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EDITORIAL

Annales Kinesiologiae has published several scientific articles, adding an important value to the role and importance of regular physical / sports activities as well as for the holistic and harmonious development of every individual. Focusing on an individual's health and prevention, several articles present interesting research findings about the preventive role of physical / sports activity and its influence on the overall quality of life. Our readers can also get an insight into numerous events, scientific meetings and congresses with a common straightforward effort to raise awareness of the discussed values. In this number, the topic is presented from a slightly different perspective. These articles all have a common starting point aiming to contribute to a successful sports performance and the quality of exercise. The studied factors are highlighted by both the social aspect − the role of the group and social integration, the set of appropriate nutrition strategies, as well as the functional aspect − the role of motor abilities and technical knowledge. The process of training and development of an individual involved are usually organized and guided by experts − kinesiologists and trainers in cooperation with the interdisciplinary team and, of course, parents when talking about the period of childhood. With the professionally adapted and integrated, but above all, coordinated operation of these factors, we can multiply the effects and impact of exercise and the sport results which is not only shown in sports results or ranking, but will represent an important positive experience for further and sustainable engagement in physical / sports activities.

prof. Rado Pišot, Ph.D.
Editor-in-Chief and Managing Editor

UVODNIK

O vlogi in pomenu redne gibalne/športne aktivnosti za celosten in skladen razvoj posameznika, za njegovo zdravje, o preventivni vlogi ter vplivu na kakovost življenja, smo v Annales Kinesiologiae objavili že vrsto znanstvenih člankov ter ob tem našim bralcem predstavili številne dogodke, znanstvena srečanja in kongrese, ki jim je skupno ravno prizadevanje za uzaveščenje omenjenih vrednot. V številki, ki je pred vami, je ta problematika izpostavljena nekoliko drugače. Prispevki imajo skupno izhodišče v doprinosu k uspešnemu športnemu nastopu in kakovosti vadbe in treninga. Kot pomembne dejavnike za doseganje cilja pa izpostavljajo tako socialni vidik – vlogo skupine in socialne integracije ter nabora ustreznih strategij prehranjevanja, kot tudi funkcionalni vidik – vlogo gibalnih sposobnosti ter tehničnega znanja. Sam proces vadbe in razvoja posameznika vključenega v vadbo in trening običajno vodijo in usmerjajo strokovnjaki – kineziologi in trenerji, v sodelovanju z interdisciplinarnim timom ter seveda starši ali skrbniki, ko govorimo o obdobju otroštva. S strokovno prilagojenim, celostnim, predvsem pa usklajenim delovanjem navedenih dejavnikov, lahko multipliciramo učinke in doprinos vadbe ter športnega dosežka tako, da ta ne bo izkazan le na področju športnega rezultata/uvrstitve, temveč bo predstavljal pomembno pozitivno izkušnjo ter spodbudo za nadaljnje in trajno udejstvovanje v gibalni/športni aktivnosti.

prof. dr. Rado Pišot,
glavni in odgovorni urednik

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INFLUENCE OF SOCIAL INTERACTION IN A GROUP ON YOUNG GIRLS' PHYSICAL PERFORMANCE

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ABSTRACT

It is assumed that there are many factors influencing sport performance in youth sport. This research is designed to find out whether there are any differences between individual and group physical performance. The aim of study is to report on the effect of social-comparative effect on young girls' physical performance. The study involved young elite synchronized swimmers from a Czech club with Olympic tradition who compete at an international level (n = 28, age 10.12±1.20). The swimmers were required to hold a wall-seat position as long as possible in two separately measured rounds, i.e. as individuals and as a group. The girls were randomly split into two groups. They started with an individual or group try of the wall-seat position exercise. There was a week's interval between the measured rounds. The mean performance was M = 108.82±57.10 in the individual try and M = 271.50±218.88 in the group one. The influence of social interaction in the group was evaluated by Cohen's d which showed high substantive differences (d = 1.1, large effect). The Wilcoxon matched pair test was used for data analysis (results were statistically significant, P < 0.05). It showed mutual social encouragement in a group that caused improvement in performing a wall-seat position and influenced significantly their performance. However, it was also established that such social interaction / encouragement is not consistent for every child. Nevertheless, there are many other important factors influencing a youth physical performance as positive verbal motivation, constructive feedback or appraisal.

Keywords: *group cohesion, mutual encouragement, self-motivation, sport performance, synchronized swimming, youth athletes.*

VPLIV SOCIALNIH INTERAKCIJ V SKUPINI NA TELESNE ZMOGLJIVOSTI DEKLIC

IZVLEČEK

Na uspešnost udejstvovanja v mladinskem športu vplivajo številni dejavniki. Namen pričujoče raziskave je bil ugotoviti morebitne razlike med telesnimi zmogljivostmi pri individualnem in skupinskem udejstvovanju. V raziskavo smo vključili skupino mladih vrhunskih športnic skladnostnega plavanja iz češkega kluba z olimpijsko tradicijo, ki tekmujejo na mednarodnem nivoju (n=28, starost 10,12±1,20). Plavalke smo prosili, da vztrajajo v položaju »sedenje ob steni« kolikor mogoče dolgo. Vajo smo ponovili dvakrat, s to razliko, da so jo udeleženke v raziskavi enkrat izvajale individualno, nato pa še skupinsko. Dekleta smo naključno razdelili v dve skupini in pri eni smo najprej merili individualno izvedbo, pri drugi pa skupinsko izvedbo vaje. Interval med enim in drugim merjenjem je bil en teden. Povprečni izmerjeni dosežki udeleženk v raziskavi so bili M=108.82±57.10 pri individualni izvedbi vaje in M=271.50±218.88 pri skupinski. Učinek socialne interakcije v skupini smo ovrednotili s pomočjo Cohenovega d indeksa, ki je pokazal visoko statistično odstopanje (d=1,1, velik učinek). Za analizo podatkov smo uporabili Wilcoxonov test predznačenih rangov (rezultati so bili statistično pomembni, P< 0,05). Izkazalo se je, da je vzajemna socialna vzpodbuda v skupini povzročila učinkovitejše izvajanje vaje sedenja ob steni in znatno vplivala na izmerjene rezultate. Tekom raziskave pa smo ugotovili tudi, da tovrstna socialna interakcija/vzpodbuda ne vpliva nujno na vsakega otroka. Vsekakor obstaja še vrsta drugih pomembnih faktorjev, ki vplivajo na otrokovo samomotivacijo kot npr. pozitivno verbalno motiviranje, konstruktivne povratne informacije in pohvale.

Ključne besede: *skupinska kohezivnost, vzajemno vzpodbujanje, samomotivacija, športna zmogljivost, skladnostno plavanje, mlade športnice*

INTRODUCTION

Motivation to exercise, often referred to as a need of achievement, is described as a need to prove something difficult, be the best, overcome yourself and your rivals. The natural social aspect of motivation to exercise is an effort to compete with others (Výrost & Slaměník, 2008).

Similarly, Heckhausen (1991) described the need to be the best or to do things better than before or to do them better than other people. Motivation to exercise is proposed by many psychological factors. Enjoyment, social influence and self-efficacy are among the most frequently mentioned (Carron, Hausenblas, & Mack, 1996; Irwin, Scorniaenchi, Kerr, Eisenmann, & Feltz, 2012; Mcauley & Courneya, 1993). Another

factor that should not be overlooked is exercising in a group. The motivational effect of a group activity has been studied for many years, mainly in social psychology, and it was shown it could lead to higher exercise adherence than individual programs (Dishman & Buckworth, 1996).

The motivational effect of exercising in a group was described in two different ways. The first one, the so-called motivational loss, is caused by a phenomenon of social lofting. Especially more capable team members developed less effort than if they worked individually (Baron & Kerr, 2003). However, motivation gain is described more frequently. The Köhler motivation effect and social compensation are two phenomena which are connected with motivation gain. In case when superior group members work hard and increase their individual effort in order to compensate the effort of less-capable group members we call it social compensation (Osborn, Irwin, Skogsberg, & Feltz, 2012). The Köhler effect occurs when the inferior group members enhance their effort to cooperate with the superior members (Baron & Kerr, 2003). It was shown that the Kohler effect is task-dependent (Weber & Hertel, 2007). For example, Steiner (1972) created the task taxonomy which divided motivation tasks into three relevant categories: conjunctive, coactive, and additive. The first one, the conjunctive task, means that group performance is dependent on the inferior members´ performance. The result of the weakest member defined the overall team result. The second one, the coactive task, means that the task is performed simultaneously by all members of the group, but their individual result is not dependent on the outcome of other group members. The last one, the additive task, describes an exercise when the sum of members performance represents the result of the group. On the other hand, Kerr et al. (2007) proposed two main explanations of the Köhler effect. One explanation works with conjunctive theory. It says that group performance will always be as strong as the weakest group member. It brings motivation gain for the inferior group members who want to get closer to the stronger members because they know that the group result is dependent on their performance. The other explanation suggests an increase in motivation due to social comparison. It means that the presence of superior group members may enhance personal and performance goals of weaker group members.

It was shown from previous studies that the greatest motivation gains for the weakest group members was in a conjunctive group task, when the weaker members were exercising with moderate partners, it worked especially for women. On the other hand, it has been shown that a lot of men work better in coactive tasks with a superior coworker and it does not matter if they cooperate on a task or not (Weber & Hertel, 2007). On the contrary, Feltz, Kerr and Irwin (2011) found out that the increase in motivation was entirely the result of social comparison. It means that the presence of the other group member brought the main motivation gain regardless if they work on the group goal or not. It was also confirmed that the motivation gains are greatest when the inferior members are 1.4 times weaker than the stronger ones (Messé, Hertel, Kerr, Lount Jr, & Park, 2002). Nevertheless, the differences between the most and the least capable partners should not be too large as this can cause motivation losses (Hertel, Niemeyer, & Clauss, 2008).

Osborn et al. (2012) states that motivation is a cognitive process and it is impossible to express it in the correct way. For this reason, the motivation is inferred from the performance differences that could be weakness as well. Unfortunately, many previous studies have been done in laboratory conditions only and they have not been tested on real existing sports teams. It means that we have many results which demonstrated the effects of Kohler motivation gains but only a few of them aim to show effectiveness in real sport team groups.

METHODS

Subject

A number of thirty-three girls at the age ranging from eight to twelve (M=10.12±1.20) were randomly split into two groups (fifteen and sixteen). The girls were young elite synchronized swimmers from the Czech club with Olympic tradition who compete at an international level. The experimental group consisted of two smaller training groups (younger and older ones). The girls are close friends within the training group, but they do not know well the girls from the other training group. The girls from both training groups were randomly split in two experimental groups. Their physical performance was measured in two separate rounds, i.e. as individuals and as a group. The first group started with individual exercises and the second one with exercising in a group. Though this approach we controlled the effect of previous experience with testing session. There was a one-week interval between the rounds. Five girls did not finish the research because of health reasons. Therefore, only twenty-eight girls fulfilled the whole protocol. It changed the number of participants in the examined groups to 13:15.

Consent

Before the beginning of this research, all under-aged girls´ parents were thoroughly informed about the research purpose and all potential health and other risks. All parents agreed on their children´s participation and signed appropriate consensus documents.

Procedure

All girls held a wall-seat position (isometric strength) as long as they were able to in two separate occasion. In the individual try, there was only the researcher and the tested girl, however, in the group test, there were all girls from the selected part of the sample. The group exercising was coactive, it means the girls exercised together in the same room and at the same time but we measured individual time of each girl, not a team result. Both measurements took place at the same time of a day with a one-week

rest interval. All of the girls participated in both tests, in the individual as well as the group one, so we gathered the data to compare performance with or without the presence of teammates for each participant. In this way, we were able to measure the effect of the exercise on physical performance in a small social group. Performance duration was recorded for each occasion and later used to interpret the findings. The girls held a wall-seat position when they leaned their back against the wall with arms held forward. They bent the ankles, knees, and hips at the right angle. It looked as if they were sitting on an imaginary chair (fig. 1 and 2). All girls received the same instructions: "Girls, I would like you to hold the wall-seat position as long as you can. When it starts to hurt too much or you get too tired only then you can sit on the floor and leave the room. Do you understand what to do?" The subjects were not allowed to talk during the session and were informed about their results after their second measurement. When they did not abide by the instructions, during the exercise position, they were immediately asked to adjust it. If they did not adjust the position immediately, the exercise was stopped.

Fig. 1 and 2: Wall seat position

Research Questions

1. How does social comparison affect the performance in wall-seat test of the synchronized swimmers at the age from eight to twelve?
2. Does the social comparison have the same effect on inferior and superior members?

RESULTS

The data were tested by the Kologmo-Smirmov test and it was established that it did not come from a normal distribution. The data from both measurements were recorded and inserted into Table 1. We can see the performance of all girls in the individual and group exercises, the differences between these two measurements and the percentage changes. The mean performance was M = 108.82±57.10 for the individual try and M = 271.50±218.88 for the group one.

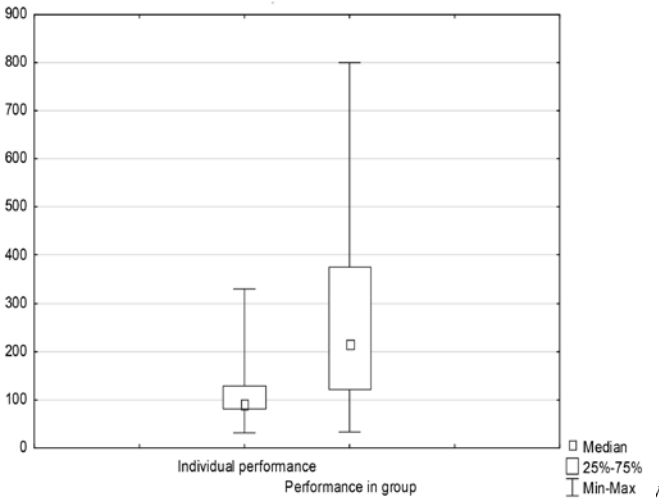
Other average values (median, values coming from the 2nd and 3rd quartile and min / max value) you can see from Figure 3. The influence of group interaction on the performance of synchronised swimmers was evaluated by the *Cohen's d* which showed a high substantive dependence (d=1.1, large effect). The *Wilcoxon matched pair test* was used for the data analysis. The results showed significant differences ($P < 0.05$) between the performance carried out individually and the one in the group. Based on the results of both tests, we can conclude that the social interaction had a positive impact on girls' physical performance in the wall-seat test. We also evaluated the size of the motivation gain or loss for individual girls. The influence of social interaction on each girl is described in the Figure 4. The graph shows percentage changes in girls' performance between the individual and group exercises. Girls were ranked in the chart from the weakest to the strongest (rated according to their performance from individual exercises). The mean percentage change in the wall-seat position test was +166.6 % (range -18.5 % to +616.3 %). We can see a slight trend in the graph, which suggests that inferior girls from individual exercises achieved a slightly higher positive change in performance.

Table 1. Performance result, difference and percentage change for the wall-seat test.

