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Epidemiology of Injury Complaints in Elite Sprinting Athletes in Athletics (Track and Field)

Pascal Edouard [1,2,3,*], Benjamin Caumeil [4], Caroline Giroux [4], Antoine Bruneau [5], Jeanne Tondut [1,6], Laurent Navarro [6], Christine Hanon [4,5], Gaël Guilhem [4] and Alexis Ruffault [4,7]

1 Inter-University Laboratory of Human Movement Science (LIBM EA 7424), University Jean Monnet Saint-Etienne, Lyon 1, University Savoie Mont-Blanc, F-42023 Saint-Etienne, France; jeanne.tondut@univ-st-etienne.fr
2 Sports Medicine Unit, Department of Clinical and Exercise Physiology, Faculty of Medicine, University Hospital of Saint-Etienne, F-42055 Saint-Etienne, France
3 European Athletics Medical & Anti Doping Commission, European Athletics Association (EAA), 1007 Lausanne, Switzerland
4 Laboratory of Sport, Expertise and Performance (EA 7370), French Institute of Sport (INSEP), F-75012 Paris, France; benjamin.caumeil@gmail.com (B.C.); caroline.giroux@insep.fr (C.G.); christinehanon@gmail.com (C.H.); gael.guilhem@insep.fr (G.G.); alexis.ruffault@insep.fr (A.R.)
5 French Athletics Federation (FFA), F-75013 Paris, France; antoine.bruneau@athle.fr
6 Mines Saint-Etienne, INSERM, U 1059 Sainbiose, Centre CIS, University Lyon, University Jean Monnet Saint-Etienne, F-42023 Saint-Etienne, France; navarro@emse.fr
7 Unité de Recherche Interfacultaire Santé et Société (URiSS), Université de Liège, 4000 Liège, Belgium
* Correspondence: pascal.edouard@univ-st-etienne.fr; Tel.: +33-674-574-691; Fax: +33-477-127-229

Abstract: Objective: To describe the epidemiology of injury complaints related to the athletics activity in elite athletics (track and field) athletes practicing disciplines with sprints (i.e., sprints, hurdles, combined events, long jump, and triple jump). Methods: We conducted a cross-sectional study on elite sprinting athletes licensed with the French Federation of Athletics with retrospective data collection of injury complaints related to the athletics activity that occurred during their lifetime athletics activity, allowing the reporting of the injury complaints during the one-year period before the survey and at the time of the survey, using a self-reported online survey system. We calculated the (i) lifetime, (ii) 1 year, and (iii) point (at the time of the survey) prevalence proportion, and we descriptively analyzed the injury complaint characteristics. Results: A total of 302 injury complaints related to the athletics activity were reported by 64 athletes of the 68 included athletes. The lifetime prevalence proportion was 95.6% (95% CI: 90.7 to 100.5%). The 1-year prevalence proportion was 61.8% (95% CI: 50.2 to 73.3%). The point prevalence proportion (at the time of the survey) was 16.2% (95% CI: 7.4 to 24.9%). Almost all injury complaints were located in the lower limb (92.7%) and especially involved the hamstrings (33.4%); the main type involved was the muscle (49.0%), and injury complaints mainly occurred during training and with a sudden mode of onset. The most frequent diagnosis was hamstring muscle injury (31.1%). Conclusions: This study provides new insights specifically in elite sprinting athletes, confirming the injury risk in this population and that the main injury diagnosis was the hamstring muscle injury. Efforts should thus continue to monitor injuries in this population and to develop athletics- and sprinting-specific injury risk reduction strategies.

Keywords: track and field; epidemiology; sports injuries; musculoskeletal pathologies; prevention; injury surveillance

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1. Introduction

Athletics (also known as track and field) is an Olympic sport, which invariably leads to a risk of injuries [1]. Consequently, reducing the risk of injuries related to athletics activity is fundamental to promote performance and to allow a healthy and sustainable athletics

activity for competitive athletes. With this aim, the first step in the injury prevention sequence is to understand the extent of the injury problem [2]. This can be achieved by clear and detailed knowledge on epidemiology of injuries in athletics, which is a crucial step in the view of developing injury risk reduction strategies [2].

Among the athletes participating in athletics, the population of elite athletes competing (or with the goal of competing) at an international level represents a population of interest when dealing with injury risk. Indeed, elite athletes are exposed to high training volume and/or intensity as well as to regular competitions [3,4], which can increase their injury risk [5]. There is, thus, a need to have clear and detailed knowledge of their injury epidemiology to develop injury risk reduction strategies appropriate to their specificities [2].

In addition, athletes participating in explosive disciplines requiring sprints (i.e., sprints, hurdles, combined events, and jumps), named "sprinting athletes", comprise a significant proportion of elite athletes, representing about 50% of the athletes engaged in international championships [6]. The injury epidemiology in elite sprinting athletes does not represent, currently and to our knowledge, several publications. The extent of their injury problem is well described during the context of international athletics championships [6,7]; however, it only represents 3 to 9 days in the athletics season. During the whole athletics season, there are few studies in elite athletics [8–14]. However, detailed injury epidemiology was not always available for sprinting athletes only [8–14], and/or did not include international-level athletes (or it was not specified) [9,10,12–14], and/or were youth and junior elite athletes [13,14].

