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Original scientific paper

Success in Adopting Technique of Alpine Skiing with Respect to Motor Abilities of the Children Aged 7–8 Years

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ABSTRACT

The aim of this research was to determine relations between estimated motor abilities and efficiency of alpine ski learning in children ski beginners. It included 54 children between 7 and 8 years of age (average 7.44±0.52years). Children were tested for balance, agility, strength, coordination and frequency of movement on ten motor ability tests. After motor abilities were assessed, participants learned alpine skiing during six-day alpine ski school and upon completion of ski school program, were tested on three elements of alpine ski technique (stopping in a snow-plough, uphill turn and turns around the posted marks) by three independent judges. According to achieved level of ski knowledge, they were allocated to three groups differing by the level of success; less successful (N=18; 26–44 points), moderately successful (N=11; 45–48 points) and successful (N=25; 49–55 points). Significant differences in success of adopting basic ski technique were noticed with respect to the results achieved in the task polygon backwards (F=6.162, p=0.004), foot tapping (F=6.337, p=0.003) and crossed arm sit-ups (F=3.099, p=0.053). The participants who successfully adopted the basic ski technique also achieved good results in tests: polygon backwards, foot tapping, crossed arm sit-ups, side steps, balancing on left leg perpendicular on balance board, vertical jump and medium results in tests 20m dash and balancing on right leg perpendicular on balance board. Our results suggest that successful participants have better developed coordination, frequency of movement, strength and agility.

Key words: *ski skills, children, motor abilities, learning program, assessment*

Introduction

Children grow and develop intensively and the opportunity to take part in different physical activities improves their regular process of development[1]. In the preschool and early primary school years they learn the basic types of motor activity and that is a fundamental motor skill stage upon which they acquire more advanced skills such as coordination, speed, strength, flexibility, balance, and precision[2–4]. Mentioned age is also the time when selection of talented children for specific sport takes place and serious training for competitive sport starts. In alpine skiing, successful adoption of basic ski technique at preschool age is one of the first preconditions for detection of young talents. Numerous researches confirmed the connection between the certain motor abilities and the success of adult competitors in alpine skiing[5–7]. Authors mainly accentuate explosive strength, agility, balance and coordination as the dominant prerequisite motor abilities for success in competitive alpine skiing[8–12]. Significantly fewer studies were oriented toward the investigation of motor abilities important for the process of learning alpine skiing[13–16]. Moreover, there are almost no studies of alpine ski learning of children at preschool and younger primary school age at the initial states of training, although the importance of early detection of talents is constantly stressed. Therefore, another issue while testing motor abilities of preschool and early primary school children important for adoption of alpine ski technique is selection of adequate test battery. In our research we selected ten standardized tests, which are the most frequently used in numerous

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research for the assessment of motor abilities of the children[17–21].

The research question of this investigation is whether the motor abilities known to contribute to success of an adult skier – competitor, influence the efficiency of adoption of basic ski technique of children, beginners at skiing. The objective of this research was to determine whether differences exist in adoption of basic ski technique with respect to motor abilities of the children aged 7–8 years.

Materials and Methods

Study population: The research was conducted on 54 children aged 7–8 years who attended ski school for the first time and never skied before. Mean age of the participants was 7.44±0.52 years. For participation in this research the written consent was obtained from parents of all participants.

Variables: The assessment of motor status was conducted using the battery of ten standardized tests for evaluation of motor abilities: balancing on the right leg perpendicular on balance board, balancing on the left leg perpendicular on balance board, bend and touch on a bench, foot tapping in 15 seconds, polygon backwards, vertical jump, standing long jump, side steps, 20m dash and crossed arm sit-ups in 60 seconds[22]. Tests were repeated three times, and the best result was selected as final. The tests battery for the assessment of motor abilities of participants in this study, were selected according to the up-to date research and the tests which are selected are usually chosen for the assessment of motor abilities for the ski competitors[7–9], ski instructors[12], as well as children aged 7–8 years[17–21]. The assessment of the adopted ski technique elements was performed through the following tasks: stopping in a snow-plough, uphill turn and turns around the posted marks. Mentioned elements are good representatives of basic alpine ski school and they implement: basic ski posture during movement, characteristic movements for snow plough and parallel ski technique, ways of stopping and changes of moving directions.

