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## Original Research Article

## Skiing and snowboarding sport injuries



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## ARTICLE INFO

## Article history:

Received 11 November 2013

Received in revised form

8 December 2013

Accepted 24 January 2014

Available online 18 April 2014

## Keywords:

Skiing injuries

Snowboarding injuries

Skiing and snowboarding injuries patterns

Skiing and snowboarding injuries mechanisms

Skiing and snowboarding injuries comparison

## ABSTRACT

**Introduction:** Skiing being one of most popular sport disciplines has a long history and tradition. Snowboarding was counted into leading sport disciplines in the 1970s. Both disciplines popularity growth led to increase of injuries rate. Knowledge of risk factors, causes and injuries patterns allows to improve safety and decrease injuries and harmful effects.

**Aim:** Study aim was an attempt to characterize injuries patterns in skiing and snowboarding.

**Material and methods:** Study involved 100 people (60 females and 40 males), age range: 20–49 years (mean age:  $30.95 \pm 10.64$ ). Participants were Upper Silesia Region inhabitants, 70% of them do skiing while 30% snowboarding. Study was based on self-prepared questionnaire. **Results and discussion:** 45% of questioned sustained injury during skiing or snowboarding. In skiers knee joint injuries dominated (45%) while in snowboarders most frequently shoulder joint was affected (25%). Contusions predominately occurred in snowboarders (63%), in skiers sprains were most frequent (47%). Falls were main causes of injuries in both groups. Age, ability, fitness and physical activity level are factors increasing risk of injuries. Sex and weather conditions do not impact on injuries occurrence.

**Conclusions:** Anatomical localization and types of injuries occurring in skiing and snowboarding differentiates both disciplines.

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## 1. Introduction

Skiing with its long history and tradition is a one of the most famous sport disciplines and form of spending free time. Skiing was incorporated into Winter Olympic Games in Garmisch-Partenkirchen in 1936 due to constant popularity growth.

Snowboarding was recognized to be leading sport discipline in 1970s. Snowboarding stands in opposition to skiing and other winter sport disciplines because of its young participants wearing characteristic cloths and using specific vocabulary.<sup>1–4</sup>

Skiing and snowboarding popularity increase is associated with higher injuries rate. Injuries in snowboarders and skiers may have serious consequences or even be life threatening. In

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literature various injuries risk factors can be indicated. In snowboarders, males more frequently sustain injuries while in skiers injuries distribution in males and females is almost equal.<sup>1–6</sup> Age of participants also may determine injuries. Snowboarding injuries dominate in young people in their 20s. In skiers, injuries occur predominately in teenagers below 16 years and in people with age range 25–40 years.<sup>1,3,4,6–8</sup> Skiing and snowboarding lessons taking is another risk factor. Injuries dominate in people who did not take any lesson or in those who attended only one.<sup>6</sup>

Sports injuries occurring in particular discipline are undoubtedly associated with its specificity; however opportunistic injuries cannot be excluded. Injuries anatomical localization in particular disciplines may be different and results from different mechanisms of injuries and biomechanical conditions.<sup>6,9</sup>

Since its inception snowboarding was associated with higher, in comparison with skiing, upper extremity injuries rate. Shoulder joint and shoulder girdle are most frequent injury zones in that discipline. Matsunaga reports about the case of “spaghetti wrist” as a result of forearm cutting with snowboard sharp edges. “Snowboarders wrist” is acute and complex fracture of distal forearm.<sup>6,10</sup> Even though upper limb injuries are typical for snowboarding, in skiing “skier thumb” as a sport specific may be also indicated.<sup>3,9</sup>

In skiers more researches are focused on lower limb injuries because majority affect that part of the body.<sup>3,5,7</sup> Knee joint injuries constitute about 30% of all skiers injuries. Different mechanisms of knee injuries lead to ligaments insults, particularly: anterior cruciate ligament (ACL) and medial collateral ligament (MCL) distortions.<sup>11</sup> “Boot-top fracture” being spiral fracture of tibia can occur in both disciplines.<sup>3,12</sup> In snowboarders, due to soft boots and foot inversion, ankle sprains may occur.<sup>13</sup>

In skiers and snowboarders spine injuries are mainly presented by wedge fractures of thoracolumbar junction as a result of fall down force transition. Vertebral discs pathologies may also occur.<sup>14,15</sup> Head and face injuries types in both disciplines are different. Skiers often sustain fractures of zygomatic bone and jaw. In snowboarders, head and face injuries are presented by lacerations and contusions or concussions. Guards protect from soft tissues injuries, temporomandibular joint dysfunctions, jaw and maxilla fractures and even reduce risk of concussion.<sup>16–18</sup>

## 2. Aim

Study aim was an attempt to characterize injuries and factors correlating with them in skiers and snowboarders.