No.	Time in individual exercise (sec)	Time in group exercise (sec)	Difference (sec)	Percent. Change (%)
1	32	34	2	6.3
2	90	625	535	594.4
3	83	225	142	171.1
4	40	120	80	200.0
5	83	171	88	106.0
6	47	195	148	314.9
7	178	800	622	349.4
8	92	93	1	1.1
9	62	121	59	95.2
10	124	197	73	58.9
11	109	238	129	118.3
12	173	141	-32	-18.5
13	102	337	235	230.4
14	87	126	39	44.8
15	70	316	246	351.4
16	65	76	11	16.9
17	330	411	81	24.5
18	105	419	314	299.0
19	140	536	396	282.9
20	85	487	402	472.9
21	86	91	5	5.8
22	98	702	604	616.3
23	175	240	65	37.1
24	87	91	4	4.6
25	109	108	-1	-0.9
26	182	255	73	40.1
27	134	241	107	79.9
28	79	206	127	160.8

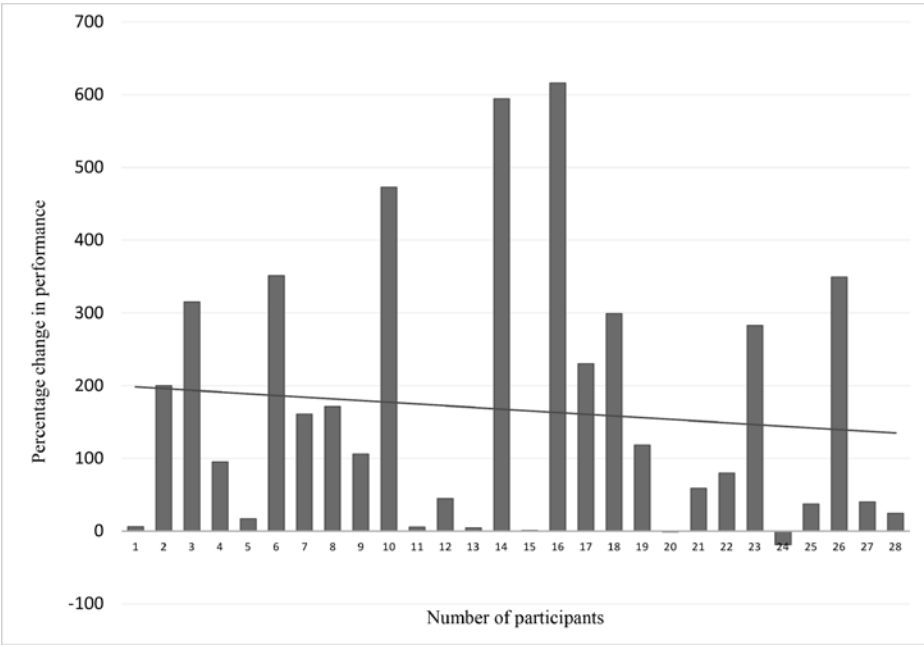
Note: The girls were divided into two groups. The first one started with the individual and the other one with the group measurements. The group results are separated by a line in the tables.

Fig. 3: Average difference in physical performance in wall-seat position.



Note: Particip /eakest to the strongest one.

Fig. 4: Percentage changes in performance in individual and group tries.



DISCUSSION

The primary aim of the study was to find out whether the group exercise (Kohler effect) could positively influence the performance of girls aged 8 to 12. The results showed significant differences between the performance of the girls in individual and group exercises. Based on these results, we can conclude that the group exercise caused a positive performance increase for most girls, which is consistent with the results of many other studies. For example, Hertel, Kerr, and Messé (2000) investigated the influence of group condition on motor persistence task. The participants held a metal bar in stretched arms for as long as possible. The exercising time was measured in an individual and in a group condition for all the participants. In the group condition, the partners held the bar over a rope. Once the first partner touched the rope the timer was stopped and exercising was ended. The authors found out that less capable participants held the bar longer if they worked in the group. Feltz et al. (2011) empirically tested the impact of Köhler motivation gain. They found out that people who were exercising with superior partner in a series of five isometric exercises improved by 24 % (d=0.99) compared to a check-up sample where people were exercising individually. Irwin et al. (2012) examined the impact of a coactive and a conjunctive task on an aerobic exercise. They described the performance increase up to 86 % per coactive and even to 208 % for conjunctive tasks.

We also evaluated the individual performance differences of all girls in an individual and a group try. There we can see a slightly higher impact of motivation gain on the inferior member. A similar motivation gain was described by Weber and Hertel (2007) in the coactive task. In their research, they discovered the stronger impact of social interaction due to additive and conjunctive task in women. They also suggested that the strongest gain of the Köhler effect occurs when: (a) all group members are involved in the team goal, (b) all team members care about the good team performance, (c) all group members perceive the group as a team. Furthermore, they proposed that connecting these three points could bring a particularly large enhancement in motivation. Their results showed a large effect on the physical performance due to these three points (d = 0.94). We would like to extend our research by a comparison of these three points in accordance with Weber and Hertel in our next study.

However, the influence of the group motivation could be affected due to friendships between or among some girls. We tried to reduce the impact of friendship in the way that the experimental groups were randomly split and mixing younger and older girls. For example, the last two exercising girls in the first experimental group were from the same training group and the last two girls from the other experimental group were from different training groups. Yet all of them increased their physical performance in the group try in comparison with their individual tries. So we believe that the enhancement was caused because of the group exercising and not because of the relationships in the group. Nevertheless, it is possible that this effect will not be traceable or effective in other sport groups or in boys. Because of this reason, we would like to extend our

research to another different group of children, for example boys, in some individual / team disciplines, games, etc.

CONCLUSION

To sum up, we established that social interaction, i.e. mutual encouragement in a group of young girls, could influence their sport performance. However, it was also found out that such social interaction / encouragement is not consistent for every girl; it was fluctuating in the sample. A small positive trend was noticed, which showed that the motivation gain was a little bit higher for the inferior group members. We believe that this effect could be important in exercises that girls do not enjoy so much and where they have to overcome a certain degree of discomfort or even pain. Not only young girls but children in general often do not understand why they should do some unpleasant activities and put their effort in them. So there is surely some extra motivation gain needed. Exercising in a training group could be used to increase the attractiveness of training in the individual sports and increase the training efforts of youth through competitions and fun. But it should be noted that group dynamics can influence the effectiveness of this result.

Nevertheless, it seems that social interaction could be beneficial for the young girls´ training as well as other factors influencing a child's self-motivation, such as positive verbal motivation, constructive feedback or appraisal.

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NUTRITIONAL STRATEGIES OF SLOVENIAN NATIONAL JUNIOR SWIMMING TEAM

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ABSTRACT

Purpose: *The purpose of our study was to assess the nutritional strategies of Slovenian national junior swimming team and compare them with recommendations of clinical sports nutrition. Competitive young swimmers, namely, have increased energy and nutrient needs compared to general adolescents due to frequent and intense training. Despite some physiological differences if compared with adults, adult sports nutrition recommendations for macronutrients apply to them. Further, literature reports iron, calcium, and vitamin D intake as frequently inadequate.*

Methods: *Nutritional strategies of 19 members of Slovenian national junior swimming team were assessed retrospectively through 3-day food and activity diaries, questionnaires, anthropometric data including bioimpedance analysis. Energy availability (EA), macronutrient intake and timing, iron, calcium and vitamin D intakes, hydration, consumption of sports food and dietary supplement use were evaluated.*

Results*: EA in some of male swimmers and in the majority of female swimmers was lower than recommended. Carbohydrate intake was adequate in male swimmers and two thirds of female swimmers. Although average protein intake exceeded the upper recommended limit, some female swimmers did not meet the lower recommended intake limit. Total fat intake was lower than recommended, with saturated fat intake on the upper recommended level. Calcium and iron intake in male swimmers exceeded recommended values, while female swimmers had lower calcium intake than recommended and some had lower iron intake, too. Vitamin D intake was low in all swimmers. Meal timing was adequate in the majority of swimmers, who often reached for dietary supplements, mostly omega 3 fatty acids, multivitamins and magnesium.*

Conclusions*: Low EA in young competitive swimmers is of concern. More successful, personalised nutrition strategies for young competitive swimmers, focusing on hi-*

gher energy intake and healthy food choices, would contribute to the preservation of their health and further development into top performers.

Keywords: *nutrition, young athletes, sport nutrition recommendation, health, performance.*

PREHRANSKE STRATEGIJE PLAVALCEV SLOVENSKE KADETSKE IN MLADINSKE REPREZENTANCE

IZVLEČEK

Namen: *Namen naše raziskave je bil ugotoviti ustreznost uporabljenih prehranskih strategij plavalcev slovenske kadetske in mladinske reprezentance v primerjavi z veljavnimi priporočili klinične športne prehrane. Mladi plavalci, ki tekmujejo, imajo v primerjavi z ostalimi najstniki zaradi pogostih in intenzivnih treningov povečane energijske in prehranske potrebe. Kljub očitnim fiziološkim razlikam, ki jih ločijo od odraslih, veljajo zanje priporočila za vnos makrohranil za odrasle športnike. Med mikrohranili literatura navaja, da so vnosi železa, kalcija in vitamina D pogosto nezadostni.*

Metode*: Prehranske strategije 19 plavalcev slovenske kadetske in mladinske reprezentance smo retrospektivno ocenili na osnovi 3-dnevnih prehranskih in aktivnostnih dnevnikov, vprašalnika ter podatkov antropometričnih meritev, vključno z bioimpedančno analizo. Ugotavljali smo energijsko razpoložljivost (ER), vnos in časovno razporejanje makrohranil, vnose železa, kalcija in vitamina D, hidracijo, uporabo športne prehrane in prehranskih dopolnil.*

Rezultati*: ER je bila pri nekaterih moških plavalcih in pri večini plavalk prenizka. Vnosi ogljikovih hidratov so bili primerni pri plavalcih in dveh tretjinah plavalk. Kljub temu, da je ugotovljeni povprečni vnos beljakovin presegal zgornjo priporočeno mejo, nekatere plavalke niso dosegale spodnje priporočene meje. Celokupni vnosi maščob so bili nižji od priporočenih, vnosi nasičenih maščob pa na zgornji meji. Vnos kalcija in železa je pri plavalcih presegal priporočene vrednosti, pri plavalkah pa je bil vnos kalcija in pri nekaterih tudi vnos železa pod priporočeno mejo. Ritem obrokov je bil pri večini ustrezen. Plavalci in plavalke so pogosto uživali prehranska dopolnila, najpogosteje maščobne kisline omega-3, multivitamine in magnezij.*

Zaključek*: Nizka ER pri mladih plavalcih, ki tekmujejo, je zaskrbljujoča. Bolj uspešne individualne prehranske strategije za mlade plavalce, ki bi se osredotočale na višji energijski vnos in zdravo prehrano, bi prispevale k varovanju njihovega zdravja in razvoju v vrhunske športnike.*

Ključne besede: *prehrana, mladi športnik, priporočila, zdravje, zmogljivost*

INTRODUCTION

Young athletes who participate in high intensity sports programs have higher nutritional and energy needs than the general WHO recommendations stated for children and adolescents (Desbrow & Leveritt, 2015). Competitive young swimmers belong to a group of athletes with increased energy and nutrient needs due to frequent and intense training (Petrie, Stover, & Horswill, 2004). At the metabolic level, all three energy systems (the high energy phosphagen system, anaerobic glycolysis and aerobic metabolism) are involved in all swimming competition disciplines, ranging by duration between 20 seconds (50 m) and 14.5 minutes (1,500 m) in junior elite swimmers (Federation Internationale de Natation, 2018). Although adolescents have specific nutritional needs because they differ from adults in energy consumption, substrate consumption during exercise, thermoregulation, sweat mechanism and maintenance of fluid balance as well as other physiological components (Desbrow & Leveritt, 2015), the sports nutrition principles are similar to those for adults.

For long-term health protection of athletes, adequate energy availability (EA), 45 kcal/kg of fat-free mas (FFM) or more, must be provided (Desbrow & Leveritt, 2015). Sufficient energy and nutrient intake in adolescence is critical for normal growth and development, maintaining health and injury prevention. An adequate nutrition intake also enables optimization of the training process and successful recovery. Adolescence is a crucial period, comprised of intense growth and development, involving the alteration of body composition, metabolic and hormonal fluctuations, maturation of organ systems and formation of nutrient storage, all of which has a potential impact on the individual's health in the future (Sawyer et al., 2012). Long-term suboptimal EA, in the range between 30 and 45 kcal/kg FFM, or too low EA, under 30 kcal/kg FFM, leads to relative energy deficiency in sport (RED-S) (Mountjoy et al., 2014). The latter leads to disrupted physiological functions caused by the relative lack of energy, which include lowered metabolic rate, disrupted menstrual function, and compromised bone health, immunity, protein synthesis and cardiovascular health.

Despite the fact that there are potential differences in the ability to store carbohydrates (CHO) and to use substrates during physical activity between adults and children, literature reports that the CHO needs of young athletes do not differ greatly from the needs of adults (Desbrow et al., 2014). In moderate to high-intensity endurance training, which lasts from 1 to 3 hours per day, CHO intake of 6 to 10 g/kg of body weight (BW) is recommended and in moderate to high intensity exercise, which lasts 4 to 5 hours per day, 8 to 12 g CHO/kg BW/ day is recommended (Burke, Hawley, Wong, & Jeukendrup, 2011). The recommendations must be individual, dynamic and in accordance with the requirements and goals (Thomas, Erdman, & Burke, 2016).

Due to the lack of specific research into the protein requirements of adolescent athletes, it is suggested to follow the recommendations for adult athletes (1.3 – 1.8 g protein/kg BW). Some athletes have increased protein requirements during adolescence compared to the recommended quantities for their age group, especially if they have well-developed muscle mass or if they participate in high intensity exercise programs

(Boisseau, Vermorel, & Rance, 2007; Aerenhouts, Deriemaeker, Hebbelinck, & Clarys, 2011; Aerenhouts, Van Cauwenberg, Poortmans, Hauspie, & Clarys, 2013).

Dietary fat intake of adolescent athletes should follow general recommendations (Desbrow et al., 2014). According to the National Institute for Public Health (2016) this means that in the 10- to 14-year old age group, fat should represent between 30 and 35% of total energy intake (EI), while in the 15- to 18-year old age group, fat intake should contribute up to 30% EI, with the note that in physically active individuals this share could be increased to up to 35% EI. Saturated fat should not exceed 10% EI (National Institute for Public Health, 2016).

Micronutrient deficiencies have negative impact on health and performance because micronutrients participate in a number of functions in the body. In young athletes, special attention must be paid to iron, calcium and vitamin D intakes (Desbrow & Leveritt, 2015). Recommendations for iron intake in young athletes do not differ from recommendations for the general population, despite the fact that exercise can cause additional iron loss through sweating or bleeding into the gastrointestinal system or also due to the decomposition of erythrocytes during a long run (Peeling et al., 2009; Koehler et al., 2012). Slovenian adolescent males aged 13 to 18 should therefore consume 12 mg of iron per day and females 15 mg per day (National Institute for Public Health, 2016). The only exception are vegetarian athletes who require higher intakes due to the reduced bioavailability of non-heme iron (Desbrow & Leveritt, 2015).

Calcium and vitamin D are key nutrients for the development and maintenance of bone mass. Due to intense bone growth during adolescence, calcium needs are increased in both males and females. For 13- to 18-year olds, the recommended daily intake of calcium is 1200 mg (National Institute for Public Health, 2016), which applies to adolescent athletes, too, until there is more research available (Desbrow & Leveritt, 2015). Vitamin D plays an important role in calcium and phosphate metabolism and calcium integration into bones and teeth, and in the operation of the immune and muscle systems (Desbrow & Leveritt, 2015). Approximately 90% of our daily vitamin D requirements are covered by internal synthesis in the skin after exposure to ultraviolet rays; dietary intake contributing only 10% of the requirements (Koundourakis, Avgoustinaki, Malliaraki, & Margioris, 2016). In Slovenia, typical nutritional vitamin D intakes (2–4 µg daily) in adolescents in the absence of internal synthesis do not suffice to achieve recommended serum concentrations. The difference between the intake and the recommended value of 20 µg must be reached through frequent exposure to the sun and/or taking a vitamin D formulation (National Institute for Public Health, 2016). In latitudes above 35° north, which applies to Slovenia, the sun rays angle in winter are too oblique for efficient skin vitamin D synthesis (Holick, 2008), apart from that, competitive young swimmers spend long hours practicing indoor also in autumn and spring, which poses them at risk for vitamin D deficiency. Geiker et al. (2017) reported that 45% of the 29 swimmers (16−24 years old) residing at latitude 55−56° north had 25-hydroxycholecalciferol below 50 nmol/L in March and April.

It is known that adolescent athletes have a higher height to body mass ratio (Petrie et al., 2004) and a lower sweating rate (Shibasaki, Inoue, Kondo & Iwata, 1997) than

adults. A decreased sweating rate is an advantage in maintaining hydration status and at the same time decreases the success of thermoregulation. Sawka et al. (2007) propose fluid replacement during exercise to such a degree that hypohydration exceeding 2% is prevented. Desbrow et al. (2014) and Smith, Holmes & McAllister (2015), who deal with adolescent athletes, recommend the same. Water or milk should not be replaced by sports drinks that contain electrolytes and CHO because sodium losses through sweating are smaller than in adults (Meyer, Volterman, Timmons, & Boguslaw, 2012). Sports drinks are recommended only in long-term intense physical activity. Drinking caffeinated energy drinks is advised against in young athletes (Desbrow & Leveritt, 2015).

