

Injuries among Portuguese skiers and snowboarders

Lesiones entre practicantes de esquí y snowboard portugueses

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Abstract: With the introduction of Snowboarding into the world there has been a huge increase in the number of winter sports enthusiasts. This study's aim is to analyse and compare the injury profiles associated to Portuguese Skiers and Snowboarders. A total of 218 individuals completed a 2 years retrospective questionnaire, of which 87 (40%) of them were Skiers, 113 (52%) Snowboarders and 18 (8%) practised both sports. A total of 107 (49%) subjects were injured, with 42 (39.3%) Ski related and 72 (67.3%) Snowboard related injuries. The most frequent body location of injury was the knee in both sports (59.5% in Ski and 31.9% in Snowboard). In conclusion we observe that Snowboarding has a higher risk of injury compared to Skiing.

Keywords: Snowboard, Injuries, Ski, Winter Sports, Epidemiology, Demographic, Portuguese.

Resumen: Con la introducción del snowboard en el mundo ha habido un gran aumento de lo número de entusiastas de los deportes de invierno. El objetivo de este estudio es analizar y comparar los perfiles de las lesiones de portugueses en esquí y en snowboard. Un total de 218 individuos han completado un cuestionario retrospectivo de 2 años, de los cuales 87 (40%) de ellos eran esquiadores, 113 (52%) practicantes de snowboard y 18 (8%) practicaban ambos deportes. Un total de 107 (49%) sujetos resultaron lesionados, con 42 (39.3%) de estas lesiones relacionadas con el esquí y 72 (67.3%) lesiones relacionadas con el snowboard. La localización más frecuente de la lesión en el cuerpo fue la rodilla en ambos deportes (59.5% en esquí y 31.9% en snowboard). En conclusión, observamos que el snowboard tiene un mayor riesgo de lesiones en comparación con el esquí.

Palabras clave: Snowboard, Lesiones, Ski, Deportes de Invierno, Epidemiología, Demografía, Portugueses.

Introduction

Skiing and Snowboarding have been increasing the number of enthusiasts in the past years. Portugal is no exception, according to the Portuguese Winter Sports Federation (FDIP) data. Because of this, there's an expected increase in the incidence of injury records associated with the practice of winter sports, and in the costs with the treatment of injuries that may undermine the safety reputation of such sports.

There are several studies addressing the incidence of injuries in Skiers and Snowboarders. Davidson & Laliotis (1996) compared the most common areas of Snowboarder's and Skier's bodies to sustain an injury, in California (USA), concluding that the sport of snowboarding brings with it a different set of injuries from those seen in alpine skiing. Years later, van der Zee, Richel, de Vries & Prins (2013) collected data from a paediatric trauma centre in Ohio (USA), addressing the incidence of Snowboard related trauma in children and adolescents, from 1999 to 2006. His findings suggest that Skiers had a relatively stable injury incidence during this period of time, and the number of Snowboard injuries had increased significantly, due to the rise in Snowboard's popularity. Meanwhile in Europe, Stenroos & Handolin (2015) brought to us injury incidence data from Finland, collected from 2006 to 2012's winter seasons. The data showed that the

most common injuries affect the knee in skiers, and the upper extremity, especially the wrist, in snowboarders. He finalizes his conclusion stating that a continuous review is needed to monitor the effects of changes made related to safety. This data is important, because these sports have been developed significantly over the past 20 years (especially Snowboard). Patrick, Cooper & Daniels (2015) found changes in USA's injury epidemiology from 1996 to 2013, concluding that there was a significant increase in snowboarding injuries, shoulder injuries, and helmet usage. This brings us a pertinent research subject, concerning the role of helmets in Skiing and Snowboarding. There are studies that may suggest the use of helmet associated with increased risk taking behaviours, but there's no significant evidence to support that it increases the amount of injuries. The data from a meta-analysis conducted by Russel, Christie & Hagel (2010) and from evidence based review by Haider, Saleem, Bilaniuk & Barraco (2012) showed that helmet use clearly decreased the risk of injury among Skiers and Snowboarders.

