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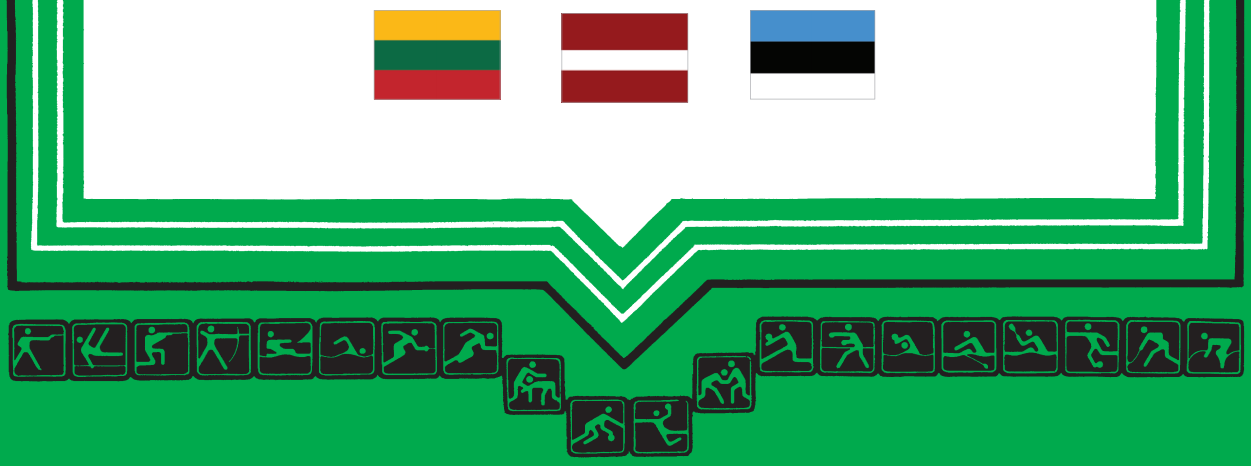

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CONTENT

Hamid Arazi, Mohammad Mehrtash
EFFECT OF ACUTE L-CARNITINE SUPPLEMENTATION ON BLOOD LACTATE, GLUCOSE, AEROBIC AND ANAEROBIC PERFORMANCE IN ELITE MALE ARTISTIC GYMNASTS..... 2

Julius Demenius, Rasa Kreivytė
THE BENEFITS OF ADVANCED DATA ANALYTICS IN BASKETBALL: APPROACH OF MANAGERS AND COACHES OF LITHUANIAN BASKETBALL LEAGUE TEAMS..... 8

Vida Ivaškienė, Asta Lileikienė, Gytė Levulienė, Vytautas Markevičius
ATTITUDES OF 15–16-YEAR-OLD PUPILS WITH A SUFFICIENT ACTIVITY LEVEL TOWARDS THE PHYSICAL EDUCATION TEACHER AND THEIR BEHAVIOUR 14

Mārtiņš Lauva, Uldis Grāvītis
MANAGEMENT OF AND POTENTIAL RETURN ON PRIVATE INVESTMENTS IN LATVIAN SPORTS 20

Henrikas Paulauskas, Dalia Mickevičienė, Vaida Berneckė, Kazimieras Pukėnas, Marius Brazaitis
HEAD AND NECK WARMING APPLIED IN THERMONEUTRAL CONDITIONS IMPROVES THERMAL SENSATION BUT DOES NOT ALTER COGNITIVE FUNCTION 27

Márta Ránky, Ferenc Köteles, Csaba Nyakas, György Bárdos, Attila Szabo
A 90 DAY SUPPLEMENTATION OF POLYUNSATURATED FATTY ACIDS (PUFA) HAS BENEFITS ON HEALTH MEASURES AND EXERCISE PERFORMANCE 36

Mustafa Söğüt
ACUTE EFFECTS OF CUSTOMIZING A TENNIS RACKET ON SERVE SPEED 44

Irena Valantinė, Ingrida Grigaliūnaitė, Lina Danilevičienė
IMPACT OF BASKETBALL FAN BEHAVIOUR ON THE ORGANIZATION'S BRAND..... 47

Kadir Yıldız, Pınar Güzel, Fırat Çetinöz, Tolga Beşikçi
OUTDOOR CAMP EFFECTS ON ATHLETES: ORIENTEERING EXAMPLE 55

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Editorial office

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Sporto str. 6, LT-44221 Kaunas, Lithuania
Tel. +370 37 302636
Fax +370 37 204515
E-mail zurnalas@lsu.lt
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EFFECT OF ACUTE L-CARNITINE SUPPLEMENTATION ON BLOOD LACTATE, GLUCOSE, AEROBIC AND ANAEROBIC PERFORMANCE IN ELITE MALE ARTISTIC GYMNASTS

Hamid Arazi[1], Mohammad Mehrtash[2]
University of Guilan[1], Rasht, Iran
University of Shiraz[2], Shiraz, Iran

ABSTRACT

Background. Probably L-Carnitine can induce the increase of Pyruvate dehydrogenase activity, decrease of lactic acid production and performance improvements due to the reinforcement of long chain fatty acid oxidation and stabilize of coASH to free COA. Based on this, the aim of our study was to investigate the effects of acute L-Carnitine supplementation on blood lactate, glucose, VO_2max and anaerobic power in elite male artistic gymnasts.

Methods. Eighteen male artistic gymnasts were randomly assigned to supplementation (n = 9) or placebo (n = 9) groups. In a double blind design, subjects participated in two tests with a break of one week between them. Subjects ingested 3 grams of L-Carnitine or placebo (maltodextrin) 90 minutes before aerobic and anaerobic exercise protocols. We used a 20 m shuttle run as an aerobic exercise protocol and running based anaerobic sprint test (RAST) as an anaerobic exercise protocol. Blood samples were collected 5 minutes pre and 4 minutes post-tests for the analysis of lactate and glucose.

Results. L-Carnitine group had significantly lower lactate concentration than placebo group after tests ($p < .05$). L-Carnitine group had significantly higher blood glucose ($p < .05$) compared with placebo group, too. Also VO_2max as well as mean and maximum power in L-Carnitine group were significantly higher than those in placebo group ($p < .05$).

Conclusions. These findings indicated that acute oral supplementation of L-Carnitine can probably induce fatigue decrease and improvement of aerobic and anaerobic performance in elite male artistic gymnasts.

Keywords: L-carnitine, lactate, glucose, aerobic exercise, anaerobic exercise, gymnastics.

INTRODUCTION

Today, L-Carnitine is introduced as an enhancer of athletic performance (Karlic & Lohninger, 2004). In the field of L-carnitine supplementation it has been reported that consuming this supplement can increase fat oxidation, decrease carbohydrate oxidation and improve performance (Dehghani, Shakerian, Nasseri, Nikbakht, & Nejad, 2013), maintain the integrity of the cell membrane, establishing the physiological ratio of CoA (COA) to acetyl-CoA (coA SH) within the mitochondria, then leads to increased activity of pyruvate dehydrogenase enzyme and finally reduces lactate production (Reed, 2013; Stephens, Constantin-Teodosiu, & Greenhaff, 2007).

On the other hand, the main substrate in anaerobic activity is carbohydrate and the pyruvate converted to lactate by lactate dehydrogenase, which affects performance (Bangsbo, Mohr, Poulsen, Perez-Gomez, & Krustrup, 2006). Also, the production of acyl-carnitine through the buffering of CoA storage can be useful for cell function (Furuichi, 2016). High-intensity exercise is associated with hypoxia and increased concentrations of blood ammonia (ZhanQi, 2011).

So, the availability of carnitine even in the baseline level can reduce the rate of loss of physical function and prevent muscle fatigue (Naclerio, Larumbe-Zabala, Cooper, Allgrove, & Earnest, 2015; Pandareesh & Anand, 2013; Sato et al., 2015).

Eizadi et al. (2009) investigated the Influence of short-term L-carnitine and heparin 90 minutes before exercise. The results of this study showed that short-term use of L-carnitine and heparin did not have any effect on glucose and blood lactate (Mojtaba, Maryam, Davood, & Fatemeh, 2009). Arazi and colleagues (2013) showed that short-term supplementation of L-carnitine can reduce lactate concentration after a high intensity exercise (Arazi, Rahmaninia, Azali, & Mehrtash, 2013). Nourshahi and Ebrahimi (2010) observed that taking 2 grams of L-carnitine before a maximum aerobic activity (90 minutes) reduced lactate production and increased VO_2max. Stuessi and colleagues (2005) studied the effect of 2 g L-carnitine supplementation before ergometer bike. Finally, results showed no significant change in the lactate concentration in post-test compared to pre-test (Stuessi, Hofer, Meier, & Boutellier, 2005). Also, Jacobs et al. (2009) investigated the effects of short-term 4.5 grams L-carnitine with glycine propionyl supplementation 90 minutes before the Wingate test. They found a significant reduction in blood lactate and also a significant increase in peak power of experimental group compared to the placebo (Jacobs, Goldstein, Blackburn, Orem, & Hughes, 2009). Barnett et al. (1994) studied the effect of carnitine supplementation on lactate concentration after 14 days of high-intensity exercise. Their results did not show any effect of carnitine on lactate concentration (Barnett et al., 1994). Eroğlu et al. (2008) showed that ingestion of L-carnitine (2 grams) for 1 hour before playing badminton did not have any impact on blood lactate concentration (Eroğlu, Senel, & Güzel, 2008). Nasuri (2014) reported that consuming 3 grams of L-carnitine 90 minutes before aerobic exercise can reduce lactate production and increase aerobic performance.

As carnitine improvise performance and reduces fatigue in the short-term and intense activity (anaerobic), it is expected that these supplements can play an ergogenic role in anaerobic activities such as gymnastics (Caine, Russell, & Lim, 2013; Jeukendrup, 2002). Trappe et al. (1994) examined the effect of L-carnitine (2 g) in 100 meters speed swimming and there was no significant change in performance and lactate concentration (Trappe, Costill, Goodpaster, Vukovich, & Fink, 1994). Havanloo et al. showed that consumption of 30mg/kg/d L-carnetine plus Q10 can improve anaerobic capacity and reduce fatigue index (Hovanloo, Nourshahi, Amini, & Sahami, 2012).

On the other hand, since male artistic gymnasts have very severe workout, athletes who have higher aerobic fitness have a shorter recovery time and continue their workouts with high quality (Vass, 2004). In this context, Arazi and colleagues (2013) reported that consumption of L-carnitine can reduce lactate production, increase plasma glucose, VO_2max, peak and maximal power in trained men (Arazi et al., 2013).

Therefore, studies are scarce and controversial. A few studies have shown the positive effects of this supplement in anaerobic activities, and expected this supplement to have a significant role in the development of aerobic and anaerobic capacity of male artistic gymnasts. Thus, in this study we tried to investigate the effect of short-term consumption of L-carnitine supplementation on plasma glucose and lactate concentration, aerobic and anaerobic capacity in elite male artistic gymnasts.

METHODS

Subjects. This was a double-blind placebo-controlled randomized study. Considering the small number of professional male artistic gymnasts in Iran, statistical sample of this study were 18 elite male artistic gymnasts who were purposefully selected as an available sample. All subjects had experience in professional gymnastics training for more than 10 years (5–6 sessions per week) and were invited to national camp. Subjects announced their readiness by completing the consent form and health questionnaire after full awareness of the benefits and risks of the test. Seven days before the main test, subjects' anthropometric characteristics (age, height, weight, and body fat percentage) were measured to report in this study (Table 1). 3-site Jackson-Pollack equation was used for the estimation of body fat percentage. Then, the subjects were randomly divided into 2 groups (n = 9) of placebo or supplementation. To eliminate individual differences, each group (placebo or supplementation) equally were bound to take the aerobic and anaerobic tests. The subjects were asked to maintain their usual diet. Based on this, the subjects were controlled for food and eating foods containing carnitine, such as meat and dairy products, for about 48 hours before the test. Also,

in this period participants were asked to avoid severe physical activity.

Table 1. **Descriptive characteristics (mean ± *SD*)**

Characteristics	Mean	*SD*
Age (years)	21	2.12
Height (cm)	171.77	2.63
Weight (kg)	64.11	3.68
Body mass index (kg/m^2)	21.73	1.36
Body fat (%)	10.77	2.63

Procedure. 90 minutes before the beginning of the test participants consumed 3 grams of L-carnitine or placebo (maltodextrin) with 200 ml of water (Jacobs et al., 2009). For aerobic and anaerobic testing the 20 m shuttle run (beep test), and the RAST test were used respectively (Arazi et al., 2013). VO_2max was estimated applying the formula: 18.043461 + (0.3689295 x ST) + (–0.000349 x ST x ST), (ST = total number of shuttles). Also, in the part of anaerobic activity, the maximum power was equal to the highest value in RAST test, and the mean power equivalent – to the sum of all six values ÷ 6 (Mackenzie, 2005). Blood samples (5 ml) were collected at 5 minute pre and 4 minute post-tests from the brachial vein of subjects by a technician and then lactate and glucose were analysed in the biochemistry laboratory.

Statistical Analysis. In this study, Kolomogorov–Smirnov test was used for normal distribution of the data and parametric test was used to ensure to normality of the data. Independent *t*-test was used to compare the differences between the measured variables in placebo and supplementation groups. The significance level for all tests was considered .05. Also, SPSS (version 18) software was used for all statistical procedures.

RESULTS

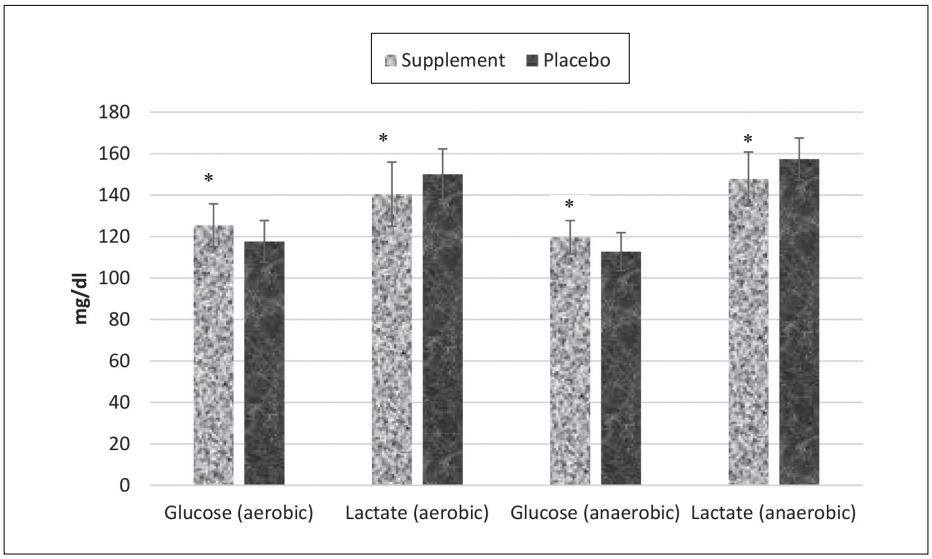
Mean values of body mass index and fat percentage (Jackson/Pollock 3-Site Caliper Method) of subjects were 21.73 ± 1.36% and 10.77 ± 2.63 kg/m^2 respectively (Table 1). The values of VO_2max, maximum and mean powers were shown in Table 2. Lactate concentration was significantly lower in the supplementation group after aerobic (140.4 ± 15.5 mg/dl) and anaerobic (147.8 ±12.8 mg/dl) exercise compared to the placebo group (respectively 150.1 ± 12.1 and 157.4 ± 10.1 mg/dl) ($p \leq .05$) (Figure).

Table 2. **VO_2max, maximum and mean power (mean ± *SD*)**

Variable \ Groups	Supplement	Placebo	*t*	*sig*
VO_2max (ml/kg/min)	*4.0 ± 49.5	4.8 ± 47.6	–2.5	.03
Maximum power (watt)	*77.3 ± 486.5	67.8 ± 475.3	–2.4	.04
Mean power (watt)	73.0 ± 383.6	60.6 ± 363.4	–2.1	.06

Note. * – Significant diffe-rence compared with placebo group at $p \leq .05$.

Figure. **Comparison of plasma glucose and lactate in the placebo and supplementation groups after aerobic and anaerobic activity**



Note. * – significant difference compared with placebo group at $p \leq .05$.

Blood glucose concentration was statistically higher after aerobic and anaerobic exercise in supplementation group (respectively 125.4 ± 10.3 and 119.6 ± 8.0 mg/dl) compared with the placebo group (respectively 117.6 ± 10.0 and 112.7 ± 9.1 mg/dl) ($p \leq .05$) (Figure).

DISCUSSION

L-carnitine plays a significant role in transfering long-chain fatty acids into the mitochondria through membrane. Thereby, it leads to the increase of fatty oxidation and glycogen storage. High intensity exercise can produce acetyl-CoA and carnitine that can react with it and produce acetyl L-carnitine that leads to a decrease of acetyl-CoA to CoA ratio. Also, it may increase the activity of the pyruvate dehydrogenase and cause decreasing lactate concentration (Karlic & Lohninger, 2004). Anaerobic power is one of the success factors in the short and fast sport events such as gymnastics, and it improves when the body becomes fatigued later. Lactic acid is fatigue factor in anaerobic activity, which produces lactic acid. During intense activities, conversion of acetyl-CoA to free CoA ratio increases; thereby it leads to increased lactate accumulation. L-carnitine plus acetyl-CoA form acetyl L-carnitine and cause fixing this ratio that leads to reduced lactate accumulation.

Also, Krebs cycle produces some free coenzymes that can improve anaerobic performance. Results of our study showed that male artistic gymnasts who were consuming supplements had higher peak power and no significant difference in mean power compared to placebo group. The results of our study are in line with the ones by Jacobs and colleagues (2010, 2009), probably due to the dose and duration of supplementation and type of exercise (Jacobs & Goldstein, 2010; Jacobs et al., 2009). Arazi et al (2013) showed that consuming 3 grams of L-carnitine 90 minutes before anaerobic exercise can increase peak power and mean power (Arazi et al., 2013). Also, Havanloo et al., 2012, found that carnitine supplementation can improve anaerobic capacity, but they used Q10 supplement plus carnitine that might have affected their results (Hovanloo et al., 2012). But in Trappe et al. (1994) research, no significant difference was observed in swimmers (Trappe et al., 1994). The test in Trappe study was the fast swimming with 2 min breaks between each trial. Accordingly, the difference in the type of exercise and rest time between each exercise can be due to this disruption, although the difference in the type of environments (ambient air and liquid water) can also affect the test. As gymnastics exercises need high power (Caine et al., 2013; Jeukendrup, 2002), it is likely that carnitine supplementation may improve athletic performance by increasing the male artistic gymnasts' power.

Gymnastics includes high intensity exercise and this contributes to an increase in lactate production, which can affect male artistic gymnasts' performance (Caine et al., 2013; Jeukendrup, 2002). Due to the effects of L-carnitine supplementation on the stability of acetyl-CoA to free CoA ratio and prevention of the accumulation of lactate, our results in relation to both aerobic and anaerobic exercise showed that after exercise supplementation group had lower lactate concentration compared to the placebo group. Results of our study were consistent with some previous studies (Jacobs & Goldstein, 2010; Jacobs et al., 2009). Arazi and colleagues (2013) reported that short-term consumption of carnitine before activity can decrease lactate production and improve athletic performance after aerobic and anaerobic exercise (Arazi et al., 2013). But, Eizadi et al. (2009) did not observe significant differences in lactate concentrations. Presumably, the overlap effects of L-tartrate plus heparin could interfere with the effects of L-carnitine alone. Stuessi et al. (2005) suggested that L-carnitine supplementation had no effect on blood lactate concentration. Exercise reduces the muscle carnitine content and thereby increases the absorption of carnitine in muscle. In Stuessi study the subjects were sedentary and could not have enough carnitine in muscles and this amount is not required to show the effect of this supplement.