The use of sports food (sports drinks, sports bars, sports confectionery, sports gels, liquid meal supplements, …) is justified in adolescents in cases of long and intensive training (Desbrow et al., 2014). Replacing nutrients with dietary supplements, such as calcium, iron and vitamin D, is also justified when a deficiency is confirmed (International Olympic Committee (IOC), 2011). The use of ergogenics is advised against because it is inappropriate and unnecessary, and in addition their safe use in all age groups has not been confirmed (International Olympic Committee (IOC), 2011).

To fulfil their increased energy requirements, young athletes are recommended three main meals and two snacks (Desbrow & Leveritt, 2015). A meal rich in CHO (1–4 g CHO/kg BW) is recommended 1–4 hours before activity. During exercise lasting 1–2.5 hours, 30–60 g CHO/h should be consumed. The post exercise meal should contain 1.0–1.2 g CHO/kg BW and 20 g of protein (Smith et al., 2015). Such a meal, consumed directly or as soon as possible after exercise, enables the refilling of glycogen stores, muscle repair and replaces lost fluid. This is especially important in athletes who compete several days in a row (e.g. in a tournaments) or train more than once per day (Desbrow & Leveritt, 2015).

The aim of our study was to assess the nutritional strategies of Slovenian national junior swimming team and compare them with recommendations.

METHODS

Data Collection

All members of Slovenian national junior swimming team were invited to participate in the study. The eligibility criteria for the national team are determined by the Slovenian swimming federation, which also provided us with the list of swimmers (27 competitive young swimmers). Out of 21 swimmers for whom written consents for personal data processing were obtained, 2 were excluded from analysis due to inadequate food diaries, confining the final sample to 19 competitive young swimmers (Figure 1, Table 1). The data was collected from October to December 2016 and analysed in February 2017.

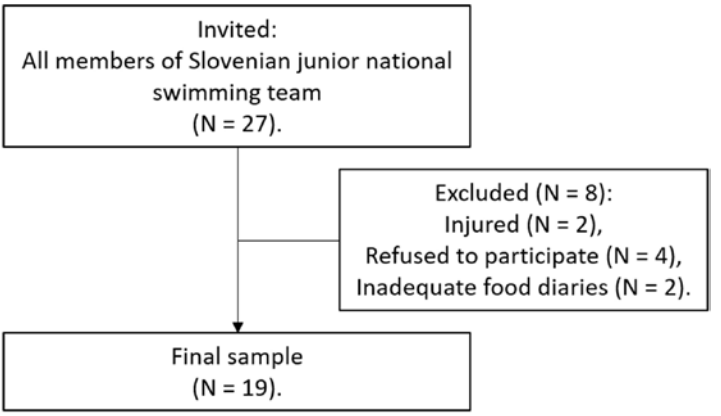


Figure 1: Swimmers flow diagram.

Anthropometric Measurements

We collected weight and height data from anthropometric measurements regularly performed during preparation training cycles. Swimmers were weighed to the nearest 10 g (M 304641-01, AED) and height was measured to the nearest 0.5 cm (Stadiometer, M 304641-01 (ADE). Whole body BIA (BIA 101 Anniversary AKERN, Florence, Italy, medically approved: EN ISO 13485 − ISO 9001) was performed using an alternating sinusoidal electric current of 400 μA at an operating frequency of 50 kHz according to recommendations (Kyle et al., 2004) for FFM assessment, that was needed for EA calculation.

Dietary Assessment and Energy Consumption Evaluation

Data were collected from food and activity diaries. Swimmers were asked to keep 3-day weighted food and activity diaries for three consecutive days (including one weekend day). Swimmers were fully briefed on how to complete the diary and asked to continue their normal diet and physical activity. They were asked to include food labels and recipes for mixed dishes in their record. For each day, they had to record the kind, duration and intensity of the physical activity.

The dietary intake was assessed using Open Platform for Clinical Nutrition (OPEN), that is an online, freely accessible, dietary assessment and planning tool for the analysis of food diary (http://www.opkp.si/en_GB/cms/vstopna-stran). OPEN food composition data was taken from the Slovenian food composition database (Golob et al., 2006); or if not available there, from the Souci, Fachmann & Kraut Food composition and nutrition tables (2008) and/or from the USDA National Nutrient Database for Standard Referen-

ce (http://www.ars.usda.gov/Services/docs.htm?docid=8964). Food composition data applied by the OPEN meet the European standard for food data CEN/TC 387, available at http://www.cen.eu/. EI, macronutrient intake and calcium, iron and vitamin D intakes were evaluated.

To examine the suitability of energy consumption, EA was calculated. EA represents the energy that is available for body function, growth and development taking in consideration exercise energy expenditure (EEE) during planned physical activity (Desbrow et al., 2014).

$$EA = \frac{\mathrm{EI} - \mathrm{EEE}}{\mathrm{FFM}} \quad (1)$$

Metabolic equivalent of task (MET) was used for EEE evaluation, as suggested by OPEN.

Questionnaire

Data from a questionnaire that was developed by nutrition expert in charge of nutrition support of national swimming team, were analysed. Swimmers were asked to answer the questionnaire on health parameters (number of infections, menstrual cycle, growth), nutritional habits, timing of meal intake, use of dietary supplements and sports food, as well as type, intensity and the duration of exercise.

Statistical Analysis

Answers from the questionnaire that refer to sports nutrition recommendations and dietary intake compared to recommended values were processed in Microsoft Excel (IBM Corp. Released 2011), while anthropometric data and dietary intakes were processed with SPSS 20.0 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

The descriptive statistics was used to determine averages, standard deviations and minimum and maximum values. The Shapiro-Wilk test was used for assessing the normality in the distribution of variables, one sample T-test and independent samples T-test were used to evaluate the difference from recommended values and difference between genders. Statistical significance was set at $P < 0{,}05$. Spearman and Eta correlations were performed to detect different associations between dietary intakes and frequency of infection as well as regularity of menstrual cycle.

RESULTS

Characteristics of swimmers grouped by gender are presented in Table 1.

Table 1: Characteristics of swimmers divided by gender

	Average (± SD)			t*	p (2-tailed)*
	All (N= 19)	Male swimmers (N= 6)	Female swimmers (N=13)		
Age (years)	14,95 ± 1,22	16,17 ± 0,75	14,38 ± 0,96	3,99	0,001
Body height (cm)	173,97 ± 7,70	181,92 ± 4,32	170,31 ± 5,91	4,28	0,001
Body weight (kg)	62,35 ± 10,07	73,33 ± 4,88	57,28 ± 7,35	4,84	0,000
BMR (kcal/day) (kJ/day)	1608,50 ± 180,30 (6729,96 ± 745,38	1827,88 ± 91,55 (7647,85 ± 383,04)	1507,25 ± 100,50 (6306,33 ± 420,49)	6,63	0,000
FFM (kg)	51,58 ± 9,39	62,97 ± 3,80	46,33 ± 5,62	6,54	0,000
Fat mass (%)	17,44 ±3,77	14,08 ± 1,75	18,99 ± 3,43	3,28	0,004
Training load (h/week)	20,78 ± 2,59	21,42 ± 3,52	20,48 ± 2,15	0,72	0,480
Energy availability (kcal/kg FFM) (kJ/kg FFM)	37,01 ± 12,99 (155,23 ± 54,35)	43,48 ± 9,16 (181,92 ± 38,32)	34,02 ± 13,69 (143,09 ± 57,28)	1,53	0,144

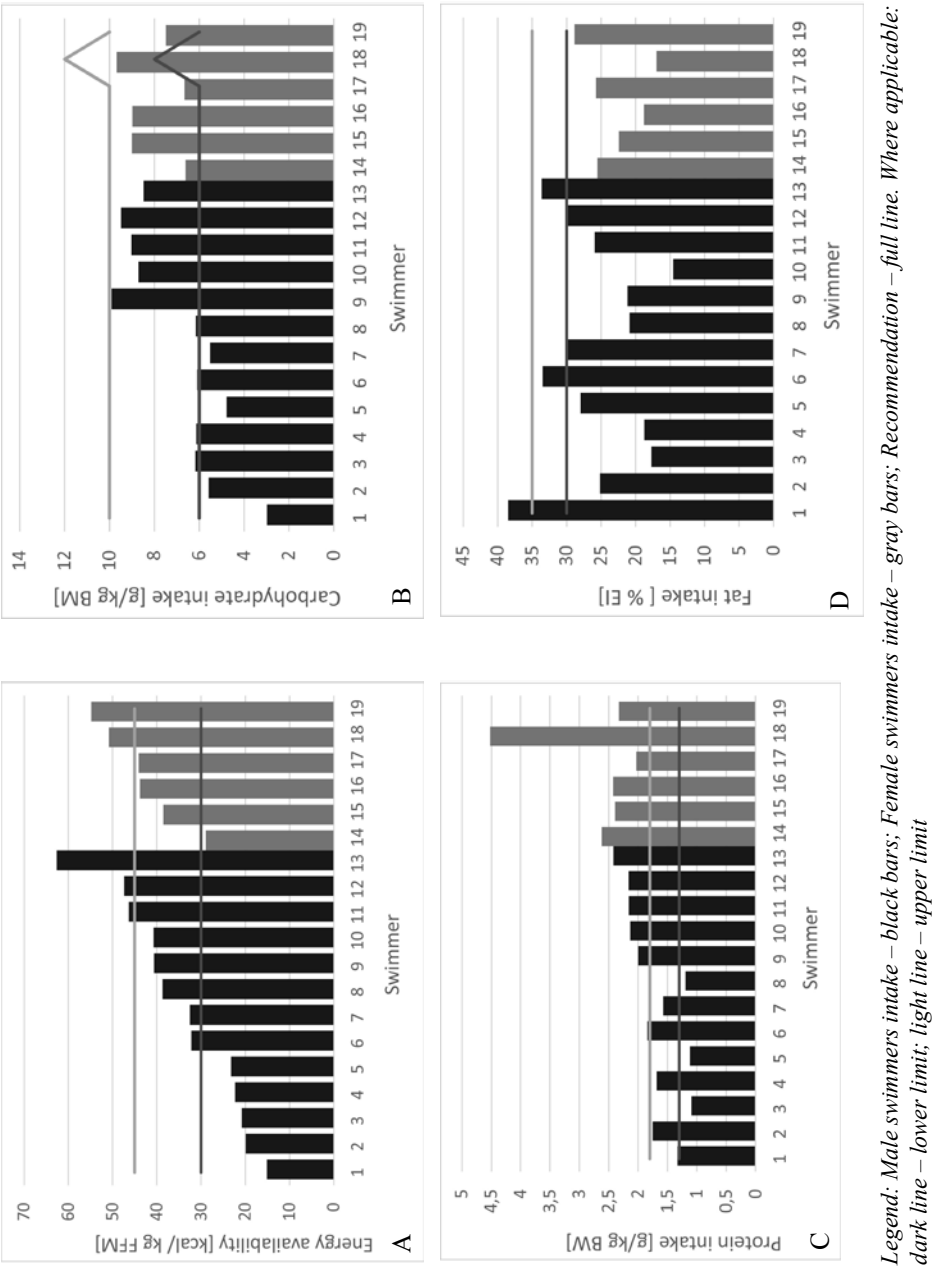
BMR – basal metabolic rate, FFM –fat free mass *Difference between male and female swimmers

Nutritional data is presented in Table 2 and graphically for each swimmer (Figure 2), coded based on the calculated EA. Female swimmers were assigned codes from 1 to 13 and male swimmers codes from 14 to 19. Each individual's code applies to all displays.

Table 2: Nutritional intakes of swimmers divided by gender

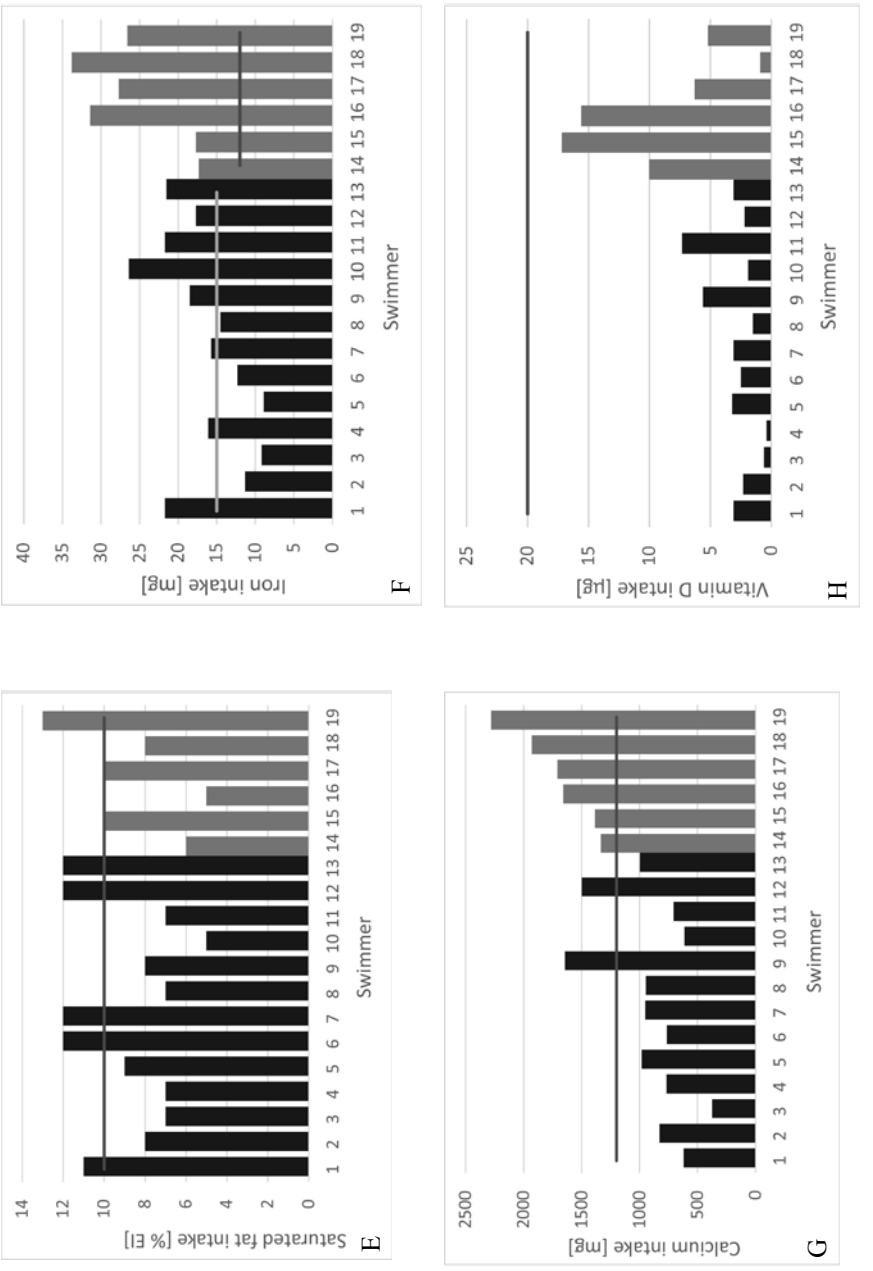
	Average (± SD)			t*	p (2-tailed)*
	All (N= 19)	Male swimmers (N= 6)	Female swimmers (N=13)		
CHO intake/kg BW (g/kg)	7,24 ± 1,92	8,08 ± 1,32	6,85 ± 2,07	1,33	0,201
Protein intake/kg BW (g/kg)	2.03 ± 0.76	2,70 ± 0,90	1,72 ± 0,44	3,21	0,005
Fat (% EI)	25,06 ± 25,98	23,07 ± 4,54	25,98 ± 7,10	-0,916	0,373
Saturated fat (% EI)	8,67 ± 9,00	8,67 ± 2,94	9,00 ± 2,48	-0,257	0,800
Iron itake (mg)	19,47 ± 7,18	25,75 ± 6,89	16,57 ± 5,35	3,180	0,005
Calcium intake (mg)	1156,99 ± 516,64	1715,57 ± 352,75	899,19 ± 347,17	4,742	0,000
Vitamin D intake (µg)	4,84 ± 4,76	9,20 ± 6,31	2,83 ± 1,88	2,424	0,056

EI – energy intake, CHO –carbohydrate, BW – body weight *Difference between male and female swimmers



Legend: Male swimmers intake – black bars; Female swimmers intake – gray bars; Recommendation – full line. Where applicable: dark line – lower limit; light line – upper limit

Figure 2a: Nutritional intake of slovenian junior national swimming team compared to recommendations. A EA. B CHO intake. C Protein intake. D Fat intake.



