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Effects of a Programme of Intensive Training of Alpine Skiing Techniques on Some Motor Abilities

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Abstract

Learning skiing, especially in the conditions of initially learning alpine skiing techniques, is quite tense and takes place over a longer period, with physical and psychological loads, caused by adaptation to new equipment and demanding conditions. This research aimed to determine the effects of a short-term experimental programme of intensive training of alpine skiing techniques to particular motor abilities of students. The sample is divided into an experimental group of beginners who were skiing for the first time and a control group. The results of ANCOVA within variables for the evaluation of motor abilities show statistically significant effects of applying the experimental programme in three out of eight variables. The contribution to these effects is seen in the Hexagon agility assessment test (p=.001) and in tests of static strength of legs: left leg squat endurance test (p=.017) and right leg squat endurance test (p=.013). From the mean value results (M), it is obvious that the experimental group achieved better results compared to the identical tests applied to the control group. The data obtained in this research are of great importance to everyone responsible for the transfer of knowledge and positive developmental effects of physical exercise.

Keywords: *ski training, students, agility, static strength*

Introduction

Alpine skiing is classified as a sport dominated by cyclic movement patterns (turn after turn), but compared to other cyclical movements in running or cycling, external circumstances (snow conditions, slope inclination, track settings, etc.) cause a high level of variability (Kröll, Birklbauer, Stricker, & Müller, 2006). Learning skiing, especially in the conditions of initially learning alpine skiing techniques, is quite tense and takes place over a longer period, with physical and psychological loads caused by adaptation to new equipment and demanding external conditions. Successfully learning skiing techniques is related to practical training in which the skiers form images of movement and movement habits. Learning a setup method must always contain precise settings that allow one to perform the tasks correctly (Ćurić et al., 2018). Skiing is a very dynamic sport and recreational activity, which, in addition to technique, is strongly influenced by the anthropological characteristics of skiers, among which, motor abilities are highly significant (Cvetković, Radosav, Matić, Jakšić, & Orlić, 2010). As researchers state (E. Mujanović, Atiković, & Nožinović Mujanović, 2014), coordinated action of the whole body of the skiers in which work of the legs, upper body and hands is equally important. Theoretically, balance dominates, but the other motor skills described in this paper are significant. It should be emphasized that agility and static strength contribute the most in learning the specific motor knowledge of alpine skiing – parallel turns (Cigrovski, Božić, & Prlenda, 2012). Mujanović and Krsmanović (2008) state that students with higher levels of motor abilities, such as balance, agility, flexibility and repetitive strength, have more success in mastering dynamic short radius turns.

Accordingly, this research aimed to determine if there are effects of a short-term experimental programme of intensive

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training of alpine skiing techniques to particular motor abilities of students.

Methods

Participants

The test sample included 65 male students enrolled in the second and third year of study at the Faculty of Physical Education and Sport at the University of Tuzla. The sample is divided into an experimental group (31 students, age 21.4±1 and body height 180.7±6.3cm) and control group (34 students, age 20.6±.8 and body height 180.3±6.8 cm). Students who participated in the study were healthy, not excused from physical education for health reasons, and they gave their written consent to participate in testing. The study was carried out according to the principles of the Helsinki Declaration on experimentation on living subjects (WMA, 2017).

Variables

Based on previous studies, tests were selected, which correspond to characteristic movements when performing the basic elements of alpine skiing, on the basis of which relevant indicators can be drawn on the effects of the intensive training programme for alpine skiing, and because of their good metric characteristics (Semenick 1990; Reid, Johnson, Kipp, Albert, & White, 1997; Bosco, 1997;)

For the assessment of motor abilities, the tests were Hexagon, agility T-Test, squat jump, counter-movement jump, left leg counter-movement jump, right leg counter-movement jump, left leg squat endurance, and right leg squat endurance.

Procedure

The assessment of motor abilities selected for this research was conducted two days before and after the end of the experimental programme, which lasted six days. The programme was implemented on a daily basis during the period 09:00-16.00h for 33 hours over 6 days (4 hours of training with instructors and 2 hours of free practice for 5 days; and on 3 hours of free practice the 6th day).