In this context, the aim of this study was to describe the epidemiology of injury complaints related to the athletics activity in elite sprinting athletes.

2. Methods

2.1. Study Design and Overall Procedure

We conducted a cross-sectional study, with retrospective data collection of injury complaints related to the athletics activity, using a self-reported online survey system (LimeSurvey), asking elite sprinting athletes in explosive disciplines requiring sprints (i.e., sprints, hurdles, combined events, and jumps), to report their injury complaints during their lifetime athletics activity, allowing them also to report the injury complaints during the one-year period before the survey and at the time of the survey. The present study was approved by the Committee for the Protection of Persons (CPP Ouest I—Tours, number: 2021-A02523-38).

2.2. Population

The eligible population consisted of athletes (*i*) licensed with the French Federation of Athletics (FFA), for (*ii*) competitive athletics activity in explosive disciplines requiring sprints (i.e., sprints, hurdles, combined events, and jumps), and (*iii*) listed in the Sport Ministry repository of "elite athletes" or being elite athletes sparring partners, and (*iv*) competing at least at the international or national level. Eligible athletes were contacted to participate in this study *(i)* by the research team directly or indirectly via their coaches or (*ii*) by the technical national director of the FFA directly or indirectly via their coaches. They were informed about the study aim and procedure and that their data would be used for research, as well as about their rights. Eligible athletes interested in participating in this study were included if they agreed to participate, signed the informed consent, and completed the online survey. Informed consent was obtained from all participants involved in the study, as well as their parents for those under 18 years old.

2.3. Primary Outcome

The primary outcome was the *injury complaint related to the athletics activity*, defined as "a pain, discomfort, or lesion of the musculoskeletal system, occurring during athletics practice (training or competition), and having had a negative impact on sports practice (reduction of practice, adaptation and incomplete practice, or stopping the practice) regard-

less of whether or not the athlete consulted a healthcare professional" [15]. We chose the term "injury complaint", as in previous studies, since it refers to self-reported information without medical diagnosis [15].

2.4. Data Collection

Data were collected using an online survey (LimeSurvey). This online survey was developed by one sports medicine physician with experience in injury epidemiology in athletics (P.E.), two researchers in sport psychology (B.C. and A.R.), and three researchers in sport biomechanics (C.G., C.H., and G.G.). This online survey was developed with the goal of exhaustively collecting injury complaints related to the athletics activity of the included athletes based on the "International Olympic Committee consensus statement: methods for recording and reporting of epidemiological data on injury and illness in sport" [16]. The survey was divided into two parts (Supplementary Materials): (1) information on anthropometrics and athletics activity: age, sex, body mass, height, main athletics discipline (i.e., sprints, hurdles, jumps, or combined events), level of athletics (international or national), number of years of athletics activity, average number of athletics sessions per week, average number of hours of athletics activity per week, and average number of hours of sports outside of athletics per week; and (2) injury complaints related to the athletics activity: each athlete was asked to report for each location (i.e., the foot, the ankle, the lower leg, the knee, the thigh (hamstrings, quadriceps and adductors), the hip and groin, the trunk, the upper limbs and the head/neck), how many injury complaints he/she had during their lifetime (i.e., from the start of their athletics activity), and then for each reported injury complaints: the date of occurrence, the type of injury (i.e., muscle, tendon, ligament, bone, articular, nerve, skin, others [6]), the circumstance of occurrence (training or competition), the mode of onset (sudden or gradual), the injury mechanisms (clearly identifiable injury with contact, clearly identifiable without contact, or not clearly identifiable), and the severity (i.e., the duration of absence in sports due to the injury complaint (none, less than 7 days, between 7 and 28 days, or more than 28 days) [16]. The survey was tested by two sports medicine physicians and four sports scientists, until the final version was validated by the group of the six initial developers; it was not tested on the targeted population.

Data were collected using the survey from 31 August 2021 to 10 November 2022. Athletes who agreed to participate in this study were asked to complete the online survey. A member of the research team (B.C.) was available to answer any question the athletes may have had about the survey.

2.5. Statistical Analyses

We performed a descriptive analysis using frequency and percentages for categorical data, means, and standard deviations (SD) for continuous variables. We also calculated the prevalence proportion (% and 95% confidence interval (95% CI)) [17]: (1) the percentage of athletes with at least one injury complaint related to the athletics activity during the time period from the start of their athletics activity and the time of the study (*lifetime prevalence proportion*), (2) the percentage of athletes with at least one injury complaint related to the athletics activity during the one-year time period before the survey (*1-year prevalence proportion*), and (3) the percentage of athletes with at least one injury complaint related to the athletics activity at the time of the survey (*point prevalence proportion*).

3. Results

3.1. Population

A total of 68 elite sprinting athletes, 34 female and 34 male athletes, licensed with the French Federation of Athletics, were included in the present study (Table 1). The average number of years from the start of their athletics activity was 7.8 $\pm$ 4.1 years (Table 1). They were training in athletics an average 6.8 $\pm$ 1.7 times per week for 13.9 $\pm$ 4.7 h, and were practicing an average of 2.2 $\pm$ 5.1 h of sports outside of athletics (Table 1).

Table 1. Characteristics of included elite athletes practicing explosive disciplines requiring sprints.

