ED	9	17.91±1.05	1.76±0.03	68.09±1.75	22.05±0.72
	CD	13	17.97±0.82	1.78±0.06	69.52±7.18	21.94±1.97
	CM	17	17.92±0.91	1.72±0.09	63.66±8.90	21.47±2.16
	EM	13	17.87±0.66	1.74±0.06	65.43±4.22	21.54±1.60
	FW	11	18.22±1.06	1.74±0.09	67.92±9.62	22.30±2.23
	Total	69	17.94±0.89	1.75±0.07	67.26±7.57	22.00±2.01
U23	GK	2	20.25±0.28	1.86±0.04	76.50±3.54	22.11±0.01
	ED	3	21.50±1.12	1.77±0.06	70.70±3.74	22.48±0.29
	CD	5	21.89±1.68	1.81±0.06	78.78±6.38	24.00±1.21
	CM	5	21.60±1.79	1.76±0.06	68.88±7.13	22.14±1.15
	EM	3	21.25±0.97	1.71±0.08	65.53±7.67	22.44±2.55
	FW	11	21.98±1.10	1.76±0.06	69.40±5.06	22.54±1.83
	Total	29	21.66±1.29	1.77±0.06	71.15±6.77	22.68±1.57

All subjects trained 3-4 times per week in sessions of at least 90 minutes. They also played competitions every weekend in matches that varied according to age (40 minutes for U9, 60 minutes for U11, 70 minutes for U13, 80 minutes for U15, and 90 minutes for U18 and U23). All training sessions and matches took place on second generation synthetic turf.

All participants signed a consent form and received a detailed report regarding the confidentiality of the data according to Organic Law 15/1999, dated December 13th (BOE 14-12-1999). Also, an informed consent form was presented to all the soccer players over 18 years and to the legal guardians of the underage players. An assent of soccer players under 18 was also provided along with parental consent. The participants were free to participate in this study. The study was in accordance with the European University of Atlantic´s Ethics Committee and the latest version of the Declaration of Helsinki (World Medical Association, 2001).

Procedures

The study took place following the criteria established through the consensus statement on definitions and data collection procedures of injuries for epidemiological research in soccer (Fuller et al., 2006). These variables were collected by qualified personnel through a questionnaire (Chena et al., 2019), respecting the criteria proposed by the Orchard Sports Injury Classification System (OSICS) (Orchard, Rae, Brooks, Hägglund, Til, Wales & Wood, 2010; Rae & Orchard, 2007).

The data were collected through individual interviews, performed by a single interviewer, using a reported condition inquiry addressing the occurrence of injury and its characteristics in the current season (Bastos et al., 2013). In addition to the information collected in the questionnaire, a weekly interview was performed with the medical services, injured players and the coach or physical trainer (Chena et al., 2019). As Bastos et al. (2013), a pilot study was first conducted to adjust the data acquisition procedures and test the inquiry on a population with similar characteristics to those of the present study, which confirmed the full possibility of use and fit in the proposed methodological design.

According to the consensus statement, the type, location, and severity of the injury were recorded, the latter depending on the time the player was absent from training or competition (Bastos et al., 2013, Chena et al., 2019; Van Beijsterveldt et al., 2013; Brito et al., 2012; Pfirrmann et al., 2016; Ekstrand, Hägglund & Waldén, 2011). Injury severity was classed into 4 subdivisions according to the definition previously used in studies (Brito et al., 2012; Ekstrand et al., 2011; Hägglund et al, 2013; Le Gall et al., 2006): major (more than 28 days), moderate (7-28 days), mild (4-7 days) and minor (1-3 days).

Statistical analyses

This study used descriptive procedures with no

manipulation of variables nor modification of the natural course of events. It was considered a cohort study due to the longitudinal nature of the research design in which the subjects were selected by the independent variables and were followed throughout the season until a response was detected. Results were presented using a descriptive method.

A comparison of proportions was performed using a Chi-square test of independence ($\div^2$), with Bonferroni corrections of the P values to determine significant difference between groups. In addition, a Chi-square test for trend was performed for some cases in order to test linear trend within a group.