The experimental programme is designed for beginners to learn the basic techniques of alpine skiing. It (Table 1) was precisely determined by the predetermined number of repetitions of a particular methodical exercise or the ski technique itself and was formed on the basis of current knowledge in the training of motor activity of alpine skiing. It has been proven that the number of repetition and training of a particular element of ski technique and the way it is presented affects the higher level of the adopted knowledge of alpine skiing (Grouios, Kouthouris, & Bagiatis, 1993; Almåsbakk, Whiting, & Helgerud, 2004).

During the period of experimental treatment, the control group performed the regular duties prescribed by the curriculum (training of their choice for a practical exam in judo, handball and dances).

Table 1. Design of experimental programme elaborated on a daily basis

Learning day	Design of experimental programme
1st	Determining the initial knowledge of alpine skiing and forming homogeneous groups of skiers by the quality of knowledge; overview of equipment and attachment and removal of skis; walking with and without ski poles on the platform, turning around the tops and tails, falling and lifting; climbing the slope, turning on a slope, falling and lifting; gliding straight down the gentle slope (on flat terrain and over uneven terrain), with different ways of stopping (at the end of a slope, in a plow, by a transient step); the use of ski lifts; traversing the slope traversing the slope with sliding and stoping; gliding wedge (speed control and stopping in the plow); wedge turns.
2nd	Repeat alpine skiing technique elements from the previous day; ski curves with wedge turns; gliding wedge on a steeper slope (speed control and stopping); wedge turns on a steeper slope; parallel turn towards the slope (with sliding and carving the skis); wedge parallel turn.
3rd	Repeat alpine skiing technique elements from the previous days; advanced wedge turns with pole plant; wedge parallel turns on a steeper slope; parallel turns on a gentle slope.
4th	Repeat alpine skiing technique elements from the previous days; parallel turns on a steeper slope; basic parallel turns on a gentle slope.
5th	Repeat alpine skiing technique elements from the previous days; wedge turns; wedge parallel turns; basic parallel turns.
6th	Free practice.

Data analysis

To determine the effects of an experimental programme on some motor abilities of students, a univariate covariance analysis was applied (ANCOVA). As a preliminary analysis (assumption) for ANCOVA, Levene's test was used to evaluate the equality of variances between the compared groups.

Results

Preliminary testing tested the assumption of variance homogeneity; no perceived contingency was noted in the applied variables. The statistical significance of Levene's test in all variables is $p>.05$, indicating that observed variance, two groups of respondents, are similar in these variables, which means that there are no significant differences between the variants. The zero hypothesis is accepted, and we conclude that the condition of homogeneity is met. Therefore, differences in the size of the experimental treatment effect between the groups can be attributed to the differences due to the treatment.

Results of ANCOVA within the variables for the evaluation of motor abilities show statistically significant effects of the applied experimental programme in three of the eight used variables at the level of significance $p<.05$. The contribution to these effects is evident in the hexagon test HEX - $p=.001$, left leg squat endurance test LSE - $p=.017$, and right leg squat en-

Table 2. Levene's test for both groups of respondents in variables for estimating motor abilities

Dependent Variable	F	df1	df2	p
HEX	3.775	1	63	.056
T-Test	.006	1	63	.937
SJ	.466	1	63	.497
CMJ	3.921	1	63	.052
LCMJ	3.738	1	63	.058
RCMJ	3.776	1	63	.056
LSE	1.859	1	63	.178
RSE	.001	1	63	.975

Legend: F - Fisher's F ratio; p – level of statistical significance; HEX - Hexagon; T-Test - agility test; SJ - squat jump; CMJ - counter-movement jump; LCMJ - left leg counter-movement jump; RCMJ - right leg counter-movement jump; LSE - left leg squat endurance; RSE - right leg squat endurance

durance test RSE - p=.013. If we look at the results of the mean values (M) in the mentioned variables, we can see that the subjects of the experimental group achieved better results on the tests than the identical tests applied with the control group.