During activity with constant speed, increase or decrease in plasma glucose concentration is normal. In general, light activities do not have specific effect on plasma glucose. If the training load is moderate or severe, at first glucose increases and if the physical activity continues for a longer time, glucose concentration decreases and reaches lower levels than baseline (Murthy & Pande, 1987). On the other hand, the increase in muscle carnitine leads to an increase in Triacyl glycerol and fatty acid oxidation in muscle during endurance exercise and reduces liver glycogen breakdown that leads to lower blood glucose levels (Brass, Hoppel, & Hiatt, 1994; Rebouche, Lombard, & Chenard, 1993). In this study, we observed that blood glucose level in supplementation group was higher than the one in placebo group after aerobic and anaerobic exercise. It could be due to the storage of glycogen and glucose

in aerobic exercise, but increase in blood glucose after anaerobic exercise is due to the multitude of uncontrolled factors that are not clear. These results are consistent with the findings of Arazi and colleagues (2013) because of the homology of supplementation (Arazi et al., 2013). Stephens et al. (2007) stated that L-carnitine supplementation leads to reduced muscle glycolysis, increased fat oxidation, increased blood glucose concentrations and increased time to exhaustion. After L-carnitine supplementation, Eizadi and colleagues did not find any significant change in glucose levels after exercise (Eizadi et al., 2009; Mojtaba et al., 2009). The subjects of this study were sedentary persons and, considering the effect of exercise on muscle carnitine uptake, the subjects' muscles did not absorb L-carnitine and did not get the required amount of impact on fat oxidation.

Entering long-chain fatty acids into the mitochondria and to the oxidation process needs to have a carrier. L-Carnitine plays a carrier role in the transportation of fatty acids. Since fat oxidation requires oxygen more than carbohydrates, cardiovascular system should bring more oxygen to muscles. Also, L-carnitine stimulates pyruvate dehydrogenase complex and increases the entry of pyruvate into the beta-oxidation pathway, which leads to increased oxygen consumption (Karlic & Lohninger, 2004). The results of our research showed that subjects who had taken supplements had higher VO_2max compared to placebo group. These results were in line with research by Arazi et al. (2013) and Noorshahi and colleagues (2009). However, similar results were not observed by Eizadi et al (Eizadi et al., 2009; Mojtaba et al., 2009). This may be due to long-term ingestion of L-carnitine that is likely to be associated with adaptations. On the other hand, considering that half-life of L-carnitine in the body is 2 to 3 hours, so high accumulation leads to removing excess amounts through urine (Murthy & Pande, 1987). Wachter et al. (2002) reported long-term L-carnitine supplementation without investigating the effect of it on VO_2max. Possibly long-term (3 months with 4 g daily) L-carnitine supplementation did not increase muscle carnitine content and did not show results in incremental VO_2max. Those having higher aerobic capacity need shorter recovery period and their energy reserves reconstruct faster (Trappe et al., 1994). However, due to the high intensity training sessions and gymnastics training (Caine et al., 2013; Jeukendrup, 2002), increasing aerobic capacity can improve male artistic gymnasts' performance in training.

CONCLUSION

We can conclude that L-Carnitine supplementation (3 g 90 minutes before exercise) can decrease production of lactic acid, increase blood glucose and improve aerobic and anaerobic performance of elite male artistic gymnasts. Finally, it can be suggested that investigations are needed with orientation to different doses of this supplement in gymnastic movements and various sub-disciplines such as aerobics, rhythmic and acrobatic gymnastics.

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Conflict of interests. Authors declare that there are no conflicts of interests regarding this research.

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Corresponding author **Hamid Arazi**
Department of Exercise Physiology
Faculty of Sport Sciences
University of Guilan
P.O. Box: 41635-1438, Rasht, Iran
Tel. +98 911-1399207
E-mail hamidarazi@yahoo.com

THE BENEFITS OF ADVANCED DATA ANALYTICS IN BASKETBALL: APPROACH OF MANAGERS AND COACHES OF LITHUANIAN BASKETBALL LEAGUE TEAMS

Julius Demenius, Rasa Kreivytė
Lithuanian Sports University, Kaunas, Lithuania

ABSTRACT

Background. Many industries use a variety of statistical models for a decision-making, but no industry relies on analytical data as a professional sport (Davenport, 2014). Sports organization management and decision-making have a direct relationship with the sports teams and this relationship is called a comprehensive statistical analysis (Radovanović, Radojičić, Jeremić & Savić, 2013). Alamar (2013) argues that a detailed statistical analysis of the game activities is an important aspect in order to more accurately assess the player's market value.

Methods. The sample consisted of 30 respondents (10 managers, 10 coaches, 10 coach assistants) of the 10 men's basketball teams. Managers and coaches of Lithuanian Basketball League teams had to fill in online questionnaire, the main focus of which was to identify their opinion about advanced data analytics. The questionnaire was designed based on scientific studies (Alamar, 2013; Martinez & Martinez, 2011). Questionnaire scales were tested using SPSS 20.0 statistical analysis program.

Results. Statistical analysis showed that questionnaire reliability was average (Cronbach α = .549–.558). The survey results showed that the teams of Lithuanian Basketball League there employ professionals whose main goal is to analyse performance indicators, statistical data of opponents and new incoming players. Majority of managers and coaches believe that new information technologies of advanced basketball data could help improve team performance results and draw more attention to basketball from fans' perspective. It was found that managers and coaches thought that offensive strategy depends on the players of the team. Coaches and managers had a positive approach to basketball analytics and believed that it had a bright future in basketball industry.

Conclusions. The correct use of limitless data would definitely help improve team performance and effectively use their financial resources recruiting the most efficient players.

Keywords: statistical analysis, performance indicators, basketball.

INTRODUCTION

Many industries use a variety of statistical models for a decision-making, but no industry relies on analytical statistical data as a professional sport (Davenport, 2014). Sports organization management and decision–making have a direct relationship with the sports teams results and this relationship is called a comprehensive statistical analysis (Radovanović, Radojičić, Jeremić & Savić, 2013). Presenting, developing and operating comprehensive statistical data is still one of the biggest challenges for organizations, but being able to understand such data would open big possibilities to improve productivity and also compete with other organizations (Alamar, 2013). Oliver (2004) suggests that advanced statistical data is an important aspect when we want to evaluate the player's true value in the market. However, Nikolaidis (2015) states that basketball team managers in Greece still do not understand that the quality of their decision–making could

have a big impact on the use of club financial resources. Advanced game statistics analysis gives a possibility to make better evaluations of everything that happens in a basketball game (Sampaio, Janeira, Ibañez & Lorenzo, 2006). Alamar (2013) has stated two comprehensive data statistics goals: 1) A well–built sports analytics program saves time for decision makers to make the most efficient decisions in terms of evaluating teams and players; 2) To receive comprehensive statistical data about teams and players and attain informative insights that would not be possible without advanced statistical data. STATS Sport VU camera's system (multi – lens tracking system) now is a very useful and productive system to analyse basketball games (YonggangNiu & Zhao, 2014). Oliver (2004) introduced "4 factors" that have a significant impact on team's chances to get a win: shooting, turnovers, rebounding, and free throws. Caporale & Collier (2015) carried out research about shooting and they found that basketball teams should shoot more three–point shots. Goldman & Rao (2013) believe that teams should take more three-point shots because of a simple reason – 3 is more than 2.

In this paper we examined the approach of managers and coaches of Lithuanian Basketball League (LKL) teams to advanced statistical data. While using advanced statistical data coaches could create and adapt more effective game strategies, also managers could have an opportunity to take a closer look at players' individual abilities and their value in the market. Research about basketball players and team performance analyses using comprehensive statistical data is new so far (Ergül, Yavuz & Yavuz, 2014). Basketball analytics is a growing area in Europe, so only few (http://www.inthegame.org/ or www.draftexpress.com) websites have comprehensive data about players and teams from Europe (Martinez & Martinez, 2011). In Lithuania Kreivytė and Čižauskas (2010) have carried out research about basketball statistics, but they only used fundamental statistical protocol data.

The aim of this study was to identify approach of managers and coaches of Lithuanian Basketball League teams to advanced data analytics in basketball.

METHODS

Participants. Exploration sample consisted of 30 basketball specialists from Lithuanian Basketball League (10 managers, 10 head coaches, 10 assistant coaches). The study aimed at including at least one of the specialists to participate in the survey from each club: Alytaus „Dzūkija", Utenos „Juventus", BC Panevėžio „Lietkabelis", Vilniaus „Lietuvos Rytas", Klaipėdos „Neptūnas", Kėdainių „Nevėžis", Pasvalio „Pieno žvaigždės", Šiaulių „Šiauliai", BC Prienų – Birštono „Vytautas" ir Kauno „Žalgiris". There were 4 international coaches working in Lithuanian Basketball League teams (head coach $n = 1$, assistant coaches $n = 3$). They could not participate in the survey because the questionnaire was in the Lithuanian language. Totally, 8 clubs participants attended the survey: 3 managers, 2 head coaches, 3 assistant coaches.

Procedure. An online survey link was sent to Lithuanian Basketball League team managers and front offices via e-mail on November 2, 2016. The questionnaire was closed, so only selected respondents were able to participate in the survey. Comprehensive basketball statistics and analytics were explained to them. The survey was anonymous.

Measures. The main object is comprehensive data analysis and the value of it. In this research we used a mixed study design (quantitative and qualitative research methods) – data collecting, questionnaire survey, generalization of answers using statistical methods, reflection of people's opinions (Kačerauskas, 2014). Online questionnaire was used and it was constructed using information about comprehensive statistical data from theory and partly from scientific articles and research (Alamar, 2013; Martinez & Martinez, 2011), also using made up questions. The goal of the questionnaire survey was to learn about the approach of managers and coaches. The questionnaire consisted of 11 questions, where respondents could have picked one or few answer options. The structure of questionnaire was as follows: 8 closed type questions (quantitative – when a respondent had to choose one or few answers) and 3 open type questions (qualitative – when a respondent could write their own answer).

Data analysis. Questionnaire scales were verified using SPSS for Windows 20.0 statistical analysis program. Statistical analysis showed that questionnaire reliability was average (Cronbach's α =.549 –.558) (Table). Internal consistency of the main questionnaire scales was calculated. Cronbach's α of the Opponents and Individual Players' Analysis and Playing Strategy Scale was .549. Cronbach's α of the Use of New Technology Scale was .558.

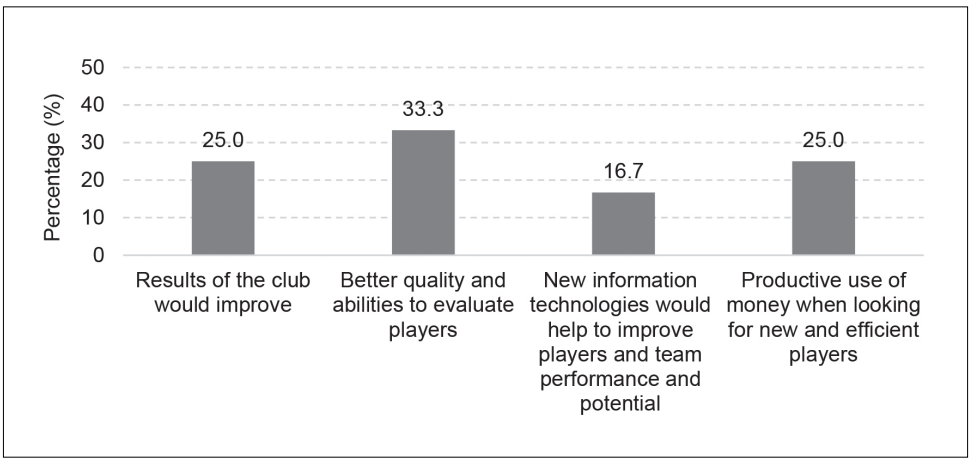
Table. **The criteria for the internal consistency of the scales**

Scales	Number of statements	Cronbach's alfa coefficient
Opponents and Individual Players Analysis and Playing Strategy (Scouting)	$n = 17$	.549
The Use of New Technology	$n = 12$	.558

RESULTS

First question was "Is there a person or people (scouts) whose main focus are opponents and individual players' analysis?" and even 66.7% of respondents answered that team coaches did analysis and 33.3% of respondents said that their club had scouts whose main focus was to analyse video and data of opponents and individual players. The research results revealed that there were no significant differences between managers, head and assistant coaches in terms of their answers about the people whose main focus was opponents' and individual players' analysis ($p > .05$). So, the first question showed that in LKL teams, coaches and scouts did opponents' and players' analyses, but off–season managers and clubs' front offices were collectively looking for new players and making decisions about team roster. Even 25% of respondents said that head coach and team front office was responsible for taking new team players; 25 % respondents said that the whole coaching staff, head coach and team front office were responsible for taking new free agents; 50% of respondents noted that all coaching staff were responsible for team roster construction. The research results revealed that there were no significant differences between managers, head and assistant coaches in terms of who was responsible for team roster decisions ($p > .05$). The survey included a question how teams performed opponents' and new individual players' analysis. After the survey it was clear that 35.3% of clubs watched videos and evaluated players with an "eye test", also the same percentage (35.3%) of respondents said that teams performed advanced statistical data analysis (player offensive rating, effective field goal percentage (eFG%), number of dribbles before attacking, offensive and defensive rebounding). 29.4% of teams peerformed traditional game statistics analysis. Participants were asked what value to their team new technologies could bring. One of four (25%) of respondents believed that new information technologies would help to analyse basketball more deeply and it would help to improve teams results. Also one of four (25%) of respondents believed that new technologies would help to save money for teams (looking for new and efficient players) and one third of respondents (33.3%) said that they would love to have new information technologies and it would improve their abilities to evaluate players; 16.7% of respondents believed that new information technologies would help to improve players' and team performance and potential (Figure 1).

Figure 1. **Respondents' answers of perceived value indicators**



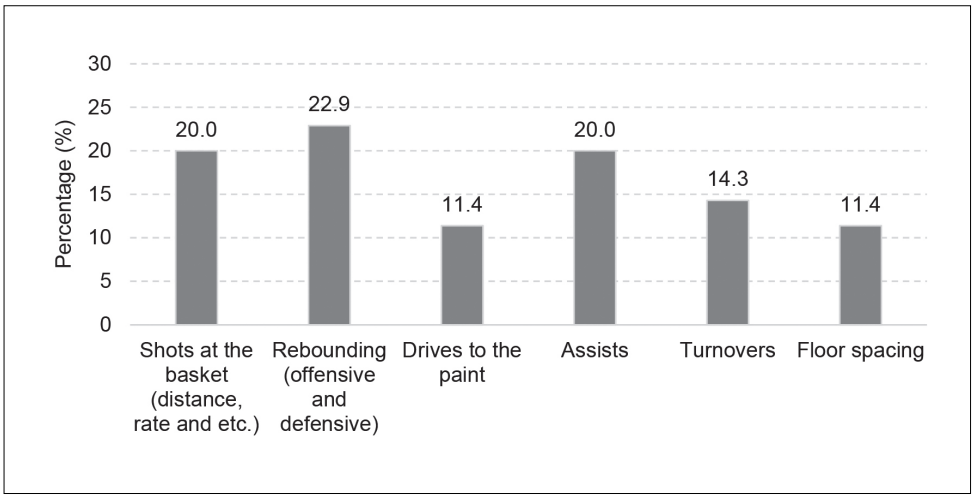


Figure 2. **Indicators to be analysed first**

If managers and coaches could have the newest information technologies, the first data indicators, they would like to analyse: 22.9% rebounding, 20% shooting – distance, rate, location on the court, type of shot: jump shot, floater, the hook, dribbles before a shot, last second shots. Also, 20% would look in assist category, 11.4% drives to the painted area, 14.3% turnovers, 11.4% spacing on the floor (Figure 2).

Respondents were asked to write their opinion about basketball offensive strategy, where the main focus is to make shots close to the basket and three point shots. Six respondents gave their answers., two respondents said that coaches should think about what type of players they had first and then make the best strategy for them: *"Offensive strategy depends on the players you have: shooters, skilled big mans, fast and quick guards"; "There is no one strategy. Every coach and player is unique, so offensive strategy should be adjusted to the players you have".* One of the managers agreed that game offensive strategies and elements are changing in Europe and the main influence is National Basketball Association (NBA) teams: *"Basketball is changing and the main influence is NBA".* Two respondents agreed that the mid-range shot is still very useful in basketball: *"I don't see a problem attacking from mid-range area in games, especially when power forwards and centres these days could attack from mid – range and spread the floor"; "I think that all types of shots are very useful in basketball".* One of respondents did not see anything special from this type of strategy: *"Nothing special".*

Respondents had a possibility to write their opinion about advanced data analytics and its influence to basketball community. The total of 7 specialists answered: 4 specialists had a positive opinion about advanced data analytics and thought that comprehensive data ccould help to attract more people to play and be a part of basketball community: *"Maybe a new way of analytics can show people a different and interesting perspective to basketball"; "Of course"; "Basketball community are able to gather more information about basketball"; "Yes".* Two respondents thought that advanced data analytics could help to analyse opponents better: *"In this day of age, small details could have a big influence which team will be able to win. It is important to know opponents offensive and defensive tactics and their weaknesses. Prepared team have an opportunity to perform an analysis and become more professional in what they do, also have a better chance to play at the highest level"; It helps to reveal strengths and weaknesses of opponents".* One respondent thought that there was no need to use advanced data statistics and the best way to evaluate a player was just to look at his shooting percentage: *"I understand the value of player by his shooting statistics: he score 20 points by shooting 13 shots and other example – player score 20 points, but by shooting 23 shots".*

Only one respondent out of seven who expressed their opinion said that he was not sure if basketball analytics had a future in basketball: *"I don't know",* but other 6 specialists believed that basketball analytics was and would be very useful: *"It is going to help evaluating players and their skills"; "Yes"; "Yes"; "Yes, because basketball is evolving"; "Basketball analytics would be very useful, but at first they have to prove teams, that their information and methods could help to win*

games"; "In this industry (basketball) just the highest level teams have a possibility to have various types of basketball specialists on their teams. I think that basketball analytics and scouts have a bright future in basketball because the majority of teams are doing several of opponent's analysis, but basketball analytics specialists have to understand not only math and numbers, but also basketball in general".

DISCUSSION

Online survey results showed that clubs from Lithuanian Basketball League performed various basketball analysis and teams used some kind of basketball advanced data analysis, so it can be stated that there is a positive approach towards comprehensive basketball statistical data. Basketball is the most popular sports in Lithuania, that it is natural there is a lot of attention and money dedicated to basketball and teams are trying to be competitive in Lithuanian and European leagues. Basketball advanced data analytics is widely spread in all of NBA teams (30), where every team has their own basketball analytics specialist team. Teams spend a lot of money for having newest information technologies and media using basketball advanced data to write more informative articles about basketball. However but comprehensive data statistics is still a new area of basketball in Europe (Martinez & Martinez, 2011). There is still a lot of questions on how to use all of the advanced data while creating new playing strategies and evaluating individual players. The majority of team managers and coaches confirmed that they were combining video, "eye test" and advanced basketball data. Alamar (2013) had similar results in his research, where respondents said that they were using 3–4 methods for statistical analysis.

This research shows that there is a need for new information technologies for basketball clubs. Specialists from basketball teams believe that new information technologies would be very beneficial and useful: better evaluation of opponents and individual players, team results could improve, a search for new player would be more productive and clubs could spend money on new players more efficiently. Eschker, Perez and Siegler (2004) established that NBA teams hadpaid 2 times more money than they should have because of lack of information and new technologies. Comprehensive data analysis would provide better opportunities to analyse new potential players' skill sets and would be beneficial in looking for new ways on how to improve team performance during basketball season in highest level competition.