Although there's an increasing development in both sports, Snowboarding has gained significantly more enthusiasts than Skiing since it was first invented in 1965, in the USA. In Portugal, Skiing was officially recognized with the foundation of the Portuguese Ski Federation in 15th May 1992, even though there are records of the introduction of the sport in this country since around 1918. Snowboard, on the other hand, only started to gain popularity since the past 20 years,

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so in 2008 the Portuguese Ski Federation changed its name to Portuguese Winter Sports Federation, in order to be responsible of all Winter Sports in Portugal and coordinate the events, teams and rules related to them. With Snowboard being a relatively new sport in Portugal, and the lack of investment on winter sports since they first appeared in the country, there is little to no scientific information about Portuguese Snowboarders and Skiers. As the popularity of these sports increases, more data related to injury cause and prevention is needed in order to continue the development of Skiing and Snowboarding in this country. This study aims to investigate the data from Portuguese Skiers and Snowboarders, to provide a clear description of this specific population group and better understand the associated injury mechanisms, in order to develop possible prevention strategies.

Methods

Participants

A total of 218 individuals participated in this study, all Portuguese. The sample contained 49 female and 169 male participants, with their ages ranging from 18 to 70 years old (Table 1). From beginners to advanced, athletes and non-athletes, 87 (40%) were Skiers, 113 (52%) were Snowboarders, and 18 (8%) practised both sports.

Instruments

The data collection was made via online questionnaire using Google Forms (<https://docs.google.com/forms/d/e/1FAIpQ>

LSFTFOaBO6vfHNYDEZ1Lkv69oVN34DNH_-DDNU_GW7ATMmd1rA/closedform). This 2-years retrospective questionnaire had 3 sections. The answers were confidential and the subjects would not be able to be identified. The first part was related to general information, secondly sport related data and thirdly the injury related data. The questionnaire took about 7 minutes to complete and the injury related section was based on the previously validated Kitesurfing Injuries questionnaire from Silva, Viana, Gama, Pérez-Turpin & Bezerra (2015). In order to accomplish the specifications of winter sports a few changes were completed according to a group of Winter Sports Experts. This board of Winter Sports Experts included the Portuguese National Snowboard Coach, Snowboard Specialist from CCBoardCenter, and other members of the Portuguese Winter Sports Federation, that reviewed the questionnaire until they agree that all questions were objectively corrected according to the main purposes.

Procedures

The online questionnaire was submitted to pages and forums related to Portuguese Snowboard and Ski, sent by email, and advertised on social media platforms like Instagram and Facebook. The Portuguese Winter Sports Federation, National Portuguese Snowboard Team, MegaSnowtrips, and CCBoardCenter were included as the main collaborators in spreading the questionnaire to reach all members of the Winter Sports community in Portugal, being successful at collecting a good database.

Table 1. Sample's sports data characterization (n(%)) with age, weight and height (M±SD).

		Ski (N=87)	Snowboard (N=113)	Ski and Snowboard (N=18)
Sex	Male	60 (69.0%)	96 (85.0%)	13 (72.2%)
	Female	27 (31.0%)	17 (15.0%)	5 (27.8%)
Age (years)	30,68 ± 11,80	30,52 ± 7,83	28,89 ± 10,53	8 (44.4%)
Weight (kg)	71,20 ± 14,18	72,18 ± 11,20	69,78 ± 10,77	7 (38.9%)
Height (cm)	173,05 ± 8,82	174,39 ± 7,57	172,17 ± 10,25	3 (16.7%)
Experience	Begginer	12 (13.8%)	12 (10.6%)	1 (5.6%)
	Intermediate	44 (50.6%)	67 (59.3%)	6 (33.3%)
	Advanced	31 (35.6%)	34 (30.1%)	11 (61.1%)
Federated Athlete	Yes	3 (3.4%)	3 (2.7%)	2 (11.1%)
	No	79 (90.8%)	107 (94.7%)	15 (83.3%)
	Was	5 (5.7%)	3 (2.7%)	1 (5.6%)
Access to Equipment	Rental	46 (52.9%)	23 (20.4%)	5 (27.8%)
	Borrowed	4 (4.6%)	4 (3.5%)	1 (5.6%)
	Owner	37 (42.5%)	86 (76.1%)	12 (66.7%)

