EFFECTS OF PROGRAM OF INTENSIVE TRAINING OF ALPINE SKIING TECHNIQUES ON SOME MORPHOLOGICAL CHARACTERISTICS

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Abstract
The aim of this research was to determine the effects of experimental short-term program of intensive training of alpine skiing techniques (experimental program) on morphological characteristics (body composition) of students. The sample is divided into an experimental group (31 males, age 21.4 ± 1 and body height 180.7 ± 6.3cm) beginners who were on skis for the first time and control group (34 males, age 20.6 ± .8 and body height 180.3 ± 6.8 cm). The following body parameters were measured at the beginning and end of the experimental program: body weight, body mass index, fat percent, total weight (in kg) of fat in the body, total weight (in kg) of body mass without body fat, total weight (in kg) of water in the body. To determine the effects of an experimental program on some morphological characteristics of students a univariate covariance analysis was applied. Results of ANCOVA show statistically significant effects of the applied experimental program in variable total weight (in kg) of water in the body p = .018 where the variable showed higher values for the experimental group compared to the control group.
Key words: *Ski training, students, body composition*

INTRODUCTION

Alpine skiing is a sport and recreational physical activity which takes place in specific and complex winter mountain conditions, during which skiers overcome the steepness of different slopes using different ski techniques (Matković, Ferenčak & Žvan, 2004). Movements in alpine skiing are generated by external forces, mainly gravity (Klous, Müller & Schwameder, 2014) so the effectiveness of skiing requires the match in the movement of individual parts of the body and the whole body, i.e. coordinated action of the whole body of the skiers where work of the legs, upper body and hands is equally important (Mujanović, Atiković & Nožinović Mujanović, 2014). Skiing activity especially in the conditions of initial learning of alpine skiing technique, is quite tense and takes place over a longer period of time during the day, with physical and psychological loads, caused by adaptation to new equipment and external tough conditions. Alpine skiing belongs to the group of sports, where the combined work is reported of cyclic (rhythmic connection of turns) and acyclic (breaks, jumps, etc.) structures of movement with multiple changes of effort, maximum and submaximal intensity. Somatic characteristics of skiers are mainly defined with anthropometric, motor and functional characteristics of the organism (Dodig, 1980). Anthropometric characteristics of skiers represent a number of dimensions of skeleton dimensionality and plays an important role as a factor of the amount of subcutaneous fat which, due to the high energy consumption of skiers, is subject to the reduction process (Dodig, 1980).

The learning process and advancement in skiing is very complex, meaning skiing teacher is a versatile person who knows the technique of skiing, methodology and psychology so that students can transfer knowledge in an efficient and easy way. All this will be achieved if the exercise takes place according to the ski school program whose purpose is to accelerate the process of mastering the skiing knowledge and is based on his ability to allow gradual learning in skiing where skiing elements and methodical exercises are arranged for each other in the order in which they should be trained. (Mujanović, Nožinović Mujanović i Šabović, 2012). Different training programs provide improvements in body composition as well as improving balance maintenance skills (Camliguney, Ramazanoglu, Atilgan, Yilmaz & Uzun, 2012). The Learning setup method must always contain precise settings that allow you to perform the tasks correctly. Exercises must be put into concrete tasks because wrong adoption is difficult to correct, and when it comes to motion automation, it's almost impossible to correct the mistakes (Hadžić, 2006).
The aim of this research was to determine the effects of experimental short-term program of intensive training of alpine skiing techniques (experimental program) on morphological characteristics (body composition) of students.

METHODS

Participants

The test sample included 60 male students enrolled in the second and third year of study at

the Faculty of physical education and sport University of Tuzla. The sample is divided into an experimental group (31 males, age 21.4 ± 1 and body height 180.7 ± 6.3cm) beginners who were on skis for the first time and control group (34 males, age 20.6 ± .8 and body height 180.3 ± 6.8 cm). Students who participated in the study were healthy, without those excused from physical education for health reasons, and they all 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

For the assessment of morphological characteristics we used Body Composition Analyzer Tanita TBF- 300a, Tokyo, Japan which works on the principle bioelectrical impedance analysis (BIA). From the parameters measured by the measuring instrument as variables were taken into account: WEIGHT – body weight, BMI – body mass index, FAT% - fat percent, FAT MASS – total weight (in kg) of fat in the body, FFM – total weight (in kg) of body mass without body fat, TBW – total weight (in kg) of water in the body.

Procedure

The assessment of morphological characteristics selected for this research was conducted two days before and after the end of the experimental program which lasted six days. Experimental program was implemented on a daily basis during the period 09:00-16.00h in duration of 33 hours in 6 days (4 hours of training with instructors i 2 hours of free practice 5 days and on 6th day 3 hours of free practice).

Experimental program is designed for beginners to learn the basic techniques of alpine skiing. The program itself (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 et al., 1993; AlmÍsbakka et al., 2004).

During the period of experimental treatment, the control group will perform 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 program elaborated on daily basis

Learning day	Design of experimental program
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 program on some morphological characteristics 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 where 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. This means that there are no significant differences between the variants and 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.