Caporale & Collier (2015), Nikolaidis (2015), Shea (2014) all collectively maintain that teams should avoid mid – range shots and shoot more close to the basket shots and three pointers, but this trend is still not used in Lithuanian basketball clubs because the majority of LKL clubs managers and coaches think that mid – range shots are still very important in basketball. It is worth mentioning that some respondents think that coaches have to adapt offensive strategies to players and not vice versa, but Houston „Rockets" were able to be at a competitive position in NBA even when they lost 2 All – star players because of the strategy where the team shoots a lot of shots close to the basket, free throws and three pointers.

The majority of respondents have an opinion that advanced basketball data analytics has a bright future in basketball industry, but for now just only the highest level teams have an opportunity to have that kind of technologies and specialists. It has to be a specialist who understands numbers, math and basketball. Also, he/she needs to find ways how to present advanced statistical data to coaches and prove that this type of data could be helpful and useful for improving and making their game strategy more efficient for team performance. Advanced basketball data analytics should be interesting not only for the best clubs in Lithuania, but also for lower level league teams. Teams use limited amount of resources (money), so advanced statistical data information could help to spend money for team roster more efficiently. It is worth saying that LKL team managers and coaches think that advanced data analytics specialists have a bright future in basketball industry.

To sum up, it can be stated that managers and coaches of Lithuanian Basketball League teams have a positive approach to basketball analytics and its future. However, there are a lot of limitations for doing a more comprehensive research in this field because of the lack of data and other scientific research. Basketball analytics is widely used in NBA. Teams are playing in analytical way and creating new front office positions for basketball data specialists. Basketball analytics is just a growing area in Europe (Martinez & Martinez, 2011). It is important for team managers to find ways how to use club resources in the most efficient

way, find players and evaluate their use on the court and value in the market. More basketball related comprehensive data would be beneficial for managers' decision-making.

CONCLUSIONS

New information technologies could help to improve opponents' and new individual players' analysis. Club teams would be able to use their resources (money) more efficiently. Respondents were asked to write their opinions about basketball offensive strategy, where the main focus is to make shots close to the basket and three point shots, and it was found that managers and coaches thought that offensive strategy depends on the players a coach has and that mid – range shot is a very efficient shot at basketball. It was found that advanced basketball data analytics specialists have a bright future in basketball industry.

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Corresponding author **Julius Demenius**
Lithuanian Sports University
Sporto str. 6, LT-44221 Kaunas
Lithuania
Tel. +37063070175
Email julius.demenius@gmail.com

ATTITUDES OF 15–16-YEAR-OLD PUPILS WITH A SUFFICIENT ACTIVITY LEVEL TOWARDS THE PHYSICAL EDUCATION TEACHER AND THEIR BEHAVIOUR

Vida Ivaškienė[1], Asta Lileikienė[1], Gytė Levulienė[1], Vytautas Markevičius[2]
Lithuanian Sports University[1], Kaunas, Lithuania,
Mykolas Romeris University[2], Vilnius, Lithuania

ABSTRACT

Background. As our society is subject to changes, knowledge about the learners' attitudes towards a physical education teacher, their behaviour and characteristics can help to more effectively address the problems of physical education at school. The research hypothesis was raised in this article as follows: attitudes of 15–16-year-old pupils with a sufficient activity level towards a physical education teacher and their behaviour will differ with respect to gender: the male pupils' approach will be more positive than that of female pupils. Research aim was to investigate the attitudes of 15–16-year-old pupils with a sufficient activity level towards a physical education teacher and their behaviour.

Methods. The survey was conducted during physical education classes in Kaunas secondary schools in spring, 2015. The questionnaire survey was carried out. Questionnaire data of 300 sufficiently physically active pupils (150 boys and 150 girls) were analysed.

Results. Both boys and girls indicated good knowledge of the subject, friendliness, communication with the group, taking into account pupils' opinions as the most appealing characteristics of the physical education teacher. Both genders considered that the most unfavourable teacher characteristics were insisting on meeting physical standards, non-involvement in physical activities together with pupils in the classroom and disregarding pupils' needs and wishes. More girls than boys ($p < .05$) did not appreciate the teacher's non-communication with pupils, lack of dedication and making offensive comments.

Conclusions. Both boys and girls pointed out that the most appealing traits of the physical education teacher's characteristics were good knowledge of the subject, friendliness, communication with the group and taking into account pupils' opinions. Girls appeared to be more demanding to the physical education teacher's behaviour than boys.

Keywords: attitude to physical education teacher, pupils, teacher's behaviour.

INTRODUCTION

Physical education (PE) teacher is the most important person at school who should not only aim to meet pupils' need for activity, improve their physical fitness but also develop the competencies of physical education in the field, promote a positive attitude towards physical activity and physical self-development (Emeljanovas & Trinkūnienė, 2011; Hardman, 2008; Jaakkola & Washington, 2013; Van den Berghe et al., 2014).

Scientists claim that pupils are educated physically effectively when they experience positive emotions, joy, happiness during physical education lessons, as these factors in particular induce the need for physical activity, increase the desire to play sports and socialize (Blauzdys & Vilkas, 2007). Fominienė, Kardelienė, and Kardelis (2006), Petrylaitė and Emeljanovas (2012) argue that a pleasant surprise is important in the

PE lesson. Physical education teachers have a possibility to influence each individual learner, apply the alternative forms of teaching and achieve quick and significant results, etc. (Atencio, Jess, & Dewar, 2012; Blauzdys & Vilkas, 2007; Freire & Miranda, 2014; Juškelienė, Poteliūnienė, Gudžinskienė, & Blauzdys, 2010; Poteliūnienė, Blauzdys, & Juškelienė, 2012).

Scientific research is more focused on the PE teacher's perception of health education and competence at school (Juškelienė et al., 2010), professional challenges in the physical education teacher's work (Trinkūnienė & Kardelienė, 2013; Trinkūnienė, 2015), the PE teacher's opinion about the learners' personal traits (Kardelienė, Trinkūnienė, Kardelis, & Masiliauskas, 2013), pupils' progress and achievement assessment during physical education classes (Emeljanovas &Trinkūnienė, 2011; Van den Berghe et al., 2014), teachers' readiness to apply the new ideas for pupils' physical education (Atencio et al., 2012; Poteliūnienė et al., 2012; Jaakkola & Washington, 2013; Trinkūnienė, 2015).

Understanding and communication between the teacher and the pupil take place simultaneously (Freire & Miranda, 2014; McDavid, Cox, & McDonough, 2014; Van den Berghe et al., 2014). The PE teacher's personality, features of interaction with pupils, ability to motivate pupils to be physically active, exercise lead to pupils' positive attitudes to physical education, create the need to be physically active in their further lives (Atencio et al., 2012; Bernstein, Phillips, & Silverman, 2011; Jaakkola & Washington, 2013; McDavid et al., 2014).

We believe that as our society is subject to changes, knowledge about the learners' attitudes towards the physical education teacher, their behaviour and characteristics can help to more effectively address the problems of physical education at school, thus research in this area is meaningful and relevant.

Hypothesis: attitudes of 15–16-year-old pupils with a sufficient activity level towards the physical education teacher and their behaviour will differ with respect to gender: the male pupils' approach will be more positive than that of female pupils.

Research aim was to investigate the attitudes of 15–16-year-old pupils with a sufficient activity level towards physical education teacher and their behaviour.

METHODS

Research methods: 1) analysis and discussion of scientific literature; 2) questionnaire survey; 3) statistical analysis. Anonymous questionnaire survey was conducted during physical education lessons in Kaunas secondary schools in spring, 2015. Questionnaire data of 300 pupils (150 boys and 150 girls) were analysed. According to the responses to the IPAQ International Questionnaire (http://ipaq.ki.se/downloads.htm) they were determined as sufficiently physically active.

The research data were analysed using the statistical data software package *SPSS 17.0* for Windows. Chi-square test (χ^2) was used to evaluate statistical differences between the groups. The significance level of hypotheses' conclusions was set at $p < .05$, statistically non-significant – at $p > .05$. Internal consistency of the scales was evaluated according to Cronbach's alpha coefficient (.79).

RESULTS

The analysis of pupils' responses about the most appealing physical education teacher characteristics established that there was no significant difference in replies to the given statements between boys and girls ($p > .05$) (Table 1). Both boys and girls appreciated the PE teacher's knowledge of their study course: answer options *strongly agree* and *agree* were noted by 90% of boys and 89.3% of girls. They liked friendliness of PE teacher very much as well (answer options *strongly agree* and *agree* were noted by 89.3 and 89.4% of the respondents respectively), interaction with a group (86.7 and 90% of the respondents respectively); they emphasized that the physical education teacher was easy to communicate with (84% and 80% of the respondents respectively) (Table 1).

It was determined that pupils liked the fact that physical education teacher took into account pupils' opinions, was calm, creative, applied innovations, was interested in each pupil, had a sense of humour and a good physical appearance – answer options *strongly agree* and *agree* were noted by more than half of the respondents (Table 1).

The analysis of pupils' responses about the least appealing physical education teacher characteristics demonstrated (Table 2) that both boys and girls did not like the same traits of physical education teacher. Most pupils did not appreciate when the teacher

Table 1. **Percentage distribution of responses to the question "What traits of the PE teacher characteristics do you like?"**

Statements	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		χ^2 and p values
	M	F	M	F	M	F	M	F	M	F	
Good physical appearance	30.0	32.7	29.3	31.3	28.7	26.0	5.3	7.3	4.7	0.7	$\chi^2 = 5.438$ $p = .365$
Friendly	39.3	48.7	50.0	40.7	6.7	6.7	2.0	2.7	1.3	1.3	$\chi^2 = 4.069$ $p = .540$
Good knowledge of the subject	42.7	49.3	47.3	40.0	10.0	9.3	0	1.3	0	0	$\chi^2 p = .298$
Calm	30.7	33.3	40.7	44.0	22.0	18.0	3.3	2.7	3.3	1.3	$\chi^2 = 3.360$ $p = .645$
Interaction with the group	38.7	44.0	48.0	46.0	12.0	6.7	1.3	2.7	0	0	$\chi^2 = 4.532$ $p = .339$
Has a sense of humour	34.0	30.0	41.3	46.0	20.0	18.7	1.3	4.0	2.0	1.3	$\chi^2 = 5.018$ $p = .414$
Interested in each pupil	30.0	25.3	52.7	44.7	12.0	19.3	4.0	8.0	0.7	2.7	$\chi^2 = 8.951$ $p = .111$
Easy to communicate with	38.0	37.3	46.0	42.7	12.7	15.3	2.0	0.7	1.3	4.0	$\chi^2 = 3.578$ $p = .466$
Creative	24.7	30.7	40.0	34.0	25.3	30.7	6.7	3.3	3.3	1.3	$\chi^2 = 5.420$ $p = .247$
Applies novelties	32.0	26.0	23.3	30.0	34.7	27.3	5.3	9.3	4.7	7.3	$\chi^2 = 6.007$ $p = .199$
Considers pupils' opinions while giving the tasks	38.7	31.3	36.7	35.3	16.7	15.3	4.7	8.0	3.3	10.0	$\chi^2 = 7.589$ $p = .108$

Note. M – males, F – females in all tables.

required to meet the physical standards (answer options *strongly agree* and *agree* were noted by 26% of boys and 32% of girls) when the teacher did not participate in physical activities with pupils in the classroom (respectively 21.3 and 27.4% of the respondents) when they did not take into account pupils' wishes and preferences (respectively 12.6 and 37.4% of the respondents). There was no significant difference found between male and female responses ($p > .05$), but the responses to some statements differed with respect to gender.

More girls than boys ($p < .05$) did not like that physical education teachers did not communicate with pupils (answer options *strongly agree* and agree were noted by 12% of boys and 19.3% of girls), when teachers lacked dedication (respectively 10 and 18.7% of the respondents), teachers were not objective to pupils (10.7 and 14.7% of the respondents), when physical education lessons were not interesting (respectively 12 and 24% of the respondents), physical education teachers made offensive remarks in the class (respectively 10.7 and 14.7% of the respondents) (Table 2).

Analysing the statement "You are performing an exercise well, the PE teacher..." it was determined that (Table 3) the teacher often praised pupils (as indicated by 50% of boys and 42.7% of girls, $p > .05$); that the teacher often served as an example to others (respectively 35.3 and 23.33% of the respondents, $p < .05$). About the tenth of the subjects identified that physical education teacher did not often pay attention to the fact that pupils were performing an exercise well.

Analysing the statement "When you did not succeed to perform an exercise well, your PE teacher…" it was determined (Table 4) that the teacher often gave advice how to perform an exercise correctly (as indicated by 64.7% of boys and 70% of girls, $p > .05$); a small number of pupils indicated that the teacher often mocked them (respectively 4 and 5.3% of the respondents, $p > .05$), ridiculed pupils (respectively 4 and 2.7% of the respondents, $p > .05$). The statistically significant difference was established in one aspect – more boys than girls were shouted at ($p > .05$).

Analysing the statement "You contradict willing to defend your wishes, the PE teacher..." it was identified (Table 5) that the teacher often changed the task, as indicated by 30% of boys and 10% of girls. A relatively small number of male subjects

Table 2. **Percentage distribution of responses to the question "What traits of the PE teacher characteristics do you dislike"**

Statements	Strongly agree		Agree		Neither agree nor disagree		Disagree		Strongly disagree		χ^2 and p values
	M	F	M	F	M	F	M	F	M	F	
Does not communicate with pupils	6.7	7.3	5.3	12.0	25.3	10.7	32.7	38.0	28.0	32.0	$\chi^2 = 16.861$ $p = .005$
Asks to meet physical standards	6.7	8.0	19.3	24.0	26.7	24.0	27.3	26.7	20.0	17.3	$\chi^2 = 1.444$ $p = .836$
Not involved in physical activities with pupils	5.3	10.7	16.0	16.7	28.7	27.3	26.7	20.0	23.3	25.3	$\chi^2 = 4.287$ $p = .369$
Makes offensive remarks	8.0	6.7	2.7	8.0	16.7	6.0	36.0	32.0	36.7	47.3	$\chi^2 = 14.096$ $p = .007$
Does not show enthusiasm	5.3	5.3	6.7	9.3	27.3	21.3	32.7	31.3	28.0	32.7	$\chi^2 = 2.356$ $p = .671$
Impatient	4.0	4.7	6.7	11.3	24.7	18.7	30.7	29.3	31.3	35.3	$\chi^2 = 5.342$ $p = .376$
Lacks dedication	4.0	8.0	6.0	10.7	32.7	17.3	28.0	32.7	29.3	31.3	$\chi^2 = 11.651$ $p = .020$
Not objective to pupils	4.0	6.0	6.7	8.7	34.7	18.0	26.7	32.0	28.0	34.7	$\chi^2 = 11.694$ $p = .039$
Non-interesting activities	8.7	11.3	3.3	12.7	26.0	20.7	24.7	27.3	36.7	28.0	$\chi^2 = 12.562$ $p = .028$
Does not pay attention to pupils' wishes	6.0	12.7	6.7	24.7	25.3	44.7	30.7	14.0	30.7	4.0	$\chi^2 = 8.781$ $p = .118$

Statements	Often		Sometimes		Never		χ^2 and p values
	M	F	M	F	M	F	
Praises	50.00	42.67	47.33	52.00	2.67	5.33	$\chi^2 = 2.537$ $p = .469$
Serves as an example to others	35.33	23.33	51.33	53.33	13.33	23.33	$\chi^2 = 7.830$ $p = .020$
Does not pay attention	10.67	8.67	32.00	27.33	57.33	64.00	$\chi^2 = 1.410$ $p = .494$

Table 3. **Percentage distribution of the statement "You are performing an exercise well, the PE teacher..."**

Statements	Often		Sometimes		Never		χ^2 and p values
	M	F	M	F	M	F	
Advises	64.67	70.00	32.67	25.33	2.67	4.67	$\chi^2 = 3.298$ $p = .348$
Mocks	4.00	5.33	16.00	8.67	80.00	86.00	$\chi^2 = 5.611$ $p = .132$
Shouts	6.00	1.33	17.33	25.33	76.67	73.33	$\chi^2 = 8.248$ $p = .041$
Ridicules	4.00	2.67	10.67	10.00	85.33	87.33	$\chi^2 = 0.467$ $p = .792$

Table 4. **Percentage distribution of the statement "When you did not succeed to perform an exercise well, your PE teacher…"**

Statements	Often		Sometimes		Never		χ^2 and p values
	M	F	M	F	M	F	
Changes the task	30.00	10.00	56.67	56.00	13.33	34.00	$\chi^2 = 29.559$ $p = .001$
Shouts	3.33	1.33	18.67	31.33	78.00	67.33	$\chi^2 = 7.545$ $p = .056$
Gesture and mimics show that teacher will not change the task	7.33	10.67	26.00	38.00	66.67	51.33	$\chi^2 = 7.290$ $p = .026$
Does not pay attention	6.67	7.33	27.33	33.33	66.00	59.33	$\chi^2 = 3.130$ $p = .372$

Table 5. **Percentage distribution of the statement "Your PE teacher gives you a task. You contradict defending your wishes, your PE teacher…"**

(97.3%) and female subjects (10.7%) pointed out that the gesture and mimics of the teacher showed their inclination not to change the task. The statistically significant difference was determined in the responses with respect to gender ($p < .05$).

DISCUSSION

Our hypothesis that attitudes of 15–16-year-old pupils with a sufficient activity level towards the physical education teacher and their behaviour will differ with respect to gender has been partly proved because the response of boys appeared to be better only in a few aspects: fewer boys than girls stated that they did not like when the teacher did not communicate with the pupils, when they lacked dedication and when they were not objective to pupils.

Our research results coincide with the data of other researchers (Blauzdys & Bagdonienė, 2007; Fominienė et al., 2006; Galkienė, 2011; Maciulevičienė, 2014; Van den Berghe et al., 2014), showing that the pupils' attitude towards the physical education teacher highly depends on the teacher's ability to communicate, be creative and their effort in behaviour with pupils during lessons. Studies by other researchers (Bernstein et al., 2011; McDavid et al., 2014; Van den Berghe et al., 2014) have revealed that the main sources for positive approach to physical education are pupils' communication with the teacher, knowledge gained during physical education classes, the teacher's ability to engage students and satisfaction of pupils' needs. These facts were confirmed by our research results.

Teacher's morale, good will directly influence pupils' mood, work capacity, attitude to the lesson's content. Only friendly and sincere relationship can create an elevated mood that promotes efficiency, increases satisfaction with the teacher (Atencio et al., 2012). Maciulevičienė (2014) indicates that pupils like when the physical education teacher speaks calmly, vividly, expressively and correctly. Our study also found that pupils really enjoyed when the physical education teacher was calm in the classroom, took pupils' wishes into account.

Pupils are being influenced not only by the organization of teaching process, but also by the relationships between teachers and pupils. It was found that the most important trait of teachers was communication. By communicating teachers and pupils can show respect to each other, express thoughts, find common solutions, identify needs and express themselves. Therefore, the communication problem of the teacher and the pupil remains relevant (Rutkauskaitė & Januseviciute, 2015). Teacher's duty is to develop honest members of society, moreover, the physical education teacher has another important task – to educate people leading physically active and healthy lifestyles (Galkienė, 2011; McDavid et al., 2014; Rutkauskaitė & Januseviciute, 2015).