		Ski (N=87)	Snowboard (N=113)	Ski and Snowboard (N=18)
Equipment Shape	Camber	5 (5.7%)	26 (23%)	6 (33.3%)
	Flat	23 (26.4%)	49 (43.4%)	4 (22.2%)
	Rocker	9 (10.3%)	14 (12.4%)	3 (16.7%)
	Rocker/Camber	2 (2.3%)	15 (13.3%)	3 (16.7%)
	Doesn't own equipment	48 (55.2%)	9 (8%)	2 (11.1%)
Protective Gear	Always	49 (56.3%)	62 (54.9%)	11 (61.1%)
	Almost Always	7 (8.0%)	16 (14.2%)	1 (5.6%)
	Sometimes	16 (18.4%)	18 (15.9%)	3 (16.7%)
	Never	15 (17.2%)	17 (15.0%)	3 (16.7%)
Warm-up	Always	16 (18.4%)	15 (13.3%)	4 (22.2%)
	Almost Always	13 (14.9%)	18 (15.9%)	4 (22.2%)
	Sometimes	28 (32.2%)	38 (33.6%)	6 (33.3%)
	Never	30 (34.5%)	42 (37.2%)	4 (22.2%)
Conditioning Level	Very good	11 (12.6%)	18 (15.9%)	5 (27.8%)
	Good	38 (43.7%)	48 (42.5%)	8 (44.4%)
	Intermediate	35 (40.2%)	42 (37.2%)	4 (22.2%)
	Poor	3 (3.4%)	5 (4.4%)	1 (5.6%)
PT*	Yes	59 (67.8%)	86 (76.1%)	14 (77.8%)
	No	28 (32.2%)	27 (23.9%)	4 (22.2%)
PT Frequency	Doesn't train	26 (29.9%)	25 (21.1%)	4 (22.2%)
	1/2x week	24 (27.6%)	33 (29.2%)	3 (16.7%)
	3/4x week	31 (35.6%)	39 (34.5%)	9 (50.0%)
	5/6x week	5 (5.7%)	15 (13.3%)	0 (0.0%)
	7x week	1 (1.1%)	1 (0.9%)	2 (11.1%)

*Physical training (PT)

Statistical Analysis

The questionnaires' information was checked to confirm if they were complete and plausible before being analysed in the SPSS software version 22.0 for Windows. Descriptive statistics were used for analysis and presentation of the results by checking mean values, standard deviation, coefficient of variance, and percentage.

Results

There's no significant difference between the age, weight and height of Skiers and Snowboarders. However, there are generally more male than female enthusiasts in both sports, but this difference is much larger in Snowboarding, being 85.0% of all participants male and only 15.0% female. In the Snowboarders group, most of them are regular footed/left foot in front (51.3%), 41.6% are goofy/right foot in front and 7.1% report using both legs equally. The ones that practice Ski and Snowboard have a higher number of goofies (44.4%), followed by regulars (38.9%) and both legs (16.7%). In Portugal, the

majority of Skiers and Snowboarders consider themselves to be intermediate or advanced. Almost all of the participants in this study were not federated athletes ($M=89.6\%$). Most Snowboarders have their own equipment (76.1%), whereas in the Ski group most choose to rent their equipment (52.9%). The ones that practice both Skiing and Snowboarding, also prefer to have their own equipment (66.7%). Within the individuals that have their own equipment, the majority chooses their board/skis with a Flat shape (26.4% Ski, 43.4% Snowboard, 22.2% Ski and Snowboard). Most of the participants in the study have reported to always wear protective gear (56.3% Ski, 54.9% Snowboard and 61.1% Ski and Snowboard). Within these, the most popular piece of protective gear is the helmet (94.0%), followed by the knee pads and back protection (both 20.2%), independent of being Skiers and Snowboarders (Table 2). Regarding to warmup, 34.5% of Skiers, 37.2% of Snowboarders and 22.2% of Ski and Snowboard, admit to never warmup before practicing. The most frequent conditioning level in the sample of this study is Good in all three groups of (Table 1). Also, most of them do physical training (67.8% of Ski, 76.1% Snowboard and 77.8% Ski and Snowboard), and

within these the majority trains 3/4 times a week (35.6% Ski, 34.5% Snowboard and 50.0% Ski and Snowboard).