The sample was segmented according to the age groups and the play position before determining that variables did not exhibit normality as the result of a Kolmogorov-Smirnov test. A Kruskal-Wallis non-parametric test was conducted to find p in order to determine possible significant differences between categories. Subsequently, in the variables that showed significance, the test was performed for two independent samples of U Mann-Whitney. In addition, this study used Multivariate Analysis, the relationship between the incidence of typology, location and severity of injuries according to age groups and playing position. The results of the multivariate tests pos hoc found no significant differences for the set of variables studied.

Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS), with significance values set at: á<0.05; á<0.01 y á<0.001.

Results

Total exposure of all the subjects (n=431) was 86,014.78 hours; 75,904.45 hours of training and 10,110.33 hours of competition. The number of hours of training and matches per age group was different for the season (Table 2).

Table 2
Exposure per category during the season.

Categories	Nº of TS.	Hours of TS.	Nº of Comp.	Hours of Comp.	Hours of exposure per category		
					TS.	Comp.	Total
U9	422	633	181	120.67	7492.75	844.67	8337.42
U11	426	639	140	140.00	13290.33	1540.00	14830.33
U13	659	988.5	221	257.83	19681.87	2836.17	22518.03
U15	460	690	141	188.00	12905.75	2068.00	14973.75
U18	443	664.5	125	187.50	16058.92	2062.50	18121.42
U23	144	216	46	69.00	6474.83	759.00	7233.83
Total	2554		854		75.904.45	10.110.33	86.014.78

TS.: Training sessions; Comp.: Competition

The distribution of the percentage of injuries sustained per groups is illustrated in Figure 1. There was a growth trend in the percentage of injured players according to age. However, the percentage of injuries was greater among U18 players (Figure 1A). When comparing the difference in the total number of injuries between groups, FW reported a greater frequency of injuries in comparison to the other playing position (Figure 1B).

Frequency of injuries was different according to age and playing position. Table 3 shows the number and percentages of injuries according to individual playing position in all age groups.

The 431 soccer players from this study registered a total of 329 injuries in 86,014.78 hours of exposure, with an injury incidence of 3.82 injuries per 1,000 hours. Injury incidence demonstrated a growth trend as a function of age, showing statistically significant differences between players older than 14 (U15, U18, and U23) (Figure 2).

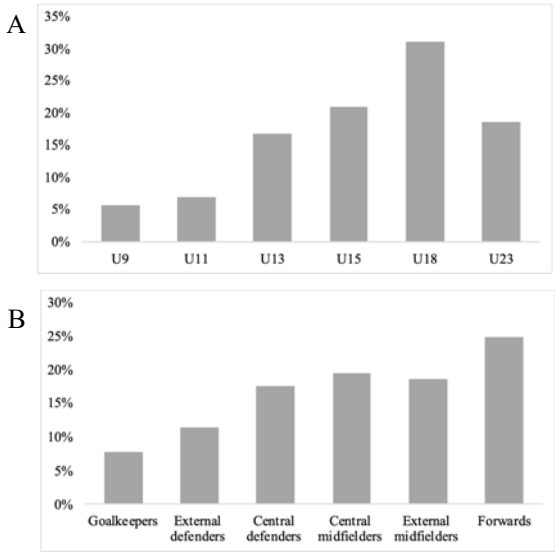

Figure 1. Distribution of injuries according to age groups (A) and playing position (B)

Table 3
Injuries according to playing position in the age groups

		Injuries												
		U9		U11		U13		U15		U18		U23		Total
	Total players	n	%	n	%	n	%	n	%	n	%	n	%	n	%
GK	38	2	10.5	8	34.8	4	7.3	3	4.3	7	6.9	2	3.3	26	7.9
ED	59	0	0.0	1	4.3	6	10.9	11	15.9	12	11.8	8	13.1	38	11.6
CD	82	1	5.3	3	13.0	16	29.1	11	15.9	19	18.6	8	13.1	58	17.6
CM	85	2	10.5	5	21.7	9	16.4	13	18.8	28	27.5	7	11.5	64	19.5
EM	76	7	36.8	2	8.7	13	23.6	13	18.8	17	16.7	9	14.8	61	18.5
FW	91	7	36.8	4	17.4	7	12.7	18	26.1	19	18.6	27	44.3	82	24.9
Total	431	19	100	23	100	55	100	69	100	102	100	61	100	329	100