Legend: Male swimmers intake – black bars; Female swimmers intake – gray bars; Recommendation – full line. Where applicable: dark line – lower limit; light line – upper limit

Figure 2b: Nutritional intake of slovenian junior national swimming team compared to recommendations. E Saturated fat intake. F Iron intake. G Calcium intake. H Vitamin D intake.

EA of the majority of swimmers was between 30 and 45 kcal/kg FFM, little less than of one third under 30 and only 5 above 45 (Figure 2A). 4 female swimmers with low EA also had a low CHO intake (Figure 2B). All male swimmers exceeded the upper limit for protein intake, while 3 female swimmers did not reach the lower limit of the recommendations, 4 were within the recommended values, and 6 exceeded the upper limit of the recommendations (Figure 2C). The intake of fat was below the recommended limit for all male swimmers and for 8 female swimmers (Figure 2D), while the intake of saturated fat was in accordance with the recommendations in 13 swimmers, whereas 5 female swimmers and 1 male swimmer had intakes that were higher than recommended (Figure 2E). 5 female swimmers had inadequate iron intake (Figure 2F). All male swimmers and 2 female swimmers exceeded the recommended calcium intake, while the remaining 11 female swimmers were under the recommended limit (Figure 2G). Vitamin D intake was below the recommended limit in all swimmers (Figure 2H).

4 female swimmers drank less than 1.5 L of fluid per day, while the majority of male swimmers (N = 5) and one female swimmer drank more than 3 L of fluid. The rest drank 1.5 − 2.5 L of fluid per day (N = 6) or 2.5 − 3 L (N = 3) on days when they were training. Most of the swimmers drank 0.3 − 0.8 L of fluid in one hour of training (N = 9). 6 swimmers consumed less than that, 3 swimmers drank 0.8 − 1 L, and 1 swimmer drank 1 − 1.5 L of fluid in an hour.

The questionnaire gave us the insight in swimmers' nutritional habits. 17 swimmers (6 male swimmers and 11 female swimmers) regularly consumed fluid during their training, one female swimmer rarely and one never. All swimmers consumed an isotonic beverage with electrolytes during the exercise, while 17 of them never consumed caffeinated energy drinks, and 2 swimmers rarely took them. All swimmers consumed sports food (energy bars, gels, …), 15 also took dietary supplements, 3 of which took one dietary supplement, 3 took two dietary supplements, 4 took 3 dietary supplements, while 2 took 4 dietary supplements. The most consumed dietary supplement were omega 3 fatty acids (N = 8 swimmers), followed by multivitamins (N = 6) and magnesium (N = 5), 4 took iron, glutamine or vitamin C and 3 took vitamin D. Vitamin B, creatine, Q10 or branched amino acids were taken by 1 swimmer each.

The majority (N = 15) consumed five meals or more per day. Others consumed four (N = 2) or three (N = 2) meals per day, but none less than that. The majority of swimmers (N = 14) also always consumed a balanced meal 2 – 3 hours before training, 4 rarely and 1 never. The majority (N = 12) consumed a CHO rich meal one hour before training. Almost all (N = 18) regularly consumed a meal rich in CHO and protein within an hour after training, while one swimmer rarely did so. To the question "Do you consume a protein supplement within an hour after training?" 6 swimmers answered "always", 5 answered that they "rarely consumed protein in the form of a supplement" and 8 answered "never".

We also determined the frequency of infections in competitive young swimmers. The majority (N = 13) fell ill 1 – 2 times per year, 4 more frequently and 2 never. Only 3 female swimmers had a regular menstrual cycle. 2 females in the group who had never had a period (N= 6) were over 15 years old. 4 female swimmers had an irregular menstrual cycle. The frequency of infection was not statistically significantly associated

with energy availability ($\rho = -0.223$, $p = 0.360$), CHO ($\rho = 0.099$, $p = 0.686$), protein ($\rho = -0.066$, $p = 0.787$) nor fat ($\rho = -0.354$, $p = 0.138$) intake. The regularity of menstrual cycles in females was not statistically significantly associated with energy availability ($\eta = 0.186$, $\eta^2 = 0.340$, $p = 0.839$), CHO ($\eta = 0.264$, $\eta^2 = 0.070$, $p = 0.696$), protein ($\eta = 0.543$, $\eta^2 = 0.295$, $p = 0.175$) nor fat intake ($\eta = 0.444$, $\eta^2 = 0.197$, $p = 0.333$), either.

DISCUSSION

The first systematic insight into the nutrition status of young competitive athletes in Slovenia showed some inadequate intake of nutrients that may influence the performance and health of young athletes.

Some exceptionally low EA values (min. = 15.1 kcal/kg FFM) and the fact that almost three quarters of the swimmers did not achieve the recommended EA values indicated that the EI in some young male swimmers and mostly in female swimmers were too low and needed improvement, because long-lasting low relative EA influences a number of organic systems and may in the short and long-term compromise health and performance (Mountjoy et al., 2014). The calculated low EA may also be due to methodological causes. It is known that in determining dietary intake with the use of a food diary, inaccuracies may occur that may be the consequence of a changed diet due to recording into the food diary itself, incorrectly recording foods that are or are not desired in order to improve the impression on what was eaten, or actual errors that occur in the weighing or description of consumed quantities (Burke, 2001). It is also known that as many as 80 % of participants report too low quantities of food intake, with reported quantity being up to 20 % lower than actual intake (Black et al., 1993). Another problem could be the EEE, because it was not measured but calculated based on reported time and type of exercise, using MET. The small sample of swimmers and unequal representation of genders also represented an additional restriction.

Based on reported training load, 18 swimmers required CHO intake of 6 to 10 g /kg BW, while one swimmer had higher requirements due to a higher exercise load (8 – 12 g/kg BW). While all male swimmers had adequate CHO intake, 4 female swimmers did not reach the lower recommended intake limit. Inadequate intake leads to inadequate glycogen stores and the onset of fatigue, which, in connection with low EA that was identified in all of them, has a negative effect on health and performance (Loucks, Kiens, & Wright, 2011). An adequate intake of CHO also prevents protein catabolism. Burke et al. (2011) define CHO availability as a dynamic measure of suitable CHO intake, both on daily basis and on strategic time points around important exercise sessions as high CHO availability provides CHO for muscle and nervous system and has thus the potential to enhance performance and recovery at key times. We examined the adequacy of meal timing and composition around training with a questionnaire. 14 swimmers followed the recommendations and always consumed a balanced meal, including CHO, 2 – 3 hours prior to training. In addition, 12 consumed one more meal rich in CHO within one hour prior to exercise, which is an effective strategy for ensuring an additional

energy source for working muscles and the central nervous system (Jeukendrup & Cronin, 2011). During their exercise, all swimmers replaced fluids, CHO and electrolytes. As many as 18 swimmers consumed a CHO and protein rich meal after training. All the above shows that top young Slovenian swimmers mainly use nutrition strategies in accordance with recommendations before, during and after training. However, since CHO availability covers both, daily intake and meals around exercise, inadequate daily CHO intake in 4 female swimmers means low CHO availability, which means their glycogen stores are not optimally replenished which can affect performance, both on training and competition (Burke et al., 2011). More emphasis should therefore be placed on adequate daily CHO intake in female young swimmers. This would enable them to reach adequate CHO availability and EA and consequently adequate glycogen stores and prevent them from fatigue and muscle catabolism.

The protein intake of all male swimmers and 6 female swimmers exceeded the upper recommended limit, 1.8 g/kg BW/day, despite EA being too low in 4 male swimmers and 3 female swimmers. The literature reports that young athletes who have adequate EA reach or exceed protein intake recommendations (Petrie et al., 2004; Heanley, O'Connor, Giifford, & Naughton, 2010; Gibson, Stuart-Hill, Martin, & Gaul, 2011). After training, 3 male swimmers and 3 female swimmers always consumed protein in the form of a supplement, 1 male and 4 female swimmers did so occasionally, while the others did not consume protein in the form of supplements. The use of protein supplement in young athletes could be justified merely due to their practicality, however, food sources of protein would be a better choice, especially because protein needs can be fulfilled within normal EA. On the other hand, 3 female swimmers (all 3 with low EA) did not reach the lower recommended protein intake, 1.3 g/kg BW/day. An inadequate protein intake or a low EA, where part of the protein is used as a substrate in the process of energy acquisition, could potentially lower the amino acid availability for basic physiological functions (Petrie et al., 2004; Campbell et al., 2007). Therefore, low protein intake is problematic, and even (too) high intake in the context of low EA does not guarantee appropriate protein availability. The average EA in female swimmers was lower than the recommended limit, and therefore they were more prone to protein deficiency in our sample than male swimmers. To prevent protein and energy deficiency, we would suggest to fulfil protein needs by increasing EI through normal food.

No guidelines or recommendations mention the absolute fat content in an individual's diet, the values refer to the percentage of EI provided by fat. Our swimmers had low fat intake, contrary to literature reports (Croll et al., 2006; Juzwiak, Amancio, Vitalle, Pinheiro, & Szejnfeld, 2008), which state that the fat intake in young athletes usually exceeds 30 % of EI. This lack of fat may be the cause of the low EA that was noticed mainly in female swimmers, which is why we, in line with other authors, recommend that young athletes be encouraged to eat fish and unsaturated fats from plant sources and to avoid the consumption of saturated fats from fried foods and baked goods as well as fats of animal origin (Desbrow et al., 2014) which contribute to higher saturated fat intake. Indeed, the intake of saturated fat in some swimmers was above the upper recommended value.

Three key micronutrients for young athletes can be identified from the literature: iron, calcium and vitamin D (Desbrow et al., 2014; Smith et al., 2015). The average iron intake in female swimmers was sufficient, but individual intake was insufficient in 5 female swimmers. The findings partially correspond to the findings of other authors who state that the dietary intake of iron in young male athletes exceeds the recommendations, while in females they are within the recommended limits (Juzwiak et al., 2008; Heanley, et al., 2010; Gibson et al., 2011; Martinez et al., 2011). Since low iron stores are usually observed in female swimmers, regular supervision of iron status is necessary as well as early detection of low iron stores and appropriate intervention in order to increase iron intake or to increase the iron bioavailability. Taking iron as a dietary supplement is justified only in cases of proven deficiency (Desbrow et al., 2014).

The literature states that young athletes achieve only one half of the recommended calcium intake (Gibson et al., 2011; Juzwiak et al., 2008), which was not the case in our study. Calcium intake was above the recommended values in male swimmers, but under the recommended limit in female swimmers, which is in line with Martinez et al. (2011). Encouraging milk and dairy consumption would not only improve calcium intake, but also fat and protein intake and EA (Fayet, Ridges, Wright, & Petocz, 2013).

The estimated dietary intake of vitamin D was lower in female swimmers than in male swimmers. A comparison with recommendations was not possible as they define vitamin D requirements that may be met through dietary intake as well as through internal synthesis. Serum concentrations of 25-hydroxycholecalciferol would give us a better insight into vitamin D status, however considering our latitude (above 35th parallel north), long hours spent indoors due to training and the low dietary intake of vitamin D in female swimmers, we can suspect that this group is at risk of vitamin D deficiency. Due to the high physical load we are concerned that the current nutrition strategies of some competitive female swimmers together with calcium deficiency and low EA may have a negative impact on bone health, which is further exacerbated by the physical activity in water which lowers the workload against gravity (Gomez-Bruton et al., 2017). Regular monitoring of vitamin D status is necessary in athletes at increased risk of deficiency and suitable supplementation should be advised in case of discovered inadequacy (Desbrow et al., 2014).

Fluid intake was assessed using a questionnaire as we were not able to assess it based on the food diary due to insufficient data. The problem with sufficient fluid intake is that there are noticeable individual differences between athletes, due to which there are no concrete fluid intake recommendations. Reference values for nutrient intake (German nutrition society (DGE), 2004) state that moderately active 15-year-old adolescents or younger should consume 1330 mL of fluid daily, while those over 15 years old should consume 1530 mL. From the questionnaire, we discovered that 4 female swimmers drank less than 1.5 L of fluid per day on training days, which we can certainly assess as inadequate as that is the recommended intake for non-active individuals. Adams et al. (2016) discovered that as many as 67 – 78 % (depending on the method) of swimmers aged 8 to 17 came to morning training in a hypohydrated state. Due to significant differences between individuals and physical activities, Australian dieticians

and sports nutrition specialists (Desbrow et al., 2014) recommend regular monitoring of fluid intake needs by weighing before and after training. We do not have the data on individual weight losses during exercise and cannot estimate the quantitative adequacy of fluid replacement. Drinking energy drinks containing caffeine is not recommended in this age group (Desbrow & Leveritt, 2015). Only 2 young swimmers (10.5 %) reported consuming energy drinks, which is a good result, as O'Dea (2003) found that in the age group between 11 and 18 years old as many as 42.3 % of otherwise moderately active children consumed energy drinks.

All the competitive young swimmers in the sample consumed sports food, which is justified considering their heavy training load. They also often used dietary supplements (78.8 %), possibly including more than one supplement (up to four), which is a little more than reported by McDowall (2007), who found the prevalence between 22 % and 71 %. The competitive young swimmers most commonly took omega-3 fatty acids, multivitamins and magnesium. The supplementation of nutrients is considered justified when a deficiency is discovered or if needs cannot be met through nutrition. Based on our results, competitive young swimmers should consider supplementing vitamin D. Even though the use of ergogenic aids for better performance is inappropriate and unnecessary and their safe use has not been confirmed in this age group, we discovered that 1 swimmer used creatine. Competitive young swimmers should be familiarized with the risks of using dietary supplements because they may not be safe, may be disallowed or ineffective or even contaminated with banned substances (Desbrow et al., 2014). They should be encouraged to meet their nutritional requirements through the correct choice of foods and not through supplements.

It is known that low EA is a risk factor for low immune function and increased susceptibility to infection (Montenero, Lopez-Varela, Nova, & Marcos, 2002). Despite the fact that there was the possibility that the reported intake was too low, the low EA that we noticed in 14 of the competitive young swimmers indicated an increased risk of infection that we did not manage to prove in our sample of 19 swimmers. We also did not manage to determine a correlation between the frequency of infection and the intake of other macronutrients that are connected with immune system function.

Low EA influences the regularity of the menstrual cycle and causes functional hypothalamic menstrual dysfunction, which has a negative impact on bone health as it leads to decreased formation of new bone tissue and increased resorption of existing bone tissue, which represents the second largest protein store after muscles (Loucks et al., 2011). Low EA in our female swimmers is of concern, as only 3 female swimmers had reported regular menstrual cycle. In the group of 6 female swimmers that had never had their period, there were 2 swimmers over the age of 15, thus expressing primary amenorrhea. For those with irregular menstrual cycles (N = 4), we did not manage to acquire the information on the length of the absence of their period, so we cannot discuss secondary amenorrhea in our swimmers. We did not find a statistically significant correlation between EA, intakes of CHO, protein and fat and menstrual cycle regularity. Nevertheless, we find alarming to identify 4 young female swimmers (nearly 1/3 of female swimmers) with low EA, low CHO intake (one also with low protein intake)

as well as low calcium and vitamin D intake. Only one of them stated that she had a regular menstrual cycle. Since female swimmers, due to their high training load, belong in the group with a high risk of RED-S, and consequently of functional hypothalamic menstrual dysfunction, which may also have long-term negative effects on health, we believe that the menstrual cycle must be monitored in competitive young swimmers and measures be taken in cases where a dysfunction is discovered. Measures include an increase in EI, a decrease in EEE or both (Mountjoy et al., 2014; De Souza et al., 2014).

Hereby, it is important to emphasize the necessity of adaptation of strategies to specific individual, for they have to be aligned with their individual goals, their ability to execute and potential intolerance for certain specific nutrients. Those strategies must take into consideration the athlete‘s favourite foods as well as individual responses to strategies themselves (Thomas et al., 2016).