Table 2. Frequencies (n(%)) of protective gear choice by Snowboarders and Skiers.

	Frequency of choice (n=183)
Helmet	172 (94.0%)
Knee pads	37 (20.2%)
Back protection	37 (20.2%)
Wrist pads	24 (13.1%)
Protection vest	14 (7.7%)
Elbow pads	13 (7.1%)

From the total of 218 subjects that completed the questionnaire, 107 (49%) were injured. Within these injured individuals, there were 42 (39.3%) Ski related injuries and 72 (67.3%) Snowboard related injuries (Table 3).

Table 3. Injured individuals in Ski and in Snowboard (n(%)).

Number of injuries	Injured Skiers	Injured Snowboarders
1	31 (29%)	49 (45.8%)
2	5 (4.7%)	13 (12.1%)
3	2 (1.9%)	5 (4.7%)
4	1 (0.9%)	0 (0.0%)
>5	3 (2.8%)	5 (4.7%)
Total of injured individuals	42 (39.3%)	72 (67.3%)

The most frequent body location of injury was the knee (59.5% in Ski and 31.9% in Snowboard), followed by the wrist in both sports (19.0%, same as the Shoulder shoulder, in Ski, and 26.4% in Snowboard) (Table 4).

Table 4. Injured individuals per body location and sport (n(%)).

	Ski (n=42)	Snowboard (n=72)
Forearm	1 (2.4%)	6 (8.4%)
Arm	1 (2.4%)	7 (9.7%)
Clavicle	2 (4.8%)	6 (8.4%)
Elbow	2 (4.8%)	4 (5.6%)
Spine	2 (4.8%)	6 (8.4%)
Head	2 (4.8%)	3 (4.2%)
Knee	25 (59.5%)	23 (31.9%)
Shoulder	8 (19.0%)	13 (18.1%)
Wrist	8 (19.0%)	19 (26.4%)
Hips	0 (0%)	2 (2.8%)
Heel	0 (0%)	1 (1.4%)

	Ski (n=42)	Snowboard (n=72)
Ribs	2 (4.8%)	5 (7.0%)
Coccyx	0 (0%)	3 (4.2%)
Calves	0 (0%)	1 (1.4%)
Hand	1 (2.4%)	1 (1.4%)
Leg	1 (2.4%)	1 (1.4%)
Thigh	0 (0%)	1 (1.4%)
Thumb	0 (0%)	1 (1.4%)
Ankle	1 (2.4%)	3 (4.2%)

The most common injury moment or context was in Piste in both sports (66.7% Skiing and 59.7% Snowboarding), and next to it was the Snowpark, also in Ski (16.7% tied with recreational practice) and Snowboard (25%) (Table 5).

Table 5. Injured individuals per moment/context of injury and sport (n(%)).

	Ski (n=42)	Snowboard (n=72)
Chairlifts	2 (4.8%)	6 (8.3%)
Competition	0 (0.0%)	3 (4.2%)
Recreational	7 (16.7%)	12 (16.7%)
Training	1 (2.4%)	1 (1.4%)
Piste	28 (66.7%)	43 (59.7%)
Off piste	5 (11.9%)	12 (16.7%)
Snowpark	7 (16.7%)	18 (25%)

Most of the Ski injuries were contusions (38.1%), but in Snowboard the most common injury type was luxation/strain (38.9%). Second and third most common injuries in Ski were luxations/strains (28.6%) and tendinitis (14.3%), and in Snowboard were contusions (30.6%) and muscle tears (23.6%) respectively (Table 6).