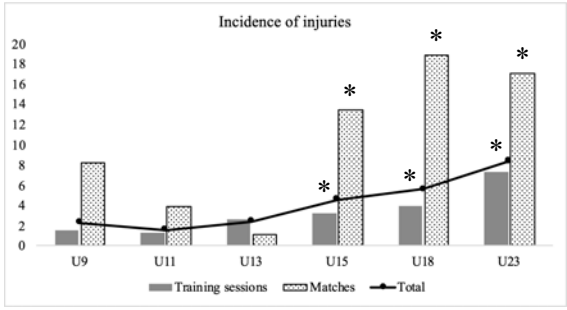

Figure 2. Number of injuries per each 1,000 hours of exposure. *Significant differences with U13, U11 and U9 (p<0,001)

FW were the players who suffered the most injuries compared to the other playing positions as shown in table 4. The statistical analysis showed a significant difference in the incidence of injury between goalkeepers, CD, ED and EM. FW sustained a significantly greater incidence of injuries compared with goalkeepers, CD, ED and EM (Table 4).

Table 4
Number of injuries per each 1,000 hours of exposure according to age groups and playing position.

	Injury incidence						
	U9	U11	U13	U15	U18	U23	Total
GK	0.24	**0.96**^{bce}	0.48	0.36	0.84	0.24	3.12
ED	0.00	0.07	0.40	0.74	0.81	0.54	2.56
CD	0.04	0.13	0.71	0.49	0.84	0.36	2.58
CM	0.13	0.33	0.60	0.87	1.87	0.47	4.27
EM	0.39	0.11	0.72	0.72	0.94	0.50	3.37
FW	0.97	0.55	0.97	**2.49**^{abce}	**2.63**^{abc}	**3.73**^{abcde}	**11.34**^{abcde}
Total	2.28	**1.55***	**2.44**$^{*\$}$	**4.61**$^{*\&\$}$	**5.63**$^{*\&\$}$	**8.43**$^{*\&\$}$	3.82

[a] Significant differences with goalkeepers; [b] Significant differences with external defenders; [c] Significant differences with central defenders; [d] Significant differences with central midfielders; [e] Significant differences with external midfielders; [f] Significant differences with forwards (p<.05)

[¤] Significant differences with U23; [ø] Significant differences with U18; [#] Significant differences with U15; [&] Significant differences with U13; [$] Significant differences with U11; [*] Significant differences with U9 (p<.001)

The majority of injury sites were found in the lower extremities (83.59%). The thigh area was the most affected

and knees and ankles were the joints where most injuries occurred, with variable distribution according to the playing position and the age groups. There was a growth trend in the incidence of muscle-tendinous injuries in the players according to age. The majority of observed injuries were muscle-tendinous and joint injuries, totalling 47.11% and 34.95% respectively (155 and 115 injuries of the 329 incidences). The incidence of muscle-tendinous injuries was significantly higher in U15, U18 and U23 soccer players compared to U9, U11 and U13 players. The incidence of joint injuries was significantly higher in U23 while U18 players showed significantly more contusion injuries than in the other categories (Table 5). Results showed that 23.10% of injuries were minor, 34.95% were mild, 27.36% were moderate, and 14.59% were severe.

Table 5
Incidence of injuries according to typology for each of the age groups

	Injury incidence					
	U9	U11	U13	U15	U18	U23
Bone injuries	**0**[abcde]	**0.13**[acd]	**0.49**[bc]	**0.33**[b]	**0.17**[a]	0.41
Joint injuries	**1.56**[abcde]	**0.88**[abd]	**0.58**[abc]	**1.07**[ab]	**2.1**[a]	3.04
Muscle and tendon injuries	**0.24**[abcd]	**0.41**[abcd]	**1.2**[abc]	**2.67**[a]	**2.65**[a]	4.42
Contusion injuries	**0.36**[b]	**0.07**[abc]	**0.13**[abc]	**0.4**[a]	**0.61**[a]	0.28
Skin injuries and lacerations	0	0	0	0.07	0.11	0.14
CNS and PNS injuries	0	0	0	0	0	0
Other types of injuries	0.12	0.07	0.04	0.07	0	0.14

[a] Significant differences with U23; [b] significant differences with U18; [c] significant differences with U15; [d] significant differences with U13; [e] significant differences with U11; [f] significant differences with U9 (p<.001)

lthough the statistical analysis found differences in the incidence of injuries according to the typology, location and severity according to the age group, these differences were not found according to positional roles (Table 6).