Rutkauskaitė and Januseviciute's (2015) study revealed that both boys and girls distinguished teacher's ability to understand as the most dominant trait. Pupils usually described their teacher as understanding, helpful, not indifferent and leading; pupils thought that their teacher was patient, friendly, had a sense of humour and understood jokes, worked with confidence, spoke with enthusiasm, was a good leader. Our research results partially confirmed these statements.

The teacher has the most crucial impact on the emotional atmosphere during physical education classes. During the lessons the teacher should avoid dictatorship, autocratic command, the pupil's personality suppression. Positive characteristics of learners, gains and optimistic points of view, beliefs in pupils should be taken into account. When the teacher, conducting the lesson, highlights positive things most pupils justify the confidence, and emotional atmosphere improves (Galkienė, 2011; Maciulevičienė, 2014).

In summary, common trends can be observed in much of the research by scientists and this article: pupils favour an intelligent, calm, creative, as well as teaching and willing to communicate physical education teacher, pupils seek their well-meaning advice. We believe that for the physical education teacher it is essential to know the wishes, needs, abilities, inclinations, character and temper of pupils as well as strive to fulfil their professional skills in developing fully-fledged members of the society.

CONCLUSION

Both boys and girls indicated knowledge of the subject, friendliness, communication with the group, taking into account pupils' opinions as the most appreciated characteristics of physical education teacher. Both genders considered that the most unfavourable teacher characteristics were insisting on meeting physical standards, non-involvement in physical activities together with pupils in the classroom and disregarding pupils' needs and wishes. More girls than boys ($p < .05$) did not favour teacher's non-communication with pupils, lack of dedication and making offensive comments.

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Coresponding autor **Vida Ivaškienė**
Lithuanian Sports University
Sporto str. 6, LT-44221 Kaunas
Lithuania
Tel. +370 699 57373
E-mail: vida.ivaskiene@lsu.lt

MANAGEMENT OF AND POTENTIAL RETURN ON PRIVATE INVESTMENTS IN LATVIAN SPORTS

Mārtiņš Lauva[1], Uldis Grāvītis[2]
Ventspils University College[1], Ventspils, Latvia
Latvian Academy of Sport Education[2], Riga, Latvia

ABSTRACT

Background. Latvian sports authorities under the Ministry of Education and Science are the main organisers of the sports life in Latvia. However, they have not been successful in providing equally good support to all athletes who need it. It is especially difficult to receive support for improving skills of individual athletes engaged in team sports. Often it is the individual mastery of an athlete that prohibits them from moving on to the adult level of sports of high achievement, even if the athlete was very talented and one of the best in the country when he/she was young.

Methods. The descriptive statistics method and content analysis were used to assess shortcomings in the allocation of finances in the Latvian sports industry. Conclusions were drawn on the data collected, on the basis of which a new method was developed in sports management, the efficiency of which was verified by performing an experiment.

Results. After analysing the most popular sports among young people in the country, as well as the available infrastructure, it may be suggested which sports are the most attractive for investors. It may be concluded that the state is able to successfully solve this problem by attracting private investors who would be personally interested in the development of athletes and also carry out successful investment management. The study demonstrated that a successful process of private investments ensures a positive return on the investments, as well as the development of athletes. One way to build successful cooperation is by creating high-quality sports development centres or sports investment management companies which will efficiently contribute to athletes' transition from youth to professional sports. The efficiency of the methodology developed can be demonstrated by creating a company which would act as an example for attracting private investments in the development of athletes.

Conclusion. The development of athletes would become more efficient and purposeful if sports could attract potential investments with promising returns. This would create a tripartite cooperation among the state, athletes and private investors, which would benefit each of the three cooperating parties. Additional funding in the development of Latvian athletes would have a positive impact on the entire sports industry as a whole.

Keywords: Latvian sports, private investments, sports funding, massive sports system, investment criteria, high-class sports, sports development, efficient investment management.

INTRODUCTION

Latvian sports authorities are the main organisers and maintainers of the sports life in Latvia. However, they are not able to successfully provide equally good support to all athletes who need it. Some gaps can be observed in the distribution of funding, which may affect the quality of high-achievement sports in the country.

High-achievement sports in Latvia can be divided into individual and team sports, which might make it easier to demonstrate the shortcomings of the state funding for equal development of athletes. Latvia has created a quality system for the support of Olympic individual sports through the Latvian Olympic Team. The Latvian Olympic Team provides great support to the individual athletes of Olympic sports and sports involving small teams, such as bobsleigh, luge, beach volleyball and the like. State authorities provide funding to

these, so that athletes can be successful in raising their individual mastery levels and receive the best possible instruction, equipment, medicine and training infrastructure on a high level during the entire season. At the same time, Latvia offers neither state, nor municipal funding, which would provide systematic support for high-achievement team sport athletes to build their individual capacity. There are some youth academies under a few sports clubs, but it must be admitted that their existence is merely formal, and currently there are no world-class athletes prepared by these academies. Another thing to mention is the fact that the majority of team sports clubs are funded through private sponsorship and donations.

Taking into account the objective constraints of the state budget, it is impossible to expect state funding for special youth high-achievement sports development programmes in order to produce world-class professionals in adult sports. This is the main reason why Latvian youth sports teams enjoy brilliant success until the athletes turn eighteen to twenty years old, but after that, upon entering or trying to enter adult sport, the athletes' mastery starts lagging behind that of other athletes, although at eighteen years old they were better.

World experience shows that such shortages in public funding can be successfully filled with private funding. This is usually done within team sports club youth academies, while sports management companies usually invest in tennis, golf, auto racing, or football. These companies use investment agreements and hope to recover the invested funds from professional contracts of athletes. In Latvia, also, private investment is currently the only way to ensure systematic preparation of high-achievement athletes in football, ice hockey, basketball and tennis. In Latvia this is done in the form of social support. World experience shows that direct investments in young athletes and proper management thereof can provide investors with positive return on their investments, as well as ensure enhanced overall mastery of athletes to promote the development of sports in the country as a whole.

The issue which has been reviewed in this article is related to the lack of funding and professional career support needed for young Latvian athletes, and the one-sided support from Latvian sports supporters unable to attract investors, who would be willing to make large investments. According to the hypothesis of the study, by investing private financial resources to ensure high-achievement sports conditions for individual Latvian athletes in certain sports from the age of 14 and ensuring adequate investment management, it is possible to achieve a positive return on investment. The goal of the study was to show the importance of private investments in Latvian sports, the opportunities to address current issues related to the development of youth sports and the entire sports industry by attracting private investors, develop innovative methodologies for private investment management in sports, while at the same time ensuring a positive investment balance of the investor and high achievement in sports.

To achieve this goal, the following tasks were defined:

- Examine public investments in sports;
- Identify gaps in the public funding;
- Develop a solution to the funding gaps;
- Develop innovative methodologies for a more efficient investment management in Latvian sports;
- Check the efficiency of these methodologies.

The investment management processes and the general management processes are widely described in the literature throughout the world. John Maynard Keynes was one of the first to define investments in his book "General Theory of Employment, Interest, and Money" (Keynes, 1997). Obviously, the investment processes and management have been covered in countless works. On the other hand, sports investment management and sports management in general has not been a subject of much scientific research. As the sports industry realises the importance of successful sports management, the development of a successful sports management strategy is increasingly highlighted. Principles and practice of sport management (Masteralexis & Barr 2011) are being defined and established more widely. Descriptions of sports management and administration (Watt, 2003) and financial management in the sport industry (Brown, 2010) have been discussed. Although there is a wide spectrum of research and descriptions on sports investment management processes and investment management to increase the mastery of athletes in the world, after analysing the available information in major scientific databases, it may be concluded that the investment management for increasing the mastery of athletes has not been previously described or studied scientifically.

METHODS

Analysed indicators. The paper analyses indicators that affect the allocation of public funds in the sports sector, as well as the statistical indicators on youth sports system and the availability of sports infrastructure necessary to define the investment objects.

1. Sports industry structure of the Ministry of Education and Science.
2. State budget for 2015.
3. Student statistics of professional sport education institutions.
4. Sports facilities.
5. Present value of the experimental company at the end of period.

Data set. The study used publicly available data from the database of the Central Statistical Bureau of Latvia, information provided by the Latvian Olympic Unit, information available on the website of the Latvian Ministry of Education and Science, database of the Sports Facilities' register, as well as unpublished data from the Ministry of Education and Science on the number of students and rates at professional sports education institutions. Analysed data was for the year 2015. Also, the financial indicators of the experimental company engaged in the management of private investments in Latvian athletes were used.

Methods. The descriptive statistics method and content analysis were used to assess shortcomings in the allocation of finances in the Latvian sports sector. By analysing data on sports funding in Latvia and especially the funding to increase individual mastery of athletes, conclusions were drawn on the shortcomings in the promotion of successful activities of all athletes in the country and the common flaws in the development of high-class athletes. After analysing the data on funding, an innovative methodology was developed to remedy the shortcomings of funding, and a company was established to deal with private investments in sports, in order to prove the hypothesis. The return on investments made by the experimental company was calculated by using the future profit calculation formula and investment return coefficient formula. (Geske & Grīnfelds, 2006).

RESULTS

To show the shortcomings of state funding in the Latvian sports industry, the study investigated the state budget funds allocated to sporting bodies, and the sports industry structure as a whole. The breakdown is shown in Figure 1, providing a clear overview of how much funding has been allocated to each public institution.

Looking at Figure 1, it may be concluded that the main organiser of the sports life in Latvia is the Ministry of Education and Science. The Ministry of Education and Science is responsible for the allocation of funding between sporting bodies (Parliament of Latvia, 2014), and the key authority that has the greatest effect on the allocation of funding in the sports sector is the National Sports Council.

By analysing and drawing conclusions about sporting bodies, it may be concluded that almost all sports organisations are engaged in the mastery training, promotion of development and ensuring the activities of individual sports athletes. It should be noted that the state provides funding to sports federations that organise sports competitions in both team and individual sports, while the main task of the federations is to organise local championships. Also, the majority of these institutions have been established primarily to ensure the participation of athletes in international competitions.

The country has an efficient system of preparation of young athletes, but there is a lack of support of individual development, which is required in perhaps the most important stage of an athlete's career – the transition from youth to adult sport.

These deficiencies in the country's sports sector indicate that there is a need to attract private investor resources in the development of young athletes, especially in team sports.

Table 1 contains summary information on the most popular sports among young people in Latvia (Ministry of Education and Science, 2013) and the resources available to sports facilities (Sports Facilities Register, 2015), by type of sport. Table 1 can serve as the basis for the successful attraction of investors in different types of sports.

After analysing the data in Table 1 on the most popular sports among young people in Latvia, it may be concluded that it would be the easiest to attract investors for the types of sport such as basketball, football, ice-hockey, and maybe also volleyball and handball. Although relatively few young people engage in ice-hockey, it is still a likely investment object because Latvia has strong ice-hockey traditions and probably the most

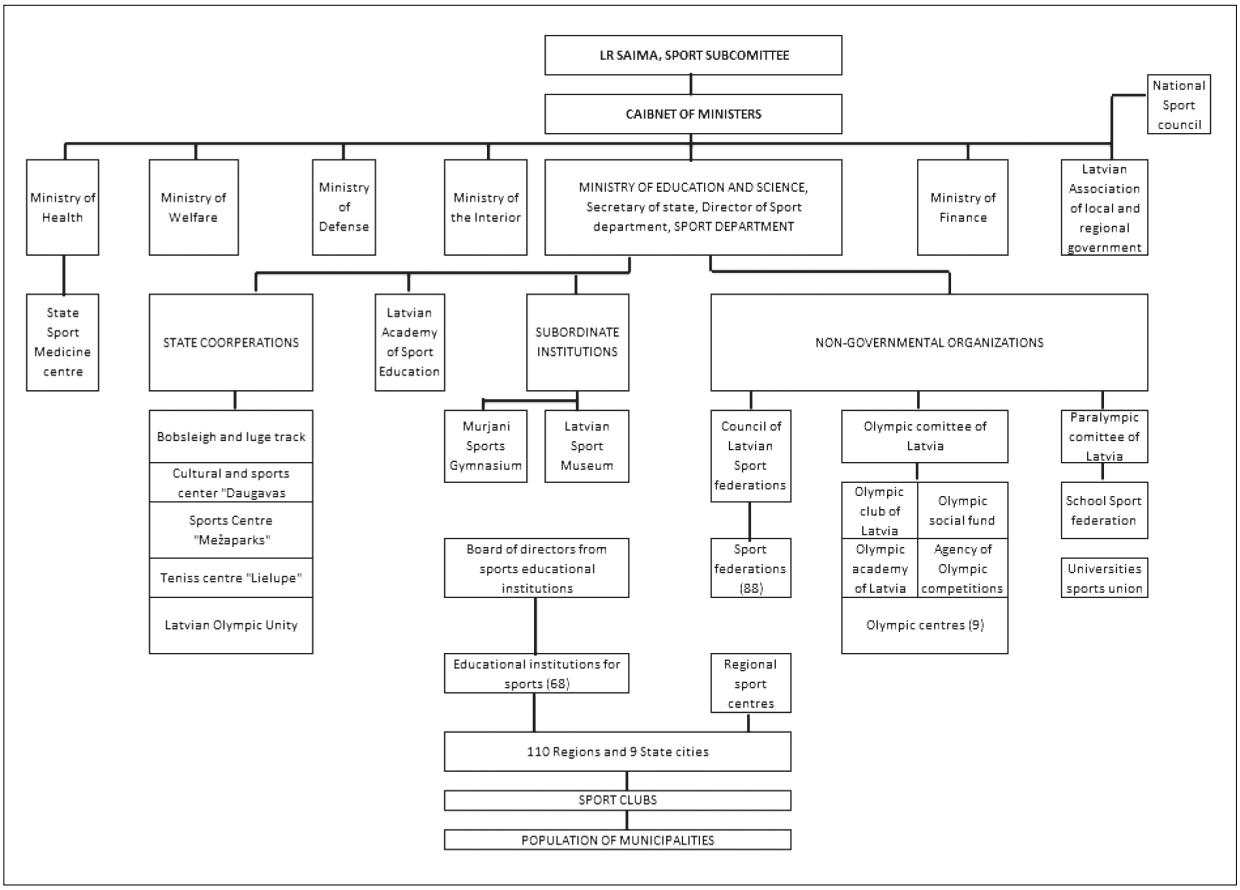


Figure 1. **Sports industry structure and funding**

professional hockey players per number of youth engaged in this sport, which might be an important aspect for potential investors (Central Statistics Bureau, 2015; Ministry of Education and Science, 2013).

Table 1. **The most popular types of sport among youth in Latvia and the available resources of sports facilities**

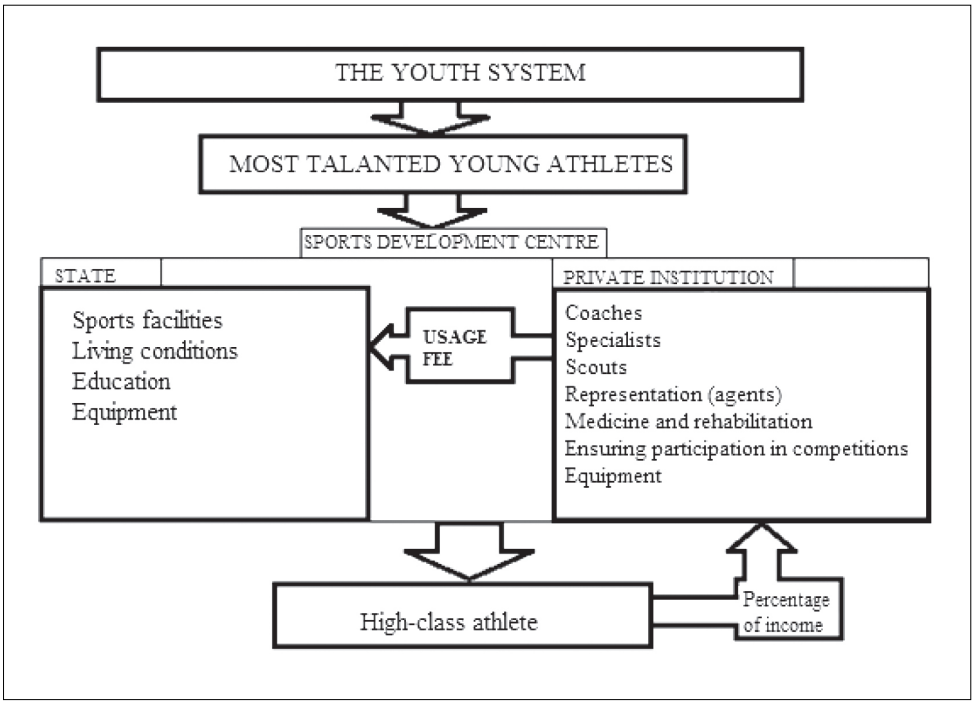
Type of sport	Participants in state sport schools	Facilities
Basketball	6753	710
Volleyball	5307	658
Football	4646	591
Track and Field	2902	425
Floorball	2527	288
Handball	1572	85
Swimming	995	63
Ice-hockey	916	54
Chess	797	48
Freestyle wrestling	712	31
Gymnastics	655	27
Judo	597	23
Gymnastics	494	22
Kayak and Canoe	433	8

Private investors must be able to cooperate with the state, thus developing a successfully functioning high-class athlete preparation centre, as depicted in Figure 2.

In order for the cooperation to run smoothly, state institutions must provide sports infrastructure, while private investors provide many components related to athletes' career development which will help ensure successful development of team sports in the country as a whole.

To demonstrate the efficiency of the innovative method in furthering the achievements of athletes, an experiment was carried out, in which a company was established engaged in the preparation of athletes for professional sports. Basketball was selected as the focus, because it is the most popular sport among young people in the country, and the Latvian Basketball League has the most professional athletes from all sports leagues in the country. The company operated in accordance with the diagram depicted in Figure 2 and provided all liabilities pertaining to the private partner as described in the diagram, thus maximising the career opportunities of athletes and facilitating their transition from youth to adult

Figure 2. **High-achievement sports development centre operation model**



sport (Central Statistical Bureau, 2015; Latvian Basketball Association, 2015). Table 2 shows the company's performance over the years. The table also shows the company's ability to function and operate continuously, as well as investment project and management performance indicators and their development.

Table 2. **Profit/loss of Sia Baa Rīga, per year, EUR**

Year	Profit / Loss
2008	(–1917)
2009	(–5867)
2010	(–3024)
2011	16433
2012	3939.80
2013	6958
2014	19808

In order to properly evaluate the success of the experiment and validate the hypothesis, calculations were made to estimate the future value of resources invested and the return on investment coefficient. The return on investment was calculated as 2.12, from which it could be concluded that the investment project works and is able to sustain its future operation, which proves that it is possible to attract private investments in the development of athletes in Latvia and ensure their management.

DISCUSSION

It is also important to understand that in most team sports adult athletes engage in sports for a certain fee and are able to sustain themselves and improve their mastery. Therefore, it is essential for the state to support the many individual types of sport, where athletes are not able to fund their own training from their professional sports activities. Although many team sport athletes are able to fund their own development, the vast majority of athletes fail to build a professional athlete's career due to the difficult transition from youth to adult sport.

Funds for training are provided only from the Latvian Olympic Unit, and these funds are allocated according to the criteria for individual sports. Although Latvian team sport athletes achieve equally good results, it is virtually impossible for them to receive state funding for training. It goes without saying that the state does not have enough resources to support athletes of all types of team sports (Latvian Olympic Unit, 2015).

The main drawback of state funding is the insufficient funding of team sport athletes to prepare them for adult sport, which can become an obstacle in the careers of many athletes. When making conclusions on the practice and the development of athletes in other countries, one can develop a successful model where private investors support

young athletes. The country has a successfully functioning selection process of athletes for the allocation of funding to individual sports athletes. A similar system with strict selection criteria can also be used by private investors in order to increase effective operation of their investment projects and evaluate investment objects.