	Total		**Female Athletes**		**Male Athletes**	
Number of athletes (n (%))	**68**	**(100.0%)**	34	(50.0%)	34	(50.0%)
Anthropometrics						
Age (years) (mean ± SD)	23.3	±3.8	23.1	±4.3	23.6	±3.3
Body mass (kg) (mean ± SD)	68.5	±10.7	60.7	±5.9	76.3	±8.7
Height (cm) (mean ± SD)	175.4	±8.5	169.3	±5.2	181.5	±6.5
Athletics activity						
Disciplines of athletics (n (%)):						
Sprints	37	(54.4%)	18	(52.9%)	19	(52.8%)
Hurdles	23	(33.8%)	10	(29.4%)	13	(36.1%)
Jumps	2	(2.9%)	2	(5.9%)	0	(0.0%)
Combined events	6	(8.8%)	4	(11.8%)	2	(5.9%)
Level of athletics activity (n (%)):						
International	28	(41.2%)	18	(52.9%)	10	(29.4%)
National	40	(58.8%)	16	(47.1%)	24	(70.6%)
Number of years of athletics activity (mean ± SD)	7.8	±4.1	7.1	±4.5	8.4	±3.7
Mean number of athletics sessions per week (mean ± SD)	6.8	±1.7	6.9	±1.8	6.6	±1.5
Mean hours of athletics per week (mean ± SD)	13.9	±4.7	14.3	±4.2	13.5	±5.3
Mean hours of sports outside athletics per week (mean ± SD)	2.2	±5.1	1.9	±5.6	2.5	±4.7
History of injury complaints related to athletics activity						
Lifetime injury complaints (n (%))	65	(95.6%)	33	(97.1%)	32	(94.1%)
Lifetime prevalence proportion (% (95% CI))	95.6	(90.7 to 100.5)	97.1	(91.4 to 102.7)	94.1	(86.2 to 102.0)
Injury complaints during the one-year period (n (%))	42	(61.8%)	19	(55.9%)	23	(67.6%)
1-year prevalence proportion (% (95% CI))	61.8	(50.2 to 73.3)	55.9	(39.2 to 72.6)	67.6	(51.9 to 83.4)
Injury complaints at the time of the survey (n (%))	11	(16.2%)	6	(17.6%)	5	(14.7%)
Point prevalence proportion (% (95% CI))	16.2	(7.4 to 24.9)	17.6	(4.8 to 30.5)	14.7	(2.8 to 26.6)

95% CI: 95% confidence interval.

3.2. Injury Number and Prevalence

A total of 302 injury complaints related to athletics activity were reported by 65 athletes of the 68 included athletes. The lifetime prevalence proportion was 95.6% (95% CI: 90.7 to 100.5%) (Table 1). Six athletes reported 1 injury, 10 athletes reported 2 injuries, 11 reported 3 injuries, 8 reported 4 injuries, 9 reported 5 injuries, 7 reported 6 injuries, 5 reported 7 injuries, 1 reported 8 injuries, 4 reported 9 injuries, 2 reported 10 injuries, 1 reported 11 injuries, and 1 reported 14 injuries (Figure 1).

During the one-year period before the survey, 42 athletes reported having at least one injury complaint occurring during athletics. The 1-year prevalence proportion was 61.8% (95% CI: 50.2 to 73.3%) (Table 1). Eighteen athletes reported 1 injury, 14 athletes reported 2 injuries, 6 reported 3 injuries, 1 reported 4 injuries, 2 reported 5 injuries, and 1 reported 6 injuries (Figure 1).

Eleven athletes reported having at least one injury complaint related to the athletics activity when filling out the survey. The point prevalence proportion was 16.2% (95% CI: 7.4 to 24.9%) (Table 1). Nine athletes reported one injury, one reported two injuries, and one reported six injuries (Figure 1).

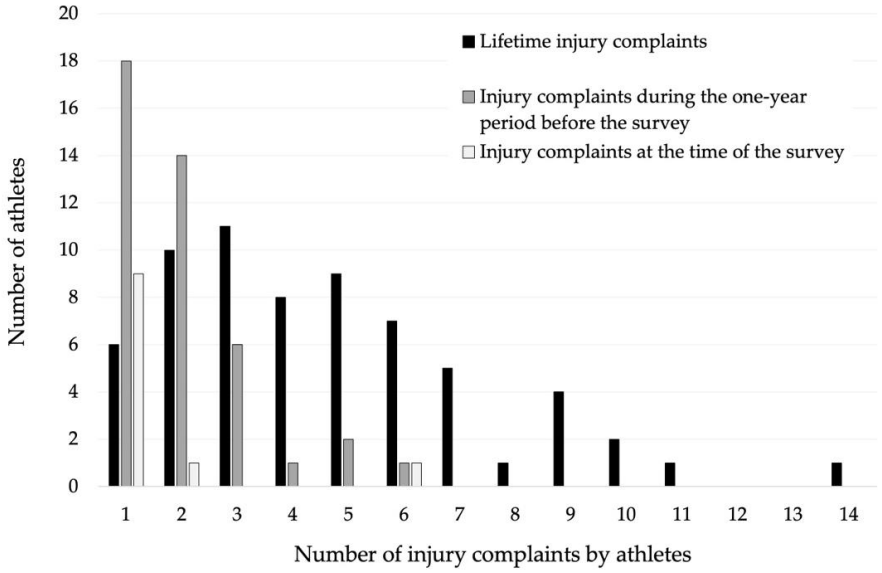

Figure 1. Numbers of injury complaints related to the athletics activity reported by elite sprinting athletes over their lifetime, during the one-year period before the survey, and at the time of the survey.