The FW showed more joint injuries in U9 (0.84 joint injuries per 1,000 hours of exposure) and the majority were located in the knee and ankle. GK from U11 suffered 0.27 joint injuries per 1,000 hours of exposure which were minor and were located mainly in the ankle. However, MD from U11 showed more muscle and tendon injuries. The incidence of bone injuries was higher in U13 and the CD were the players who showed most injuries of this typology. Muscle and tendon injuries were significantly more frequent in U23, U18 and U15. FW from U23 were the players who suffered more joint and muscle-tendinous injuries with 1.52 and 1.8 injuries per each 1,000 hours respectively. The majority of these injuries were located in the ankle and the back thigh and caused between 3 and 28 days for time loss injury. The EM from U18 showed more joint injuries located in the ankle, while the CD suffered more muscle and tendon injuries. Muscle injuries were distributed between the different positions in U15, but the ED and forward were the players who most injuries suffered in the front thigh while the MD and EM showed more injuries in the back thigh.

Table 6
Incidence of the typology, location and severity of injuries according to playing position for each to the age groups

		Typology of injuries				Location of injuries				Severity of injuries			
		Bone	Joint	Muscle-Tendon	Contusion	Front thigh	Back thigh	Knee	Ankle	Minor	Mild	Moderate	Severe
U9	GK	0.00	0.12	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00
	ED	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	CD	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00
	CM	0.00	0.12	0.12	0.00	0.24	0.00	0.00	0.24	0.24	0.00	0.00	0.00
	EM	0.00	0.48	0.12	0.12	0.00	0.00	0.12	0.24	0.48	0.12	0.12	0.12
	FW	0.00	0.84	0.00	0.00	0.00	0.00	0.24	0.60	0.36	0.36	0.12	0.00
U11	GK	0.07	0.27	0.13	0.00	0.00	0.00	0.00	0.27	0.07	0.20	0.20	0.07
	ED	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00
	CD	0.00	0.07	0.07	0.07	0.00	0.00	0.07	0.07	0.13	0.07	0.00	0.00
	CM	0.00	0.13	0.20	0.00	0.00	0.00	0.00	0.00	0.07	0.20	0.00	0.07
	EM	0.00	0.13	0.00	0.00	0.00	0.00	0.07	0.13	0.07	0.00	0.07	0.00
	FW	0.07	0.20	0.00	0.00	0.00	0.00	0.00	0.20	0.20	0.00	0.00	0.07
U13	GK	0.04	0.09	0.04	0.00	0.00	0.00	0.04	0.04	0.00	0.04	0.00	0.13
	ED	0.09	0.04	0.13	0.00	0.09	0.00	0.00	0.04	0.09	0.09	0.04	0.04
	CD	0.18	0.13	0.36	0.04	0.09	0.00	0.09	0.13	0.04	0.40	0.13	0.13
	CM	0.04	0.09	0.22	0.00	0.00	0.09	0.04	0.09	0.04	0.13	0.13	0.09
	EM	0.09	0.18	0.27	0.04	0.13	0.04	0.13	0.09	0.04	0.22	0.18	0.13
	FW	0.04	0.04	0.18	0.04	0.09	0.00	0.09	0.00	0.18	0.04	0.09	0.00
U15	GK	0.00	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.07	0.00
	ED	0.00	0.20	0.53	0.00	0.20	0.13	0.13	0.00	0.00	0.53	0.20	0.00
	CD	0.07	0.20	0.47	0.00	0.13	0.07	0.00	0.20	0.27	0.13	0.00	0.33
	CM	0.07	0.13	0.53	0.13	0.07	0.20	0.20	0.13	0.27	0.20	0.40	0.00
	EM	0.07	0.13	0.53	0.07	0.07	0.20	0.13	0.13	0.20	0.47	0.00	0.20
	FW	0.13	0.33	0.53	0.20	0.20	0.13	0.13	0.20	0.20	0.60	0.27	0.13
U18	GK	0.00	0.28	0.11	0.00	0.00	0.00	0.00	0.17	0.06	0.28	0.06	0.00
	ED	0.00	0.22	0.22	0.11	0.11	0.00	0.00	0.28	0.22	0.17	0.17	0.11
	CD	0.00	0.39	0.50	0.17	0.11	0.06	0.33	0.17	0.17	0.22	0.44	0.22
	CM	0.00	0.28	1.16	0.11	0.06	0.28	0.06	0.28	0.17	0.50	0.77	0.11
	EM	0.06	0.55	0.22	0.11	0.06	0.11	0.17	0.39	0.11	0.28	0.39	0.17
	FW	0.11	0.39	0.44	0.11	0.17	0.11	0.28	0.17	0.11	0.39	0.28	0.28
U23	GK	0.00	0.14	0.00	0.14	0.00	0.00	0.14	0.00	0.14	0.00	0.00	0.14
	ED	0.00	0.41	0.69	0.00	0.14	0.14	0.00	0.41	0.55	0.41	0.14	0.00
	CD	0.14	0.14	0.69	0.00	0.00	0.28	0.00	0.14	0.55	0.14	0.41	0.00
	CM	0.00	0.41	0.55	0.00	0.14	0.00	0.00	0.28	0.14	0.14	0.41	0.28
	EM	0.00	0.41	0.69	0.14	0.14	0.55	0.14	0.28	0.41	0.41	0.41	0.00
	FW	0.28	1.52	1.80	0.00	0.14	0.83	0.14	1.38	0.97	1.11	1.24	0.41