## 3. Material and methods

Study was carried out between March and April 2011 among Upper Silesia Region inhabitants doing skiing or snowboarding. Inclusion criteria were: age range: 18–50 years, doing skiing or snowboarding, agreement for participation. Exclusion criteria were: age below 18 years and above 50 years, undoing skiing or snowboarding and disagreement for

participation. Study was based on self-prepared questionnaire composed of three parts, assessing respectively: sociodemographic factors, participated sport discipline and sustained injuries. Study participation was anonymous and voluntary. Research protocol did not require local Bioethics Committee acceptance.

Surveys were distributed randomly among 122 people who had left for winter holidays; 8 people were excluded from the study because of not meeting the age inclusion criterion, while 14 because of undoing skiing/snowboarding. For further analysis 100 people were qualified: 60 females and 40 males, age range: 20–49 years (mean age:  $30.95 \pm 10.64$ ). The most numerous group of participants were people between 20 and 25 years, respectively 30% of females and 19% of males. Among questioned people 90% live in city while 10% in the country. Most of participants (70%) do skiing while 30% snowboarding.

Microsoft Excel 2007 for statistical analysis was used. Pearson's  $\chi^2$  test and analysis of variance (ANOVA) were used to calculate the statistical significance level which was set at  $P < .05$ .

## 4. Results

Injuries during skiing or snowboarding were reported by 55% of participants. In snowboarders group, the number of injured participants (63%) was higher than in skiers (51%). In researched group 53% of females sustained injuries while skiing or snowboarding in comparison with 57% of injured males; thus, gender do not modify the risk of sustaining injuries ( $P > .05$ ) (Fig. 1).

Most of injured participants were in the age between 20 and 25 years, respectively 33% of skiers and 68% of snowboarders. Injuries dependency on age of participants is statistically significant ( $P < .05$ ) (Table 1).

In both disciplines anatomical localizations of injuries are different. In snowboarders upper extremity injuries predominantly occur (35%) while in skiers lower limb injuries are most frequent (62%). In both disciplines the type of sustained injuries is equally important as anatomical localization. Types of injuries differ between skiing and snowboarding. In skiers the most common injuries were sprains (47%) while in snowboarders contusions (63%) (Table 2).

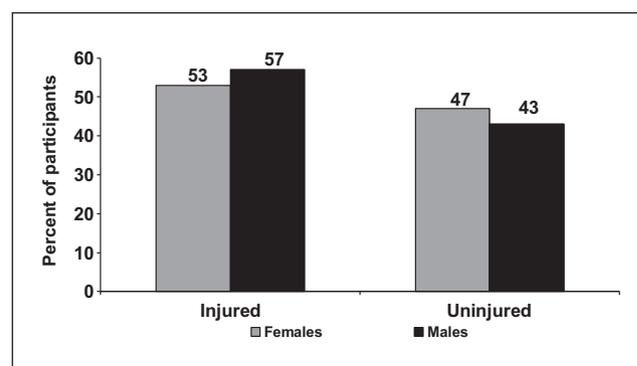


Fig. 1 – Injuries distribution due to participants' gender.

**Table 1 – Injuries dependency on participants' age.**

Age range (years)	Injured participants (no.)	Uninjured participants (no.)
20–25	26	23
26–30	7	3
31–35	6	2
36–40	2	4
41–45	3	7
46–50	11	6

**Table 2 – Localizations and types of injuries in skiers and snowboarders.**

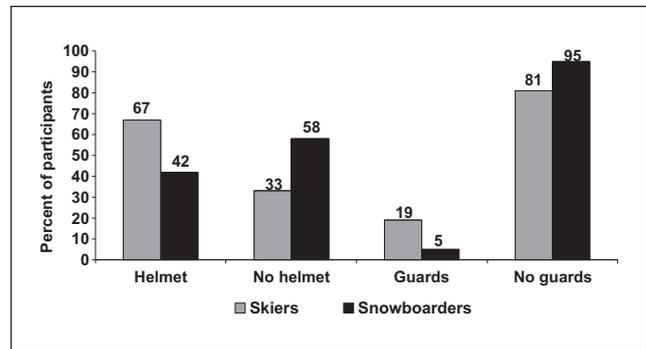
Skiing		Snowboarding	
Anatomical localization	Injured skiers (%)	Anatomical localization	Injured snowboarders (%)
Shoulder	7	Shoulder	25
Elbow	4	Humerus	5
Wrist	16	Wrist	5
Thumb	2	Hip	10
Hip	4	Ankle	15
Knee	45	Ribs	5
Ankle	13	Sacrum	15
Ribs	2	Occipital bone	15
Sacrum	5	Abdomen	5
Abdomen	2		
Type of injury	Injured skiers (%)	Type of injury	Injured snowboarders (%)
Contusion	34	Contusion	63
Sprain	47	Sprain	16
Luxation	11	Luxation	5
Fractures	8	Fractures	16

In young participants in age of 20–25 years the most frequent injuries were contusions and sprains. The relationship between age and the type of sustained injuries is statistically significant ( $P < .05$ ).