3.3. Injury Characteristics

The characteristics of the injury complaints related to the athletics activity are presented in Tables 2–4 and in Figure 2. These characteristics were, in general, similar between female and male athletes as well as between lifetime, one-year, and point observations. Over the lifetime, the main injury complaint location was the hamstrings (33.4%), the main type was the muscle (49.0%), the main circumstance was training (69.5%), the main mode of onset was sudden (67.2%), the main injury mechanism was "not a clearly identifiable mode of onset" (50.3%), and the main severity was time loss between 7 and 28 days (Table 2). The hamstring muscle injury complaints were the most frequent injury diagnosis (31.1%), with comparable proportion between female and male athletes (Table 3).

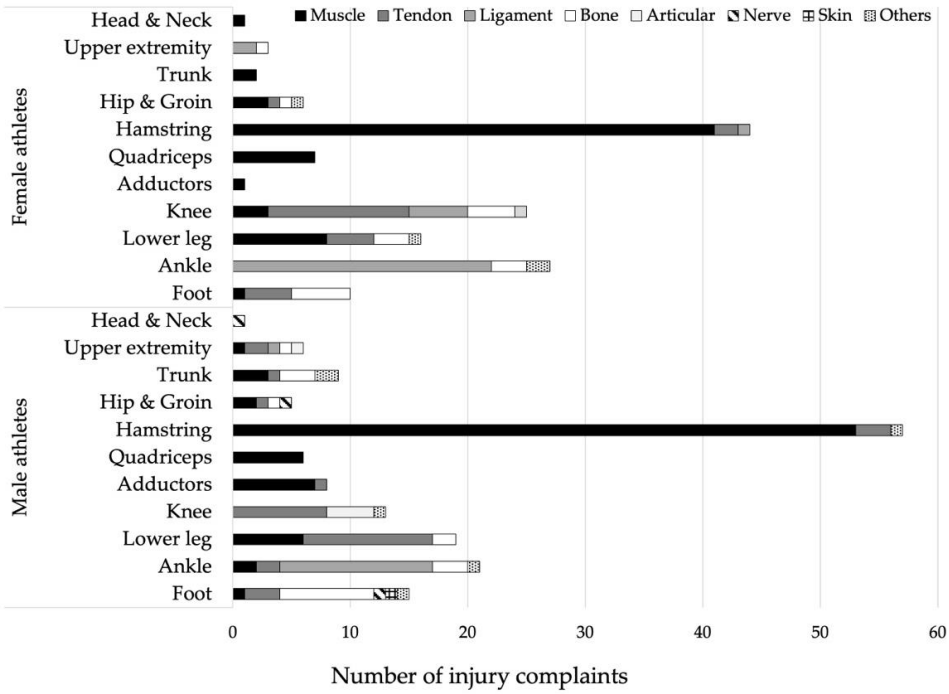

Figure 2. Number of injury complaints related to the athletics activity by location and type in elite sprinting athletes over the lifetime according to sex.

Table 2. Characteristics of injury complaints related to the athletics activity in elite sprinting athletes, regarding location, type, circumstance, mode of onset, mechanism, and severity, according to sex, over the lifetime, over the one-year period before the survey, and at the time of the survey. Values are presented in numbers, and percentages in brackets.