Table 6. Injured individuals per type of injury and sport (n(%)).

	Ski (n=42)	Snowboard (n=72)
Contusion	16 (38.1%)	22 (30.6%)
Luxation/strain	12 (28.6%)	28 (38.9%)
Fracture	5 (11.9%)	12 (16.7%)
Wound	3 (7.1%)	4 (5.5%)
Muscle tear	4 (9.5%)	17 (23.6%)
Ligament tear	2 (4.8%)	0 (0.0%)
Tendinitis	6 (14.3%)	7 (9.7%)
Meniscus compression	2 (4.8%)	0 (0.0%)
Contracture	0 (0.0%)	1 (1.4%)
Sprain	1 (2.4%)	1 (1.4%)
Osteochondral injury	0 (0.0%)	1 (1.4%)
Burn	1 (2.4%)	1 (1.4%)

By analyzing Table 7, we can observe that the most frequent injury mechanism in both sports is by falling. Landings are in second place in Snowboarding (23.7%), as well as crashes and maneuvers in Skiing (both 16.7%).

Table 7. Injured individuals per injury mechanism and sport (n(%)).

	Ski (n=42)	Snowboard (n=72)
Jump	2 (4.8%)	8 (11.1%)
Landing	6 (14.3%)	17 (23.7%)
Fall	21 (50%)	44 (61.1%)
Crash	7 (16.7%)	10 (13.9%)
Maneuver	7 (16.7%)	10 (13.9%)
Overuse	5 (11.9%)	9 (12.5%)
Rotation	1 (2.4%)	0 (0.0%)

The number of injuries was higher when the snow depth was shallow/by the ankle (54.8% in skiers and 48.6% in snowboarders). In snowboard, the second most common snow condition when injured was icy snow (34.7%), whereas in ski was average snow depth, or with a depth below the knee joint (40.5%) (Table 8).

Table 8. Injured individuals per snow conditions and sport (n(%)).

	Ski (n=42)	Snowboard (n=72)
Deep	5 (11.9%)	5 (7.0%)
Average	17 (40.5%)	24 (33.3%)
Shallow	23 (54.8%)	35 (48.6%)
Ice	7 (16.7%)	25 (34.7%)

For Skiers, being sunny represents 69% of the condition when their injuries occurred, as well as 65.3% of Snowboarders, being the most common visibility condition among the injured individuals. The second most common visibility condition in injuries both in Skiers and Snowboarders was cloudy (23.8% and 22.2% respectively) (Table 9).

Table 9. Injured individuals per visibility conditions and sport (n(%)).

	Ski (n=42)	Snowboard (n=72)
Fogg	8 (19.0%)	12 (16.6%)
Sunny	29 (69.0%)	47 (65.3%)
Cloudy	10 (23.8%)	16 (22.2%)
Snowing	4 (9.6%)	11 (15.3%)
Raining	0 (0.0%)	1 (1.4%)
Indoor	1 (2.4%)	0 (0.0%)

The majority of injured individuals were with friends in the moment of injury (61.9% of Skiers and 68.1% of Snowboarders). Only 1 Skier (2.4%) and 1 Snowboarder (1.4%) were with instructors in the moment of injury. Just 7.1% of Skiers and 8.3% of Snowboarders were alone when injured (Table 10).

Table 10. Injured individuals per accompaniment at the moment of injury and type of sport (n(%)).

	Ski (n=42)	Snowboard (n=72)
Alone	3 (7.1%)	6 (8.3%)
With friends	26 (61.9%)	49 (68.1%)
With friends and alone	0 (0.0%)	5 (6.9%)
With friends and family	8 (19.0%)	3 (4.2%)
With friends and instructors	0 (0.0%)	1 (1.4%)
With family	3 (7.1%)	5 (6.9%)
With instructors	1 (2.4%)	1 (1.4%)

In terms of traffic conditions/number of people practicing on the scene of the injury, most Skiers (52.4%) and Snowboarders (56.9%) reported having some people on the scene, but not many (23.8% of Skiers and 16.6% of Snowboarders reported many people) (Table 11).

