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INLINE SKATING AS AN AIDING TOOL FOR BETTER LEARNING BASICS OF ALPINE SKIING IN ADULT SKI BEGINNERS

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Abstract

This research aimed to investigate the possible correlation between the knowledge of inline skating with learning of alpine skiing. We included 134 participants, randomized to two equal-sized groups based on their previous knowledge on recreational level inline skating. They were enrolled in 10-days alpine ski school under similar conditions. The acquired knowledge of alpine skiing was graded based on performance of six previously chosen elements of alpine ski technique. The overall level of new alpine ski knowledge was tested by Factor analysis. The calculated Eigen value of first principal component (λ=5,741) was significant and represented the acquired alpine ski knowledge which was further used in data analysis. The group of participants with the recreational level knowledge of inline skating was more efficient while learning alpine skiing compared to participants lacking knowledge of inline skating (4.1 vs. 3.4; p=0.00). Moreover, results have shown high and statistically significant correlation between the level of acquired alpine ski knowledge and estimated knowledge of inline skating (r=0.78). We conclude that inline skating can be used as an efficient tool for better learning alpine skiing.

Key words: *learning alpine skiing, recreational skiers, alternative sport*

Introduction

Condition training for alpine skiing uses many alternative sports such as: mountain bike, uphill and downhill running, inline skating, football, judo or sports gymnastics. Frequency and amount of their use depends upon the skier's age and period of training (Maffiuletti et al., 2003). As alpine skiing is a winter sport, training during summer months often relies on alternative sports, which use similar elements as skiing, and help in conditioning trainings for upcoming competitions. For competitive alpine skiers inline skating can to some extent replace skiing training. On skates one can make similar turns in narrow corridor as on skies. The example of such discipline is slalom (Kroll et al., 2005). On the other hand, research also showed differences between turns made on skies and skates. Mainly differences are evident in ground surface and equipment used, which in turn affect speed. This also changes distribution and intensity of forces influencing skier during a turn (Takahashi & Yoneyama, 2001). However, there are far more similarities than differences between skier's movements during turns while skiing and inline skating (Ropret, 2010). When skier's movements during ski and inline skating turn are compared in sagittal and frontal planes there seem to be no great differences. Almost identical movements in ankles, knees and hips as well as in leg muscles and back extensors must be performed in order to make continuous turns in an ideal balance position during both ski and inline skating turns (Kroll et al., 2005). From the aspect of motor abilities, one has to accentuate explosive strength, balance and agility as being the most important for success in alpine skiing (Neumayr et al., 2003). Investigation also suggests that inline skating and skiing influence development of similar motor abilities (Muehlbauer et al., 2013). According to the theory of similarity, there is a dependence of identical elements among the tasks which can be transferred when there are similarities between the two motor activities. This could explain the relationship between balance and rotation which are important for inline skating but can also aid teaching alpine skiing (Roman et al., 2009). In contrast to studies on elite skiers, there is still paucity of scientific literature concerning the recreational alpine skiing and influence of inline skating on better and faster learning basics of alpine skiing. The single study to the best of our knowledge investigation relationship of inline skating and learning basics of alpine skiing was published in 2009 by Roman and coworkers on children aged 7 to 13. This study pointed to positive effects of inline skating on efficiency of alpine ski learning. Positive correlation between movements performed during skiing and inline skating leads to an assumption that knowledge of inline skating might influence process of learning alpine skiing at a recreational level. Due to correlation between turns on skates and skies, this investigation aimed at determining correlation between the levels of acquired knowledge of alpine skiing with previous knowledge of inline skating in adult alpine ski beginners.

Methods

Participants – 139 volunteers entered the study. They were recruited from University of Zagreb. The participant's sample was separated into two groups according to the knowledge of inline skating-one group consisted of 67 participants with prior knowledge of inline skating at a recreational level and other of 72 participants with no knowledge of inline skating.

Variables – Acquired ski knowledge of all study participants was measured on six representative elements of ski technique: traversing, uphill turn, basic turn, snowplough, parallel turn and short turn. Each participant demonstrated all the mentioned elements, and traversing and uphill turn were performed in the left and right side so overall four marks were given for these specific elements. Based on the grades, the knowledge of skiing was rated. Final grade was calculated by factorial analysis.