	Lifetime Injury Complaints						**Injury Complaints during the One-Year Period before the Survey**						**Injury Complaints at the Time of the Survey**					
	Total		**Female Athletes**		**Male Athletes**		**Total**		**Female Athletes**		**Male Athletes**		**Total**		**Female Athletes**		**Male Athletes**	
Total (n (%))	302	(100.0)	142	(100.0)	160	(100.0)	84	(100.0)	37	(100.0)	47	(100.0)	17	(100.0)	11	(100.0)	6	(100.0)
Location																		
Head and neck	2	(0.6)	1	(0.7)	1	(0.6)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Upper extremity	9	(3.0)	3	(2.1)	6	(3.8)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Trunk	11	(3.6)	2	(1.4)	9	(5.6)	5	(6.0)	2	(5.4)	3	(6.4)	1	(5.9)	1	(9.1)	0	(0.0)
Hip and groin	11	(3.6)	6	(4.2)	5	(3.1)	4	(4.8)	3	(8.1)	1	(2.1)	1	(5.9)	1	(9.1)	0	(0.0)
Hamstrings	101	(33.4)	44	(31.0)	57	(35.6)	31	(36.9)	17	(45.9)	14	(29.8)	7	(41.2)	5	(45.5)	2	(33.3)
Quadriceps	13	(4.3)	7	(4.9)	6	(3.8)	1	(1.2)	0	(0.0)	1	(2.1)	1	(5.9)	0	(0.0)	1	(16.7)
Adductors	9	(3.0)	1	(0.7)	8	(5.0)	2	(2.4)	0	(0.0)	2	(4.3)	0	(0.0)	0	(0.0)	0	(0.0)
Knee	38	(12.6)	25	(17.6)	13	(8.1)	8	(9.5)	5	(13.5)	3	(6.4)	1	(5.9)	1	(9.1)	0	(0.0)
Lower leg	35	(11.6)	16	(11.3)	19	(11.9)	14	(16.7)	3	(8.1)	11	(23.4)	0	(0.0)	0	(0.0)	0	(0.0)
Ankle	48	(15.9)	27	(19.0)	21	(13.1)	14	(16.7)	6	(16.2)	8	(17.0)	4	(23.5)	2	(18.2)	2	(33.3)
Foot	25	(8.3)	10	(7.0)	15	(9.4)	5	(6.0)	1	(2.7)	4	(8.5)	2	(11.8)	1	(9.1)	1	(16.7)
Type																		
Muscle	148	(49.0)	67	(47.2)	81	(50.6)	42	(50.0)	21	(56.8)	21	(44.7)	7	(41.2)	5	(45.5)	2	(33.3)
Tendon	55	(18.2)	23	(16.2)	32	(20.0)	16	(19.0)	5	(13.5)	11	(23.4)	3	(17.6)	2	(18.2)	1	(16.7)
Ligament	44	(14.6)	30	(21.1)	14	(8.8)	14	(16.7)	6	(16.2)	8	(17.0)	4	(23.5)	2	(18.2)	2	(33.3)
Bone	35	(11.6)	17	(12.0)	18	(11.3)	6	(7.1)	4	(10.8)	2	(4.3)	2	(11.8)	2	(18.2)	0	(0.0)
Articular	6	(2.0)	1	(0.7)	5	(3.1)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Nerve	3	(1.0)	0	(0.0)	3	(1.9)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Skin	1	(0.3)	0	(0.0)	1	(0.6)	1	(1.2)	0	(0.0)	1	(2.1)	1	(5.9)	0	(0.0)	1	(16.7)
Others	10	(3.3)	4	(2.8)	6	(3.8)	5	(6.0)	1	(2.7)	4	(8.5)	0	(0.0)	0	(0.0)	0	(0.0)
Circumstances																		
Training	210	(69.5)	106	(74.6)	104	(65.0)	65	(77.4)	26	(70.3)	39	(83.0)	11	(64.7)	6	(54.5)	5	(83.3)
Competition	92	(30.5)	36	(25.4)	56	(35.0)	19	(22.6)	11	(29.7)	8	(17.0)	6	(35.3)	5	(45.5)	1	(16.7)
Mode of onset																		
Sudden	203	(67.2)	93	(65.5)	110	(68.8)	51	(60.7)	27	(73.0)	24	(51.1)	13	(76.5)	9	(81.8)	4	(66.7)
Gradual	98	(32.5)	49	(34.5)	49	(30.6)	33	(39.3)	10	(27.0)	23	(48.9)	4	(23.5)	2	(18.2)	2	(33.3)
Missing	1	(0.3)	0	(0.0)	1	(0.6)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Mechanism																		
Mode of onset clearly identifiable with contact	32	(10.6)	17	(12.0)	15	(9.4)	10	(11.9)	5	(13.5)	5	(10.6)	3	(17.6)	1	(9.1)	2	(33.3)
Mode of onset clearly identifiable without contact	89	(29.5)	44	(31.0)	45	(28.1)	21	(25.0)	12	(32.4)	9	(19.1)	7	(41.2)	7	(63.6)		(0.0)
Mode of onset not clearly identifiable	152	(50.3)	67	(47.2)	85	(53.1)	45	(53.6)	17	(45.9)	28	(59.6)	7	(41.2)	3	(27.3)	4	(66.7)
Missing	29	(9.6)	14	(9.9)	15	(9.4)	8	(9.5)	3	(8.1)	5	(10.6)	0	(0.0)	0	(0.0)	0	(0.0)
Severity																		
No time loss in sport	48	(15.9)	26	(18.3)	22	(13.8)	21	(25.0)	8	(21.6)	13	(27.7)	0	(0.0)	0	(0.0)	0	(0.0)

Table 2. *Cont.*

	Lifetime Injury Complaints						Injury Complaints during the One-Year Period before the Survey						Injury Complaints at the Time of the Survey					
	Total		Female Athletes		Male Athletes		Total		Female Athletes		Male Athletes		Total		Female Athletes		Male Athletes	
Time loss < 7 days	42	(13.9)	19	(13.4)	23	(14.4)	18	(21.4)	6	(16.2)	12	(25.5)	3	(17.6)	2	(18.2)	1	(16.7)
Time loss between 7 and 28 days	112	(37.1)	53	(37.3)	59	(36.9)	22	(26.2)	10	(27.0)	12	(25.5)	7	(41.2)	3	(27.3)	4	(66.7)
Time loss > 28 days	100	(33.1)	44	(31.0)	56	(35.0)	23	(27.4)	13	(35.1)	10	(21.3)	7	(41.2)	6	(54.5)	1	(16.7)

Table 3. Characteristics of injury complaints related to the athletics activity by location and type in elite sprinting athletes over the lifetime according to sex. Values are presented in numbers, and percentages in brackets.