Performing skiing and snowboarding injuries analysis it is fundamental to discover circumstances of injury. Falls were the main reason for injuries in questioned people, respectively: in skiers 59%, in snowboarders 47%. Less frequently occurring causes were: high speed, collisions and human error. Cause of injury may determine its type ( $P < .05$ ) (Table 3).

**Table 3 – Types of injuries due to causes in skiers and snowboarders.**

Cause	Injuries (no.)			
	Contusion	Sprain	Luxation	Fracture
Fall	10	14	3	3
Jump	2	0	0	0
Speed	6	2	0	0
Collision	4	1	0	1
Human error	3	2	1	2
Equipment failure	0	0	1	0

**Fig. 2 – Guards and helmet wearing in skiers and snowboarders.**

Previous experience in skiing and snowboarding may modify the risk of sustaining injuries. In the group of injured participants 65% claim to do skiing and snowboarding for more than five years. One-year experienced participants who sustained injuries constituted 13%. Injuries sustaining dependency on years of experience is statistically significant ( $P < .05$ ).

Using guards and helmets to protect from injuries harmful effects in researched group was diverse. Most of skiers and snowboarders use helmets, 67% and 58%, respectively. Only 19% of skiers and 5% of snowboarders use guards (Fig. 2).

## 5. Discussion

Considering injuries in skiing and snowboarding risk factors should be taken into account. Risk factors may be divided into intrinsic (e.g. gender and age) and extrinsic (being external stimuli affecting athlete). Interaction between them may lead to injury; however, it is not a rule.<sup>2</sup>

Both, in males and females doing skiing and snowboarding injuries distribution was almost equal. However, the relationship between gender and injuries was not statistically significant, obtained results are in accordance with data reported by different authors.<sup>5,6</sup> Some studies results indicate for disproportion of injuries in males and females.<sup>8,14</sup> Some researchers considering skiers and snowboarders injuries do not find the gender as a factor associated with injuries.<sup>3,19</sup>

Received data indicated that injuries frequency is greater in young skiers and snowboarders between 20 and 25 years. Literature reports about snowboarders injuries prove that the most frequently injured are people in their 20s.<sup>3,6</sup> In skiers injuries dominate in teenagers below 16 years.<sup>3,4</sup> Some reports do not point the age in skiers and snowboarders injuries analysis.<sup>1,8,19</sup> Higher frequency of injuries in youth sport participants may be an effect of psychological and physiological changes associated with puberty.<sup>20</sup> Young people do predict the consequences of inappropriate behaviors; thus, more injuries may occur.

Anatomical localization of injuries in received data differentiates skiing and snowboarding. Most frequently affected area in skiers was lower limb while in snowboarders

it was the upper extremity. Received results find confirmation in researches where the injuries localizations were similar in both groups.<sup>3,6</sup> Different mechanisms of injuries are the fundamental aspect in considering injuries localization differences in skiers and snowboarders. Upper extremity injuries domination in snowboarders is associated with foot fixation and reflex arm out stretching during the fall thus force of injury is transited to upper limb. In skiers lower limb injuries are mainly presented by knee joint insults. Knee joint injuries in skiers may be a result of the following mechanisms of injuries: boot-induced anterior drawer and phantom-fall.<sup>11</sup>

Different injuries types in both disciplines also underline their diversity. In obtained results sprains dominated in skiers while in snowboarders that are contusions. However, self-reported injury type may differ from patient's medical record. Canadian Academy of Sport Medicine report underlines the sprains as the most common problem in snowboarders. It stays in accordance with results presented by Langran and Selvaraj. Both, in received results and available literature sprains in skiers dominate.<sup>3,6</sup>

The cause of injury is strongly related with its type and localization. The mainly reported causes of injuries in both groups were falls. Most of skiers and snowboarders report that the fall was a result of personal error.<sup>2</sup>

Davidson and Laliotis assess skiers and snowboarders experience due to self-reported, subjective ability level.<sup>8,5</sup> Langran and Selvaraj assessed the ability level by years of discipline participation.<sup>6</sup> Surprisingly, results showed that injuries dominate in people doing skiing or snowboarding for more than five years. Probably, reaching high speed during skiing or snowboarding and less safety awareness are explanations. Spending at least five days on the slope in a lifetime reduces the risk of sustaining injury and has a preventive value.<sup>6</sup>

Helmets reduce the risk of serious head traumas; thus, it is recommended to skiers and snowboarders, particularly to beginners.<sup>3</sup> Macnab et al. report that 54% of skiers wear helmets while only 27% snowboarders do so.<sup>18</sup> Obtained results confirm Macnab's report that most of snowboarders do not use helmets and guards. Helmets designing should reduce hearing and vision problems and improve material resistance.<sup>4,18</sup> Guards wearing may also reduce the frequency and severity of injuries.<sup>3</sup>

## 6. Conclusions

Skiing and snowboarding injuries occurrence confirms those sport disciplines diversity. Risk factors modifying may have a preventive value; thus, it may lead to reduction of injuries harmful effects. Training process ought to contain the exercises of falling since it was the main reason of injuries in the present study.

## Conflict of interest

None declared.

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