Study protocol – At the beginning of investigation participants' with prior knowledge of inline skating self-evaluated their inline skating according to the three proposed levels; no knowledge of inline skating whatsoever, basic knowledge of inline skating, and advanced knowledge of inline skating. Mentioned use of self-evaluation was previously seen in other investigations (Sporis et al., 2011), and is especially reliable among young people. Moreover, participants involved in this investigation were from the population of kinesiology students, who among other, are educated to evaluate/self-evaluate abilities and knowledge. All participants were taught alpine skiing during 10 days alpine ski school. During the period they had identical conditions concerning the number of participants pro group (10), number of learning hours per day (4), number of hours for practice daily (2), quality and adequacy of skiing equipment, quality of ski instructors, and adequacy of ski terrains. Upon finishing structured program of alpine ski school each participant demonstrated the acquired knowledge of alpine skiing on six elements, graded by independent judges. According to the grades obtained, each participant's knowledge of alpine skiing was ranked. Grading process followed the five point scale, where one represented worst and five best knowledge of skiing. Data acquisition followed the standardized procedure of rating ski knowledge (Cigrovski et al., 2008).

Statistical methods – Obtained data was analyzed by statistical package "SPSS for Windows 14.0". Obtained distributions were tested by Kolmogorov-Smirnov test (K-S). Basic descriptive parameters were calculated for six tests used to value acquired alpine ski knowledge. Significance of difference between ski knowledge of two participant groups was determined by ANOVA. Fisher's test was then used to analyze the determined difference. Factor analysis was used to determine the participants' overall skiing knowledge. Catell scree criterion or GK criterion were used to determine the number of factors. Afterwards, Pearsons correlation coefficients (r) were used to determine the level of correlation between knowledge of alpine skiing and knowledge of rolling.

Results were significant with $p<0.05$.

Results

Results of central and dispersive parameters for mean knowledge of alpine skiing and inline skating are given in Table 1.

Table 1: Descriptive statistical parameters of graded knowledge of alpine skiing; alpine skiing of participants with prior knowledge of inline skating; alpine skiing of participants with no prior knowledge of inline skating and graded knowledge of inline skating

Motor knowledge	N	Min	Max	M	SD
Alpine skiing	139	2.25	5.00	3.7	0.70
Alpine skiing in participant with prior knowledge of inline skating	67	3.00	5.00	4.1	0.54
Alpine skiing in participants with no prior knowledge of inline skating	72	2.25	5.00	3.4	0.65
Inline skating	67	2.00	5.00	3.91	0.82

Of 139 participants who were included in the investigation, 67 had previous knowledge of inline skating. Average grades of acquired alpine skiing were significantly higher for participants who had previous knowledge of inline skating. Significance of difference between the participants of the two groups (4.1 *vs.* 3.4) was tested by ANOVA.

Table 2: Results of difference between the two groups of participants based on graded level of alpine skiing

Variable	Alpine skiing in participants with prior knowledge of inline skating		Alpine skiing in participants with no prior knowledge of inline skating		ANOVA	
	M	SD	M	SD	F	P
Knowledge of alpine skiing	4.1	0.54	3.4	0.65	52.29	0.00

F=Fisher's test

Statistically significant difference in the level of acquired alpine ski knowledge was determined between the two groups of participants (p=0.00; Table 2). One group used inline skating before the school of alpine skiing and the other didn't. Results suggest how inline skating prior to structured program of alpine ski school can aid better learning of alpine skiing.

Factor analysis determined the main components based on eight grades given to each participant for the demonstration of chosen elements of alpine ski technique (Table 3).

Table 3: Results of factor analysis

Components (factors)	λ	%	Cumulative %
1	**5.741**	**71.765**	**71.765**
2	0.589	7.362	79.127
3	0.442	5.526	84.653
4	0.389	4.858	89.511
5	0.311	3.891	93.403
6	0.198	2.474	95.876
7	0.178	2.228	98.104
8	0.152	1.896	100

λ = Eigen value; %= percentage of explained variance

Table 3 shows the results of main components, and first main component with the only statistical significance (λ=5.741). Based on calculated results, one can extract the first main component explaining almost 72% of overall variance and presenting the factor of skiing knowledge.

By correlation we analyzed the first main component, correlating the defined factor of ski knowledge with grade of each participant on elements of alpine ski technique.