Discussion

Injuries constitute a health threat, especially in soccer, where it is considered a high-risk sport (Bastos et al., 2013). Knowledge of the epidemiology of injuries in young soccer players is very important in order to be able to develop appropriate preventive measures (Chena et al., 2019). According to Pfirrmann et al. (2016) the epidemiologic information provides a composite picture of injury prevalence and incidences and can enable researchers to detect possible susceptibilities to injury in different age groups and across different performance levels. Considering that only 15% of the studies refer to youth soccer (Volpi & Bisciotti, 2015) and there is very little information about Spanish soccer players, the aim of this study was to describe the epidemiology of injuries in young Spanish soccer players according to playing position in of all age groups.

Variations in definitions and methodologies have created differences in the results and conclusions obtained from studies of soccer injuries. This has made interstudy comparisons difficult (Fuller et al., 2006). Thus, the definitions of injury, incidence and severity used in the present study follow those employed in other epidemiologic studies on elite soccer (Chena et al., 2019; Van Beijsterveldt et al., 2013; Froholdt et al., 2009; Brito et al., 2012; Le Gall et al., 2006).

The epidemiological variables were collected by qualified personnel through a questionnaire (Chena et al., 2019), respecting the criteria proposed by OSICS (Orchard et al., 2010; Rae & Orchard, 2007) as used in other studies (Chena et al., 2019; Brito et al., 2012; Le Gall et al., 2006). Soccer seems to be considered a safe sport in young players (Dvorak, 2009) if the variables and the risks of injury is properly monitored (Brito et al., 2012; Dahlström, Backe, Ekberg, Janson & Timpka, 2012).

The results from this study show a growth trend in the percentage of injured players according to the age with statistically significant differences in the incidence of injuries in players older than 14 compared to youngers players. This event coincided with other publications (Froholdt et al., 2009), however, Brito et al. (2012) considered he overall incidence of injury and incidence of training and match injuries in sub-

elite youth male soccer players did not increase with age. When Le Gall et al. (2006) compared the age groups, also observed that the injury rate was highest in the youngest. On the other hand, an older study showed that in young players, more injuries occurred in the 14- to 16-year-old players than in the 16 to 18-year-old players (Peterson, Junge, Chomiak, Graf-Baumann & Dvorak, 2000). This might be explained by weaknesses in techniques and tactics as well as in muscle strength, endurance, and coordination in the less experienced, younger players. Considering the importance of soccer injuries today, the results found in this study could have benefited from the methodological evolution that Spanish soccer has had in the last years. However, other studies have shown that the injury rate among players aged 16 years or older approaches that of adult players (Froholdt et al., 2009) as shown in this study.

Observing the differences found in the incidence of injuries, soccer can be considered a safer sport for players under 12 years of age (Froholdt et al., 2009). Le Gall et al. (2006) showed a total of 4.8 injuries per 1000 hours of exposure time through a cohort study (Prevalence), while our data reported of 3.82 injuries per 1000 hours of exposure time. However, other studies showed a less injuries incidence in youth soccer (Brito et al., 2012).