	Total Lifetime Injuries		Muscle		Tendon		Ligament		Bone		Articular		Nerve		Skin		Others	
Total																		
Total lifetime injuries	302	(100.0)	148	(49.0)	55	(18.2)	44	(14.6)	35	(11.6)	6	(2.0)	3	(1.0)	1	(0.3)	10	(3.3)
Head and neck	2	(0.7)	1	(0.3)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.3)	0	(0.0)	0	(0.0)
Upper extremity	9	(3.0)	1	(0.3)	2	(0.7)	3	(1.0)	2	(0.7)	1	(0.3)	0	(0.0)	0	(0.0)	0	(0.0)
Trunk	11	(3.6)	5	(1.7)	1	(0.3)	0	(0.0)	3	(1.0)	0	(0.0)	0	(0.0)	0	(0.0)	2	(0.7)
Hip and groin	11	(3.6)	5	(1.7)	2	(0.7)	0	(0.0)	2	(0.7)	0	(0.0)	1	(0.3)	0	(0.0)	1	(0.3)
Hamstrings	101	(33.4)	94	(31.1)	5	(1.7)	1	(0.3)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.3)
Quadriceps	13	(4.3)	13	(4.3)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Adductors	9	(3.0)	8	(2.6)	1	(0.3)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Knee	38	(12.6)	3	(1.0)	20	(6.6)	5	(1.7)	4	(1.3)	5	(1.7)	0	(0.0)	0	(0.0)	1	(0.3)
Lower leg	35	(11.6)	14	(4.6)	15	(5.0)	0	(0.0)	5	(1.7)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.3)
Ankle	48	(15.9)	2	(0.7)	2	(0.7)	35	(11.6)	6	(2.0)	0	(0.0)	0	(0.0)	0	(0.0)	3	(1.0)
Foot	25	(8.3)	2	(0.7)	7	(2.3)	0	(0.0)	13	(4.3)	0	(0.0)	1	(0.3)	1	(0.3)	1	(0.3)
Female athletes																		
Total lifetime injuries	142	(100.0)	67	(47.2)	23	(16.2)	30	(21.1)	17	(12.0)	1	(0.7)	0	(0.0)	0	(0.0)	4	(2.8)
Head and neck	1	(0.7)	1	(0.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Upper extremity	3	(2.1)	0	(0.0)	0	(0.0)	2	(1.4)	1	(0.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Trunk	2	(1.4)	2	(1.4)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Hip and groin	6	(4.2)	3	(2.1)	1	(0.7)	0	(0.0)	1	(0.7)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.7)
Hamstrings	44	(31.0)	41	(28.9)	2	(1.4)	1	(0.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Quadriceps	7	(4.9)	7	(4.9)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Adductors	1	(0.7)	1	(0.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Knee	25	(17.6)	3	(2.1)	12	(8.5)	5	(3.5)	4	(2.8)	1	(0.7)	0	(0.0)	0	(0.0)	0	(0.0)
Lower leg	16	(11.3)	8	(5.6)	4	(2.8)	0	(0.0)	3	(2.1)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.7)
Ankle	27	(19.0)	0	(0.0)	0	(0.0)	22	(15.5)	3	(2.1)	0	(0.0)	0	(0.0)	0	(0.0)	2	(1.4)
Foot	10	(7.0)	1	(0.7)	4	(2.8)	0	(0.0)	5	(3.5)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Male athletes																		
Total lifetime injuries	160	(100.0)	81	(50.6)	32	(20.0)	14	(8.8)	18	(11.3)	5	(3.1)	3	(1.9)	1	(0.6)	6	(3.8)
Head and neck	1	(0.6)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.6)	0	(0.0)	0	(0.0)
Upper extremity	6	(3.8)	1	(0.6)	2	(1.3)	1	(0.6)	1	(0.6)	1	(0.6)	0	(0.0)	0	(0.0)	0	(0.0)
Trunk	9	(5.6)	3	(1.9)	1	(0.6)	0	(0.0)	3	(1.9)	0	(0.0)	0	(0.0)	0	(0.0)	2	(1.3)
Hip and groin	5	(3.1)	2	(1.3)	1	(0.6)	0	(0.0)	1	(0.6)	0	(0.0)	1	(0.6)	0	(0.0)	0	(0.0)
Hamstrings	57	(35.6)	53	(33.1)	3	(1.9)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.6)

Table 3. *Cont.*

	Total Lifetime Injuries		Muscle		Tendon		Ligament		Bone		Articular		Nerve		Skin		Others	
Quadriceps	6	(3.8)	6	(3.8)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Adductors	8	(5.0)	7	(4.4)	1	(0.6)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Knee	13	(8.1)	0	(0.0)	8	(5.0)	0	(0.0)	0	(0.0)	4	(2.5)	0	(0.0)	0	(0.0)	1	(0.6)
Lower leg	19	(11.9)	6	(3.8)	11	(6.9)	0	(0.0)	2	(1.3)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Ankle	21	(13.1)	2	(1.3)	2	(1.3)	13	(8.1)	3	(1.9)	0	(0.0)	0	(0.0)	0	(0.0)	1	(0.6)
Foot	15	(9.4)	1	(0.6)	3	(1.9)	0	(0.0)	8	(5.0)	0	(0.0)	1	(0.6)	1	(0.6)	1	(0.6)

Table 4. Characteristics of injury complaints related to the athletics activity in elite sprinting athletes over the one-year period before the survey according to location, type and sex. Values are presented in numbers, and percentages in brackets.