Table 4: Results of correlation analysis between average grades for elements of alpine ski technique and first main component defined as ski knowledge

Elements of alpine ski technique	Correlation with first main component
traversing left	0.84*
traversing right	0.859*
uphill turn to the left	0.854*
uphill turn to the right	0.879*
basic turn	0.797*
snow plough turn	0.821*
parallel turn	0.874*
short turn	0.85*

* p<.05; ** p<.01

Based on calculated correlation shown in Table 4, it is evident how grades of all eight elements of alpine ski technique correlate significantly with first main component. Calculated correlations are high and significant and allow the use of first main component as a factor of acquired knowledge of alpine skiing.

Table 5 shows results of correlation analysis between the level of alpine ski knowledge and estimated knowledge of inline skating.

Table 5: Correlation coefficients between the level of alpine ski knowledge and knowledge of inline skating

	knowledge of alpine skiing	knowledge of inline skating
knowledge of alpine skiing	1	0.78**
knowledge of inline skating		1

* p<.05; ** p<.01

Correlation analysis shows significant correlation between level of acquired knowledge of alpine skiing and knowledge of inline skating. Alpine skiing and inline skating share many similarities so calculated correlation is not surprising (Kroll et al., 2005; Ropret, 2010). Results suggest positive correlation between knowledge of inline skating and learning of alpine skiing.

Discussion and conclusion

The purpose of our investigation was to test whether recreational level inline skating can aid safer and more successful learning alpine skiing in adult ski beginners. The statistically significant correlation between knowledge of inline skating and level of acquired alpine skiing in our investigation suggests that this is an advantage when starting a basic alpine ski school program for adults. Same results were also seen for children alpine ski beginners by Roman and coworkers (2009), where children with previous knowledge of inline skating learned basics of alpine skiing better than children with no experience in inline skating. In the mentioned research, experimental group of children were training inline skating sixteen days before attending basic alpine ski school and achieved better results compared to control group. Mentioned can be explained by the theory of similarity, which emphasizes how the alikeness of tasks can be transferred into better learning (Rienhoff et al, 2013), suggesting knowledge of one sport can make learning of other similar sport much easier. In the example of alpine skiing and inline skating sharing balance and rotation, one can expect knowledge of skating to aid acquisition or improvement of alpine skiing. Following this principal, ski beginners could benefit from knowledge of inline skating which could facilitate successful and safe motor learning of an activity such as alpine skiing (Roman et al., 2009). Previous investigation showed no significant difference between alpine ski competitor's movements during slalom turn and similar radius turn made on inline skates (Takahashi and Yoneyama, 2001). From the aspect of controlling both skies and skates, the main correlation is in the way of achieving speed and change of direction. The mentioned in turn led to the wider use of inline skating during condition training of alpine ski competitors (Kroll et al., 2005). As alpine skiing is a risky and technical sport, many of research investigates the safe ways of learning alpine skiing under controlled and structured programs of alpine ski school (Žvan et al., 2015). Inline skating is a popular sport on a recreational level, but also for the beginners it is often associated with a high potential for falls and injuries (Muehlbauer et al., 2013). According to one model of learning, ski beginners would advance in alpine skiing by changing the length of skies every few days during alpine ski program. During mentioned approach, in the first ski day ski beginners use very short skies, 90 cm in length. Afterwards they are advanced to skies of 125 cm and only at the end of the program to the skies of standard length, customized for each individual ski beginner (Murovec, 2006). Such program favors inline skating in the pre-alpine ski school program not only because of the similar length of skates and starting skies but also because of the similar motor patterns during inline skating and alpine skiing. Short skies just like skates require constant maintenance of central position during turns, which in turn help in keeping perfect balance. One could for the mentioned reason expect the adjustment to the short skies to be faster if participants are experienced in inline skating. Our own results suggest more successful and consistent learning of alpine skiing for adult participants of alpine ski school with previous knowledge of inline skating. For the above mentioned reasons, participants of the alpine ski school with knowledge of inline skating would in the same time period of structured alpine ski school program achieve basics of alpine skiing much faster. Based on our results we would suggest ski beginners to use inline skating as a preparation for basic alpine ski school. Inline skating is a practical tool while its basics can be learned on almost all hard and flat surfaces available in different town or village settings and easily matched with every-day life responsibilities. To conclude, inline skating is an ideal activity to prepare adult ski beginners for learning basics of alpine skiing.

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