Table 3. Results of ANCOVA within the variables of motor abilities

Dependent Variable		Control group M±SD	Experimental group M±SD	ANCOVA	
				F	p
HEX	I	11.99±1.607	12.72±1.81	11.793	.001
	F	12.01±2.23	11.44±1.24		
T-Test	I	9.60±.79	10.07±.70	1.193	.279
	F	9.78±.79	10.01±.75		
SJ	I	32.46±4.42	31.41±6.24	.023	.881
	F	33.26±4.82	32.73±4.59		
CMJ	I	34.34±5.47	33.20±6.16	.319	.574
	F	34.60±6.03	34.10±5.85		
LCMJ	I	16.56±3.66	16.48±4.16	.021	.885
	F	16.91±3.53	16.74±4.46		
RCMJ	I	16.77±2.93	15.63±5.08	.907	.345
	F	17.11±3.24	16.83±4.23		
LSE	I	33.59±17.03	33.99±16.95	6.062	.017
	F	34.49±16.26	38.87±15.99		
RSE	I	35.05±18.29	33.63±15.92	6.507	.013
	F	36.69±19.52	39.99±14.45		

Legend: I – initial testing; F – final testing; M–arithmetic mean; SD–standard deviation; F - Fisher's F ratio; p – level of statistical significance

Discussion

The primary aim of the presented research was to determine the effects of the short-term experimental programme of intensive training of alpine skiing techniques to particular motor abilities of students. As we see in the results, the programme was effective on the hexagon test, left leg squat endurance test and right leg squat endurance test. Those effects are reflected in the improvement of the results in the aforementioned tests in the subjects of the experimental group compared to the identical variables tested in the control group.

In a study of determining the effects of a ten-day skiing course at students of the Faculty of Sports and Physical Education, with respect to certain motor abilities, the authors (Cvetković, Radosav, Matic, Jaksic, & Orlic, 2010) found statistically significant changes in the transformation of variables for estimation of agility and flexibility, while no statistically significant changes were found in the variable for the estimation of the explosive power of the lower extremities and coordination.

In research (Camliguney, Ramazanoglu, Atilgan, Yilmaz, & Uzun, 2012) that was aimed to observe the effects of intensive ski training, for a period of six days, the authors state that there was an improvement in the results of the experimental ski group compared to the control group in the dynamic-isometric leg strength test. As possible causes of these changes, the authors stated that while performing skiing, balance and movement controls represent the foundation of skiing for the lower extremities. This is especially true when, while training on skis, the centre of gravity approaches the ground, and there are frequent dynamic and isometric contractions of the mus-

cles, leading to an increase in leg strength. Cigrovski, Bilić, Prlenda, and Martinčević (2010), state that research on competitors in alpine skiing has shown that the explosive power of the lower extremities is highly correlated with the result, whether among young alpine skiers or older skiers and also added that motor ability explosive strength is not crucial in the initial phases of the adoption of ski knowledge and does not represent a significant link for beginners when acquiring the basics of the sport.

Cigrovski et al. (2012) conducted a study on a sample of 86 male respondents of average age 22.76±1.15, beginners with no previous skiing experience, which is aimed at determining the impact of some motor abilities on the success in learning alpine skiing. The results obtained in their study indicate the positive impact of agility, static leg strength and balance on learning the initial alpine skiing technique. Accordingly, they recommend to all future recreational skiers to optimize the level of motor abilities listed before going to the ski slopes.

In contrast, Mujanovic (2008) in his research to determine the prognosis of results in alpine skiing in the basic variable parallel turns based on motor abilities, concluded that the prediction of results in the criterion variable based on motor abilities is better with the help of the whole system of predictor variables and that the prognosis of the results is only possible when adequate and complete physical preparation has been carried out to increase motor abilities to the optimum level for easier mastering of the basic elements of alpine skiing technique. Furthermore, Mujanović and Krsmanović (2008) indicate that for successful mastering of the ski elements short turns and basic turns is required adequate physical preparation of all motor abilities equally.

In the study by Hydren et al. (2013), which aimed to determine the acute impact of exposure to higher altitudes during ski camp on the specific abilities of ski competitors age 13.7±0.5, the results revealed improved balance and reaction time during the first three days; on the sixth day, there was an improvement in vertical jumps, flexibility, agility in the T-test and push-ups.

Based on the aforementioned results of the previous research as well as the results obtained in this research, the general conclusion is that there is a causal relationship between mastering skiing technique and motor abilities, or that an increase in the level of motor abilities, agility and static leg strength during learning skiing, if sufficiently trained, can affect the success of mastering skiing techniques. This study and all previous ones emphasize agility, static leg strength and balance as the key to achieving success in skiing; however, while learning skiing contributes to better management of agility, static leg strength and balance, it is necessary to include exercises that enhance these abilities in fitness training.

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Conflict of Interest
The author declare that there are no conflicts of interest.

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