It is important to note that private investors and the state share the risks in case of a failed athlete's career, which might allow to maximise the return from a youth system in the country, and to raise high-achievement sport results in the country as a whole, and in particular in those sports that require large investments in early stages of athletes' careers.

In order to successfully attract private investors in the development of athletes, it is necessary to identify the types of sports that have the required base of young athletes and who can provide the investor with sufficient return on investment for the management project to be profitable and sustainable in the long term. Another thing to be understood is that it is virtually impossible for private investors to create new sports facilities for the development of athletes, which are vital for the development of young athletes.

Looking at the company's operating results, it can be concluded that, as in other investment management projects, the beginning is associated with selecting the right investment and the right investment objects, while further steps are related to successful product development and promotion. For an investment project to function properly, a legal relationship was established between the investor and the athlete, so that in case of a successful activity of the investor, the athlete would pay back the support provided in his/her career development.

The analysis showed that private investors are much better equipped to prepare athletes for adult team sports. One of the main factors is certainly the fact that private investors have a personal interest in raising the mastery of the athlete. Also, private investors have much better opportunities of attracting foreign specialists to raise the mastery of young athletes.

The weakest link of private investments in sports is the necessary sports infrastructure to ensure one's own operations, which requires large investments. That is why public and private investors need to build successful partnership from which both parties will benefit.

CONCLUSION

The state provides funding to ensure sports activities in the country. The main organ for the organisation of the national sports life is the Ministry of Education and Science. The institution, which influences the distribution of sports funding the most, is the National Sports Council. Several state institutions provide development of individual athletes.

1. The main problem of state funding is the inability to ensure sufficient funds for the individual development of team sports athletes in accordance with high-achievement sport requirements.
2. The problem described above can be solved by attracting private investments to ensure efficient development of athletes, where the return will be produced by direct payments of the athletes upon reaching a certain level of mastery.
3. After verifying the efficiency of the method, i.e., the development of sports investment management centres and companies, by using the experimental method, as well as analysing the financial indicators of the established company, it may be concluded that the method works in the development of athletes and that it is a successful investment opportunity.

The study has led to the conclusion that, in order to improve the efficiency of investment management methods, research should be performed on topics such as the development of criteria for a successful selection of young athletes, factors contributing to the development of athletes, circumstances promoting the cooperation between state institutions and private entrepreneurs, legal and psychological aspects of the cooperation between investors and athletes, and the connection between risk capital investment management and investments in athletes. Further studies must be conducted on the role of private investment management in the development of athletes. Moreover, several further research options arouse from the study which may lead to more improvements of investment management in sports. One of the main fields of further study is to draft criteria of potential athletes' physical abilities allowing to better distinguish investment opportunities. As well further research of athlete psychological aspects, significant components in athletes' progress, health monitoring development, athletes' guidance in professional sports market and several other shall be studied in order to evolve investment management in sports in Latvia.

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Corresponding author **Uldis Gravitis**
Latvian Academy of Sport Education
Brīvības gatve 333, LV-1006 Rīga
Latvia
Tel. +371 29282890
E-mail Uldis.Gravitis@lspa.lv

HEAD AND NECK WARMING APPLIED IN THERMONEUTRAL CONDITIONS IMPROVES THERMAL SENSATION BUT DOES NOT ALTER COGNITIVE FUNCTION

Henrikas Paulauskas, Dalia Mickevičienė, Vaida Berneckė, Kazimieras Pukėnas, Marius Brazaitis
Institute of Sport Science and Innovations, Lithuanian Sports University, Kaunas, Lithuania

ABSTRACT

Background. Heat therapy is widely used for therapeutic purposes in health SPA resorts or hospitals. However, its benefits and consequences are not strongly evidenced and it is partially-related with a lack of experimental information. No one has explored how continuous head and neck warming applied in thermoneutral environment can affect body temperatures, subjective sensations and cognition and the purpose of this study was to investigate it.

Methods. Seven subjects (21 ± 1 years) participated in two experimental trials: CON – control trial; and CONW – head and neck warming trial. These trials were designed to introduce the effects of continuous head and neck warming (surface warming by 44 ± 1°C) on thermal sensations, body temperatures and cognitive function in thermoneutral environment (24°C and 60% relative humidity). In each trial body temperatures (rectal, Tre; mean skin, Tsk), heart rate (HR) response, ratios of subjective sensations (SS) and cognitive function were assessed.

Results. Head and neck warming (CONW trial) maintained significantly higher Tre and Tsk values (by 0.2 ± 0.1°C and 1 ± 0.3 °C, respectively), compared to the control (CON) trial. Head and neck warming caused significant increment in heart rate (8 ± 2 b/min) and improved thermal sensation ($p < .05$), but had no effect on shivering/sweating sensation and thermal comfort. Moreover, head and neck warming (CONW trial) does not induce any significant impact on accuracy ($p > .05$) and response times ($p > .05$) in mathematical and spatial processing tasks.

Conclusions. Continuous head and neck warming applied in thermoneutral conditions maintains higher internal (Tre) and peripheral (Tsk) body temperatures and improves thermal sensation, but does not alter cognitive function.

Keywords: head and neck warming, subjective sensations, body temperature, cognitive function.

INTRODUCTION

Heat therapy is widely used for therapeutic purposes in health SPA resorts and hospitals. The heat can be applied with hot water bottles, neck wraps, hot tubs, electric heating pads, etc. These various methods are certainly one of the frequently recommended non-invasive modalities for various kinds of acute or chronic pain relief (Garra et al., 2010; Malanga, Yan, & Stark, 2015; Nadler et al., 2002; Nadler, Weingand, & Kruse, 2004). Some residual after-effects associated with sports injuries, surgical procedures, broken bones can be minimized by using heat to increase blood circulation into the region, to help decrease bruising, inflammation, muscle spasms, swelling, stiffness as well as pain (Malanga et al., 2015; Nadler et al., 2004). However, it remains unclear whether local warming (usually used in heat therapy) induced changes in body temperatures and subjective sensations may affect cognitive function.

Inconsistent findings of previous investigators have shown that increment in both peripheral and core body temperatures may have negative (Gaoua, Grantham, Racinais, & El Massioui, 2012; Solianik, Skurvydas, Mickevičienė, & Brazaitis,

2014; Sun et al., 2012), positive (Brazaitis et al., 2016) or no impact on cognitive function (Brazaitis et al., 2015). These inconsistent findings are a due to the large number of factors that come into play, such as task type, exposure duration, skill and acclimatization level of the individual and due to the absence of a concise theory on which experimental work can be based (Hancock & Vasmatzidis, 2003; Taylor, Watkins, Marshall, Dascombe, & Foster, 2016). Some previous reviews suggest that cognitive function is generally unaffected unless the external stimulus is sufficient in intensity and duration to increase core temperature away from a homeostatic range approximate to 37°C (Hancock & Vasmatzidis, 2003). However, recent studies demonstrates that an increase in Tsk, independent of any rise (Gaoua et al., 2012) or decline (Brazaitis et al., 2016) in core temperature, may be responsible for alterations in cognitive function.

The head, neck, and face are regions of high allesthesial thermosensitivity (Cotter & Taylor, 2005) and investigators have proposed that the neck might be an optimal site for temperature manipulations because of its close proximity to the thermoregulation centre (Gordon, Bogdanffy, & Wilkinson, 1990; Shvartz, 1976). The previous studies have demonstrated that cooling the head and neck as compared to cooling equal body surface area on the torso, arm and thighs is more efficient at dissipating heat, reducing thermal strain and improving thermal comfort (Nunneley & Maldonado, 1983; Shvartz, 1970, 1976). Furthermore, head and neck cooling applied in hyperthermic conditions may mask the true state of the body (Tyler & Sunderland, 2011a, 2011b), alleviate unpleasant sensation (Cohen, Allan, & Sowood, 1989; Nunneley & Maldonado, 1983) decrease heart rate, oxygen consumption (Watanuki, 1993), and allow to tolerate higher rectal temperatures (Tyler & Sunderland, 2011a).

The aforementioned studies demonstrate that the head and neck cooling effects are quite well established. However, the physiological and psychological head and neck warming effects have not been investigated and remain unknown. Recent research suggests that increased skin temperature (Tsk), independent of any rise in core temperature, may be responsible for any heat induced cognitive deteriorations (Gaoua et al., 2012). Thus, we hypothesized that continuous head and neck warming (surface warming by 44 ± 1°C) applied in thermoneutral environment should affect subjective sensations and cognitive function without affecting internal (Tre) body temperature.

METHODS

Participants. Seven healthy male volunteers (age 21 ± 1 year, height 181 ± 2.4 cm, weight 81.9 ± 6.0 kg, body mass index 24.8 ± 1.3, body fat 17.0 ± 2.1%, and body surface area 2.0 ± 0.1 m^2) participated in the study which was approved by LUHS Kaunas Region Biomedical Research Ethics Committee and conducted according to the guidelines of the Declaration of Helsinki. The participants were moderately physically active (< 3 times per week) and did not participate in any formal physical exercise, sports program and were not involved in any temperature-manipulation programme or procedure for at least 1 year. The additional criteria for inclusion were age 18–30 years, being non-smokers, and not taking medication or dietary supplements.

Research design. The research design is presented in Figure 1. One week before starting the experiment, each subject read and signed a written informed consent form, and was familiarized with the experimental procedures for the subjective scales and cognitive testing. The software used for the cognitive testing battery (see "Cognitive function assessment") provided a familiarization procedure for each test before completing the full test procedure of both cognitive tests.

During the experiment, participants attended the laboratory at the same time of day within the time frame of 8:00–13:00 h to avoid circadian fluctuations in body temperature. They were instructed to sleep for a minimum 7–8 h on the night before the experiment; to refrain from alcohol, heavy exercise, and caffeine for at least 24 h; and to refrain from consuming any food for at least 12 h before arrival at the laboratory. To standardize the morning state of hydration, subjects were allowed to drink still water as desired until 60 min before the experiment. The study was performed at a room temperature of 24°C and 60% relative humidity.

Experiment consisted of two experimental trials: CON trial (included lying in relax chair in a semi-recumbent lposture for 170 minutes and cognitive function testing) and CONW trial (included lying in relax chair in a semi-recumbent posture for 170 minutes wearing head and neck warming device and cognitive function assessment

wearing head and neck warming device). Each trial lasted approximately 175 min (170 minutes of lying in relax chair + cognitive function testing). Experimental trials were randomized and separated by one week break. All measurements and experimental procedures in these trials were identical (Figure 1).

On arrival at the laboratory the participant was asked to prepare for the resting in a semi-recumbent posture for 20 minutes dressed in swimming shorts. During these 20 minutes of resting, heart rate (HR), rectal (Tre) and skin (Tsk) temperature stabilization was assessed and recorded. Within ~3 minutes after these measurements participants were asked to assess subjective sensations (SS) and one of experimental trial (CON or CONW) started. Before lying in relax chair in the CONW trial, head and neck warming device (Figure 2) was fitted to the head and neck and kept until the end of the trial. Throughout each experimental trial subjective sensations (thermal sensation and shivering/sweating sensation), HR, Tre, were recorded every 5 minutes. Final HR, Tre, Tsk and ratings of subjective perception were recorded at the end of each trial (Figure 1).

Measurements. During the initial visit the height (cm) of participants was measured, and body mass (kg), body fat (%), body mass index were determined by taking their nude body mass with body composition analyser (Tanita, TBF-300, Illinois, USA).

HR was measured at rest and throughout each experimental trial using a HR monitor (S-625X, Polar Electro, Kempele, Finland).

Tre was measured at rest and throughout each experimental trial using a thermocouple (Rectal Probe; Ellab, Hvidovre, Denmark; accuracy ± 0.01°C) inserted to a depth of 12 cm past the anal sphincter. The rectal thermistor sensor was placed by each participant.

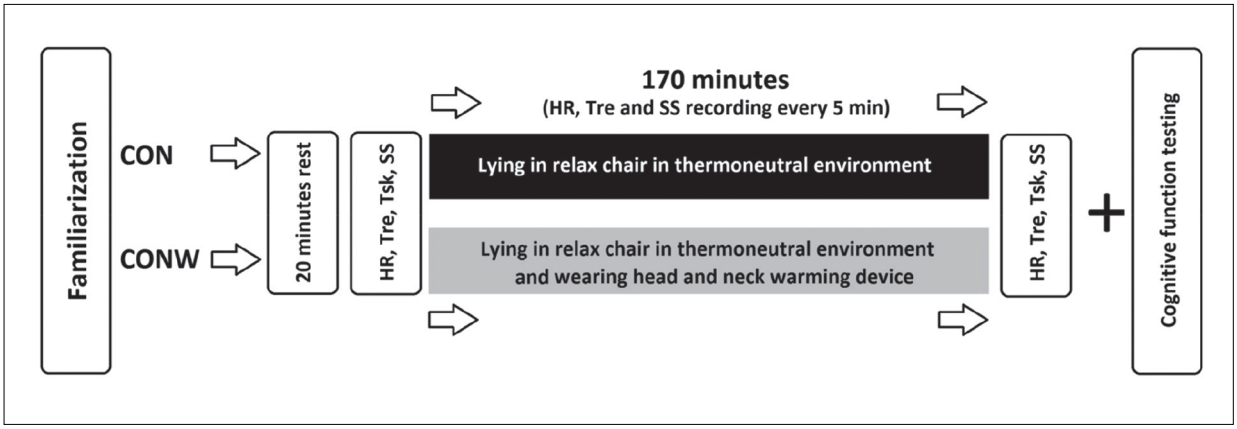

Figure 1. **Research design**

Notes. CON and CONW – experimental trials. Measurements of heart rate (HR) and body temperatures (rectal, Tre; skin, Tsk). Thermal sensation, thermal comfort and shivering/sweating sensation assessment (SS).

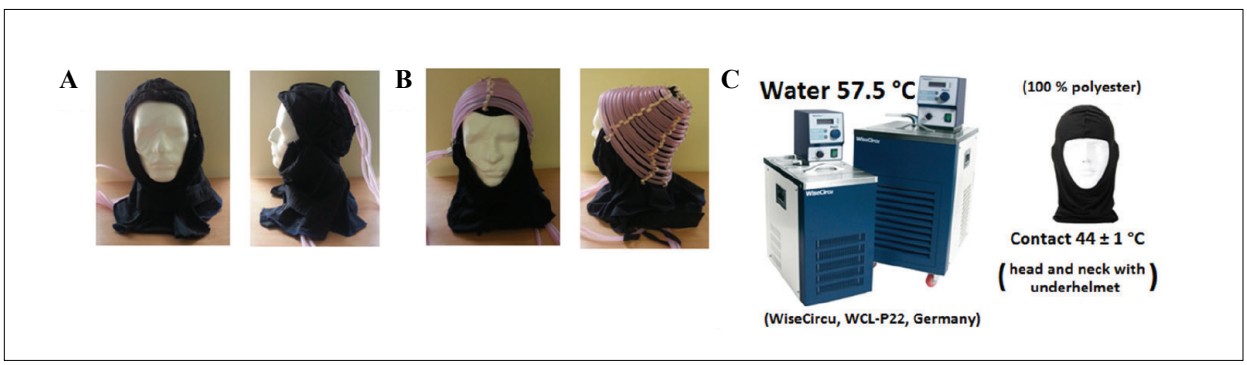

Figure 2**. Head and neck warming device**

Notes. A – outer view of head-neck device, B – inner view of head-neck device, C – example of circulator and underhelmet.

Tsk was measured with thermistors (Skin/Surface probe, DM852, Ellab; accuracy ± 0.01°C) taped at three sites: back, thigh and forearm. The mean Tsk was calculated using the Burton (1935) equation: $Tsk = 0.5_{back} + 0.36_{thigh} + 0.14_{forearm}$. Tsk temperature measurements were taken before and after each experimental trial.

Rating of subjective sensations. The method to measure subjective ratings for the whole body has been described elsewhere (Brazaitis et al., 2014; Brazaitis, Kamandulis, Skurvydas, & Daniuseviciute, 2010). Briefly, ratings of thermal sensation ranged between 1 (very cold) to 9 (very hot), with 5 being neutral. The shivering/sweating sensation ranged from 1 (vigorously shivering) to 7 (heavily sweating), with 4 (not at all) being neutral. Thermal comfort sensation ranged from 1 (comfortable) to 5 (extremely uncomfortable). The rating of subjective sensations was reported by the participant after resting and every 5 min during each trial. The mean rating score value per trial was calculated.

Cognitive function assessment. Automated Neuropsychological Assessment Metric (ANAM[4], Norman, OK, USA) was administered (Reeves, Kane, Winter, Raynsford, & Pancella, 2010). All tests were computer (Samsung R538) controlled with the information being presented on the screen of a laptop (~40 cm in front of the participant). Cognitive tests battery was performed in a quiet and semi-darkened laboratory. The duration for performing the ANAM test battery was 2 ± 0.5 min and included the following tasks which, were randomized in the (CON, CONW) trials. Cognitive test battery was performed at the end of each experimental trial, immediately after resting in relax chair (see 'Research Design'). In each cognitive test the percentage of accurate response and response time were determined.

Mathematical Processing. Results of this test are used as an index of basic computational skills, concentration, and working memory (Kabat, Kane, Jefferson, & DiPino, 2001). During this task, an arithmetic problem involving three single-digit numbers and two operators is displayed (e.g. 5 – 2 + 3 =). The user presses buttons to indicate whether the answer to the problem is less than five or greater than five.

Spatial Processing. This test presents two four-bar histograms, the first of which is displayed upright and the second of which is displayed after a 90 degree rotation either clockwise or counter-clockwise. The user presses designated buttons to indicate if the two histograms are the same or different, regardless of the orientation. This test relies heavily on visual spatial skills and mental rotation (Reeves et al., 2010). The examinee must be able to perceive the histograms accurately and determine if they match after mentally rotating one of them. Because this task is based on speed and accuracy of performance it also requires parallel cognitive processes of sustained and selective attention and information processing speed.

Head and neck warming device. The system was designed using circulator (WiseCircu, WCL-P22, Germany), silicone tubes and fire-fighter underhelmet made of fire-resistant material (Figure 2). The pilot study was performed to determine maximal available temperature for warming without discomfort (burning sensation); temperature changes in different contact places; and temperature stabilization time after putting the head-neck device. The temperature between frontal, dorsal and lateral contact places of the head and dorsal contact place of the neck wearing head-neck device with underhelmet (100% polyester) varied in 44 ± 1°C range during 3 hours of warming procedure (contact place: head and/or neck with underhelmet temperature was measured with Skin/Surface probe, DM852, Ellab). Temperature stabilization in the contact places was reached in 5 minutes. To keep this temperature in 44 ± 1°C range the circulator's liquid (water) temperature was raised and maintained in 57.5 °C.

Statistical analysis. Statistical analyses were performed using IBM SPSS Statistics software (v. 22; IBM Corp., Armonk, NY). The data of experiment were tested for normal distribution using the Kolmogorov–Smirnov test, and all data were found to be normally distributed. Descriptive data are presented as mean ± standard error (SE) of the mean. A two-factor (trial (CON vs. CONW) × time (before vs. after)) repeated-measures analysis of variance (ANOVA) was used to analyse the changes in thermophysiological responses (Tre, ΔTre, Tsk, ΔTsk, HR, ΔHR) and cognition (response time, and accuracy of cognitive tests). If significant effects were found, Sidak's *post hoc* adjustment was used to locate the difference. Statistical significance was defined as $p > .05$. Statistical power (*SP*, as percentage) was calculated, and the partial eta squared (η_p^2) was estimated as a measure of time or trial effect size. The non-parametric Wilcoxon signed-rank test for

two related samples was used to compare changes in ratings of subjective sensations (thermal and shivering/sweating sensations) between CON and CONW trials.