CONCLUSIONS

Comparison of applied nutrition strategies with the current recommendations of clinical sports nutrition in young Slovenian competitive swimmers enabled us to identify dietary deficits, especially among female swimmers, where too low EI leads to insufficient macronutrient and micronutrient intake and too low EA, which can lead to a decline in performance and even seriously compromise their health. The acquired information can enable dietitians to prepare more successful, personalised nutrition strategies for young competitive swimmers, hence contribute to the preservation of their health and their development into top athletes.

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CORRELATION BETWEEN DIFFERENT MOTOR ABILITIES AND SCORE POINTS IN THE RAUCH CUP

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ABSTRACT

In alpine skiing, like in other sports, achieving good results depends on a variety of factors and the quality of planning and conducting the process of training. The purpose of the research was to determine whether there is a correlation between the selected motor tests and the number of points achieved in Rauch Cup. The research was conducted on a sample of 41 male competitors from different ski clubs across Slovenia. The following tests were conducted on our selected group of 13- to 14-year old males: taping with a dominant leg, test of stability, run from a flying start (maximum speed), ten jumps on both legs, 400-metre run, running nines, counter-movement jump and reaction time to a visual impulse (squat jump). The linear regression analysis was used to determine the relationship between the selected motor tests and performance in alpine skiing (Rauch Cup points). Correlation was found between each individual motor test and criterion variable (Rauch Cup points) except test of stability and reaction time test (squat jump). Multiple linear regression (MLR) showed us that the selected model, assembled of four tests that gave the highest MLR was significant ($R = .727$; $p < .001$). According to the findings, we can conclude that motor skills represent 53 % of the competitive performance variance of the alpine skier.

Keywords: *alpine skiing, competition, motor functions, performance.*

POVEZAVA RAZLIČNIH MOTORIČNIH SPOSOBNOSTI Z DOSEŽENIMI TOČKAMI V RAUCH POKALU

IZVLEČEK

Pri alpskem smučanju je doseganje dobrih rezultatov, enako kot tudi pri drugih športnih disciplinah, odvisno od različnih dejavnikov in kakovosti načrtovanja ter izvajanja trenažnega procesa. Namen naše raziskave je ugotoviti, ali obstaja korelacija med rezultati v izbranih motoričnih testih in številom doseženih točk v Rauch pokalu. V raziskavo smo vključili 41 moških tekmovalcev, starih od 13 do 14 let, iz različnih slovenskih smučarskih klubov. Izvedli smo sledeče teste: taping z dominantno nogo, test stabilnosti, tek z letečim štartom (maksimalna hitrost), deseteroskok sonožno, tek na 400 metrov, osmice med devetimi keglji, skok z nasprotnim gibanjem in reakcijski čas na vizualni impulz (skok iz polčepa). S Pearsonovim koeficientom smo določili linearno razmerje med motoričnimi testi in kriterijsko spremenljivko (dosežene točke v Rauch pokalu). Regresijska analiza je bila uporabljena za določitev hipotetičnega vpliva celotnega spektra izbranih motoričnih sposobnosti na uspešnost pri alpskem smučanju. Korelacijska analiza med posameznimi testi in kriterijsko spremenljivko je pokazala, da vsi testi razen testa stabilnosti in reakcijskega časa na vizualni impulz, medsebojno korelirajo. Multipla regresija nam je pokazala, da je regresijski model, sestavljen iz štirih izbranih spremenljivk, značilen ($R = .727$; $p < .001$). Glede na ugotovitve lahko trdimo, da motorične sposobnosti predstavljajo velik delež tekmovalne uspešnosti v alpskem smučanju, zato bi morali redno testiranje vključiti v program treninga in evalvacije.

Ključne besede: *alpsko smučanje, tekmovanje, motorika, tekmovalna uspešnost*

INTRODUCTION

Good psychophysical preparation is one of the basic conditions for achieving good results at competitions. That is why this part requires extra attention in younger as well as in older categories of competitors. The potential of the psychosomatic status of an alpine skiing competitor depends on the development of their motor skills, which also represents a basic guideline for designing a training process with content that is as closely as possible related to the quality of movement in alpine skiing. Depending on this, we need to define a method to help us monitoring positive or negative changes which result from both the content and intensity of the training process (Šturm, 2012). Coaches should perform regular tests of their athletes aiming to obtain valid results for efficient and healthy athlete's development and health (Ušaj, 2003).

Alpine skiing is a complex sport discipline which requires basic muscular power, aerobic and anaerobic abilities as well as a wide movement program of specific motor

abilities. The contribution level of each factor depends on the competition demands in which the athlete takes part. Some sports, like swimming or track, are performed in a controlled environment and there the demands of competition can be quantified quite easily. On the other hand, sports like alpine skiing or football are exposed to various external influences and an athlete must often adapt to them in the middle of their performance (Heikkinen, 2003).

If we want to develop an appropriate battery of tests for alpine skiers, we need to understand which muscles are used during a competition and in what way (the type of contraction). During these tests, the athletes need to stimulate those muscles in the same way as they do at the competition. Hintermeister et al. (1995) conducted research involving elite skiers and found out that their lower body and torso musculature was heavily activated during the alpine skiing movements. Throughout a turn, adductors and some other muscles were working almost continuously at over 100 % of maximum voluntary rate of contraction. Brown and Wilkinson (1983) state that alpine skiers have, in comparison with untrained general population, lower body fat and that their body composition is similar to weight lifters' and swimmers'. A study conducted by Haymes & Dickinson (1980) documented that alpine skiers have high ranking of isokinetic leg strength. The conclusion from these results suggests that lower body strength is an important predictor of a successful alpine ski competitor. This can help us conduct a proper battery of tests for alpine skiers.

There is not a lot of research done with younger populations in alpine skiing correlating competition performance and field or laboratory tests. Mladenović et al. (2015) investigated the correlation between results in ten motor ability tests and achieved level of ski knowledge during six-day alpine ski school in children aged between 7 and 8. They found that successful children have better developed agility, coordination, strength and frequency of movement. Bandalo and Lešnik (2011) studied a correlation, based on a model of potential and competitive performance, on a sample of 30 older boys aged from 13 to 14 who participated in the Argeta Cup 2009 / 2010 and showed 4 correlations of anthropometric dimensions and 13 correlations of motor dimensions. Dolenec and Lešnik also found an important correlation between competition success and morphology and motor abilities in young female (Dolenec, 1996) and young male competitors (Lešnik, 1996) in alpine skiing. Based on the results they concluded that it would be reasonable to reduce the number of variables from battery of tests.

According to these findings, we have put together a potentially successful battery of tests that measure those motor skills that are most associated with competitive performance. As Dolenec (1996), Bandalo and Lešnik (2011) and Lešnik (1996) suggested, we have reduced the number of motor variables from eighteen to eight variables. We set the following research questions: i.) is there a correlation between selected motor tests and points achieved in Rauch Cup in male U14 age class and ii) does the selected model of four variables has a correlation with points achieved in the Rauch Cup.

METHODS

Participants

The sample consisted of 41 boys who were competing in Rauch Cup (slalom, giant slalom and super-G) in season 2016 / 17 in U14 age class. They came from different ski clubs across Slovenia. The Ethical Board of the Faculty of Sport, University of Ljubljana, approved the research experiment. All participants were informed of the study purpose and voluntarily participated in all tests. Parental written agreement was also obtained for each participant.

Procedure

Measurements were assessed in autumn, before the competition season started. The whole procedure and tests were explained prior to the start of measurements. Tests were conducted at the Faculty of Sport in Ljubljana. The athletes were properly warmed-up before the start. First we assessed basic anthropometric measurements, body height and body weight. Then we used the following motor tests:

Taping with a dominant leg (TAP)

This represents the rate of movements test and is performed by shifting one's foot as quickly as possible over a 15-cm-high bar within 15 sec. The athlete sits on a chair with arms along his torso. One full cycle consists of moving the foot over the bar, touching the ground and returning the foot to its original position. The device counts only fully completed cycles and our research consisted of each athlete having two attempts, with the better of the two taken into account.

Test of stability (STAB)

The athlete had two attempts for this test, which was used to assess the overall dynamic stability and was performed in laboratory with Biodex Balance SD. The result is presented in the form of stability index. The athlete was positioned with both legs on the device's platform and attempted to maintain the stable position for as long as possible.

Run from the flying start – maximum speed (MAXSP)

The athletes had two attempts and were asked to start in the ski stance position. On starting mark athlete must in 30m develop maximum speed. The results are measured in m / s by a laser device, maximum speed achieved during running was recorded.

Ten jumps on both legs (MSKOK10)

This test measured driving power of the legs, with each athlete having two attempts and the longest of the two was taken into analysis. The test involved the measurement of the distance achieved by 10 consecutive jumps with no interruption between repetitions.

400m run (MT400)

Speed endurance was assessed by 400 meters run test. Athletes performed this test only once.

Running nines (SKI9)

The task here was to run as quickly as possible around nine pins (in the form of an eight) and represents a test of agility. This test was performed only once.

Counter movement jump (CMJ)

In this test, the athletes had to jump as high as possible using countermovement jumping technique (CMJ). They had three trial jumps followed by two recorded attempts. There was a 2-minute rest between each jump, with jumps being performed on a ground-force plate. The height was calculated based on the flight time. The highest jump was taken into account.

Reaction time to a visual impulse (squat jump) (SJREAC)

Reaction time to a visual impulse triggered by computer screen was measured using Optojump device. On a visual signal, the athlete had to jump as quickly as possible from a squat position. They had three trial jumps followed by two recorded attempts.

Criterion variable (points in Rauch Cup)

The criterion variable represents the actual performance of all measured competitors on Rauch Cup in the 2016 / 2017 season. This was expressed by the total number of points, achieved in each individual competition for Rauch Cup.

Statistical Analysis

Collected data was analysed using SPSS (IBM, version 22, USA) and Microsoft Excel 2013 and we summarized data with descriptive statistics. With Pearson's correlation coefficient we determined the linear correlation of each individual variable with competitive performance (Rauch Cup points). The multiple linear regression (MLR) analysis was used to determine how multiple independent variables are related to one dependent variable, in our case to competitive performance. With Enter method we inserted four variables that gave the highest MLR, with that we predicted the level of effect of this model and each variable on criterion variable. The criterion variable was represented by the total number of points, achieved in the Rauch Cup. Statistical significance was accepted at $p < .05$.

RESULTS

Participant's basic anthropometric data are presented in Table 1.

Table 1: Basic anthropometric data.

	AM ± SD
N	41
Body height (cm)	158.2 ± 9.3
Body mass (kg)	49.5 ± 11.7

In Table 2 we determined for each variable minimum value, maximum value, range of values and arithmetic mean ± standard deviation.

Table 2: Descriptive statistics for each variable.

	RANGE	MIN	MAX	AM ± SD
Taping with the dominant leg	9.0	17.0	26.0	22.0 ± 2.3
Test of stability	6.6	1.3	7.9	3.9 ± 1.8
Maximum speed	2.47	5.39	7.87	6.64 ± .55
Ten jumps on both legs	11.1	15.2	26.3	19.6 ± 2.4
400m run	41.7	62.1	103.8	79.8 ± 9.6
Running nines	11.6	28.1	39.7	33.0 ± 2.8
Counter-movement jump	22.5	18.6	41.1	27.6 ± 4.8
Reaction time to a visual impulse	.23	.39	.62	0.47 ± .06

Note: Range - the range between minimum and maximum value, MIN – minimum value, MAX - maximum value, AM±SD – arithmetic mean with standard deviation.

Table 3: Pearson correlation coefficient values between motor variables and performance (points) in the Rauch Cup.

TEST		POINTS
Taping with the dominant leg	r	.320*
	p	.041
Test of stability	r	.111
	p	.488
Maximum speed	r	.712**
	p	<.001
Ten jumps on both legs	r	.678**
	p	<.001
400m run	r	-.583**
	p	<.001
Running nines	r	-.563**
	p	.001
Counter-movement jump	r	.576**
	p	.001
Reaction time to a visual impulse	r	-.293
	p	.063
Note: ** - Correlation is significant at the 0.01 level (2-tailed), * - Correlation is significant at the 0.05 level (2-tailed), r – Pearson's coefficient.		

Table 3 presents Pearson's correlation coefficients for the motor tests in relation to skiing performance. We found positive correlation between criterion variable and variables TAP, MSKOK10, MAXSP and CMJ, while negative for MT400 and SKI9. In the case of SJREAC and STAB, the correlation coefficient calculation did not show a significant correlation.

Multiple linear regression (MLR) analysis was performed with Enter method. We included 4 predictors that gave the highest MLR for our sample of 41 participants. These were MAXSP, MSKOK10, MT400 and CMJ. Results showed that the linear relationship, between four motor tests and skiing performance is high ($R = .727$; $P < .001$) and explained 53 % of skiing performance variance (Table 4).

Table 4: Model.

R	R^2	P
.727	.53	< .001
Note: R – coefficient of multiple correlation; R^2- coefficient of determination. Predictors: (Constant), MAXSP - run from the flying start (max. speed), MSKOK10 – ten jumps on both legs, MT400 - 400m run, CMJ – counter-movement jump.		

Table 5: The multiple linear regression (MLR) analysis.

	B	Beta	Partial R	P
Constant	-1773.776			.033
Maximum speed	199.497	.613	.342	.036
Ten jumps on both legs	24.375	.325	.178	.284
400m run	2.917	.156	.113	.498
Counter-movement jump	-2.373	-.063	-.046	.784

Note: dependent variable: Pokal; predictors: (Constant), MAXSP - run from the flying start (max. speed), MSKOK10 – ten jumps on both legs, MT400 - 400m run, CMJ – counter-movement jump.

In Table 5 we can see that when we add four variables into MLR analysis, some of them are not significant anymore. In our case, the variable MAXSP is the most important contributor ($p = .036$).

DISCUSSION

This study was focused on the correlation between the selected motor abilities and competitive performance in U14 age group of alpine skiers. We found a correlation between competitive performance and results in six out of eight motor tests. Positive correlation was found between Rauch points and variables TAP, MSKOK10, MAXSP and CMJ, while negative for MT400 and SKI9. The same as Bandalo and Lešnik (2011), we also did not find a significant correlation between balance (variable STAB) and criterion variable. This is interesting because the postural control in alpine skiing, in particular the management of the balance, is widely considered as one of the limiting factors of performance. For future research, we suggest that researchers use different balance tests and find out which test is best correlated with performance. In multiple linear regression, we included 4 predictors that gave the highest MLR: MAXSP, CMJ, MSKOK10 and MT400. Simple linear regression showed us that each predictor variable had a significant p-value. But from the multiple regression model output, CMJ, MSKOK10 and MT400 no longer displayed a significant p-value. We think this is an example of collinearity of the predictors. But overall, the model is still significant. In our case, the variable MAXSP, which represents maximum speed, had a strongest correlation with the criterion. With our research we addressed the dilemma with using a greater or smaller battery of test. As Lešnik (1996) and Dolenec (1996) suggested, we used a smaller battery, which can be performed at once. Based on the test results we can plan and conduct the training process, which later leads to efficient effort overcoming at training and at competitions. In future, it will be necessary to monitor the development of young athletes even more systematically. This is a sensitive period and that is why it is even more important that the battery of tests is effective and tells us those things about the athlete, which professionals needs in order to guide them in the training process. Nowadays, the differences between individuals' performance are getting smaller, that is why we need to focus on raising the level of motor and functional skills to the highest level possible. In this part, testing motor abilities plays an important role. Although highly developed motor abilities are crucial for good competitive performance, we must not ignore the role of biological age, motivation and concentration for this age group.

CONCLUSION

Our findings show the suitability of selected motor tests in determining the potential success of young alpine skiers. We will continue with deployment of state-of-the-art measurement methods and try to connect them with the measurements of older age categories of competitors in alpine skiing. In conclusion, the test concepts presented in this study can help ski schools, clubs and skiing federations in the guidance and evaluation of young talents. In the future, we suggest that in addition to motor test, researches also include several anthropometric measures and examine cognitive and behavioural measures of motivation.