Study design: The training in basic techniques of alpine skiing followed the same curriculum for all participants, and lasted six days. Program was based on two hours daily of alpine ski learning with ski instructor according to previously determined protocol. In this investigation special attention was given to the selection of ski instructors and judges engaged in the grading process. They were all experienced in teaching alpine skiing and evaluation of ski technique. After completing the alpine ski learning program, participants' knowledge of alpine skiing was determined by three independent judges. Judges attributed grades from one to five for the demonstration of three representative elements of alpine ski technique (one representing poor and five superb demonstration). The final grade for the adoption of the basic ski technique was derived from all the grades given for the demonstration of the chosen elements of basic ski technique. Grades were added, and according to their frequency statistically transformed into the categories: less successful, moderately successful and successful.

Statistical analysis: Descriptive statistics were calculated for all variables. Obtained distributions were tested by Kolmogorov-Smirnov test in order to determine distribution of variables. Between the groups differences on each variable were tested by ANOVA. Existing differences were determined by Fischer test. By calculating the discrimination coefficients, distinguished were the specific features of the sub-groups. The features of each subgroup and homogeneity were defined using mathematical and statistical analysis. Results were considered significant if it was below or equal to 0.05.

Results

After data collection was done, participants were categorized into three groups according to results achieved during basic alpine ski school: less successful (N=18) moderately successful (N=11) and successful (N=25). The participant with the lowest score of adopting basic ski technique had 26 points and with the highest score had 55 points. In the category of less successful participants had between 26 and 44 points; moderately successful participants achieved between 45 and 48 points and those that were successful achieved between 49 and 55 points. In Table 1 are shown descriptive statistics of participants' motor variables in order to get an overview of the basic group characteristics according to their success of adopting basic ski technique.

Mean values of motor variables of the participants aged 7–8 years are within the expected range for that age[23]. Results of the tests of foot tapping and crossed arm sit-ups, expressed by the number of repetitions within a certain time, were treated as categorical variables. From methodological point of view results of tests that are expressed in number of repetitions are more properly analyzed in mentioned manner. On the basis of the cumulative sum of frequencies, for the foot tapping results were arranged as follows: poor (8–13 repetitions), average (14–15 repetitions), good (16 and more repetitions), and for the crossed arm sit-ups: poor (up to 14 repetitions), average (15–20 repetitions), good (21 and more repetitions).

In Table 2 are presented the test results of foot tapping and crossed arm sit-ups, according to participants' success in adoption of ski techniques. Results showed that participants with poor results in the test foot tapping (between 8 and 13 repetitions) were those who were moderately successful in adopting ski technique. Those with 14 and 15 repetitions in the same test were less successful in adopting ski technique, while participants with 16 and more repetitions successfully adopted alpine ski technique.

Additionally, participants can be differentiated according to the results achieved in test crossed arm sit-ups (Table 2). Less successful in adopting alpine ski technique were participants with poor results in test crossed arm sit-ups (up to 14 repetitions). Participants achieving be-

TABLE 1
DESCIPTIVE STATISTICS of participants' motor variables (n=54) as per success in adopting basic ski Technique

Motor variables	Less successful in adopting basic ski technique (N=18)			Moderately successful in adopting basic ski technique (N=11)			Successful in adopting basic ski technique (N=25)		
	$\overline{X}$	SD	p	$\overline{X}$	SD	p	$\overline{X}$	SD	p
Balancing on the right leg (s)	2.03	0.87	0.199	2.61	2.20	0.280	2.08	0.86	0.311
Balancing on the left leg (s)	1.77	0.56	0.762	1.73	0.7.8	0.435	2.17	1.51	0.051
Bend and touch on a bench (cm)	43.28	3.53	0.897	41.09	7.13	0.999	44.64	7.21	0.981
Polygon backwards (s)	27.56	8.51	0.475	29.46	12.37	0.866	19.87	7.27	0.568
Vertical jump (cm)	19.50	7.42	0.014	19.09	5.30	1.000	21.04	6.13	0.325
Standing long jump (cm)	109.72	17.56	1.000	112.91	22.32	0.556	120.96	21.87	0.824
Side steps (s)	16.90	3.51	0.687	17.70	5.68	0.251	15.45	3.25	0.482
20m dash (s)	5.52	0.99	0.061	5.15	0.79	0.681	5.19	0.72	0.867
Foot tapping (n)	15.00	1.59	0.000	15.90	1.97	0.200	17.00	2.34	0.046
Crossed arm sit-ups (n)	24.89	9.53	0.048	23.81	7.11	0.200	28.33	9.73	0.200