RESULTS

Lying in relax chair lasted for the same amount of time (170 min) in both experimental trials (CON and CONW). There were no significant differences between HR, body temperature values (Tre, Tsk) (CON vs. CONW trial effect; $p > .05$, $\eta_p^2 < 0.19$, $SP < 17\%$) and rating of subjective sensations ($p > .05$) measured before the experimental trials (Table 1).

Tre did not change significantly in experimental (CON and CONW) trials. However, Tre remained significantly higher (by 0.2°C) after lying in relax chair with head and neck warming device (CONW trial), compared with CON trial (CON vs. CONW time effect; $p < .05$, $\eta_p^2 = 0.6$, $SP = 80\%$). The change in Tre also differed significantly between experimental trials (ΔCON vs. ΔCONW trial effect; $p < .05$, $\eta_p^2 = 0.5$, $SP = 63\%$). Tsk significantly decreased (by 0.9°C) after lying in relax chair in the CON trial (time effect in the CON trial; $p < .05$, $\eta_p^2 = 0.77$, $SP = 97\%$), but did not change in the CONW trial. Thus, after the CONW trial Tsk was significantly higher (by 1°C), comparing with CON trial (ΔCON vs. ΔCONW trial effect; $p < .05$, $\eta_p^2 = 0.66$, $SP = 80\%$). HR did not change in the CON trial, but increased significantly when head and neck warming was applied (time effect in the CONW trial; $p < .05$, $\eta_p^2 = 0.76$, $SP = 95\%$). Furthermore, the change in HR significantly differed between trials (ΔCON vs. ΔCONW trial effect; $p < .05$, $\eta_p^2 = 0.59$, $SP = 68\%$) (Table 1).

Table 2 summarizes subjective ratings of thermal sensation, thermal comfort and shivering/sweating sensation in experimental trials. Subjects felt warmer ($p < .05$) in the CONW trial, compared to CON trial. However, shivering/sweating sensation and thermal comfort did not differ between trials.

Figure 3 summarizes accuracy (%) and response time (ms) changes in the mathematical processing and spatial processing (simultaneous) tasks in experimental trials. There were no significant differences in accuracy (CON vs. CONW trial effect; $p > .05$, $\eta_p^2 < 0.07$, $SP < 9\%$) and response times (CON vs. CONW trial effect; $p > .05$, $\eta_p^2 < 0.07$, $SP < 9\%$) in both cognitive tasks, comparing CON and CONW trials (Figure 3).

	CON		CONW	
	Before	**After**	**Before**	**After**
HR, b/min	60 ± 5	57 ± 3	55 ± 2	64 ± 3*#
Δ,	–3 ± 3		8 ± 2#	
ΔΔ,	11 ± 4			
Tre, °C	36.9 ± 0.1	36.8 ± 0.1	36.9 ± 0.1	37.0 ± 0.1#
Δ,	–0.1 ± 0.3		0.1 ± 0.2#	
ΔΔ,	0.2 ± 0.1			
Tsk, °C	31.7 ± 0.2	30.8 ± 0.3*	31.8 ± 0.2	31.9 ± 0.2#
Δ,	–0.9 ± 0.2		0.1 ± 0.3#	
ΔΔ,	1.0 ± 0.3			

Table 1. **Body temperatures and heart rate in the experimental (CON and CONW) trials**

Notes. Δ – mean difference between before and after values, ΔΔ – difference of mean difference between CON and CONW trials, *$p < .05$, compared to before, #$p < .05$, compared to CON. Values are means ± *SE*.

	CON	CONW	
Sweeting/shivering sensation	4.0 ± 0.0	4.1 ± 0.1	Sweeting sensation did not change
Thermal sensation	4.7 ± 0.1	5.7 ± 0.3#	Thermal sensation improved
Thermal comfort	1.0 ± 0.0	1.0 ± 0.0	Thermal comfort did not change

Table 2. **Sweating/shivering sensation and thermal sensation in the experimental (CON and CONW) trials**

Notes. #$p < .05$, compared to CON. Values are means ± *SE*.

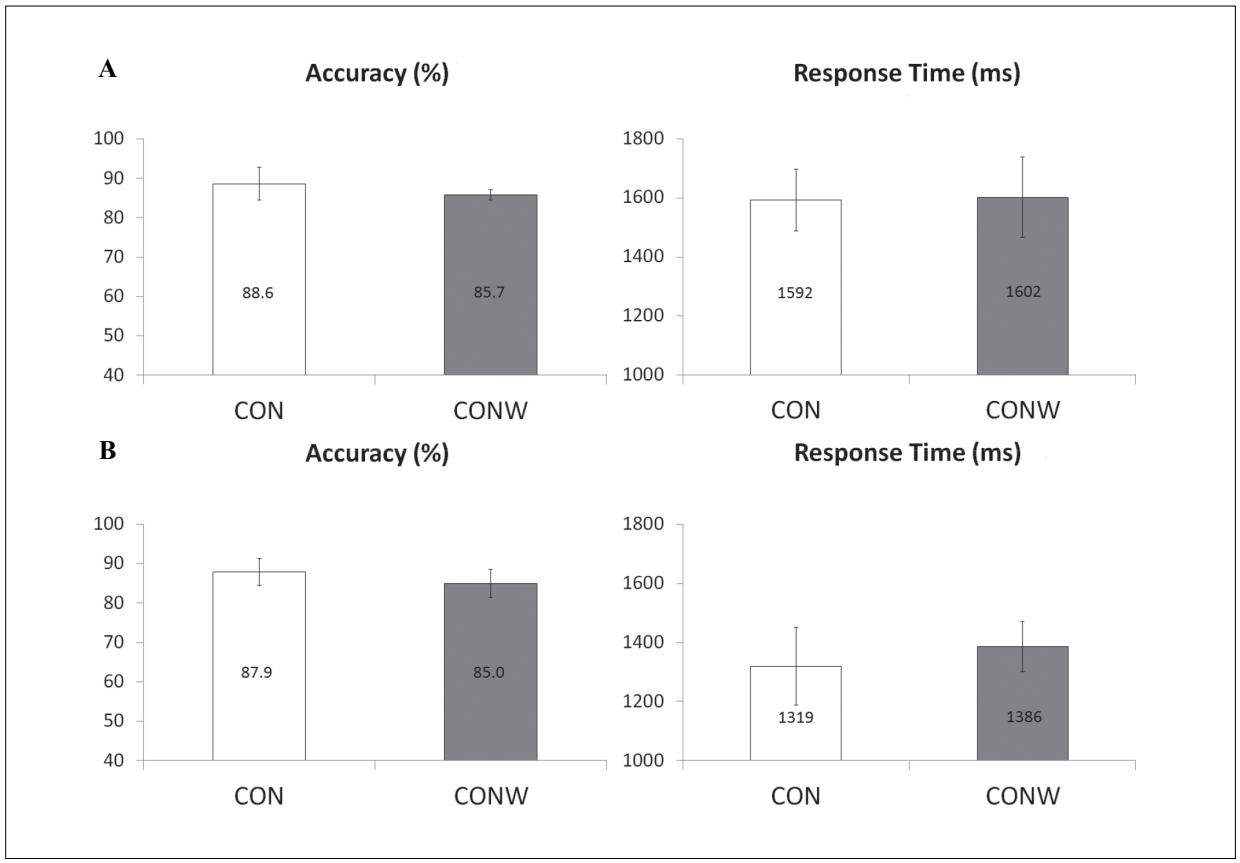

Figure 3. **Accuracy (%) and response times (milliseconds) in (A) mathematical processing and (B) spatial processing (simultaneous) tasks**

DISCUSSION

Our expectations that continuous head and neck warming applied in a thermoneutral environment (CONW trial) should affect subjective sensations and cognitive function without affecting internal (Tre) body temperature were not confirmed. The findings in the study demonstrated that head and neck warming applied in thermoneutral conditions increased heart rate, maintained higher internal (Tre) and peripheral (Tsk) body temperatures and improved thermal sensation without alterations in cognitive function, thermal comfort and shivering/sweating sensation.

Continuous head and neck warming applied in thermoneutral conditions during 170 minutes lying in relax chair (CONW trial) was sufficient to maintain higher Tre (by 0.2°C) and mean Tsk (by 1°C), compared with CON trial (Table 1). We believe that higher body temperatures preserved in the head and neck warming trial may possibly be explained by heat transfer from head and neck warming device to superficial head and neck regions via conduction (constant 44 ± 1°C temperature), and later heat transfer to internal organs and other peripheral body regions via blood circulation. In the head and neck warming trial (CONW), blood circulation was improved due to significant heart rate increment (Table 1) and this might ensure better heat transfer to other body regions. According to Nakamura and Morrison (2010), skin warming induced tachycardia would help the heat dissipating effect of the simultaneous cutaneous vasodilation by maintaining cardiac output and arterial pressure at a sufficient level to assure optimal increases in cutaneous blood flow. Heat transfer from one body region to another was also observed in previous studies where peripheral feet and lower legs' warming in 42ºC water (25 and 35ºC ambient conditions) was sufficient to increase Tre and Tsk (chest, back, forearm, forehead and thigh) in young subjects (Inoue & Shibasaki, 1996; Inoue, Shibasaki, Hirata, & Araki, 1998). Similarly, in a recent (Brazaitis et al., 2015) study it was demonstrated that immersion to the waistline in 43–44ºC water markedly increased both internal (Tre by ~2.5ºC) and peripheral (Tsk ~4ºC) body temperatures. Besides, this study showed that even the vast increment in body temperatures may not induce any significant alterations in cognitive function.

Despite controversial findings, it is almost universally accepted that various aspects of attention (Gaoua, Racinais, Grantham, & El Massioui, 2011; Hancock, 1986; Simmons, Saxby, McGlone, & Jones, 2008), memory (Gaoua et al., 2011; Jiang et al., 2013; Racinais, Gaoua, & Grantham, 2008), and executive function (Gaoua et al., 2012; Gaoua et al., 2011) are reduced in heat-stressed persons. In the CONW trial, head and neck were constantly affected by ~44ºC temperature, but it was insufficient to induce heat stress increasing internal temperature away from a homeostatic range (Tre was 37 ± 0.1°C). Besides, head and neck warming (CONW trial) caused significant improvement in thermal sensation (from "neutral" to "slightly warm"), but did not induce any alterations in shivering/ sweating sensation (subjects did not feel shivering or sweating) and thermal comfort (subjects felt comfortable) (Table 2). According to Gaoua et al. (2012), the subjective state of the individual could be a key factor affecting cognitive function in the heat. The authors demonstrated that exposure to 50ºC (for ~15 min) induced increment in mean Tsk (~3ºC, without any change in core temperature and motor cortical excitability) and thus reduced thermal comfort, improved negative feelings (i.e. subjects felt hotter and less comfortable) and impaired complex (working memory) task performance, while it had no significant effect on simple task performance. In a current study, subjects felt slightly warm and comfortable, and this might be one of the reasons why mathematical and spatial processing tasks performance was not affected (Figure 3). The other reason might be rather simple cognitive tasks. It is generally accepted that in the hot conditions simple task performance is less vulnerable than complex task performance (Gaoua et al., 2012; Hancock, 1986; Pilcher, Nadler, & Busch, 2002).

S*imilarly* to the results found in *our study*, Watkins et al. (2014) established that slightly, but significantly higher Tre (37.1 ± 0.3°C), Tsk (33.2 ± 1.1°C), increased heart rate (82.1 ± 13.9 b/min) and thermal sensation did not deteriorate soccer goal line officials' ability to complete simple tasks (tracking, simple reaction time, and numerical vigilance) during a 90 min passive exposure to 30ºC. In earlier report, Simmons et al. (2008) demonstrated that cognitive function remained stable even if whole body warming increased Tsk (by ~2ºC, without increment in Tcore) and caused significant heart rate increment and thermal discomfort. However, in this study we used rather simple cognitive tasks. Very recent study reported that increasing thermal comfort (rather than mitigating Tcore increases) may be effective in maintaining complex cognitive function (and consequently safety) in passively experienced thermally stressful environments (Taylor et al., 2016). Moreover, selective head skin cooling, which alleviates unpleasant sensation in a heat (Cohen et al., 1989; Nunneley & Maldonado, 1983), has been shown to preserve some complex cognitive functions during passive hyperthermia (Gaoua et al., 2011). Aforementioned studies support that cognitive decline (especially in a complex cognitive tasks) is primarily mediated by a reduction in thermal comfort. This is consistent with the distraction hypothesis, which suggests that discomfort caused by temperature stimulus may cause a shift of attention from the primary task and thus lead to impaired performance (Teichner, 1958).

In agreement with previous findings, a present study demonstrates that cognitive function may remain stable, mainly because of rather simple cognitive tasks and absence of heat stress and discomfort. Head and neck warming seems promising technique to maintain higher internal and peripheral body temperatures and improve thermal sensation for humans resting in normothermic conditions. The greater body area of peripheral warming should be considered to avoid internal temperature increment away from a homeostatic range. The current study focused on changes in body temperatures, heart rate, subjective sensations and specific cognitive (mathematical and spatial processing) tasks in normothermic conditions. Therefore, further research is needed to explore and validate possible head and neck warming effects on thermogenesis, neuromuscular function and cognition, especially in more extreme (ex. cold) environments.

CONCLUSIONS

Continuous head and neck warming applied in thermoneutral conditions maintain higher internal (Tre) and peripheral (Tsk) body temperatures and improves thermal sensation. However, these alterations are insufficient to induce any significant impact on accuracy and response times in mathematical and spatial processing tasks.

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Corresponding author **Henrikas Paulauskas**
Lithuanian Sports University
Sporto str. 6, LT-44221 Kaunas
Lithuania
Tel. +37066223283
E-mail: henrikas.paulauskas@lsu.lt

A 90 DAY SUPPLEMENTATION OF POLYUNSATURATED FATTY ACIDS (PUFA) HAS BENEFITS ON HEALTH MEASURES AND EXERCISE PERFORMANCE

Márta Ránky[1], Ferenc Köteles[1], Csaba Nyakas[2], György Bárdos[1], Attila Szabo[1, 3]
Institute of Health Promotion and Sport Sciences[1], Eötvös Loránd University, Budapest, Hungary
Research Institute of Sport Sciences[2], Hungarian University of Physical Education, Budapest, Hungary
Institute of Psychology[3], Eötvös Loránd University, Budapest, Hungary

ABSTRACT

Background. Fish oil contains essential fatty acids that are linked to better cardiovascular health and even the prevention of sudden cardiac death in athletes. The purpose of this work was to examine the effects of 90 days of fish oil supplementation in elite-, leisure-, and non-athletes on body fat percent, body mass index (BMI), blood cholesterol and triglycerides, heart rate and blood pressure, and on exercise performance.

Method. Three groups of participants were tested with 12 equally distributed men and women in each: elite-athletes, leisure-athletes, and non-athletes. Participants received body weight-adjusted commercially available fish oil over 90 days. These nutritional supplements were taken in the morning, immediately following breakfast.

Results. The findings revealed that compared to the baseline, body fat percent decreased in all the three groups (p = .034), however, blood cholesterol and the cholesterol/high density lipoprotein (HDL) ratio increased (p < .05), with the elite-athletes showing the largest increase. Exercise performance, in terms of the time of running to voluntary exhaustion, increased (p = .05), but the largest benefits were observed in non-athletes (22%) in contrast to leisure-athletes (4%) and elite-athletes (1%), which could be linked to a ceiling effect. No statistically significant changes were observed in any other anthropometric, physiological, or biochemical measures.

Conclusion. These findings suggest that 90 days of fish oil supplementation may benefit body composition and increase exercise performance, especially in non-athletes, and increases cholesterol, as well as cholesterol/HDL ratio levels, primarily in elite-athletes. Based on these results, it appears that fish oil supplementation yields greater benefits in non-athletes than in athletes.

Keywords: anthropometric measures, biochemical measures, body composition, in-situ, real life setting.

INTRODUCTION

Long-chain omega (n)-3 polyunsaturated fatty acids (LC-PUFAs; e.g. eicosapentaeoic acid – EPA, or docosahexaenoic acid – DHA) have well-documented anti-inflammatory and anti-oxidant effects (Deckelbaum & Torrejon, 2012). PUFAs were found to be beneficial in the prevention and treatment of various cardiovascular diseases due to their triglyceride-lowering, anti-thrombotic, anti-inflammatory, and anti-hypertensive properties (Breslow, 2006; Deckelbaum & Torrejon, 2012; Kotwal, Jun, Sullivan, Perkovic, & Neal, 2012; Marik & Varon, 2009). In addition to cardiovascular effects, PUFAs promote early eye and brain development (Gódor-Kacsándi, Felszeghy, Ranky, Luiten, & Nyakas, 2013; Walker, Jebb, & Calder, 2013), regulate the immune function (Gorjão et al., 2006), and can improve inflammatory conditions such as arthritis (Calder, 2013; Serhan, Chiang, & Van Dyke, 2008). Based on these considerations, recent dietary guidelines recommend regular consumption of seafood to increase intake of PUFAs (Papanikolaou, Brooks, Reider, & Fulgoni, 2014).

Beyond health promotion and disease prevention, PUFAs also reduce exercise-related oxidative stress, immune and inflammatory responses to exercise, and soreness (Andrade, Ribeiro, Bozza, Costa Rosa, & do Carmo, 2007; Gray, Chappell, Jenkinson, Thies, & Gray, 2014; Jouris, McDaniel, & Weiss, 2011; Lembke, Capodice, Hebert, & Swenson, 2014). These positive effects can lead to the improvement of exercise performance. For example, in a recent study examining 30 male athletes, a 21-day administration of PUFAs (5 ml sea oil per day, containing, 375 mg EPA, 230 mg DPA, and 10 mg DHA) significantly improved peripheral neuromuscular function and aspects of fatigue compared to olive oil placebo. On the other hand, no beneficial effect on the central neuromuscular function was reported (Lewis, Radonic, Wolever, & Wells, 2015). In another placebo-controlled study, no improvement in the maximal aerobic power, anaerobic threshold and running performance was found in 28 well-trained male soccer players following a 10-week supplementation of PUFAs (1600 mg/day EPA, 1004 mg/day DHA) which led to the conclusion that the maximal aerobic performance of endurance athletes cannot be improved by PUFAs (Raastad, Høstmark, & Strømme, 1997). According to a recent review, available empirical data regarding the positive impact of PUFAs on exercise performance are inconclusive, and, therefore further studies are needed to assess the effectiveness of PUFAs supplementation on delayed onset muscle soreness, and subsequent exercise performance in elite-athletes and military personnel (Shei, Lindley, & Mickleborough, 2014).

The effectiveness of PUFAs may also depend on the intensity of exercise and the training status of the participants. In a recent study, untrained males receiving a green-lipped mussel oil PUFA blend for 26 days showed a significant decrease of muscle damage and strength loss compared to the a placebo control group after a muscle damaging exercise (Mickleborough, Sinex, Platt, Chapman, & Hirt, 2015). In the current research, the effects of 90-day PUFA supplementation were assessed on measures of exercise performance, blood lipid profiles, and cardiovascular indices in three groups of participants with different training status (i.e. elite endurance athletes, leisure runners, and individuals with a sedentary lifestyle). Complementing past research, we report here the effects of PUFAs over a longer period (90 days) of administration, on anthropometric, physiological, biochemical, as well as exercise performance variables, and in function of training status. It was conjectured that this multi-level repeated measures factorial design will yield a clearer picture about the effects of PUFAs on health- and exercise-behaviour.