	Total One-Year Period Injuries		Muscle		Tendon		Ligament		Bone		Articular		Nerve		Skin		Others	
Total																		
Total one-year period injuries	84	(100.0)	42	(50.0)	16	(19.0)	14	(16.7)	6	(7.1)	0	(0.0)	0	(0.0)	1	(1.2)	5	(6.0)
Head and neck	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Upper extremity	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Trunk	5	(6.0)	3	(3.6)	1	(1.2)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.2)
Hip and groin	4	(4.8)	3	(3.6)	0	(0.0)	0	(0.0)	1	(1.2)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Hamstring	31	(36.9)	25	(29.8)	4	(4.8)	1	(1.2)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.2)
Quadriceps	1	(1.2)	1	(1.2)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Adductors	2	(2.4)	2	(2.4)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Knee	8	(9.5)	1	(1.2)	5	(6.0)	1	(1.2)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.2)
Lower leg	14	(16.7)	7	(8.3)	5	(6.0)	0	(0.0)	1	(1.2)	0	(0.0)	0	(0.0)	0	(0.0)	1	(1.2)
Ankle	14	(16.7)	0	(0.0)	0	(0.0)	12	(14.3)	2	(2.4)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Foot	5	(6.0)	0	(0.0)	1	(1.2)	0	(0.0)	2	(2.4)	0	(0.0)	0	(0.0)	1	(1.2)	1	(1.2)
Female athletes																		
Total one-year period injuries	37	(100.0)	21	(56.8)	5	(13.5)	6	(16.2)	4	(10.8)	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.7)
Head and neck	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Upper extremity	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Trunk	2	(5.4)	2	(5.4)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Hip and groin	3	(8.1)	2	(5.4)	0	(0.0)	0	(0.0)	1	(2.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Hamstring	17	(45.9)	15	(40.5)	1	(2.7)	1	(2.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Quadriceps	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Adductors	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Knee	5	(13.5)	1	(2.7)	3	(8.1)	1	(2.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Lower leg	3	(8.1)	1	(2.7)	0	(0.0)	0	(0.0)	1	(2.7)	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.7)
Ankle	6	(16.2)	0	(0.0)	0	(0.0)	4	(10.8)	2	(5.4)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Foot	1	(2.7)	0	(0.0)	1	(2.7)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Male athletes																		
Total one-year period injuries	47	(100.0)	21	(44.7)	11	(23.4)	8	(17.0)	2	(4.3)	0	(0.0)	0	(0.0)	1	(2.1)	4	(8.5)
Head and neck	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Upper extremity	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)

Table 4. *Cont.*

	Total One-Year Period Injuries		Muscle		Tendon		Ligament		Bone		Articular		Nerve		Skin		Others	
Trunk	3	(6.4)	1	(2.1)	1	(2.1)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.1)
Hip and groin	1	(2.1)	1	(2.1)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Hamstring	14	(29.8)	10	(21.3)	3	(6.4)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.1)
Quadriceps	1	(2.1)	1	(2.1)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Adductors	2	(4.3)	2	(4.3)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Knee	3	(6.4)	0	(0.0)	2	(4.3)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	1	(2.1)
Lower leg	11	(23.4)	6	(12.8)	5	(10.6)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Ankle	8	(17.0)	0	(0.0)	0	(0.0)	8	(17.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)	0	(0.0)
Foot	4	(8.5)	0	(0.0)	0	(0.0)	0	(0.0)	2	(4.3)	0	(0.0)	0	(0.0)	1	(2.1)	1	(2.1)

4. Discussion

The main findings of the present study were that, in elite sprinting athletes licensed with the French Federation of Athletics (FFA), (1) almost all elite athletes included in the present study had at least one injury complaint related to athletics activity during their lifetime athletics activity, (2) the 1-year prevalence proportion was 61.8% (95% CI: 50.2 to 73.3%) and the point prevalence proportion (at the time of the survey) was 16.2% (95% CI: 7.4 to 24.9%), (3) muscle was the most affected tissue (49.0%), and (4) hamstring muscle injury was the most frequent diagnosis (31.1%). Although this was a retrospective data collection, this study contributes to providing additional epidemiological data in athletics [1], specifically in elite athletes in disciplines of sprints, hurdles, combined events, and jumps.