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THE RELATIONSHIP BETWEEN DIMENSIONS OF TECHNICAL KNOWLEDGE OF YOUNG ALPINE SKIING COMPETITORS AND COMPETITIVE PERFORMANCE

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ABSTRACT

In the research, the relationship between individual variables of technical assessment of free and competitive style alpine skiing and the criterion variable (competitive performance) are addressed. The criterion variable is the total number of points that was achieved in the Rauch Ski Cup in the season 2013/2014. Twenty selected alpine skiers between the ages of 12 and 14were included in the research. Technical knowledge and tactics of alpine skiing were assessed in the free skiing (TFS) during two giant slalom races for the Rauch Ski Cup (TCS). In order to determine bivariate correlations between the TFS and TFC variables and the competitive performance, the Pearson correlation coefficient method was used. For this particular section of the study, it was confirmed that all the variables used were significantly related to the criterion variable. In the successive test, using the calculation of multiple regression coefficients, we confirmed the high percentage of the explained variance of the two sets of measurements (TFS and TCS). In this research, the influence of technical knowledge of skiing in the free (TFS) and competitive skiing (TCS) on the competitive performance of alpine skiing in Slovenia was studied for the first time. Based on the results of the research, the foundation for both an improved concept of psychophysical and technical training and for the modernization of the selection criteria for the young competitors in alpine skiing will be proposed.

Keywords: *alpine skiing, young categories, competitive successfulness, technique in free skiing, technique in competitive skiing.*

POVEZANOST DIMENZIJ TEHNIČNEGA ZNANJA MLADIH TEKMOVALCEV V ALPSKEM SMUČANJU S TEKMOVALNO USPEŠNOSTJO

IZVLEČEK

V raziskavi smo ugotavljali povezavo med posameznimi spremenljivkami pri oceni tehnike alpskega smučanja v prostem in tekmovalnem smučanju s kriterijsko spremenljivko (tekmovalna uspešnost). Slednjo je predstavljal seštevek točk v smučarskem pokalu Rauch v sezoni 2013/14. V raziskavo je bilo vključenih 40 izbranih tekmovalcev alpskega smučanja starih od 12 do 14 let. Področje tehnike in taktike alpskega smučanja je bilo ocenjeno v prostem smučanju (TFS) in na dveh tekmovanjih v veleslalomu za pokal Rauch (TCS). Za določitev bivariatnih povezanosti posameznih spremenljivk TFS in TCS s tekmovalno uspešnostjo smo uporabili metodo izračuna Pearsonovih koeficientov korelacije. V tem delu smo potrdili, da so s kriterijsko spremenljivko statistično značilno povezane vse uporabljene spremenljivke. V nadaljevanju smo s pomočjo izračuna multiplih regresijskih koeficientov potrdili visok odstotek pojasnjene variance obeh sklopov meritev (TFS in TCS). V tej raziskavi je bil v slovenskem prostoru prvič raziskan vpliv tehničnega znanja smučanja v prostem (TFS) in tekmovalnem smučanju (TCS) na uspešnost v tekmovalnem alpskem smučanju. Na osnovi rezultatov raziskave bodo predlagana izhodišča za izboljšan koncept psihofizične in tehnične priprave ter za posodobitev kriterijev za selekcioniranje mladih tekmovalcev in tekmovalk v alpskem smučanju.

Ključne besede: *alpsko smučanje, mlajše kategorije, tekmovalna uspešnost, tehnika v prostem smučanju, tekmovalna tehnika*

INTRODUCTION

Alpine skiing as an athletic and recreational activity is a small part of global sports. However, in snowy and mountainous regions it is an integral part of the lifestyle of both the young and the old (Krautgasser et al., 2012). This research interest follows the concept of scientific approach in alpine skiing for children in late childhood and in adolescence, exploring some of the factors that influence success in this sport. Alpine skiing is a sport in which success in competitions depends on various internal and external factors that are related to each other (Lešnik & Žvan, 2003). With the development of skiing disciplines, alpine skiing has reached the level where top results are very hard to reach (Hébert-Losier, Supej, & Holmberg, 2014). In the process of training, there is a set of different and special elements that are more effective for each discipline in alpine

skiing (Lešnik et al., 2017). In a multitude of factors that influence the performance of young alpine skiers, technical knowledge of skiing is certainly one of the most important. Based on observations in practice, we find that the skiing technique of young athletes is not on the level that is needed to achieve top results in competitions. The reasons for this, on one hand, are the modes and contents of training that include a lot of skiing between the gates. This, on the other hand, leaves too little time to train the elements of skiing techniques that are outside the ski course setting. As a consequence, many young competitors have a relatively narrow base of skiing skills, and there are many with incorrectly learned movement patterns.

The movements executed during alpine skiing, which involve continuous connecting of short parallel turns, are much more complicated than the movements needed during performance and experimental conditions (Cigrovski et al., 2017). Each skiing turn consists of three phases. The first phase is the beginning of a turn. The second phase is the pivoting phase of a turn, and the third phase is the completion phase (Lešnik & Žvan, 2010). The most common deficiencies in technical knowledge in younger categories are the imbalance of the body, excessive slipping of the skis throughout the turn, choosing a slower skiing line, and uncoordinated excessive movements during the performances of racing, skiing turns and other technical elements of skiing. All this is becoming one of the main reasons for achieving poorer results in competitions, especially in competitions with more demanding course settings (Lešnik & Žvan, 2007; Puhalj, 2018).

Special elements of alpine skiing sports techniques correlate highly with the successes and accomplishments in competitive alpine skiing (Loland & Haugen, 2000). It is important that the development of sporting techniques, psychological potentials and motoric abilities take place simultaneously (Weineck, 2009). Technical elements can be carried out in a series of small partial services or movement patterns which can be connected into a well-functioning technical execution that present quality skiing (LeMaster, 1999). One of the main goals of the ski training technique is stable skiing on the ski edges even in the most difficult conditions. In terms of mastering the technique of skiing, this means constant fine adjustments of body angles, particularly in the hips, knees and ankles, as well as tilting of the body to the side. Distribution of the appropriate strength to complete a turn especially across the fall-line refers to when an increasing gravitational force and resistance develop through extreme inclination of the skis in order to maintain the line of a turn (Wörndle, 2007). In practice, we talk about slipping in turns, which often reflects inadequate or poor technique and pivoting turns on the edges with a good ski grip on a snowy surface (LeMaster, 1999) or, according to Jouberts (1978), for finding quality support on a snowy surface. Development of effective control over the skiing speed and direction can be achieved through a turn on the edges where the front and the rear of the ski slide along the same line of the turn. The skis should only move forward, preferably with zero side slipping and with minimum energy loss (Loland, 2009).

The basic aim of the training of the technique is therefore a balanced, fluid, light and controlled pivoting of skis with appropriate patterns of movement and without

excessive pressure on the surface. Quality ski training should include both skiing between the gates and skiing outside course settings. It is generally known that a high level of technical knowledge can be achieved primarily through training in a variety of conditions (hard surface, poor visibility, powder skiing and mogul skiing, to name a few). This was also the main starting point for setting up the criteria for the quality technical knowledge of young competitors in alpine skiing (Puhalj, 2018). The so-called Technical Skills Knowledge Model of Young Competitors consists of the variables of the free skiing technique (TFS) and the variables of the technique in competitive skiing between the gates (TCS). Therefore, the main aim of this research is to find out the correlation between the selected variables of skiing technique knowledge and the competitive performance of young athletes in alpine skiing.

METHODS

The study included 20 young boys (year of birth 2000 and 2001; height 158.97 cm, +/- 9.11 cm; weight 50.18 kg, +/- 9.42 kg) , all of whom were selected athletes in alpine skiing. The factors of technique in freeride skiing (TFS) that were studied are Balance in Free Skiing (FSBL), Coordination in Free Skiing (FSCO) and Phase of Completing the Turn in Free Skiing (FSCT). The factors of technique in competitive skiing (TCS) that were studied are Technique in Competitive Skiing (CSBL), Balance in Competitive Skiing (CSBL), Phase of Completing the Turn in Competitive Skiing (CSCT) and Lines of Skiing in Competitive Skiing (CSLS).

The evaluation of ski variables of the competition technique for younger boys was carried out during two giant slalom competitions, which also counted for the Rauch Cup. The first competition took place on Soriška planina (March 21, 2014), and the second one in Krvavec (March 29, 2014). In the 30-second starting intervals, the evaluators recorded grades from 1 to 3 on the pre-prepared scoreboards (grade 1 = poor, 2 = medium, 3 = good). Both competitions were carried out in ideal snow conditions, which ensured equivalent competitive conditions for all competitors.

The grades of the variables were obtained from 7 members of the National Examination Committee for Alpine Skiing from the Ski Instructors and Trainers Association of Slovenia (SITAS). The grades of the balance assessment (1 to 3) for frequent loss of balance in all four operating directions were marked with the lowest score; the cases of stable balance positions were marked with the highest score. The same evaluation was used in both the competitive and free skiing. Assessment of the pivoting of skis in turns took place under the same criteria in the competitive giant slalom as well as in the giant slalom turns in free skiing with special tasks. Turns with more slipping of the edges were marked with the score 1 and the turns without slipping of the edges were marked with the score 3. The skiing lines on the medium steep racing tracks, which were carried out with a longer pre-preparation over the gate with a turn above the gate or with a turn below the gate, were rated with the score 1. Turns with a more direct beginning and completion were rated with the score 3. Turns a little over and a little below the

gates (configuration, preparation and ski course setting all considered) were marked with the score 2. The co-ordination of movements was assessed only in free skiing and was based on harmonic, timely and spatially coordinated uninterrupted movements from one turn to another. The moving phases followed each other slower downwards and faster upwards. Special attention was also paid to the coordinated pole planting, which also marked the beginning of the vertical movement. This was absolutely necessary when passing from one turn to another on the lower ski with a lifted upper ski. A score of 3 was assigned for a well-coordinated movement from one turn to another and a score of 1 for uncoordinated movement (Puhalj, 2018).

The Pearson correlation coefficient method was used to calculate the correlation between individual variables and the criterion variable (achieved points in the Rauch Ski Cup for the season 2013/14). On the basis of certain components, consisting of free skiing (TFS) and competitive skiing between the gates variables (TCS), we also calculated the percentage of the explained variance.

The criterion variable represents competitive performance at the highest degree of children's competitions in alpine skiing organized under SAS. Ranking level at competitions (criterion variable) for each competitor is calculated on the basis of the sum of official results (SAS, 2010).

RESULTS AND DISCUSSION

The analysis of the correlation between variables of the technique in free skiing (TFS) and the variables of the technique in competitive skiing (TCS) shows a statistically significant correlation with the criterion variable (success in the Rauch Cup). As a rule, the participants of the study who received higher scores for their skiing technique also achieved a higher ranking in the competitions for the Rauch Cup.

Table 1 shows the association of all three variables of the free skiing technique skills and the performance in competitions at the level of a 1 % risk. The coordination in free skiing variable runs the highest level of association with the performance in competitions (r_{FSCO}=0.762**). An almost as high correlation was calculated for the variables of balance in free skiing (r_{FSBL}=0.728**) and for the variable quality completing the turn in free skiing (r_{FSCT}=0.601**). The three variables considered together account for as much as 83 % of the variance area of the component of the technique in free skiing (TFS), which means that the selected criteria for determining and checking the technique of young competitors in free skiing is appropriate. Statistically high significant correlations between the components of the technique in free skiing indicate that the training elements of free skiing techniques are a very important part of training for young competitors. Therefore, in the future, during snow training, trainers will have to spend more time conducting training for balance, coordination and skiing turns in freeride skiing. All these elements of skiing techniques are closely interconnected and, as such, provide a quality performance of skiing turns, which form the basis of the competition skiing style. An important reason for increasing the amount of the skiing

Table 1: Calculation of Pearson's coefficients between individual variables of the technique in free skiing (TFS) and technique in competitive skiing (TCS), and criterion variable, and percentage of explained variance of main component in free skiing (FSEV %) and in competition skiing (CSEV %).

TFS	**N**	**AV**	**SD**	**r**	h^2	**Λ**	**% EV**
FSBL	20	6.55	1.669	.728**	0.745		(F S E V %)
FSCO	20	7.10	1.518	.762**	0.928	2.494	83.140
FSCT	20	7.05	1.731	.601**	0.821		
TCS	**N**	**AV**	**SD**	**r**	h^2	**Λ**	**% EV**
CSBL	20	10.75	1.803	.613**	0.683		(C S E V %)
CSCT	20	13.05	2.328	.743**	0.814	2.188	72.940
CSLS	20	11.75	2.337	.506*	0.691		

*Legend: TFS-Technique in free skiing; FSBL-Balance in free skiing; FSCO-Coordination in free skiing; FSCT- phase of completing the turn in free skiing; TCS- technique in competitive skiing; CSBL- Technique in competitive skiing; CSCT- phase of completing the turn in competitive skiing; CSLS-lines of skiing in competitive skiing; N-number of competitors; AV-average result; SD-standard deviation; r-Person's coefficient of correlation with criterion variable; *- statistical significance of r on 5% risk level; **- statistical significance of r on 1% of risk level; h2- main component comunality; λ – main component value; %EV- % of explained variance; FSEV%- % of explained variance of main component in free skiing; CSEV%- % of explained variance of main component in competition skiing.*

technique training in free skiing is that it also allows for the diversification of training on snow. Special exercises based on atypical motor structures can be a good variation of training on snow, which in turn can have a positive impact on the technical knowledge of skiing (Lešnik & Žvan, 2010). The acquisition of technical skills for young athletes, along with quality physical conditioning, is very important because over the years all the missing technical knowledge becomes increasingly difficult to correct and the imbalances more difficult to adjust (Raschner, Müller, & Hildebrandt, 2015).

Among the 3 variables of the competition technique of skiing between the gates (TCS), the completing the turn variable (r_{CSCT}=0.743**) is strongly associated with the competition performance, while the balance variable is slightly less associated with it (r_{CSBL}=0.613**). Both connections are statistically significant at the level of a 1 % risk. The third considered variable, which determines the quality of the selected turning line, is the least connected with success in competitions, but is still statistically significant at the level of a 5 % risk (r_{CSLS}=0.506*). The three variables presented in total explain

73 % of the space variance of the competition technique of skiing between the gates component (TCS), which means that the selected criteria for identifying and assessing the technique of young competitors in the competition ski course setting are appropriate. Stable skiing on the edges means constant fine-tuning of body angles in the hips, knees and ankles, as well as tilting of the body to the side. All the measured parameters of the technique are considered to be crucial for the competition results in alpine skiing (Wörndle, 2007; Loland, 2009).

In accordance with the results, the competitors with a better balance on the skis, a cleaner turn performance and a better selected and a faster line of the turn were ranked higher in the competitions for the Rauch Cup 2014/15. Therefore, these segments of competitive skiing techniques will require even more attention in the future. At such training, the use of various didactic tools, such as markers, cones and other aids (Pišot & Videmšek, 2004) is crucial in helping athletes balance the position of the body, as well as limit the time and length of a turn and the line throughout an entire turn (Lešnik & Žvan, 2010).

The main finding of this research is that all the selected variables for checking and determining the quality of the technique of young, skiing competitors in alpine skiing are significantly related to the criterion variable (competition performance). Particularly interesting is the fact that the highest degree of association with the criterion is displayed by the variables that are manifested as the most important ones in practice too. Although all the variables used proved to be statistically significant at the highest level of integration, we must, in particular, point out the variable of the coordination of movement in free skiing (r_{FSCO}=0.762**), completing the turn between the gates variable (r_{CSCT}=0.743**) and the balance in free skiing variable (r_{FSBL}=0.728**).

In competitive alpine skiing there can be many reasons for losing time; however, from the point of view of skiing technique, one of the main reasons for losing time during the course setting is a poor performance of turns. A good skier performs in a balanced, smooth and effortless manner, ensuring that they have the situation under control through adequate pivoting of skis. Additionally, a good skier's switching between moving patterns is rolling and without excessive pressure on the surface (Loland & Haugen, 2000). This means that the competitor can lose too much time in the beginning phase of a turn, the pivoting phase as well as in the completion phase of a turn. Slipping of skis, the wrong body position and other unnecessary manoeuvres on the track may also contribute to loss of time. (Sandbakk et al., 2014). In order to keep turns on the edges and optimum arcs of turns, one must use the pressure on the ground very rationally (Loland, 2009). In this respect, the most illustrative is the high correlation between completing the turn between the gates variable (r_{CSCT}=0.743**) and the performance. Since only the smallest details distinguish the best competitors from the finest, there are still many reserves in the phase of completing a turn, which must be used with a well-targeted ski training technique.