Table 11. Injured individuals per traffic conditions around them and type of sport (n(%)).

	Ski (n=42)	Snowboard (n=72)
Many people	10 (23.8%)	12 (16.6%)
Some people	22 (52.4%)	41 (56.9%)
A few people	13 (31.0%)	18 (25.0%)
No one	1 (2.4%)	3 (4.2%)

The majority of injured Skiers and Snowboarders would rather treat their injuries by themselves (40.5% and 36.1% of them respectively), instead of seeing a doctor (19.0% and 12.5%) or a specialist (21.0% and 25.0%) (Table 12).

Table 12. Injured individuals per form of treatment and sport (n(%)).

	Ski (n=42)	Snowboard (n=72)
Self-treatment	17 (40.5%)	26 (36.1%)
Specialist	9 (21.0%)	18 (25.0%)
Specialist and self-treatment	1 (2.4%)	2 (2.8%)
Doctor	8 (19.0%)	9 (12.5%)
Doctor and Specialist	3 (7.1%)	9 (12.5%)
Doctor, Specialist and self-treatment	3 (7.1%)	4 (5.6%)
Doctor and self-treatment	0 (0.0%)	3 (4.2%)
Others	1 (2.4%)	1 (1.4%)

The most frequent report of time without practice due to injury was 0 days both in Skiers (45.2%) and Snowboarders (26.4%). However, in Skiing the second most common time without practice was 8-21 days (21.4%), whereas in Snowboarding was > 21 days (23.6%) (Table 13).

Table 13. Injured individuals by time without practice due to injury and by type of sport (n(%)).

	Ski (n=42)	Snowboard (n=72)
0 days	19 (45.2%)	19 (26.4%)
1-3 days	4 (9.5%)	9 (12.5%)
4-7 days	2 (4.8%)	6 (8.3%)
8-21 days	9 (21.4%)	9 (12.5%)
> 21 days	5 (11.9%)	17 (23.6%)
Rest of season	3 (7.1%)	10 (13.9%)
> 21 days and rest of season	0 (0.0%)	1 (1.4%)

Almost all of the injured Skiers and Snowboarders reported having fully recovered (66.7% and 70.8% respectively) and without chronic pain (61.9% and 69.4%) (Table 14).

Table 14. Recovery and chronic pain conditions of injured individuals (n(%)).

	Ski (n=42)	Snowboard (n=72)
Partial recovery	14 (33.3%)	22 (30.5%)
Full recovery	28 (66.7%)	51 (70.8%)
No recovery	3 (7.1%)	2 (2.8%)
With chronic pain	16 (38.1%)	17 (23.6%)
Without chronic pain	26 (61.9%)	50 (69.4%)

Discussion

The present study's main goal was to analyse data from Portuguese Skiers and Snowboarders in a descriptive way and we can conclude that Snowboarding has a higher injury frequency than Skiing, and a higher percentage of sportsmen.

From the total of 218 individuals participated in this study (87 (40%) Skiers; 113 (52%) Snowboarders; 18 (8%) both sports), there are generally more male than female enthusiasts in both sports, but this difference is much larger in Snowboarding, being 169 (85.0%) male and only 49 (15.0%) female. This data is in accordance to the information of the majority of studies reviewed from USA, Finland and other countries (Abu-Laban, 1991; Davidson & Laliotis, 1996; Steernos & Handolin, 2014), stating that there are generally more male enthusiasts in both sports, but even more in Snowboarding.

In accordance to the majority of the researches, this study

reveals that Snowboarding might have a relatively higher risk of injury in comparison to Skiing. Hackett (2014) has cited various articles that prove that there's a higher injury rate among Snowboarders than Skiers, and that Snowboarding injuries have still been increasing in number, alongside the relatively steady state of Alpine Skiing injuries, which has been confirmed also by Haider, Saleem, Bilaniuk & Barraco (2012), van der Zee, Richel, de Vries & Prins (2013). This could be due to the increase in number of Snowboarders in the last years.