Attending to playing position, there are little information about young soccer players and injuries, because most of the studies don't show detailed information between 6-23 years. Specific physiological demands exist for different playing positions (Bradley et al., 2009; Di Salvo et al., 2007; Lago-Peñas et al., 2011). According to physiological and tactical demands, it is common to observe that training methods in soccer increasingly require greater specialization. Recent literature has reported that coaches prefer the preparation of their players through the specific methods to maximize training adaptations (Impellizzeri, Rampinini, Coutts, Sassi & Marcora, 2004). In such cases, intensive, specific demands in sports are a potential risk for the occurrence of injuries (Brito et al., 2012; Pfirrmann et al., 2016). However, in spite of the distribution of the percentage of injuries was different according to playing position, only GKfrom U11 and FW from U15, U18 and U23 showed significant differences in the injury incidence. Cloke et al. (2012) reported different results of this study, reporting that midfield players and defenders were the most at-risk groups. However, Dauty and Collon (2011) found no difference in injury incidence or injury severity according to playing position.

The percentage of injuries in relation to playing role was relatively consistent across all the age groups and few significant differences were found (Dauty & Collon; 2011). Le Gall et al. (2006) found no significant differences between the role and age group. In spite of various studies have looked at the influence of playing position on injury incidence (Hägglund et al., 2013; Le Gall et al., 2006), the comparisons are difficult because of differing study design and the fact that youth players may not yet have settled into a definitive positional role (Le Gall et al., 2006). Thus, early specialization through training is more directed towards the specific sport than towards the positional role. The coach chooses tactical strategies and training methodology in the training stages. Each player agrees with the coach on a choice of playing position at the beginning of the season, but this decision can change during the season and players often find themselves playing in a different position. Hence, accurate statistical data analysis and interpretation are not possible (Le Gall et al., 2006).

The GK are the most specialized players because their requirements are different compared to other playing positions. However, in spite of GK from U9 and U11 reported a higher frequency of injuries, only GK from U11 showed significant differences in the injury incidence. This difference may suggest that GK acquire injuries prevention skills as they mature (Le Gall et al., 2006).

The results from the present study showed that the total number of injuries sustained per player was greatest in FW followed by midfielders and EM. Most of the injuries observed were muscular and joint injuries, as other studies showed (Bastos et al., 2013; Chena et al., 2019; Kakavelakis et al., 2003; Froholdt et al., 2009; Brito et al., 2012; Pfirmann et al., 2016; Le Gall et al., 2006, Peterson et al., 2000). FW form U9 and goalkeeper from U11 sustained a greater percentage of joint injuries. Age and lack of athletic experience in these players may explain the frequency of this type of injury, because the joint laxity and diminished neuromuscular control in specific athletic movements could increase the risk of this type of accident (Bastos et al., 2013).

Muscular and tendinous injuries that increased with the age. This result that also occurred in previous research (Bastos et al., 2013; Froholdt et al., 2009; Brito et al., 2012). Most of muscle-tendinous injuries were in hip/adductor, front thigh and back thigh in players of U15. This finding could be due to growth in muscle and tendon units arises as a response to earlier bone growth, which in turn causes rigidity in muscles and tendons, especially in cases where they cross two joints. Midfielders from U18 and FW from U23 reported greater number of these injuries and the back thigh was the most affected area. Hamstring strain is the most common single injury in elite soccer (Dauty & Collon, 2011). Although previous studies did not find significant results according to age soccer (Dauty & Collon, 2011). Askling (2011), showed that there are at least two distinctly different types of acute hamstring strains, one occurring during high-speed running and the other during movements leading to extensive lengthening of the hamstrings. This event could be a demonstration that older soccer players show similar epidemiological characteristics to adult players.

Although no difference was found according to playing positions on injuries severity as in other studies (Dauty & Collon, 2011), results of this study showed that severe injuries were less common in young soccer players compared with adult players (Pfirrmann et al., 2016). Older players in the training categories suffered a higher percentage of severe injuries, as other studies had previously shown (Brito et al., 2012). GK from U13 showed more frequency of severe injuries as a result of injuries located in wrist, knee and ankle. Le Gall et al. (2006) observed that GK had significantly more upper body and hand injuries, however, our results showed no significant differences. Midfielders from U18 suffered a higher frequency of moderate injuries and FW from U18 and U23 reported more severe injuries. This finding could be due to the possible discrepancy between the coach-intended

intensity and the actual training intensity perceived by the player in this age groups. Brink et al. (2014) showed that under 19 players reported a higher intensity and training load than the coach intended.