CONCLUSION

The research showed a high degree of correlation between the selected elements of the technique in free and competitive skiing and competitive performance. The latter is especially important when working with younger categories of competitors. However, we must realize that good technical knowledge is only the basis for good tactics in skiing. In different settings of the gates and competition slopes, the straightest route between the two ski gate poles with a short radius of a turn is not always the fastest. Therefore, at competitions, the fastest skiers do not always win. Instead, it is the skiers who lose the least time on the track who are successful (Madura, Lufkin & Brown, 2012). Researchers recommend an early start of skiing along the fall-line and thus immediate speeding at the beginning of the turning trajectory. The primary force of acceleration is gravitation (Müller & Schwameder, 2003). Using the 3D kinematical system of measuring and evaluating technical and tactical elements of 16 elite competitors, Supej (2008) also notes that the most direct and the shortest lines in turns are not always the most effective ones. It has been proven that the amplitude of the reaction of the radial force, radii of turns, speed and acceleration are not the only parameters for assessing the quality of skiing, although all these parameters are essential for the competitive alpine skiing. The high speed of the skier at the point of observation does not necessarily mean that the skier is successful because he could slow down the skiing by inappropriate trajectory of turns (Supej, Kugovnik, & Nemec, 2005). There are turns with a very direct beginning with pivoting and turns with at least 1/3 of the line of a turn performed above the gate. In line with the research of the lines of turns, we can divide them into turns with lines of 50 % above and 50 % below the gate, and on turns with lines of 60 % above and 40 % below the gate. The choice of the most optimal manner of skiing between the gates depends on different factors, especially on weather conditions, treatments of the snow, layout of the racing tracks, disciplines of alpine skiing, configuration of the racing tracks and, of course, physical and technical condition of the competitors. Mainly in the technical disciplines of alpine skiing on steep, configurable demanding fields and with difficult course settings which are dominated by turns with large radii, better racers perform skiing lines with early ski edging and transfer weight on the outside ski. They also have more turn performance above the gates than beneath them (Brodie, 2009).

On the way to achieving good results in alpine skiing, strengthening of the psychomotor base and development of motor control processes are largely linked to ski coordination. In previous research, it has been repeatedly found that general and special co-ordination have the greatest influence on the efficiency of the movement of young competitors (Bandalo, 2016; Pišot, Kipp, & Supej, 2010). Malina and Bouchard (1991) also find high association between the biological age (bone age) and motor abilities and skills in conjunction with high muscular force. In the process of acquiring ski knowledge, this is especially reflected in practice. Acquisition of basic ski skills begins through practice of the basics of the free skiing technique (Mildner et al., 2012). Only later are the acquired knowledge and skills gradually upgraded on the set-up ski courses.

Weineck (2009) also defines a theory of gradualism in acquiring motor skills (which include also technical knowledge) over a 4-tier scale. Therefore, we gradually approach the situation in competitions where measured time is the only performance parameter.

In the age group covered by the sample, the efficiency of movement is also associated with developmental changes (Grosser, Starischka & Zimmermann, 2004). Accelerated growth can greatly aggravate movement and the entire training process needs to be adapted to it (Pernitsch & Staudacher, 1998). In the study, there were many cases where competitors were unable to achieve top-level results because of a poorly developed co-ordination capability. Due to high demands for development of special motor skills (Pišot, Kipp & Supej, 2010), mechanical movement analysis is followed by the qualities, where the human body is seen as a system of internal mechanical forces and skiing is seen as the interaction between these forces and the external forces connected with the environment (Supej et al., 2005). According to the findings, the physical self--concept is more closely connected with body composition and morphologic features in boys than in girls, whereas the body fat proportion is the strongest predictor of physical self-concept in boys. The findings show that, particularly in boys, the physical self-concept is also largely based on the morphologic features and body composition (Puhalj, Matejek, & Planinšec, 2013).

In the research, the influence of technical knowledge of skiing in free and competitive skiing in comparison to the competitive performance in alpine skiing has been explored and it has shown a high degree of integration. Research findings of this study are an important confirmation for systematic integration of the training of skiing techniques into the training process of younger categories in alpine skiing. Based on the research results, the necessary conditions for devising exercise, the establishment of new criteria for selecting children, and the prediction of the likelihood of sports results in alpine skiing for the selected sample of children will be suggested with orientations for a more friendly and athletic-focused approach.

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2nd INTERNATIONAL CONFERENCE SPE BALKAN SKI

Mt. Jahorina Ski Resort, Bosnia and Herzegovina, 11th–15th March 2018

After the 1st conference organized in 2017 at the Kopaonik Ski Center in Serbia, following the initiative of prof. Rado Pišot, the Director of the Science and Research Centre Koper and his colleague prof. Ljubomir Pavlovič from the University of Niš, the Jahorina Ski Center with Faculty of Sports and Physical Education of University of Sarajevo, Bosnia and Herzegovina, hosted the 2nd International Conference SPE BALKAN. The Conference was co-organized by the Science and Research Centre of Koper (Slovenia), Faculty of Sport and Physical Education, University of Niš and the Association of Ski Teachers and Coaches of Slovenia (ZUTS).

As "Science, practice and education" remained the leading ideas of the content and scope of the Conference on Alpine skiing and boarding, this year's main theme was: "Fun and safety in contemporary skiing − the new role of ski instructors / trainers in winter sports and society."

As the first conference set high scientific standards, many experts responsible for the development and progress in winter sports have been invited to participate at the second conference. The afternoon lectures held by prof. Ron Kipp (USA) (in the absence

of prof. Erich Muller, Austria), prof. Pete Alison (Scotland and USA), prof. Blaž Lešnik (Slovenia) and many others, in over 30 scientific contributions highlighted the latest views on the sensitive areas of safety and injury, the secrets of preparing and developing the technique and tactics of the alpine skiing, and, finally, the contemporary possibilities and approaches in the methodology and didactics of teaching skiing. After the conference, the best-presented works were invited to be published in scientific journals.

Morning snow workshops were led by the members of the Demo Teams from the participating countries in the Balkans (Demo teams of Slovenia, Bulgaria, Bosnia and Hercegovina, Serbia and Montenegro) upgraded the theoretical starting points through practical work on snow. The spectacular evening Demo show was outstanding event where even the most demanding supporters enjoyed in ski proficiency of Demo teams.

Despite the warm and spring weather, the Jahorina ski resort, as the only venue of the Winter Olympic Games in the Balkans invited special guests − the Slovenian and Bosnian ski legends, Mr. Bojan Križaj and Mr. Enis Bećirbegović as well as 143 participants from 10 countries who were assurance for a diverse, interesting, dynamic and unforgettable event.

Because the winter of 2019 is the already reserved time for INTERSKI Congress in Pomporovo, Bulgaria, the next 3rd International Conference SPE BALKAN SKI will be held in Slovenia, at Rogla Ski Resort in March 2020.

Saša Pišot

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2. MEDNARODNA KONFERENCA SPE BALKAN SKI

Smučarski center Jahorina, Bosna in Hercegovina, 11.–15. marec 2018

Po lanski uspešni prvi konferenci, ki je bila organizirana v Smučarskem centru Kopaonik v Srbiji na pobudo prof. Rada Pišota, direktorja Znanstveno-raziskovalnega središča Koper in prof. Ljubomirja Pavloviča iz Univerze v Nišu, je smučarski center Jahorina s Fakulteto za šport in telesno vzgojo Univerze v Sarajevu, Bosne in Hercegovine, gostil 2. mednarodno konferenco SPE BALKAN SKI. Soorganizatorji konference so bili tudi letos Znanstveno-raziskovalno središče Koper, Fakulteta za šport in telesno vzgojo Univerze v Nišu in Zveza učiteljev in trenerjev smučanja Slovenije (ZUTS).

Vodilno idejo konference "Znanost, praksa in izobraževanje" je spremljala tokratna glavna tema "Zabava in varnost v sodobnem smučanju - nova vloga smučarskih učiteljev/trenerjev zimskih športov v družbi."

Že prva konferenca je postavila visoke znanstvene standarde, zato so bili tudi letos med povabljenimi številni priznani strokovnjaki, odgovorni za razvoj in napredek alpskega smučanja in deskanja na snegu. Na popoldanskem znanstvenem delu konference smo lahko prisluhnili dr. Ronu Kippu (ZDA), ki je nadomestil odsotnega prof. Ericha Mullerja iz Avstrije, prof. Petu Alisonu (Škotska in ZDA) in prof. Blažu Lešniku

(Slovenija) ter mnogim drugim, ki so v več kot 30 znanstvenih prispevkih predstavili najnovejše poglede na občutljiva področja varnosti in poškodb, odkrivali skrivnosti priprav in razvoja smučarske tehnike ter izpostavili sodobne možnosti in pristope v metodologiji in didaktiki učenja smučanja. Avtorji najboljših prispevkov so bili povabljeni, da dela objavijo v znanstvenih časopisih univerz gostiteljic.

Dopoldanske delavnice na snegu so vodili člani demo skupin iz sodelujočih držav na Balkanu (ekipe demonstratorjev iz Slovenije, Bolgarije, Bosne in Hercegovine, Srbije in Črne gore), kjer so udeleženci lahko nadgradili teoretična znanja s praktičnim delom na snegu. Spektakularni večer z "Demo showom" je bil izjemno odmeven dogodek, kjer so lahko še tako zahtevni poznavalci uživali v popolnosti smučarskih tehnik nastopajočih ekip demonstratorjev nacionalnih smučarskih šol.

Kljub toplemu pomladnemu vremenu in zato slabšim snežnim pogojem, je smučišče Jahorina, kot edino prizorišče zimskih olimpijskih iger na Balkanu, ob prisotnosti posebnih gostov – slovenske in bosanske smučarske legende Bojana Križaja in Enisa Bećirbegovića ter 143 udeležencev iz 10 držav, pričaralo prvovrsten in nepozaben dogodek.

Zima 2019 je že rezervirana za pomemben INTERSKI kongres v Bolgarskem smučarskem centru Pomporovo, zato bo naslednjo, 3. mednarodno konferenco SPE BALKAN SKI, v marcu 2020 gostila Slovenija v smučarskem centru Rogla.

Saša Pišot

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15th INTERNATIONAL CONFERENCE ON TRANSFORMATION PROCESSES IN SPORT

Budva, Montenegro, 12th–15th April 2018

From 12th to 15th of April 2018, a selection of researchers from the Institute for Kinesiology Research of the Science and Research Centre Koper visited and participated in the 15th International Scientific Conference on Transformation Processes in Sport organised by the Montenegrin Sports Academy (MSA). The conference entitled Sports Performance was held in coastal town of Budva.

The first lecture session was reduced to two speakers. António Figueiredo of the Faculty of Sport Science and Physical Education of the University of Coimbra Portugal displayed his extensive experience as a football coach and sports advisor into his lecture, titled Youth Soccer Coach's Decisions: There is a Biological-Related Issues Bias? However, this lecture slightly missed a strong impact, due to the absence of related content supposed to be provided by the first speaker Dejan Madić who was going to speak about Promotion of Exercise Interventions in Children: Is There a Critical Period. Concluding this session was Nejc Šarabon, representing the Faculty of Health Sciences of the University of Primorska, Slovenia with the lecture Kinesiology in Ergonomics: Focus on Back Pain, that splendidly introduced the faculty›s on-going research projects.

In two days, the scientific programme was divided into three rooms with parallel sessions that each hosted oral sessions and poster sessions with varied topics. Rang-

ing from video games influencing tennis techniques, knee arthroplasty, bed rest influencing skeletal muscle, to movement and assessment in preschool children, and from gender differences in physical activity among elderly and non-physical techniques to counteract functional decline, to the potential contribution of muscles consumption to a healthier active lifestyle. Through well-moderated sessions, the contributors among which were students and young researchers, were provided with plenty of time to present their findings and – time permitting – these were followed by fruitful discussions.

Several following lectures were of specific interest, especially Rémi Radel›s of the Université Cote d'Azur, Nice France Neurocognitive Functions Involved in the Regulation of Effort during Endurance Exercise: A Dual-Model Perspective that provided a clear theoretical proposition of the regulatory brain network of physical effort. And the lecture of Boštjan Šimunič of the Science and Research Centre, Koper, Slovenia, dealing with Skeletal Muscle Mechanical Contractile Properties: From Childhood to Late Adulthood, which showed that through tensiomyography, non-symmetrical development trends in muscle wasting could be observed for subjects that maintain different levels of physical activity.

Further detailed information on lectures and posters can be found on MSA's listing of conferences (http://csakademija.me/publications/#book-of-abstracts), where also previous editions can be found. Well worth a browse and a further orientation into developing an interest in this highly diverse and interesting regional conference on sport performance of various disciplines and the like.

Cécil Meulenberg

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15. MEDNARODNA KONFERENCA »TRANSFORMACIJSKI PROCESI V ŠPORTU«

Budva, Črna Gora, 12.–15. april 2018

Izbrani raziskovalci Inštituta za kineziološke raziskave Znanstveno-raziskovalnega središča Koper, so se s predstavitvijo prispevkov udeležili 15. mednarodne znanstvene konference »Transformacijski procesi v športu«, ki jo je od 12. do 15. aprila 2018 organizirala Športna akademija Črne Gore. Konferenca z naslovom »Športna učinkovitost« je potekala v obmorskem mestu Budva.

V uvodni sekciji sta bili predstavljeni samo dve od načrtovanih treh predavanj. Prvo je imel Prof. António Figueiredo iz Fakultete za športno znanost in telesno vzgojo, Univerze v Coimbri (Portugalska). Prikazal je dobro poznavanje področja treninga nogometa in svoje izkušnje nogometnega trenerja in športnega svetovalca predstavil v predavanju na temo odločanja nogometnih trenerjev na področju otrok in mladostnikov, z naslovom »Odločitve nogometnega trenerja in upoštevanje bioloških danosti otrok in mladostnikov«. Predavatelj je pustil precej odprtih vprašanj in tez, predvsem zaradi dejstva, da se konference žal ni mogel udeležiti tretji od načrtovanih uvodnih govorcev prof. Dejan Madić, ki naj bi predstavil komplementarno temo z naslovom »Promocija gibalno/športnih intervencij med otroci in mladostniki: ali obstaja kritična obdobje?« in v njej predstavil področje športa otrok in mladostnikov. Sekcijo je zaključil prof. Nejc

Šarabon iz Fakultete za vede o zdravju Univerze na Primorskem, Slovenija, ki je v predavanju z naslovom »Kineziologija v ergonomiji: poudarek na bolečini v spodnjem delu hrbta«, ponudil dober vpogled v raziskave in projekte, ki jih izvajajo na fakulteti.

Dvodnevni znanstveni program je potekal v treh dvoranah s paralelnimi sekcijami, od katerih je vsaka gostila tako predavanja kot poster predstavitve. Teme so bile zelo raznovrstne: vpliv video iger na tehniko tenisa, kolenska artroplastika, vpliv ležanja na skeletno mišico, gibalna aktivnost in spremljanje le-te med predšolskimi otroci, razlika med spoloma v gibalni aktivnosti v starosti, kognitivne tehnike za zmanjšanje funkcionalnega upada, potencialni vpliv uživanja školjk na aktiven življenjski slog. Skozi dobro moderirane sekcije so predavatelji, tudi študentje in mladi raziskovalci, imeli dovolj časa za temeljite predstavitve njihovih ugotovitev kot tudi za pestre razprave.

Sekcija uvodnih predavanj drugega dne je bila izredno zanimiva. Prof. Rémi Radel iz Université Cote d'Azur, Nica, Francija je v predavanju z naslovom »Neurokognitivne funkcije, vključene v regulacijo napora med vzdržljivostnim treningom. Dvodelni model« predstavil teoretično ozadje regulatornih mehanizmov možganske mreže med telesnim naporom. Prof. Boštjan Šimunič iz Znanstveno-raziskovalnega središča Koper, Slovenija je v predavanju z naslovom »Kontraktilni mehanizmi skeletne mišice: od otroštva do pozne odraslosti« predstavil metodo tenziomiografije ter pokazal, da je mogoče s to metodo opazovati nesimetrične razvojne trende propadanja mišic pri osebah, ki vzdržujejo različne stopnje telesne aktivnosti.