Table 2. Leven's test for both groups of respondents in variables for estimating morphological characteristics

Dependent Variable	F	df1	df2	p-value
WEIGHT	.488	1	63	.488
BMI	.340	1	63	.562
FAT%	.039	1	63	.843
FATMASS	.543	1	63	.464
FFM	1.561	1	63	.216
TBW	.266	1	63	.608

The real and statistical significance of the improvement of results was checked by the procedure ANCOVA which equates the results of both groups of respondents on initial measurement. Results of ANCOVA within the variables for the evaluation of morphological characteristics show statistically significant effects of the applied experimental program in one of the six used variables at the level of significance p < .05 in variable TBW p = .018. The mean values obtained (M) in said variable showed higher values for the experimental group compared to the control group.

Table 3. Results of ANCOVA within the variables of morphological characteristics

Dependent Variable		Control group		Experimental group		ANCOVA	
		M	SD	M	SD	F	p-value
WEIGHT	I	73.553	7.5149	78.281	11.8324	2.394	.127
	F	73.697	7.4314	78.874	11.4977		
BMI	I	22.459	1.9389	23.939	2.7716	.066	.797
	F	22.709	2.1524	24.161	2.5726		
FAT%	I	11.150	3.6565	14.726	4.5382	.004	.950
	F	11.912	4.3691	15.190	3.8246		
FATMASS	I	8.341	3.2768	11.910	4.8755	.003	.956
	F	8.938	3.7346	12.313	4.4424		
FFM	I	65.206	5.6618	66.371	8.0360	3.470	.067
	F	64.759	5.7994	66.577	7.7331		
TBW	I	47.729	4.1372	48.597	5.8828	5.938	**.018**
	F	47.409	4.2505	48.865	5.5455		

DISCUSSION

The main aim of the presented research was to determine the effects of experimental program on morphological characteristics of students.
As we see in the results the program was effective only on level of TBW which increased at experimental group. TBW level may vary according to respodents hydration level. Increasing hydration can occur with increasing levels in the body muscle mass. In table 3. we can see that there was an increase in the mean values of all measured variables in the experimental group although not statistically significant, which

could have affected a significant increase in the level of TBW. By observing such results it can be concluded that the intensity of exercise during ski training moved in the mode of operation when energy is not released by fat burning.

Few studies worldwide have investigated the effects of a short-term intensive skiing exercise program in healthy young adults (Camliguney et al., 2012; Staniszewski, Zybko & Wiszomirska, 2016; Wojtyczek, Pasławska & Raschner, 2014). They do not mention the effects of exercise on morphological characteristics, therefore, direct comparison of study results is difficult. In the research of Camliguney et al. (2012). body composition results were obtained prior to training and measured by X-SCAN equipment. It can be seen that the subjects of the experimental group was 23.75±2.13 year old, 178.80±8.31cm of body height and they had 78.97±10.01kg of body weight, 22.48±4.61 of FAT%, 51.87±1.47kg of FFM and 24.61±1.95 of BMI. The control group respondents was 23.18±2.44 year old, 180.59±8.cm of body height and they had 77±11.34kg of body weight, 20.56±5.29 of FAT%, 56.45±7.13kg of FFM and 23.57±2.89 BMI. In the research of authors Staniszewski et al. (2016), the participants were divided into two groups of ten beginners who were on skis for the first time (20.7±1.1 years old, body mass 76.4±8.7 kg, body height 184.4±6.1cm) and advanced skiers with several years of experience in skiing (20.5±0.5 years old, body mass 80.5±13.7 kg, body height 184.5±9.5cm). Wojtyczek et al. (2014), stated that their subjects were 20.5 ± 0.81 years of age, 182±6.51 of body height, 80±9.62 of body mass and 24±2.26 of BMI. Looking at the results of these researches we can observe that the respondents in our research had similar average values of the investigated variables before conducting the experimental program.

A study of authors Akgul and Cakmakci (2017), performed on 9 male boxer at elite level (24.11±4.137 years of age, 179.22 ±6.72cm of height) to investigate the 6-week boxing training program on body composition it was found to be significant lower than the pre-test values of body weight and BMI test values ($P<0.05$). There is no statistically significant difference in BMR, FAT, FMASS, FFM and TBW pre-test values compared to post-test values ($P>0.05$).

Also, the study of authors Nožinović Mujanović, Ćosić, Mujanović and Hadžibulić-Nurković (2015), performed on 30 persons of a female gender to investigate the effects of 8-week Zumba dance program on body composition and the mood state profile it was found to be significant lower than the pre-test values of body weight, BMI and FATMASS test values ($P<0.05$) while there is no statistically significant difference in FFM and TBW pre-test values compared to post-test values.

It is obvious that activities that are more dynamic and longer in time will increase the consumption of calories and lead to significant changes in body composition. Learning to ski is a physical activity, but the level of exercise is not at the level of the aforementioned research, so the results are probably like this. On the other hand, if we want to get more accurate data on the amount of energy consumed and the effects on body composition, we need to control the nutrition intake in order to get the most accurate results.

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