Relatively to protective gear usage, it was determined that the majority of the participants in this study always use protections (56.3% Ski, 54.9% Snowboard, 61.1% Ski and Snowboard), of which the helmet is the most popular choice (94.0%). Hackett (2014) has reviewed the helmet usage trends from 2002 to 2012, which has increased by 194%, also confirmed by Patrick, Cooper & Daniels (2015). However, the mortality rates within this period of time have not decreased, suggesting that even though people are using helmets more often, the risk behaviours leading to fatalities have not decreased. This could also be due to the big increase in number of Snowboard enthusiasts, leading to more mortality cases overall. By relating this data with Ružič & Tudor (2011) we find that in male Skiers less than 35 years of age, the use of helmet might be a contributing factor to increased risk taking behaviours. However, in this study 17% of the participants reported not using any protective gear, 6% reported not using the helmet, and around 4.6% of the total injured individuals had head injuries, which could lead us to the conclusion that this part of the sample can be correlated with the non-use of helmet. This fact lead us to conclude that risk taking behaviours are the cause of most head injuries in our sample, because only 40% of those with head injuries assume to use always helmet as protective equipment. Further analysis is needed to validate the effects of protective gear usage in risk taking behaviours.

By reviewing several articles and relating them to the injury location trends of the present study, it has been concluded that the data is very similar to the majority of the scientific findings. The most common injury location in Skiers was the knee (59.5%), in accordance to Sahlin (1989), Steernos & Handolin (2014), Steernos & Handolin (2015), Davidson & Laliotis (1996), and Patrick, Cooper & Daniels (2015). However, the most common injury location for Snowboarders is the upper portion of the body, particularly the wrist (Davidson & Laliotis, 1996; Hackett, 2014). But when analysing this subject, Hackett (2014) and Torjussen (2006) concluded that the most common injury location in high level Snowboarders prevailed to be the knee joint. By analysing our data we observed similar results, with the majority of Snowboard injuries occurring in the knee (31.9%), followed by the wrist (26.4%). Combining this fact with the answers of the per-

ceived level of experience of Snowboarders, we can conclude that the majority of the Snowboarders in our sample are on an intermediate to high level. The level of expertise concerning the Skiers can only be based on the perceived level indicated by them in the questionnaire, being also intermediate to advanced.

The most reported Ski injury type was contusion (38.1%) (Sahlin, 1989), secondly it was luxation/strain (28.6%) in Ski but in Snowboard it was the most reported one (38.9%), which is in accordance with Abu-Laban (1991), followed by contusion (30.6%). Ueland & Kopjar (1998) and Brooks, Evans & Rivara (2011) found that the most common injury types in Skiing and also in Snowboarding were sprains/strains and fractures. Fractures were also pointed out by Davidson & Laliotis (1996) to be the most frequent type of injury in Snowboard, and Steernos & Handolin (2014) concluded the same. Although, only 11.9% of Skiers and 16.7% of Snowboarders of this study's sample reported having a fracture. We can state that the most common injuries among Portuguese Skiers and Snowboarders are strains and contusions.

By reviewing the most frequent moments/contexts of injury, we concluded that the majority of injuries among the sample's data happened in specialized facilities for Winter Sports (Piste and Snowparkand). The most frequent mechanism is by falling, also verified by Steernos & Handolin (2015) and van der Zee, Richel, de Vries & Prins, (2013). This makes us question about the safety regulations of these facilities and the compliance of the rules by the winter sports people. Although the most common injury mechanism (falling) is non-related to disobedience of the rules, the second most common in Skiers is by crashing (16.7%) and landings (23.7%) in Snowboarders, which can be addressed in the rule making, and the facility's terrain organization (Hackett, 2014). Most of the injuries occurred when sunny or cloudy, with relatively good visibility conditions. Shallow snow and icy snow were the main snow conditions of the injured Skiers (54.8%) and Snowboarders (48.6%), respectively, leading us to think that the deeper the snow, the smaller the injury risks in accordance with Abu-Laban (1991) study. Although the present data suggests that there's no relation between adverse snow or climate conditions and injury rates, the icy snow conditions seem to affect Snowboarders more than Skiers. There has to be more investigation concerning this subject.