Vse informacije o predavanjih in posterjih je mogoče najti na spletni strani Športne akademije Črne gore (http://csakademija.me/publications/#book-of-abstracts), kjer so dostopne tudi vsebine prejšnjih konferenc. Priporočam ogled vsebin izvedene konference po področjih interesa. Konferenco prepoznavam kot interesantno področno srečanje na temo športne zmogljivosti in drugih sorodnih tem.

Cécil Meulenberg
(prevod v slovenščino Matej Plevnik)

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THE 23rd ANNUAL CONGRESS OF THE EUROPEAN COLLEGE OF SPORT SCIENCE

Dublin, Ireland, 4th–7th July 2018

The 23rd annual congress of the European college of sport science was held in Dublin (Ireland) between 4th and 7th July 2018. It was organized by two universities: University College Dublin (UCD) and Ulster University.

In total, there were 2900 participants from 71 countries with 2002 presented abstracts. We had 4 plenary sessions, 41 invited sessions, 161 oral sessions, and 43 mini-oral sessions. The Congress participants presented their latest research from different research fields. Namely, presentations were given in the topics of physiology, training and testing, health and fitness, sports medicine and orthopedics, biomechanics and others. This year, the ECSS Young Investigator Award 2018 contest was held again, where the oral presentation winner was Alessandro Del Vecchio (of the Imperial College London, United Kingdom with the title of his presentation: *Populations of Longitudinally Tracked Motor Neurons Increase their Discharge Rate Following Four Weeks of Isometric Strength Training*) and the mini-oral (poster) presentation winner was Henri Tilga (of the University of Tartu, Estonia with the title of his presentation: *The Effects of Web-based Intervention Program on Physical Education Teachers' Autonomy-Supportive and Controlling Behaviour*).

The ECSS 2018 was attended by one member of the Institute for Kinesiology Research, Scientific and Research Centre Koper, Slovenia. Uroš Marušič, Ph.D. presented the recent discoveries from the GIBKOP project in which he cooperates with two co-authors (prof. Rado Pisot and dr. Jeannette Mahoney). He gave a lecture as part of the "motor development and motor control" section with the title: "The influence of improved cognitive control after non-physical training on mobility-related outcomes in healthy and physically active elderly: A randomized controlled trial".

Next year's 24th annual congress of the European college of sport science will be held from 3rd to 6th July in Prague, Czech Republic.

Uroš Marušič

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23. LETNI ZNANSTVENI KONGRES »EUROPEAN COLLEGE OF SPORT SCIENCE«

Dublin, Irska, 4.–7. julij 2018

23. letni znanstveni kongres »European college of sport science« (ECSS) je potekal v Dublinu (Irska) med 4. in 7. julijem 2018. Letošnji kongres sta v sodelovanju organizirali dve univerzi in sicer »University College Dublin« (UCD) in »Ulster University«.

Letošnjega kongresa ECSS se je udeležilo 2900 udeležencev iz 71 držav z 2002 predstavljenima povzetkoma. Kongres je bil razdeljen na štiri plenarne sekcije, 41 vabljenih, 161 ustnih predstavitev in 43 kratkih ustnih predstavitev. Udeleženci kongresa so predstavili svoje najnovejše ugotovitve na različnih znanstveno-raziskovalnih področjih kot so fiziologija, treniranje in merjenje, zdravje in zmogljivost, športna medicina in ortopedija, biomehanika, če izpostavimo le nekatere. Tudi letos je potekalo tekmovanje mladih raziskovalcev (ECSS Young Investigator Award 2018 contest), kjer je v kategoriji ustnih predstavitev zmagal Alessandro Del Vecchio iz Imperial College-a iz Londona, Velika Britanija (*Populations of Longitudinally Tracked Motor Neurons Increase their Discharge Rate Following Four Weeks of Isometric Strength Training*). V kategoriji predstavitev v obliki posterja pa je slavil Henri Tilga iz Univerze Tartu, Estonija (*The Effects of Web-based Intervention Program on Physical Education Teachers' Autonomy-Supportive and Controlling Behaviour*).

Letošnjega kongresa ECSS 2018 se je udeležil en predstavnik Inštituta za kineziološke raziskave Znanstveno-raziskovalnega središča Koper. Doc. dr. Uroš Marušič je v soavtorsvu prof. dr. Rada Pišota in dr. Jeannette Mahoney predstavil izsledke svoje zadnje raziskave GIBKOP. Predaval je v sekciji gibalno učenje in kontrola in predstavil prispevek z naslovom »Vpliv izboljšane kognitivne kontrole po kognitivnem treningu na parametre mobilnosti pri zdravih in gibalno aktivnih starostnikih: randomizirana kontrolirana raziskava«.

Naslednje leto bo 24. letni znanstveni kongres ECSS potekal med 3. in 6. julijem v Pragi, Češka republika.

Uroš Marušič

REPORTS AND REVIEWS/POROČILA IN OCENE, 57–68

INTERNATIONAL CONFERENCE ON HEALTHINESS AND FITNESS ACROSS THE LIFESPAN

Magdeburg, Germany, 12th–15th September 2018

The 2018 version of the international scientific conference on Health Across Lifespan (HAL) organised by the Otto von Guericke University Magdeburg and the Centre of Neurodegenerative Diseases Magdeburg together with the European Group for Research into Elderly and Physical Activity (EGREPA) was a great success. Not only because it attracted about 160 participants of 22 different nationalities from Africa, Asia, Europe, North- and South-America. But actually because it was a well-organised and very informative conference.

The key note lectures comprised Marcela González Gross' Fitness and Lifestyle in Middle Life; Kirk Erickson's Effects of Exercise on Brain and Cognition; Rado Pišot's Bed Rest Model for Studying Physical and Cognitive Decline; Gerd Kempermann's The Neurobiology of Individualised Brain Aging; and Matthieu Lenoir's Motor Competence and Childhood Obesity, which altogether indicate the red-line of the conference, with the speakers giving excellent updates on the current status of these topics and their work.

Further, the audience could attend the invited symposia Motor Training, Mobility and Cognition (two separate sessions organised by EGREPA), and Cognitive-Motor Interactions across the Lifespan, and in three parallel sessions indulge in the oral presentations that ranged from the topics on Healthy Aging to Social Aspects of Health and Physical Activity. Additionally, two extensive poster sessions and workshops (e.g. shiatsu and various dances) gave a more hands-on character to the conference.

Further detailed information on the content of the lectures and posters can be found on (https://www.hal2018.de/index.php?id=20908).

We certainly hope that the conference will be again held in 2021, thus becoming triennial; the previous version in 2015 was entitled Active Healthy Aging (its report can be read in *Annales Kinesiologiae* 2015, vol 6 (2): 155-156), as this event is highly recommended for all the researchers or clinicians from the field of motor development, studying the effects of physical activity and cognitive-functional exercise for all ages.

Cécil Meulenberg and Uroš Marušič

REPORTS AND REVIEWS/POROČILA IN OCENE, 57–68

MEDNARODNA KONFERENCA O ZDRAVJU IN TELESNI PRIPRAVLJENOSTI V ŽIVLJENJSKI DOBI

Magdeburg, Nemčija, 12.–15. september 2018

Letošnja mednarodna znanstvena konferenca o zdravju v celotnem življenjskem obdobju ('Health Across Lifespan' HAL 2018), ki sta jo organizirala Univerza Otto von Guericke Magdeburg in Center za nevrodegenerativne bolezni Magdeburg skupaj z Evropsko skupino za raziskave starejših in gibalno/športno aktivnost ('European Group for Research into Elderly and Physical Activity' EGREPA), je bila izvedena zelo uspešno. Ne le zato, ker je pritegnila približno 160 udeležencev 22 različnih narodnosti iz Afrike, Azije, Evrope ter Severne in Južne Amerike, ampak tudi zato, ker je bila dobro organizirana in zelo informativne narave.

Vabljena predavanja so udeležencem predstavili predavatelji: Marcela González Gross 'Fitness and lifestyle in middle life'; Kirk Erickson 'Effects of exercise on brain and cognition'; Rado Pišot 'Bed rest a model for studying physical and cognitive decline'; Gerd Kempermann 'The neurobiology of individualised brain aging'; in Matthieu Lenoir 'Motor competence and childhood obesity'. Naslovi plenarnih predavanj nakazujejo rdečo nit konference, predavatelji pa so v njih odlično podali povzetke najnovejših ugotovitev na svojih raziskovalnih področjih.

Poleg plenarnih predavanj so se udeleženci konference lahko udeležili vabljenih simpozijev z naslovi: 'Motor training, mobility and cognition' (dve različni sekciji organizirani s strani EGREPA-e), 'Cognitive-motor interactions across the lifespan', in treh vzporednih sekcij prestavitev, ki so zajemale tematike od 'zdravega staranja' do 'socialnih vidikov zdravja' in 'gibalne/športne aktivnosti'. Organizirani sta bili tudi dve sekciji s predstavitvami plakatov in delavnice (npr. Shiatsu in različni plesi), ki so konferenci dale bolj praktičen značaj.

Podrobnejše informacije o vsebini predavanj in predstavitvah plakatov so dostopne preko spletnega naslova: https://www.hal2018.de/index.php?id=20908.

Vsekakor upamo, da bo ta predvidoma trienalna konferenca (predzadnja, z naslovom Aktivno zdravo staranje in za katero dostopno poročilo v *Annales Kinesiologiae* 2015, vol. 6 (2): 155-156, je potekala leta 2015), organizirana tudi 2021. Znanstvena konferenca je namreč zelo priporočljiva za vse raziskovalce ali zdravnike/medicinske delavce, ki delajo na področjih gibalnega razvoja in/ali raziskujejo učinke gibalne/športne aktivnosti in kognitivno-gibalne vadbe v vseh starostnih obdobjih.

Cécil Meulenberg in Uroš Marušič

GUIDELINES FOR AUTHORS

1. Aim and scope of the journal:

Annales Kinesiologiae is an international interdisciplinary journal covering kinesiology and its related areas. It combines fields and topics directed towards the study and research of human movement, physical activity, exercise and sport in the context of human life style and influences of specific environments. The journal publishes original scientific articles, review articles, technical notes and reports.

2. General policy of Annales Kinesiologiae

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c) **Miscellaneous**: Whenever possible, use the SI units (Système international d'unités).

d) The **title page** should include the title of the article (no more than 85 characters, including spaces), full names of the author(s) and affiliations (institution name and address) of each author; linked to each author using superscript numbers, as well as the corresponding author's full name, telephone, and e-mail address.

e) The authors are obliged to prepare two **abstracts** – one short abstract in English and one (translated) in Slovene language. For foreign authors translation of the abstract into Slovene will be provided. The content of the abstract should be structured into the following sections: purpose, methods, results, and conclusions. It should only contain the information that appears in the main text, and should not contain reference to figures, tables and citations published in the main text. The abstract is limited to 250 words.

f) Under the abstract a maximum of 6 appropriate **Keywords** shall be given in English and in Slovene. For foreign authors the translation of the key words into Slovene will be provided.

g) The **main text** should include the following sections: Introduction, Methods, Results, Discussion, Conclusions, Acknowledgement (optional), and References. Individual parts of the text can form sub-sections.

h) Each **table** should be submitted on a separate page in a Word document after the Reference section. Tables should be double-spaced. Each table shall have a brief caption; explanatory matter should be in the footnotes below the table. Abbreviations used in the tables must be consistent with those used in the main text and figures. Definitions of symbols should be listed in the order of appearance, determined by reading horizontally across the table and should be identified by standard symbols. All tables should be numbered consecutively Table 1, etc. The preferred location of the table in the main text should be indicated preferably in a style as follows: *** Table 1 somewhere here ***.

i). Captions are required for all **figures** and shall appear on a separate manuscript page, under the table captions. Each figure should be saved as a separate file without captions and named as Figure 1, etc. Files should be submitted in *.tif or *.jpg format. The minimum figure dimensions should be 17x20 cm and a resolution of at least 300 dpi. Combinations of photo and line art should be saved at 600–900 dpi. Text (symbols, letters, and numbers) should be between 8 and 12 points, with consistent spacing and alignment. Font type may be Serif (Times Roman) or Sans Serif (Arial). Any extra white or black space surrounding the image should be cropped. Ensure that participant-identifying information (i.e., faces, names, or any other identifying features) should be omitted. Each figure should be saved as a separate file without captions and named as Figure 1, etc. The preferred location of the figure in the main text should be indicated preferably in a style as follows: *** Figure 1 somewhere here ***.

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The journal uses the Harvard reference system (Publication Manual of the American Psychological Association, 5th ed., 2001). see also: http://www.apastyle.org). The list of references should only include work cited in the main text and being published or accepted for publication. Personal communications and unpublished works should only be mentioned in the text. References should be complete and contain up to six authors. If the author is unknown, start with the title of the work. If you are citing work that is in print but has not yet been published, state all the data and instead of the publication year write "in print".

Reference list entries should be alphabetized by the last name of the first author of each work. Titles of references written in languages other than English should be additionally translated into English and enclosed within square brackets. Full titles of journals are required (no abbreviations).

Examples of reference citation in the text

One author: This research spans many disciplines (Enoka, 1994) or Enoka (1994) concluded...

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Three to five authors:
a) first citation: Šimunič, Pišot and Rittweger (2009) found... or (Šimunič, Pišot & Rittweger, 2009)
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Six or more authors:
Only the first author is cited: Di Prampero et al. (2008) or (Di Prampero et al., 2008).

Several authors for the same statement with separation by using a semicolon: (Biolo et al., 2008; Plazar & Pišot, 2009)

Examples of reference list:
The style of referencing should follow the examples below:

Books:
Latash, M. L. (2008). Neurophysiologic basis of movement. Campaign (USA): Human Kinetic.

Journal articles
Marušič, U., Meeusen, R., Pišot, R., & Kavcic, V. (2014). The brain in micro- and hypergravity: the effects of changing gravity on the brain electrocortical activity. European journal of sport science, 14(8), 813-822. DOI: 10.1080/17461391.2014.908959.
De Boer, M. D., Seynnes, O., Di Prampero, P., Pišot, R., Mekjavić, I., Biolo, G., et al. (2008). Effect of 5 weeks horizontal bed rest on human muscle thickness and architecture of weight bearing and non-weight bearing muscles. European Journal of Applied Physiology, 104(2), 401–407.

Book chapters

Šimunič, B., Pišot, R., Mekjavić, I. B., Kounalakis, S. N., & Eiken, O. (2008). Orthostatic intolerance after microgravity exposures. In R. Pišot, I. B. Mekjavić, & B. Šimunič (Eds.), The effects of simulated weightlessness on the human organism (pp. 71–78). Koper: University of Primorska, Scientific and Research Centre of Koper, Publishing house Annales.

Rossi, T., & Cassidy, T. (in press). Teachers' knowledge and knowledgeable teachers in physical education. In C. Hardy, & M. Mawer (Eds.), Learning and teaching in physical education. London (UK): Falmer Press.

Conference proceeding contributions

Volmut, T., Dolenc, P., Šetina, T., Pišot, R., & Šimunič, B. (2008). Objectively measured physical activity in girls and boys before and after long summer vacations. In V. Štemberger, R. Pišot, & K. Rupret (Eds.) Proceedings 5th International Symposium A Child in Motion "The physical education related to the qualitative education" (pp. 496–501). Koper: University of Primorska, Faculty of Education Koper, Science and research centre of Koper; Ljubljana: University of Ljubljana, Faculty of Education.

Škof, B., Cecić Erpić, S., Zabukovec, V., & Boben, D. (2002). Pupils' attitudes toward endurance sports activities. In D. Prot, & F. Prot (Eds.), Kinesiology – new perspectives, 3rd International scientific conference (pp. 137–140), Opatija: University of Zagreb, Faculty of Kinesiology.

4. Manuscript submission

The main manuscript document should be saved as a Word document and named with the first author's full name and the keyword *manuscript*, e.g. *"Pisot_Rado_manuscript.doc"*. Figures should be named as "*Pisot_Rado_Figure1", etc.*

The article should be submitted via e-mail: **annales.kinesiologiae@zrs-kp.si.**

Reviewing process communication will proceed via e-mail.

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