METHODS

Participants. Elite-athletes were competitive triathletes and elite endurance runners. They were recruited with the assistance of the national athletics and triathlon associations, who sent a call for participation e-mail to their athletes and also presented them with recruitment flyers in the upcoming competitions. Leisure-athletes were recruited before street running races in a large metropolitan area, while the control, non-athlete, participants were recruited from social media targeting groups interested in health and fitness. Thirty-six participants completed the study. Ethical permission for the study was obtained from the Ethics Research Board of the National Healthcare Scientific Committee. Elite-athletes trained between 24–36 hours per week. Their mean age was 22.35 ± 2.61 (men) and 23.63 ± 2.84 (women) years. The leisure-athletes (runners) trained an average of 9–12 hours per week and their mean age was 38.09 ± 8.37 (men) and 40.76 ± 7.46 (women) years. The non-athlete control participants did not report any scheduled exercise (0 hours per week). Their mean age was 31.97 ± 7.48 (men) and 27.55 ± 5.05 (women) years.

Materials. A known commercial brand of fish oil capsule was provided to all the participants. Based on the manufacturer's information, six (6) capsules contained 138.12 kJ (32.88 kcal) of energy, 0.786 g protein, 0.355 mg carbohydrates, 2.94 g fat, 741 mg saturated fatty acids, 703 mg monounsaturated fatty acids, 1293 mg polyunsaturated fatty acids of which 529 mg EPA, 353 mg DHA, and 6 mg vitamin E. Exercise was performed on a Spiro-ergometer (Schiller CS-200, ITAM) treadmill with heart rate and blood pressure reading functions (Schiller BP-200 Plus).

Procedure. Prior to the investigation, participants were informed verbally and in writing about the purpose of the research. They were interviewed about their health status and informed about any possible complications that may arise during the course of the study. If the participant agreed to take part in the study, she/he signed a

written informed consent form. By signing the form, the participants declared that they will not make changes in their usual diet and that they will not consume any other unsaturated fatty acids during the course of the study, apart from the one supplied to them by the researchers. All tests (described below) were performed twice: on day zero (baseline) and on day 91.

Upon coming to the laboratory, participants were asked to relax in preparation for blood tests in which 15 ml of whole blood was collected by a qualified medical personnel. The cellular elements of the blood were destroyed after diagnosis as the norms of the relevant legislation require. Blood samples were stored in a refrigerator at 4ºC until they were transported to the laboratory in a cool box where the blood samples were analyzed for lipid profiles.

Anthropometric measurements were performed according to the International Biological Program recommendations (Weiner & Lourie, 1981). In this analysis, the two-component body composition estimation is based on Pariscova's recommendation and requires body weight and 5-skinfold (plica of biceps, triceps, scapula, hip, medial crural) measurements (Parízková & Bůzková, 1971), which were recorded on the basis of the International Society for the Advancement of Kinanthropometry (ISAK) method (Stewart & Marfell-Jones, 2011). Anthropometric variables included height, weight, abdominal circumference, skinfold measurements to determine body fat, body mass, relative bone-muscle ratio and fat mass determination based on the Drinkwatter and Ross procedure (Drinkwater & Ross, 1980).

Participants took fish oil capsules every morning after their breakfast for 90 days. Based on their body weight assessed on Day 0 (baseline), those under 55 kg received 4, those between 55 and 70 kg received 5 and those above 70 kg received 6 capsules for every day in the study. On days 0 and 91 we have performed anthropometric tests, collected venous blood for lipid analysis, measured resting heart rate and blood pressure, and tested participants on a two part ergometer test using a treadmill. After obtaining all measures at rest, the participants completed the "Vita Maxima" ergospirometric test (Fostikov, 1971), consisting of running at 8 km/hour steady speed starting with a 4.0% elevation (incline) that was increased by 1.5% every minute until exhaustion. After a half an hour of relaxation, the participants run again at the elevation corresponding to their 85% of maximal oxygen uptake (VO_2 max) until voluntary exhaustion.

Data were analysed with the SPSS 20.0 statistical software package. Since none of the variables violated the assumption of normal distribution – as based on preliminary Kolmogorov–Smirnov statistical tests – the data were examined with parametric statistics. Mixed (between (groups) and within (change with time) repeated measures analyses of variances were used, which were followed up with Bonferroni-corrected post hoc tests. For tests involving repeated measures, the Greenhouse-Geisser correction of the degrees of freedom was adopted.

RESULTS

The descriptive statistics of the dependent measures are presented in Table 1. A repeated measures analysis of variance (RMANOVA) of body fat percent yielded a time main effect ($F(1, 33) = 4.918$, $p = .034$), as well as a group main effect ($F(2, 33) = 4.624$, $p = .017$), but no group by time interaction ($F(2, 33) = 1.081$, $p = .351$). Post-hoc tests showed that the overall body fat percent has decreased 4.8% ($t_0 = 20.15 \pm 6.15$, $t_1 = 19.18 \pm 5.39$, $p = .034$). The between-group main effect was due to the fact that elite-athletes already differed on Day 0 from non-athletes ($p = .023$) and also – but only marginally – from the leisure-athletes ($p = .071$), while the latter two did not differ from each other (Table).

The analysis of the body mass index (BMI) only yielded a statistically significant group main effect ($F(2, 33) = 3.452$, $p = .044$), which substantiated that the BMI differed between elite-athletes and non-athletes ($p = .044$) already on Day 0. Blood cholesterol levels showed a statistically significant time main effect ($F(1, 33) = 5.325$, $p = .027$), but no group main effect and no group by time interaction. Post hoc tests revealed that overall blood cholesterol levels have increased 4.1% after 90 days of fish oil consumption ($t_0 = 4.95 \pm 0.82$, $t_1 = 5.16 \pm 0.84$, $p = .027$). The analysis of the ratio of total blood cholesterol to high-density lipoprotein (HDL) yielded a statistically significant time main effect ($F(1,33) = 16.914$, $p < 0.001$), a group main effect ($F(1,33) = 3.44$, $p = 0.044$), but no group by time interaction. Post hoc tests showed that the

Table. **Changes in the dependent measures over 90 days in three groups**

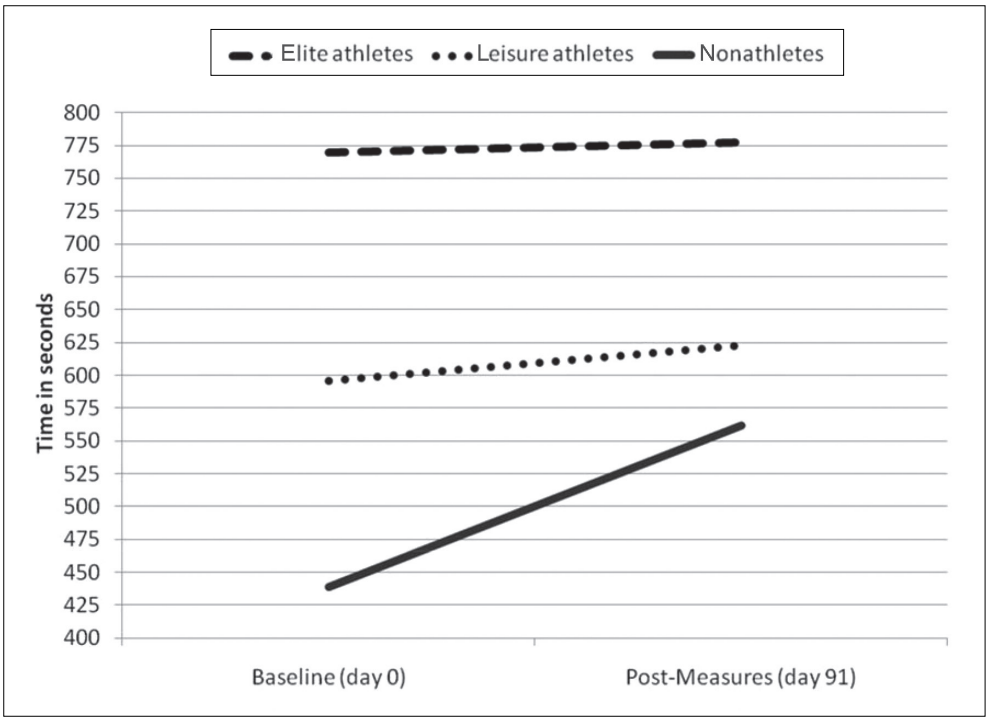
Time	Dependent Measure	Elite-athletes	Leisure- athletes	Non-athletes
Pre	Body fat (t0) (%)	16.06 ± 5.86	21.70 ± 4.68	22.69 ± 6.03
Post	Body fat (t1) (%)	16.00 ± 5.23	20.31 ± 5.47	21.24 ± 4.27
Pre	BMI (t0) (kg/m^2)	20.49 ± 1.51	23.05 ± 3.35	24.33 ± 5.27
Post	BMI (t1) (kg/m^2)	20.60 ± 1.33	23.17 ± 3.25	24.43 ± 5.17
Pre	Blood cholesterol (t0) (*mmol/l*)	4.54 ± 0.74	5.32 ± 0.96	5.00 ± 0.60
Post	Blood cholesterol (t1) (*mmol/l*)	4.92 ± 0.87	5.47 ± 0.87	5.08 ± 0.76
Pre	Total cholesterol/HDL (t0) (*mmol/l*)	2.39 ± 0.41	2.83 ± 0.59	3.12 ± 0.77
Post	Total cholesterol/HDL (t1) (*mmol/l*)	2.86 ± 0.59	3.31 ± 0.73	3.43 ± 0.94
Pre	Triglyceride (t0) (*mmol/l*)	0.99 ± 0.35	0.97 ± 0.37	1.20 ± 0.77
Post	Triglyceride (t1) (*mmol/l*)	0.86 ± 0.42	0.93 ± 0.34	1.26 ± 0.70
Pre	Resting heart rate (t0) (*bpm*)	57.08 ± 13.00	66.00 ± 9.22	71.92 ± 13.65
Post	Resting heart rate (t1) (*bpm*)	57.08 ± 10.20	63.50 ± 12.48	66.58 ± 11.99
Pre	Systolic blood pressure (t0) (*mm Hg*)	127.67 ± 12.82	126.92 ± 16.16	125.33 ± 11.11
Post	Systolic blood pressure (t1) (*mm Hg*)	125.75 ± 10.51	125.92 ± 11.76	120.42 ± 8.03
Pre	Diastolic blood pressure (t0) (*Hgmm*)	65.83 ± 9.25	71.17 ± 9.71	69.08 ± 5.81
Post	Diastolic blood pressure (t1) (*Hgmm*)	63.92 ± 7.57	70.92 ± 6.69	68.33 ± 8.44
Pre	Time to exhaustion (t0) (*s*)	770.00 ± 159.60	595.83 ± 151.75	439.17 ± 94.34
Post	Time to exhaustion (t1) (*s*)	777.50 ± 174.15	622.50 ± 150.10	561.67 ± 179.54
Pre	Exercise performance (t0) (*W*)	370.75 ± 178.26	287.25 ± 66.22	256.67 ± 69.56
Post	Exercise performance (t1) (*W*)	312.83 ± 69.65	285.75 ± 62.25	267.25 ± 70.44

Notes. Day 0 (t_0) = baseline (Pre); time 2 (t_2) = after 90 days (Post); data are presented as means ± standard deviations.

total cholesterol to HDL ratio has increased by 13% over time ($t_0 = 2.78 \pm 0.67$, $t_1 = 3.20 \pm 0.78$) and that elite-athletes differed from the non-athletes only ($p = .045$), while the latter did not differ from the leisure-athletes. No statistically significant effects have emerged in triglycerides, resting heart rate, diastolic- and systolic blood pressure.

The analysis of the duration of exercise to exhaustion yielded a statistically significant time main effect ($F(1, 33) = 8.972$, $p = .005$), a group main effect ($F(2, 33) = 10.815$, $p < .001$), and a group by time interaction ($F(2, 33) = 4.163$, $p = .024$). The time main effect reflected an increased endurance performance across the 90 days of dietary fish oil supplementation ($t_0 = 601.67 \pm 23.054$, $t_1 = 653.89 \pm 28.069$, $p = .005$), and the performance of the elite-athletes was significantly better than that of the participants in the other two groups, which did not differ from each other. The elite-athletes' performance did not change after the treatment, probably due to a ceiling effect since their performance was much better already initially than that of the two other groups. On the contrary, the other two groups had increased their performance, the leisure-athlete group with a statistically significant increase of 21.8% (see Figure and Table) from baseline to the second assessment ($t(11) = –2.73$, $p = .02$).

Figure. **Diagram the group by time interaction obtained for the performance time to exhaustion in three groups**



DISCUSSION

The current findings show that PUFA supplementation may reduce body fat percent. In spite of the lack of emergence of a group by time interaction, from Table 1 it emerges that leisure-athletes and non-athletes profited the most since the overall 4.8% decrease over time was due to over 6% decrease in these two groups, while elite-athletes showed virtually no change in this measure. These findings agree with past research showing that PUFA supplementation reduces body fat (Couet, Delarue, Ritz, Antoine, & Lamisse, 1997; Hill, Buckley, Murphy, & Howe, 2007).

In spite of reports from the literature claiming that PUFA reduces triglyceride levels in the blood (Gidding et al., 2014; Oelrich, Dewell, & Gardner, 2013; Shearer, Savinova, & Harris, 2012), in the current work triglyceride profiles were unaffected by PUFA supplementation. The most likely explanation may be linked to the small dose (under 1g/day EPA and DHA) of PUFA administered in the current work. Earlier, it was suggested that a moderate dose of 4g/day is needed to lower triglyceride levels in the blood (Miller et al., 2011). According to the recommendations of the Federal Drug Administration, the intake of consumers should not exceed 3 g/day of EPA plus DHA with no more than 2 g/day from dietary supplementation (Bradberry & Hilleman, 2013). Therefore, the dose of PUFA used in the current inquiry was probably too small to yield changes in plasma triglycerides.

Fish oil supplementation resulted in a slightly increased blood cholesterol level (4.1%), as well as increased total cholesterol/HDL ratio (13%), independent of the participants' training status.

We have no clear explanation for this novel observation. There are three possible mechanisms, however: 1) Total blood fat content has increased as a result of the PUFA consumption, which triggered an increased cholesterol release from the cell membranes; 2) The liver could not process the increased fat intake (which is unlikely given the low dose used in the current study); 3) Some components of the PUFA containing fish oil capsules may be metabolised in the same way as the cholesterol, which may slow down cholesterol metabolism.

A 90 day of fish oil supplementation did not have a statistically significant effect on resting heart rate in the current work. To some extent these findings appear to be in contrast to a large scale population-based study that revealed a decrease in heart rate (Dallongeville et al., 2003). Indeed, it was shown that regular fish consumption may be associated with a heart rate reduction of approximately 3.2 beats per minute (bpm) (Mozaffarian, Prineas, Stein, & Siscovick, 2006). These authors also found that an estimate of 1 g/day PUFA intake may be associated with a heart rate reduction of 2.3

bpm. The current findings are still consistent with Mozaffarian et al.'s report in that resting heart rate decreased an average of 2.5 bpm in leisure-athletes (runners) and by more than 5 bpm in non-athletes, in spite of the fact that a statistically significant group by time interaction could not be disclosed* which was probably due to a high variance, as well as relatively low sample size, in the studied sample. The failure to see lower resting heart rate in elite-athletes (exhibiting nearly the same heart rate at pre- and post-assessment), may be ascribed to a floor effect.

The effect of PUFA supplementation in lowering blood pressure may be the most prominent in hypertensive patients; the reduction is usually relatively small and also dose dependent (Morris, Sacks, & Rosner, 1993). Several studies did not yield an effect on healthy subjects (Morris, Sacks, & Rosner, 1993), but at higher doses (i.e. > 3g/day) PUFAs were effective in reducing both systolic blood pressure (SBP) and diastolic blood pressure (DBP) (Appel, Miller, Seidler, & Whelton, 1993; Cabo, Alonso, & Mata, 2012). It was recommended that the hypotensive effects of lower doses of fish oil supplementation (< 0.5 g/day) should be further evaluated (Geleijnse, Giltay, Grobbee, Donders, & Kok, 2002). Using a lower dose in the current study, no hypotensive effects of the PUFAs were observed. These findings are in accord with the conclusion of a recent meticulous meta-analysis of clinical trials showing that administration of ≥ 2 g/day PUFA may reduce both SBP and DBP, with the largest benefits seen among hypertensive patients who are not on medication. Further, a lower dose (between 1 and 2 g/day – that is higher than the dose used in the current work - may reduce SBP, but not DBP (P. Miller, Van Elswyk, & Alexander, 2014).

In partial accord with a recent report (Lewis et al., 2015), fish oil supplementation resulted in increased exercise performance, however, the noticed increase was statistically significant only in the non-athletes, while no changes were seen in athletes. These findings are consistent with a recent review (Macaluso et al., 2013) showing that the majority of studies could not reveal a benefit of fish oil supplementation on exercise performance in athletes. Volpe also came to the same conclusion and recommended more systematic studies (Volpe, 2012). In the current work, two levels of athletic involvement were studied by testing a group of elite triathlon and endurance runner competitors and a group of regular, but leisure-athletes. None of them showed improvement in running to voluntary exhaustion after 90 days of fish oil consumption, thus adding further data to the bulk of the studies that failed to disclose a positive link between PUFAs and exercise performance. The increase in exercise performance in non-athletes could be the manifestation of a metabolic effect induced in some way, perhaps by active energy intake represented by long term fish oil consumption, or a placebo effect associated with the PUFA supplementation.

CONCLUSIONS

Regardless of athletic or exercise status, a relatively modest dose of fish oil supplementation lowers body fat and increases cholesterol, as well as cholesterol/HDL ratio; It also tends to reduce resting heart rate in leisure-athletes and non-athletes, but not in the elite-athletes. A low dose of PUFA supplement could be used to increase exercise performance, decrease resting heart rate, and alter body composition especially in non-athletes and leisure-athletes.

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* A group by time RMANOVA excluding the elite athletes, yielded a statistically significant time main effect, showing a decrease in heart rate in the leisure athletes and nonathletes only ($F(1, 22) = 4.7$, $p = .041$).

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Corresponding author **Attila Szabo**
Institute of Health Promotion and Sport Sciences
Eötvös Loránd University
Bogdánfy Ödön u. 10, H-1117 Budapest
Hungary
Tel. +36-70-243-7123
E-mail szabo.attila@ppk.elte.hu

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ACUTE EFFECTS OF CUSTOMIZING A TENNIS RACKET ON SERVE SPEED

Mustafa Söğüt
Kırıkkale University, Kırıkkale, Turkey

ABSTRACT

Background. A vast number of tennis players use additional lead weights attached to their rackets in order to improve stroke performances. However, there is limited evidence that racket customization as such boosts efficiency in different age and performance levels. The purpose of this repeated measures design study was to determine the acute effects of adding weight to the tip of a racket on serve speed in tennis players.

Methods. Participants were male tennis players from three different age and performance levels: elite junior (n = 7, age = 15.71 ± 0.95 years), colligate (n = 11, age = 22.36 ± 2.54 years), and senior recreational (n = 17, age = 52.94 ± 9.43 years). Three identical rackets, two of which were customized by adding ten and twenty gram lead weights on the tips, were used for the measurements. A radar gun was utilized to assess serve speed of the participants.

Results. The repeated measures ANOVA results revealed no significant differences among serve speed scores for the three conditions in each group.

Conclusion. Results suggest that customizing a tennis racket by adding lead weight to the tip might not necessarily yield differences in serve speeds in tennis players from different age and performance levels.