Our present results confirm that injuries are part of the elite sprinting athletes' life [1], because almost all athletes included in this study already experienced at least one injury complaint. This outcome extends the knowledge to the specific population of elite sprinting athletes for which datasets are scarcer than for less trained populations. In addition, the 1-year prevalence proportion of 62% was comparable to that previously reported in athletics in other populations [8,10,12–15]. Therefore, our results seem to confirm that about two-thirds of athletes participating in athletics have an injury complaint during an athletics season. It seems to be a constant in athletics, whatever the population, study design, injury definition, level, sex, or discipline [8,10,12–15]. Such a finding is interesting as it suggests that either current practices are not optimized for elite athletes or they just allow preservation of injury incidence to a similar extent to less trained athletes, with prevention being at the service of the performance [3,4]. However, we could imagine that, in this population of elite athletes, several strategies are in place to reduce their injury risk. This raises the question of both the interest and implementation of injury risk reduction strategies at the elite level. Regarding the relevance, an online survey on elite French athletics athletes (i.e., a comparable population to in the present study) reported that 98% of responders perceived injury risk reduction approach as relevant [18]. We can thus expect that the injury risk reduction approach is a shared project designed in co-construction with elite athletes. Regarding the implementation of injury risk reduction strategies, Ruffault et al. [19] reported that only 29.6% of responders had already adopted an injury risk reduction program during their lifetime, and athletes competing at the highest level were more likely to adopt such a program. One explanation of the low adoption could be that, currently and to our knowledge, no injury risk reduction strategies with high level of evidence are available specifically for athletics [20]. In addition, another hypothesis could be that injury risk reduction strategies could enable an increase in athletics activities (volume and intensity) with a view to improve performance even without necessarily reducing overall risk [4]. In other words, at an increased performance level, the injury risk

is similar [4]. In any case, the present results highlight the need to pursue efforts towards injury risk reduction.

The present injury complaint characteristics are in agreement with previous studies reporting that athletes participating in athletics disciplines requiring sprinting suffer more from lower limb muscle injuries, and especially hamstring muscle injuries [3,4,6,7,21–23]. Indeed, hamstring muscle injuries are often reported as the first injury diagnosis in athletics, especially in disciplines involving sprinting [3,4,6,7,21–23]. This is consistent with biomechanical constraints of sprinting. Such disciplines mainly involve the lower limb muscles, and especially the hip extensor muscles, including hamstring muscles, to generate the forces required to increase or maintain the running velocity [24,25]. Such biomechanical constraints can lead to specific injury patterns [4,7]. Indeed, previous studies reported that the proportion of hamstring muscle injuries increased with the increase in running velocity required by athletics disciplines [4,7]. During international athletics championships, hamstring muscle injuries were the most prevalent injury in the disciplines of sprints, with 59% and 52% of all lower limb muscle injuries and 12.7 and 25.1 injuries per 1000 registered athletes in female and male athletes, respectively. Our results confirm that hamstring muscle injury risk reduction represents a top-priority target of injury risk reduction efforts in athletics. In order to improve these injury risk reduction strategies, there is probably a need to better understand sprinting mechanics, and use this in injury risk reduction strategies [26]. For hamstring injuries in particular, there is also probably a need to better understand the athletics-specific injury risk factors and mechanisms, which are limited in contrast with other sports [27]. This reinforces the need to continue efforts to develop athletics-specific injury risk reduction strategies, which are, to our knowledge, extrapolated from other sports and/or without scientific evaluation in athletics [4,7,28–30].

Some limitations should be acknowledged when it comes to interpreting the present data. The number of included athletes could be considered modest, which does not allow comparative analyses; however, this sample of athletes corresponds to elite athletes being, by definition, not numerous. In addition, this study included elite sprinting athletes licensed with the French Federation of Athletics. Consequently, not all results could be generalizable to all athletes practicing athletics. Furthermore, given the study design and procedure asking athletes regarding all injury complaints that they had from the start of their athletics activity, there could be a recall bias. In order to limit the impact of the bias on our results, we asked for injury complaints having had a negative impact on sports practice (reduction of practice, adaptation and incomplete practice, or stopping the practice). Caution should be taken regarding the type of injury complaint, since it was not possible to know if all reported injury complaints were diagnosed by a physician, in addition to the risk induced by the recall bias. This justifies the need to encourage further prospective epidemiological studies in elite sprinting athletes and in athletics in general.

5. Conclusions

This study extends our knowledge of injury epidemiology in elite sprinting athletics athletes, with the example of elite sprinting athletes licensed with the French Federation of Athletics. It confirms that athletics activity invariably leads to a risk of injuries in the elite population as well, and that about two-thirds of athletics athletes have an injury during an athletics season. The main injury was the hamstring muscle injury, which should be considered the top-priority target of injury risk reduction efforts. All these results strengthen the need to further develop athletics-specific injury risk reduction strategies from the muscle-tendon tissue scale to more a more holistic perspective of injury prevention.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/app13148105/s1.

Author Contributions: P.E., G.G. and A.R. conceived the study; P.E., B.C., C.G., L.N., G.G. and A.R. conceived the data collection procedure; B.C. and C.G. performed the data extraction; P.E.

performed data analyses and drafted the manuscript; P.E., B.C., C.G., A.B., J.T., L.N., C.H., G.G. and A.R. contributed substantially to interpreting the results, provided important revisions, and approved the manuscript. All authors understand that they are accountable for all aspects of the work and ensure the accuracy or integrity of this manuscript. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board named the Committee for the protection of persons (CPP Ouest I—Tours, number: 2021-A02523-38).

Informed Consent Statement: Informed consent was obtained from all participants involved in the study.

Data Availability Statement: Data are available upon reasonable request. Requests for data sharing from appropriate researchers and entities will be considered on a case-by-case basis. Interested parties should contact the corresponding author Pascal Edouard (pascal.edouard@univ-st-etienne.fr).

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