$\overline{X}$ – Mean value, SD – Standard Deviation, p – the value of Kolmogorov-Smirnov test

TABLE 2
the representation of the variable foot tapping and CROSSED ARM sit-ups as per success in adopting basic ski Technique

Motor variables	Less successful in adopting basic ski technique (N=18)						Moderately successful in adopting basic ski technique (N=11)						Successful in adopting basic ski technique (N=25)					
	Poor Result		Moderate Result		Good Result		Poor Result		Moderate Result		Good Result		Poor Result		Moderate Result		Good Result	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Foot tapping	3	16.66	13	72.22*	2	11.21	2	18.18	4	45.45	5	36.36	2	8.00	8	32.00	15	60.00*
Crossed arm sit-ups	5	27.77	9	50.00*	4	22.22	1	9.09	4	36.36	6	54.54	6	24.00	5	20.00	14	56.00*

* – significance of the differences between the groups within one estimate

tween 15 and 20 repetitions of crossed arm sit-ups were also in the group of less successful in adoption of basic ski technique. Participants who achieved good results in test cross arm sit-ups (21 and more repetitions) are those who were successful in adopting basic ski technique. Therefore, a positive correlation exists between participants and level of motor abilities such as frequency of movement and strength of abdominal (core) muscles. Statistically significant differences were observed in the success of adopting basic ski technique depending on motor variables by ANOVA (Table 3).

Significant differences were detected between the groups stratified according to their success of adopting basic ski technique with respect to the results achieved on polygon backwards (F=6.162; p=0.00), foot tapping (F=6.337; p=0.00) and crossed arm sit-ups (F=3.099; p=0.05), whereas with other motor variables no significant differences were observed. According to the discrimination coefficient, polygon backwards (Table 3) was the motor variable which contributed the most to the differentiation among groups as per successful adoption of basic ski technique. Participants aged 7–8 were less successful in adopting basic alpine ski technique if they achieved poor results in tests 20m dash, balancing on the right leg and average results in tests polygon backwards, side steps, balancing on the left leg and vertical jump. Participants

TABLE 3
DEGREE OF DIFFERENCE BETWEEN GROUPS STRATIFIED ACCORDING TO THE LEVEL OF ACHIEVED KNOWLEDGE OF BASIC SKI TECHNIQUE ACCORDING TO MOTOR VARIABLES

Motor variables	F	p	Discrimination coefficient
Balancing on the right leg	0.869	0.425	0.066
Balancing on the left leg	0.903	0.412	0.013
Bend and touch on a bench	1.259	0.293	–
Polygon backwards	6.162	0.004	0.269
Vertical jump	0.478	0.623	0.011
Standing long jump	1.668	0.199	–
Side steps	1.488	0.235	0.036
20m dash	1.035	0.363	0.085
Foot tapping	6.337	0.003	0.203
Crossed arm sit-ups	3.099	0.053	0.132

with poor results in tests polygon backwards, side steps, balancing on the left leg and vertical jump as well as with good results in the tests 20m dash and balancing on the right leg were moderately successful in adoption of basic alpine ski technique. Finally, the group of participants who successfully adopted the basic ski technique achieved good results in tests polygon backwards, side steps, balancing on the left leg, vertical jump and average results in the tests 20m dash and balancing on the right leg. Based on the above stated one could predict that the participants whose level of motor abilities is similar to the tested participants who adopted the basic ski technique successfully would belong to the same success group. In other words, it is possible to predict with certain reliability which child would be successful in adopting ski technique.