As the snow or climate conditions seem to be unconnected to the increased injury risk, other variables must be addressed, such as the traffic conditions of Skiers and Snowboarders on the scene of practice, and with who was the injured individual at the moment of injury. Patrick, Cooper & Daniels (2015) stated that 84.7% of injured Skiers and Snowboarders

reported the crowding conditions being "clear". Also, only 8% of Skiers and 3% of Snowboarders in Steernos & Handolin (2015) study reported being injured by colliding with another person. The relatively low frequency of injuries by collision with others while practicing, was also noted by Davidson & Laliotis (1996) and Steernos & Handolin (2014). In contrast, our findings suggest that the majority of injuries in both sports occurred when the injured person was with friends and that there was some traffic at the scene. Abu-Laban (1991) has concluded the same in his study, being "light traffic" conditions the most frequent among injured Snowboarders.

The severity of the injuries in the sample of this study seems to not be severe, as the majority of the injured individuals didn't stop practicing after the moment of injury, and most of them treated the injuries themselves. However, 25.0% of Snowboarders and 21.0% of Skiers were treated by a specialist, and those that had to stop practicing did it for 8-21 days and > 21 days in Skiing and Snowboarding respectively. This portion of the injured individuals seems to have more severe injuries, due to the time without practice. Most Skiers (66.7%) and Snowboarders (70.8%) reported having fully recovered and without chronic pain (61.9% in Ski and 69.4% in Snowboard), whereas the rest only partially recovered or didn't recover, and feel chronic pain, leading us to conclude that a small part of the sample had indeed severe injuries, but the vast majority only had minor injuries. According to van der Zee, Richel, de Vries & Prins (2013) and Steernos & Handolin (2014), the majority of the injured individuals had severe types of injury that required hospitalization and long periods of time without practice. However, more research is needed about the recovery rates of injuries and their severity, in order to determine if the majority of the injuries occurred is severe or not. The data available might lead to false assumptions because there are lots of studies that obtained their samples in hospitals, clinics and injury records of Ski resorts (van der Zee, Richel, de Vries & Prins, 2013; Abu-Laban, 1991; Davidson & Laliotis, 1996 (2); Ueland & Kopjar, 1998; Macnab & Cadman, 1996; Xiang, Stallones & Smith, 2004; Torjussen, 2006; Sahlin, 1989), which leaves behind those who never reported their injury or went to a facility to treat it. This injury information on Skiers and Snowboarders and the fact that the majority of injuries seems to not be severe both in Snowboarders and Skiers, leads to question the majority of the data available concerning the injury profiles of Winter Sports. Within the present study, a further and deeper analysis is needed about injuries in Portuguese Winter Sports enthusiasts, in order to more accurately correlate their data with other countries worldwide and contribute to the information quality both nationally and internationally.

Conclusion

The results suggest that Snowboarding has a higher injury frequency, being a sport with higher risk than Skiing. Independent of spots practice, the most common injuries among Portuguese Skiers and Snowboarders are strains and contusions, with the most frequent body location of injury was the knee (59.5% in Ski and 31.9% in Snowboard), followed by the wrist (19.0% in Ski and 26.4% in Snowboard). Climate and snow conditions are not the main cause of injury, even though icy snow seems to affect the risk of injury in Snow-

boarders. However, if the individual is accompanied with friends and there are light traffic conditions on the scene, the injury frequency seems to be increased both in Skiers and Snowboarders, leading us to think that risk behaviours are the main cause of injury. The characterization of the injury types, moments and mechanisms of Skiers and Snowboarders indicate a valid relation with the scientific information available nowadays, related to the average Winter Sports practitioner, although the Snowboarding data part of our sample seems to be more similar with the research data of high level athletes.

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