The U13 GK showed most severe injuries as result of injuries to the wrist, knee and ankle. For other authors, professional GK have significantly more upper body and hand injuries compared to outfield players (Le Gall et al., 2006; Dauty & Collon, 2011), however, in this study found no significant difference between the playing position players about this. Midfielders from U18 reported a greater frequency of muscle injuries in comparison to the other playing position. FW and midfielders from U23 had more injuries. These results were also observed in other studies (Cloke, Moore, Shah, Rushton, Shirley & Deehan, 2012) and could be in keeping with the view that greater intensity activity and distance covered during the practice are met with a higher risk of musculoskeletal injury.

Therefore, we conclude that the injury ratio is more balanced in elite youth participants (Pfirrmann et al., 2016). Whereas the epidemiological results reported in youth soccer did not indicate a higher incidence of injury than other youth sports, the results suggested that soccer is a safe physical activity for the youth (Van Beijsterveldt et al., 2013; Froholdt et al., 2009; Brito et al., 2012; Dvorak, 2009). Nevertheless, there is agreement on the need to use a surveillance system to monitor the injuries and to understand the magnitude of the problem before undertaking the corresponding preventive strategies (Dvorak, 2009; Cloke et al., 2012; Dauty & Collon, 2011). Age groups and player position influenced the normalized risk of injury. Although many significant differences were not found with respect to the playing position as in other studies, these results reinforce the case for injury prevention training specific position.

References

Askling, C. (2011). Types of hamstring injuries in sports. *Br J Sports Med, 45(1):*e2

Bastos, F.N., Vanderlei, F.M., Vanderlei, L.C.M., Júnior, J.N. & Pastre, C.M. (2013). Investigation of characteristics and risk factors of sports injuries in young soccer players: A retrospective study. *Int Arch Med, 6(1):*14. doi: 10.1186 / 1755-7682-6-14.

Bradley, P.S., Sheldon, W., Wooster, B., Olsen, P., Boanas, P. & Krustrup, P. (2009). High-intensity running in English FA Premier League Soccer Matches. *J Sports Sci, 27(2):*159-68. doi: 10.1080 / 02640410802512775.

Brink, M.S., Frencken, W., Jordet, G. & Lemmink, K.A. (2014). Coaches' and players' perceptions of training dose: not a perfect match. *Int J Sports Physiol Realizar, 9(3):*497-502. doi: 10.1123 / ijspp.2013-0009.

Brito, J., Malina, R.M., Seabra, A., Massada, J.L., Soares, J.M., Krustrup, P. & Rebelo, A. (2012). Injuries in portuguese youth soccer players during training and match play. *J Athl Train, 47(1):*191-197.

Chena, M., Rodríguez, M.L., Bores, A.J. & Ramos-Campos, D.J. (2019). Effects of a multifactorial injuries prevention program in young Spanish football players. *J Sports Med Phys Fitness, 59(8):*1353-1362. doi: 10.23736 / S0022-4707.19.09219-3.

Cloke, D., Moore, O., Shah, T., Rushton, S., Shirley, M.D. & Deehan, D.J. (2012). Thigh muscle injuries in youth soccer: predictors of recovery. Am J *Sports Med, 40(2)*:433-9. doi: 10.1177 / 0363546511428800.

Collard, D.C.M., Verhagen, E.A.L.M., Chin, A. Paw, M.J.M. & van Mechelen, W. (2008). Acute physical activity and sports injuries in children. Appl *Physiol Nutr Metab, 33(2)*:393-401. doi: 10.1139 / H07-182.

Dahlström, Ö., Backe, S., Ekberg, J., Janson, S. & Timpka, T. (2012). Is «football for all» safe for all? cross-sectional study of disparities as determinants of 1-year injury prevalence in youth football programs. *PloS One, 7(8)*:e43795. doi: 10.1371 / journal.pone.0043795.