Discussion and Conclusion

Some investigations in the field of recreational alpine skiing are dedicated to finding reasons behind more successful alpine ski learning[24]. As it is well known that level of certain motor abilities correlates with success of alpine ski racing[6,7,9,11], one can assume that development of motor abilities plays an important role in acquisition of basic alpine ski technique. Results of our investigation accentuate the importance of motor variables polygon backwards, foot tapping and crossed arm sit-ups for the success of alpine ski learning of children aged 7–8. It was noted that the participants who achieved good results in these tests were the most successful in adopting basic ski technique. Coordination is a complex motor ability, important for structuring the movement. To be fully developed, it requires developed nervous system as well as other, basic motor features[25]. Coordination is needed for the adoption of basic ski technique, and by the age 7–8 it is sufficiently developed[26]. Children aged 7–8 included in our investigation who successfully adopted basic ski technique performed better in test foot tapping. Contribution to difference between groups as per success in adoption of ski technique is significant with respect to mentioned test, and such results point to the conclusion that the capacity of body to timely and quickly exclude and include the opposite, antagonist muscle groups is mainly developed at that age. Movement frequency (speed of alternative movements) which is estimated by foot tapping closely correlates to coordination, which proved to be an important factor for adopting basic ski technique in children. The movement frequency is determined by the speed of responding to nerve stimulation, speed of relaxing after contraction and the condition of antagonist muscles[27]. It is also affected by energy mechanisms and nerve regulation mechanisms. With junior alpine female skiers Dolenc and Žvan[7] found statistically significant relations between the result of foot tapping and final success in the sport that is number of points on the list of competitors. As for test crossed arm sit-ups, mainly used to assess the muscle strength, participants who did better on this test successfully adopted basic ski technique. This shows that with the ages of 7–8 the muscles are developed enough to contribute to the success of adopting basic ski technique[28]. Strength of abdominal and back muscles and their relation is extremely important for young skiers. It not only enables the core stability, but also minimizes the risk of injury. Beside the normal growth pattern in children, strength of core muscles also contributes to better coordination of movements executed during skiing. The core stability is namely important for coordination of movements of upper and lower body during skiing. So, one can perceive that young skiers with better developed strength of abdominal muscles more easily coordinate movement of upper and lower body and therefore can longer hold balance during skiing. With skiers-competitors aged 12–13, Lesnik[29] determined statistically significant interaction between the motoric test crossed arm sit-ups ($p<0.05$) with the success of a competitor on the list. More successful competitors had better results in the tests mentioned. According to our results one can predict that children, ski-beginners will be more successful in adopting basic ski technique if characterized by more developed motor abilities coordination, movement frequency and abdominal muscle strength. Dolenc and Žvan[7] came to the similar findings when studying young girls, alpine skiers. Mentioned authors determined statistically significant interconnectedness between the results achieved in polygon backwards, side steps and foot tapping and the final success in the alpine skiing, measured by the number of points on the rank list. Although balance is important for alpine skiing, in this study it actually did not show to be statistically significant for adopting the basic ski technique. Test for assessing the balance – balancing on the one leg perpendicular on balance board, which was chosen for this research as most frequently used when testing skiers competitors (both children and adults), might not be proper for balance assessment in children. When analyzing specific movements during alpine skiing, one can conclude that during initial, learning phases, dynamic balance is more important than static[30]. So, if dynamic test for balance assessment was to be used, one would probably determine correlation between level of balance and success of alpine ski learning. The group of participants who successfully adopted the basic ski technique is characterized by the statistically significant achievement in tests: polygon backwards, foot tapping and crossed arm sit-ups, but also by achievement of good results in tests: side steps, balancing on the left leg, vertical jump and medium results in the tests 20m dash and balancing on the right leg. Based on the above stated one can predict that the participants whose features are similar to the features of ones who adopted the basic ski technique successfully would belong to the same success group. In other words it is possible to make a forecast with certain reliability which child would be successful in adopting basic ski technique.