Dauty, M. & Collon, S. (2011). Incidence of injuries in French professional soccer players. *Int J Sports Med, 32(12)*:965-9. doi: 10.1055 / s-0031-1283188.

Di Salvo, V., Baron, R., Tschan, H., Calderon Montero F.J., Bachl, N. & Pigozzi, F. (2007). Performance characteristics according to playing position in elite soccer. *Int J Sports Med, 28(3)*:222–227.

Dvorak, J. (2009). Give hippocrates a jersey: Promoting health through football/sport. *Br J Sports Med, 43(5)*:317-22. doi: 10.1136 / bjsm.2009.059618.

Ekstrand, J., Hägglund, M. & Waldén, M. (2011). Injury incidence and injury patterns in professional football - the UEFA injury study. *Br J Sports Med, 45(7)*:553-8. doi: 10.1136 / bjsm. 2009.060582.

Froholdt, A., Olsen, O.E. & Bahr, R. (2009). Low risk of injuries among children playing organized soccer: A prospective cohort study. *Am J Sports Med, 37(6)*:1155-60. doi: 10.1177 / 0363546508330132.

Fuller, C.W., Ekstrand, J., Junge, A., Andersen, T.E., Bahr, R., Dvorak, M., Hägglund, M., McCrory, P. & Meeuwisse, W.H. (2006). Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. *Scand J Med Sci Sports, 16(2)*:83-92.

Hägglund, M., Waldén, M. & Ekstrand, J. (2013). Risk factors for lower extremity muscle injury in professional soccer: The UEFA injury study. *Am J Sports Med, 41(2)*:327-35. doi: 10.1177 / 0363546512470634.

Impellizzeri, F.M., Rampinini, E., Coutts, A.J., Sassi, A. & Marcora, S.M. (2004). Use of RPE-based training load in soccer. *Med Sci Sports Exerc, 36(6)*:1042–1047.

Kakavelakis, K.N., Vlazakis, S., Vlahakis, I. & Charissis, G. (2003). Soccer injuries in childhood. *Scand J Med Sci Sports 13(3)*:13175–178.

Lago-Peñas, C., Casais, L., Dellal, A., Rey, E. & Dominguez, E. (2011). Anthropometric and physiological characteristic of young soccer players according to their playing positions: Relevance for competition success. *J Strengh Cond Res, 25(12)*:3358-67. doi: 10.1519 / JSC.0b013e318216305d.

Le Gall, F., Carling, C., Reilly, T., Vandewalle, H., Church, J. & Rochcongar, P. (2006). Incidence of injuries in elite French youth soccer players. A 10 season study. *Am J Sports Med, 34(6)*:928-998.

Orchard, J.W., Rae, K., Brooks, J., Hägglund, M., Til, L., Wales, D. & Wood, T. (2010). Revision, uptake and coding issues related to the open access orchard sports injury classification system (OSICS) versions 8, 9 and 10.1. *J Sports Med, 1:*207-14. doi:10.2147 / OAJSM.S7715.

Peterson, L., Junge, A., Chomiak, J., Graf-Baumann, T. & Dvorak, J. (2000). Incidence of football injuries and complaints in different age groups and skill-level groups. *Am J Sports Med, 28(*5 *Supl.)*: S51-7

Pfirrmann, D., Herbst, M., Ingelfinger, P., Simon, P. & Tug, S. (2016). Analysis of Injury Incidences in Male Professional Adult and Elite Youth Soccer Players: A Systematic Review. *J Athl Train, 51(5)*:410-24. doi: 10.4085 / 1062-6050-51.6.03.

Rae, K. & Orchard, J. (2007). The orchard sports injury classification system (OSICS) version 10. *Clin J Sport Med, 17(3)*:201-204.

World Medical Association (2001). Declaration of Helsinki. Ethical principles for medical research involving human subjects. *Bull World Health Organ. 79(4)*: 373–374.

Van Beijsterveldt, A.M.C., van der Horst, N., van de Port, I.G.L. & Backx, F.J.G. (2013). How effective are exercise-based injury prevention programmes for soccer players? A systematic review. *Sports Med, 43(4)*:257-65. doi: 10.1007 / s40279-013-0026-0.

Volpi, P. & Bisciotti, D.N. (2015). Epidemiology of injuries in youth soccer. *Med Sport, 68(1)*:1-7.