In our research we selected the battery of ten standardized tests for the assessment of motor abilities of the participants aged 7–8 years. This is perhaps the main drawback of the study. From the methodological point of

view, in order to better define the structure of motor capacities, one would need to use a larger battery of tests. On the other hand, most authors[31], involved in the research of motor skills of children, emphasize the need of maximally rationalized test battery while children are unable to maintain focus for longer time and are not easily and prolonged motivated. When working with preschool age and younger school age children, authors most frequently apply the batteries of 7 to 12 tests[32] designed that they can be performed within 35 to 40 minutes, using very simple equipment[33,34]. One of the problems is that the protocol for measuring the motor capacities in elite alpine skiers and adult skiers cannot always be adequately implemented in children. Measuring the motor capacities regularly involves the highest engagement of the examinees. In children it is difficult to achieve attention and awareness of the need to obtain the maximum energy engagement, which is the basis to determine the status in certain motor capacities[32]. Scientific importance of this research is in identifying the relevant features for success in the initial stages of training in alpine skiing and closer encounter with the feedback on cause and effect relations between motor abilities on one hand and success in adopting ski technique on the other. Such information enable the comparison of results obtained with the results in the previous level of training and also comparing the results obtained with the results of other skiers of same gender and age. The results of this study should assist skiing instructors in their every day work, preparing the work plan for training with children and also in planned and systematic monitoring and assessment of success and speed of adoption of ski technique. Ski instructors can use the results of this study in work on planned and systematic development of the mentioned motor abilities with competitor skiers of the youngest age, in order to meet the ever increasing requirements of modern alpine skiing. Those requirements are the result of greater speed, and with that occurrence of stronger forces affecting the skeletal and muscle system of a human body. To the best of our knowledge there is no literature on children of preschool and younger-school age in the initial stages of alpine ski training, and hence this study is especially important.

REFERENCES

1. FINN K, JOHANNSEN N, SPECKER B, J Pediatr, 140 (2002) 81. — 2. FISHER A, REILLY JJ, KELLY L, MONTGOMERY C, WILLIAMSON A, PATON JY, GRANT S, Med Sci Sports Exerc, 37 (2005) 684. — 3. WILLIAMS HG, PFEIFFER KA, O'NEILL JR, DOWDA M, MCIVER KL, BROWN WH, PATE RR, Obesity (Silver Spring), 16 (2008) 1421. — 4. HARDY LL, KING L, FARRELL L, MACNIVEN R, HOWLETT S, J Sci Med Sport, 13 (2010) 503. — 5. BACHARACH DW, VON DUVILLARD SP, Med Sci Sports Exerc, 27 (1995) 305. — 6. KLIKA RJ, MALINA RM, Predicting skiing performance in 14–18 year old competitive alpine skiers. In: Proceedings (International Congress of Science and Skiing, London, 1997). — 7. DOLENEC M, ZVAN M, KinSi, 7 (2001) 19. — 8. WHITE AT, JOHANSONS SC, Int J Sports Med, 15 (1993) 170. — 9. BOSCO C, Evaluation and Planning of conditioning training for alpine skiers. In: Proceedings (International Congress of Science and Skiing, London, 1997). — 10. FETZ F, A profile of sensorimotor balance of alpine skiers. In: Proceedings (International Congress of Science and Skiing, London, 1997). — 11. NEUMAYR G, HOERTNAGL H, PFISTER R, KOLLER A, EIBL G, RAAS E, Int J Sports Med, 24 (2003) 571. — 12. MALEŠ B, FRANJKO I, KUNA D, Coll Antropol, 37 (2013) Suppl. 2: 77. — 13. CIGROVSKI V, MATKOVIĆ B, MATKOVIĆ RB, Which motor skills contribute to better learning of ski technique elements. In Croat. In: Proceedings (3rd International Conference Contemporary Kinesiology, Mostar, 2008). — 14. MUJANOVIC E, KRSMANOVIC R, International Scientific Journal of Kinesiology, 5 (2008) 61. — 15. OREB G, VLAŠIĆ J, CIGROVSKI V, PRLENDA N, RADMAN I, Relationship between rhythm and learning alpine skiing technique. In: Proceedings (6th FIEP European congress, Poreč, 2011). — 16. CIGROVSKI V, BOŽIĆ I, PRLENDA N, SportLogia, 8 (2012) 188. — 17. KATIC R, MALEŠ B, MILETIC D, Coll Antropol, 26 (2002) 533. — 18. BALA G, JAKŠIĆ D, KATIĆ R, Coll Antropol, 33 (2009) Suppl. 2: 373. — 19. BALA G, KinSi, 9 (2003) 5. — 20. KATIĆ R, Coll Antropol, 27 (2003) Suppl. 1: 351. — 21. DELAS S, MILETIC A, MILETIC DJ, Physical Education and Sport, 6 (2008) 31. — 22. METIKOŠ D, HOFMAN E, PROT F, PINTAR Ž,OREB G, Measuring basic motor dimensions of athletes. In Croat. (University of Zagreb, Zagreb, 1989). — 23. DÜGER T, BUMIN G, UYANIK M, AKI E, KAYIHAN H, Pediatr Rehabil, 3 (1999) 125. — 24. SAVIĆ Z, STOJANOVIĆ T, STOJILJKOVIĆ N, JORGIĆ B, Physical education and Sport, 11 (2013) 147. — 25. ASSAIANTE C, Neurosci Biobehav Rev, 22 (1998) 527. — 26. BAZILE C, SIEGLER IA, BENGUIGUI N, Plos One, 8 (2013) 10:E74127. — 27. BERG HE, EIKEN O, Med Sci Sports Exerc, 31 (1999) 1065. — 28. TESCH PA, Med Sci Sports Exerc, 27 (1995) 310. — 29. LEŠNIK B, ZVAN M, KinSi, 4 (1998) 27. — 30. RUŽIĆ L, RAĐENOVIĆ O, TUDOR A, The predictive power of balance board: tests for »on-the-skis» balance performance. In: Proceedings (5th International Scientific conference on Kinesiology, Zagreb, 2008). — 31. TIEMAN BL, PALISANO RJ, SUTLIVE AC, Ment Retard Dev Disabil Res Rev, 11 (2005) 189. — 32. PIEK JP, HANDS B, LICARI MK, Neuropsychol Rev, 22 (2012) 402. — 33. OLIVER M, SCHOFIELD GM, KOLT GS, Sports Med, 37 (2007) 1045. — 34. PATE RR, O'NEILL JR, MITCHELL J, Med Sci Sports Exerc, 42 (2010) 508.

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USPJEŠNOST USVAJANJA SKIJAŠKE TEHNIKE OVISNO O RAZVIJENOSTI MOTORIČKIH SPOSOBNOSTI DJECE U DOBI 7–8 GODINA

S A Ž E T A K

Cilj istraživanja bio je utvrditi relacije između procijenjenih motoričkih sposobnosti i uspjeha prilikom usvajanja elemenata skijaške tehnike kod skijaških početnika. Istraživanje je provedeno na 54 ispitanika, u dobi od 7 i 8 godina (7,44±0,52). Ispitanicima je procijenjena ravnoteža, agilnost, snaga, koordinacija, brzina frekvencija pokreta pomoću deset motoričkih testova. Nakon procjene motoričkih sposobnosti, ispitanici su po istom programu bili poučavani osnovama alpskoga skijanja u trajanju od sedam dana. Zatim je provedeno ocjenjivanje usvojenog skijaškog znanja od strane tri nezavisna ispitivača i to na tri elemenata skijaške tehnike (zaustavljanje u plužnom položaju, zavoj k brijegu te zavoj oko oznake). Prema razini usvojenog skijaškog znanja, a nakon provedenog postupka ocjenjivanja ispitanici su svrstani u tri grupe: manje uspješni (N=18; 26–44 boda), umjereno uspješni (N=11; 45–48 bodova) i uspješni (N=25; 49–55 bodova). Utvrđena je statistički značajna razlika između tri grupe ispitanika (prema uspješnosti usvajanja skijaških znanja) u odnosu na: test za procjenu koordinacije-poligon natraške (F=6,162, p=0,004),test za procjenu brzine frekvencije pokreta-taping nogom (F=6,337, p=0,003) te test za procjenu snage-podizanje trupa za 60 sekundi (F=3,099, p=0,053). Na osnovu analize rezultata moguće je zaključiti kako ispitanici uspješne grupe imaju također i više razvijenu koordinaciju, brzinu frekvencije pokreta, snagu te agilnost.