Keywords: racket customization, serve speed, tennis.

INTRODUCTION

Customizing a tennis racket is defined as the modification on its certain points in order to render optimal feel and to enhance stroke performance (Cross, 2002). A vast majority of professional players generally customize their rackets by adding lead weights to the main strategic places such as the head or the handle (Brody, 1987; Cross, 2001, 2002; Cross & Lindsey, 2005). These adjustments cause alternation in the weight, balance point (the location of racket's centre of mass), and swing weight (resistance of racket to rotation) of the racket (Cross, 2002; Lindsey & Brody, 2002).

Adding lead weight specifically to the tip of a racket boosts swing weight (Lindsey & Brody, 2002) and also yields improvement of racket power more than adding to any other particular location (Cross, 2001). This situation generates changes in the maximum power closer to the tip, and thus it provides additional height advantages for the server (Cross, 2001, 2002).

However, current literature presents limited evidence that might prove this advantage on serve speed. There is a paucity of information about the effects of adding weight on serve speed in tennis players from different age and performance levels. The purpose of the study was to determine the acute effects of adding weight to the tip of a racket on serve speed in elite junior, colligate and senior recreational tennis players. This information is to allow for further comparative and critical assessment of results for different groups of performance level and age.

METHODS

Participants. A total of thirty-five male tennis players from three separate groups (elite junior, colligate, and senior recreational) participated to the study. Table 1 presents the descriptive statistics about the anthropometric and training

Groups	Juniors (n = 7)	Colligates (n = 11)	Seniors (n = 17)
Age (year)	15.71 ± 0.95	22.36 ± 2.54	52.94 ± 9.43
Height (m)	1.81 ± 0.07	1.79 ± 0.05	1.76 ± 0.03
Weight (kg)	67.6 ± 11.13	72.9 ± 6.24	81.8 ± 7.59
BMI (kg/m^2)	20.46 ± 2.06	22.71 ± 1.42	26.31 ± 2.40
Experience (year)	7.29 ± 0.95	8.91 ± 4.23	15.82 ± 8.13
Tennis practice (h/w)	6.86 ± 2.34	5.55 ± 2.34	4.97 ± 2.15
Physical practice (h/w)	2.71 ± 1.25	2.18 ± 0.98	2.41 ± 2.35
Total practice (h/w)	9.57 ± 3.05	7.73 ± 2.41	7.38 ± 3.13

Table 1. **Means and standard deviations for anthropometric and training characteristics**

characteristics of the participants. They were informed of the purpose of the study and the testing procedures. Informed consent forms were signed by the participants and by the parents of junior players.

Measures. Three identical rackets (strung weight = 290 gram, head size = 632 cm^2, string tension = 25/25.5, string pattern = 16 x 18), two of which were customized by adding ten and twenty gram lead weights on the tips, were used. A radar gun (PR1000-BC; Ball Coach, Santa Rosa, Calif., USA) was utilized to assess the serve speeds.

Procedures. All measurements were performed in an indoor tennis court. Participants were initially asked to complete a standard warm up. They were, then, encouraged to serve with the highest speed from the deuce court randomly with each racket. Five successful serves with each racket were recorded and the means were used for the analysis.

Statistical Analysis. Descriptive statistics (mean ± *SD*) were calculated for the variables. The Repeated Measures ANOVA was conducted to determine differences among performance scores for the three conditions in each group. Statistical significance level was set at $p < .05$.

RESULTS

The means and standard deviations for the serve speed scores of the participants are presented in Table 2. Results revealed no significant differences for three conditions in each group: juniors ($F(2, 12) = 2.82$, $p = .099$), colligates ($F(2, 20) = 1.87$, $p = .180$), seniors ($F(2, 32) = 1.31$, $p = .285$).

DISCUSSION

The purpose of this repeated measures design study was to investigate the acute effects of adding ten and twenty gram lead weights to the tip of a racket on serve speed in tennis players from different age and performance levels. The results indicated no significant effects of additional weights on serve speed in each group. A supportive finding was observed by Whiteside, Elliott, Lay, and Reid (2014). They examined the effects of increasing a tennis racket's swing weight by 5% and 10% on

Groups	Regular	10 gram added	20 gram added
Junior	156.53 ± 8.66	160.36 ± 11.85	158.70 ± 9.27
Colligate	146.67 ± 10.09	149.40 ± 9.71	150.84 ± 10.72
Senior	114.80 ± 16.34	115.74 ± 17.22	116.99 ± 16.42

Table 2. **Serve speed (km·h^{-1}) scores (mean ± standard deviation) for the three conditions**

serving arm kinematics and serve speed. Eleven elite junior female players were asked to serve with three rackets two of which were modified with lead tape. Their results showed that customizing swing weight by adding lead tape failed to boost acute increase in serve speed. It was noted that increment in the swing weight caused deceleration in the velocity of internal rotation in the serving arm which may explain standing data in serve speed. According to Elliott, Marshall, and Noffal (1995), velocity of the internal rotation during the serve is the main determinant factor (54.2%) for the racket head speed.

Similar serve speed scores performed by the participants of the current study might be explained also with the mutual effect between swing speed and swing weight. In a recent paper, Cross and Bower (2006) reported the inverse interaction between swing weight and swing speed, namely when the swing weight increase the swing speed decrease. Similarly, Mitchell, Jones, and King (2000) studied the effects of racket inertia on head speed, and found significant increment in head speed when the swing weight decreases. According to Miller (2006) swing speed depends on the distribution of mass and when the mass is added to the tip of a racket this makes the swing harder.

It must be noted that this study is limited with influences of the ten and twenty gram of lead weight. Although Cross (2001) claimed that in a normal condition weights smaller than thirty grams are more convenient for the customization, a weight smaller than ten gram or heavier than twenty gram would yield significant increment in serve speed. Furthermore, one of the constraining factors of the study is regarding the rackets used in the measurements of serve speed. Instead of using their own rackets, participants were asked to use rackets provided by the researcher. Technical features such as grip size, string tension, head size, and balance point of the rackets used in the study might also be considered as restricting factors and might cause familiarization problems.

CONCLUSION

In conclusion, results of the study suggest that customizing a tennis racket by adding lead weight to the tip might not necessarily yield differences in serve speed in elite juniors, colligates, and senior recreational tennis players. Future studies that may focus on immediate and longitudinal effects of racket customization on both swing and serve speed in male and female professional tennis players are recommended.

Authors Note. This study was partly presented at the 8th National Biomechanics Congress in Ankara, Turkey.

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Corresponding author **Mustafa Söğüt**
Faculty of Sport Sciences
Kırıkkale University
Ankara Yolu 7. Km 71450 Yahşihan/Kırıkkale
Turkey
Email msogut@kku.edu.tr

IMPACT OF BASKETBALL FAN BEHAVIOUR ON THE ORGANIZATION'S BRAND

Irena Valantinė, Ingrida Grigaliūnaitė, Lina Danilevičienė
Lithuanian Sports University, Kaunas, Lithuania

ABSTRACT

Background. In recent years sports industry has been growing fast, changing trends forced organizations to be creative and look for different ways to increase the competitiveness. Sport has become a business that meets all key management principles (Paul, 2003). In order for an organization to be profitable it is important to have good governance and effective marketing to attract new customers (Fillis & Mackay, 2014), in sports – fans that create added value for the clubs (Zagnoli & Radicchi, 2010). Some authors argue that fans are not only consumers, but also co-creators of the final product (Richelieu & Pons, 2011). The objective of this work was to measure the impact of basketball fan behaviour on the brand of sport organization.

Methods. To measure the impact of basketball fan behaviour on the brand of sports organization methodological triangulation was used in the study. The research consisted of 3 stages: questionnaire (Sandanski, Slavchev, & Draganov, 2016), semi-structured interviewing I and semi-structured interviewing II. The study was partly conducted during the Erasmus+ Sport project "Fans Against Violence". In Lithuania the aforementioned project was conducted by the Lithuanian Basketball Federation in the partnership with association "Aktyvistai". 240 basketball fans from 5 different Lithuanian basketball clubs participated in the survey, 4 representatives from different basketball clubs and 4 fan leaders from different sport clubs were interviewed.

Results and conclusions. The majority of basketball fans that participated in the survey were men aged 20–24 years (25.8%) and attended basketball matches by the guidance of hedonistic will (13.5%). The same men became basketball fans encouraged by other fans (25%). The strife between fans from different basketball teams goes from generation to generation and the main reason of aggressive behaviour is provocative actions from opposite fans (15%) and alcohol consumption (11.4%). While alcohol consumption is considered to be one of the main reasons to encourage fans' aggression, only a small percentage of the respondents were strongly against the use of alcohol (7%). Summarizing all the results that were received during a semi-structured interviewing II it can be stated that the behaviour of the fans not only affects the brand of a basketball club, but is the main factor that impacts the brand of the club.

Keywords: brand, fans, aggression, basketball clubs.

INTRODUCTION

In recent years sport industry has been expanding rapidly, as a consequence sport became a business which applies all key management principles (Paul, 2003). It is no longer sufficient just to administer a sports organization, in order for the organization to be profitable an important factor is management and effective marketing complex (Fillis & Mackay, 2014). In sports industry fans can be distinguished as main consumers (Hughson & Free, 2006). Some authors argue that fans are not only consumers, but they also contribute to the creation of the final product (Richelieu & Pons, 2011).

The main difference between ordinary spectators and fans is the fact that spectator's interest in the club quickly fades away, while fans' interest only increases over time. Fans' attachment to the team due to various circumstances, social and

economic reasons may vary. In research literature, a variety of sports fans' classification theories can be found which are based on the ground for which one becomes a fan (Fillis & Mackay, 2014).

As can be seen in the scientific literature, sports fans are divided not only according to the devotion and attachment to the team, but also fans' relations with other fans as a group (Reysen & Branscombe, 2010). One of the most detailed and the most developed classifications of fans is given by the scientists Hunt, Bristol and Bashaw (1999), which is based on individuals' motivational and behavioural differences. Classification distinguishes five types of fans: temporary, local, loyal-devoted, fanatical and dysfunctional. It can be assumed that fans' types are distinguished by the degree to which they identify themselves as supporters. Although there are many reasons why people are interested in sports, in the literature there are eight most common reasons distinguished which promote interest in sports: getaway, economic factors, eustress, self-esteem, group affiliation, entertainment, family, aesthetics (Wann, Grieve, Zapalac & Pease, 2008).

Some authors argue that one of the ways to understand motives of the individual is personal values. One of the most popular scales of values is made by scientists Kahle, Duncan, Dalak and Aiken (2001). The scale consisted of eight distinguished values: self-esteem, security, relationships with others, self-realization, excitement, sense of belonging, respect, and pleasure. Depending on the type of fans and their identification with the team level, fan behaviour occurs in different forms: from passive support to anxious or even aggressive. In order to understand the behaviour of fans it is necessary to take into account the fact that fans are divided not only according to their level of interest in the team but also by the devotion to the team, self-identification within the team, motives and personal values. After analysing the literature, it can be noted that some types of fans, compared with others, are more prone to aggressive behaviour.

Madensen and Eck (2008) listed specific characteristics of venues, events, and staff that are related to higher levels of spectator violence (Figure 1).

Typically consumers already have a pre-formed opinion about a particular organization. Sport is complex and dynamic, and the image of it may vary depending on the emotion of the consumers. Consumers tend to create preliminary expectations of a sports organization and compare them with the results or experienced feeling. In this case, fans visit games hoping to win. It was found that the success of a team game leads fans to satisfaction, which encourages them to attend more matches, while a poor team performance leads to dissatisfaction and negative emotions, which not only reduces the match attendance, but may encourage aggressive behaviour (Beccarini & Ferrand, 2006).

Aggression in sport is not a new phenomenon; in one form or another it has existed since sports began. Sometimes aggression occurs among the athletes during the match, sometimes between athletes and fans when the fans go beyond the limits and begin to threaten athletes, hurl degrading phrases or even show physical aggression. However, most of violence occurs among the fans (Swenson, 2012).

Aggressive behaviour can be two types: spontaneous and conscious (Pearson, 2008).

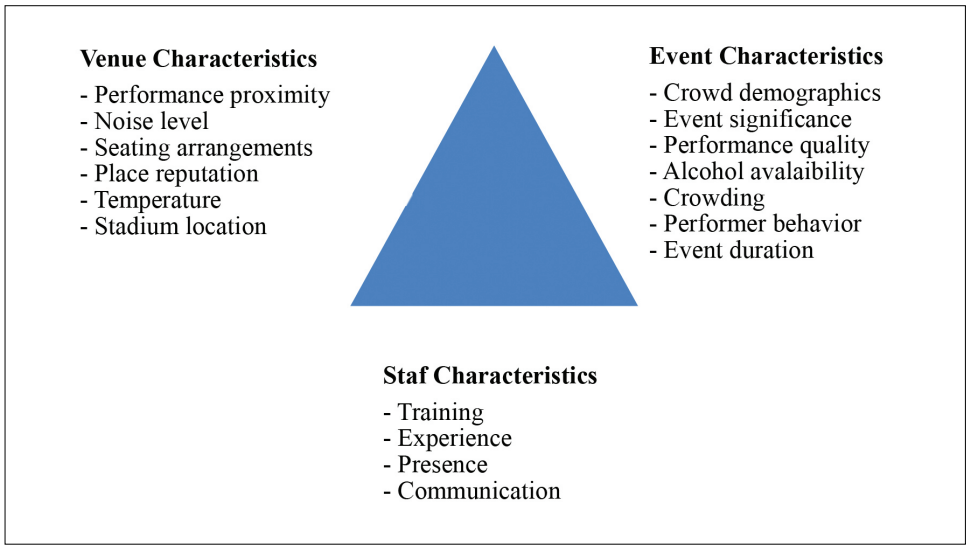


Figure 1. **Spectator violence triangle and specific causes of spectator violence (Madensen & Eck, 2008)**

Conscious violence is planned and caused by an organized group of fans (Madensen & Eck, 2008), while spontaneous aggression is often small-scale, usually caused by impulsive individuals (Shoham, Dalakas & Lahav, 2015)).

Another frequently used aggression distribution theory was described by scientists Rahmati and Momtaz (2013). The theory distinguishes hostile and instrumental aggression. Hostile aggression is caused by anger or frustration; its sole purpose is to hurt something. Meanwhile, instrumental aggression, seeks to achieve other goals, such as change the decision of the umpire or distract athletes.

In literature, six distinguished most common forms of fan aggression can be found (Madensen & Eck, 2008):

- Verbal – singing, chanting, and yelling taunts or obscenities;
- Gesturing – signalling to others with threatening or obscene motions;
- "Missile" throwing – throwing items such as food, drinks, bricks, bottles, broken seats, and cell phones at particular or random targets;
- Warming – rushing the field or stage and trying to crash the gates to gain entry, or rushing the exit, both of which may result in injury or death from trampling;
- Property destruction – knocking down sound systems, tearing up the playing field, and burning/damaging the venue or others' property;
- Physical – spitting, kicking, shoving, fistfights, stabbings, and shootings (Madensen & Eck, 2008).

Image creation is important for each organization, thus researchers and practitioners are interested in this subject. Image is not simply a name; it is not solely a positioning statement nor is it the synthesis of marketing messages about the brand. It is fundamentally a promise made by a company to its consumers, a promise that must be supported by the company and sustained over the long-term (Carlson & O'Cass, 2012).

In some cases, consumer uses club brand as a self-identification method by which they try to show others their hobbies or personalities (Richelieu & Pons, 2011). When creating an image, it is important that image would be directed into the collective consciousness because individuals need recognition of the others as well as the feeling that they belong to a certain group. It can be concluded that the image is closely related to the prestige (Dima & Vladutescu, 2012).

According to Richelieu and Pons (2011), organization constantly sends information to the consumers (advertising, word of mouth, reviews in the media, online forums). Lately, storytelling became one of the most common ways to create image. In this way, advertising professionals wrap brand with a story.

Sports industry mostly depends on the achieved results. Sports club image is mostly influenced by the athletes, sports and game results (Virvilaite & Dilys 2015). Compared with other sectors of business, sports industry receives the most emotional response from their consumers, in this case – fans (Richelieu & Pons, 2011). The relationship between the consumer and the club can

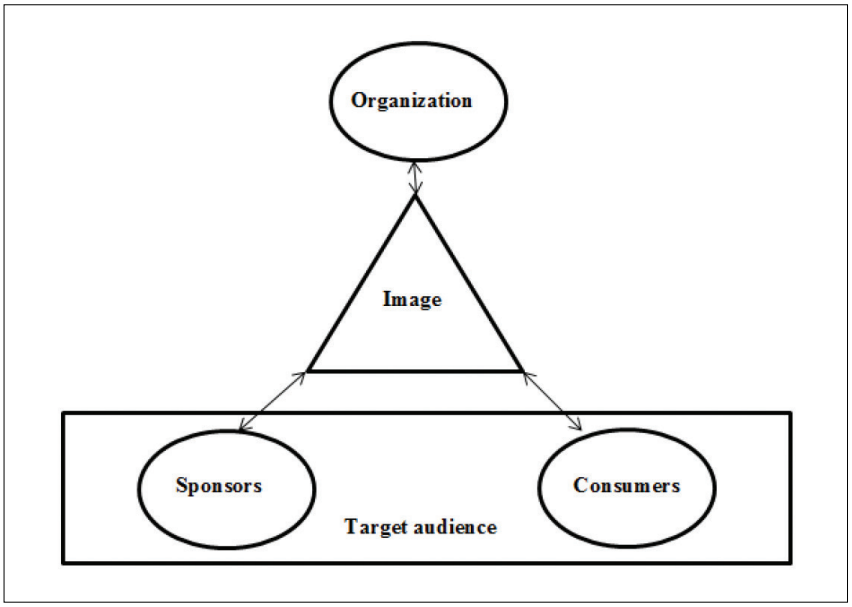


Figure 2. **Theoretical model of sports organization image formatting (Virvilaite & Dilys, 2015)**

be called in various ways: faithfulness, devotion, loyalty or pride (Fillis & Mackay 2014).

So that organization image could be formed efficiently, three interdependent agents are of great importantance: sports organization, sponsors and consumers.

Image of sports organizations is complex. It means that it consists of the image of the sport, the image of the team, the coach or the players' image. As an example, fans may like the team, but not a certain player, and vice versa (Hedlund, 2011).

Sponsors and fans are not just consumers, they are also one of the main agents creating the organization image. In the literature, fans are defined as co-creators and club representatives who not only enjoy the services they receive, but also contribute to building and branding team's image (Richelieu & Pons, 2011). Spreading information about the club also is known as word of mouth (Laczniak, DeCarlo & Ramaswami, 2001).

Fans' involvement in the formation of an image can be both positive and negative. Hedlund (2011) argues that it increases the total number of fans, creates a stronger link between the fans and strengthens commitment to the team. In the meantime, the negative consequences can be observed when fans shape a negative image about the team because of their violent behaviour. In summary, it can be concluded that the image is one of the key factors determining the success of any organization. Although there are many studies about the image or fans' violence, however fans' influence to the image is a relatively unexplored topic.

Research question. Does basketball fan behaviour influence basketball team's image?

METHODS

For the research methodological triangulation was applied (Figure 3). Triangulation is a number of different research methodologies and methods for the same phenomenon or process to investigate (Merriman, 1998; Stake, 2005; Yin, 2003).

Research partly conducted within the scope of the Erasmus+ Sport project "Fans against violence". International project "Fans against violence" was inspired by the Turkish Basketball Federation. In Lithuania this project was implemented by the Lithuanian Basketball Federation in conjunction with the association "Aktyvistai". The aim of the project was to unite different fan groups under

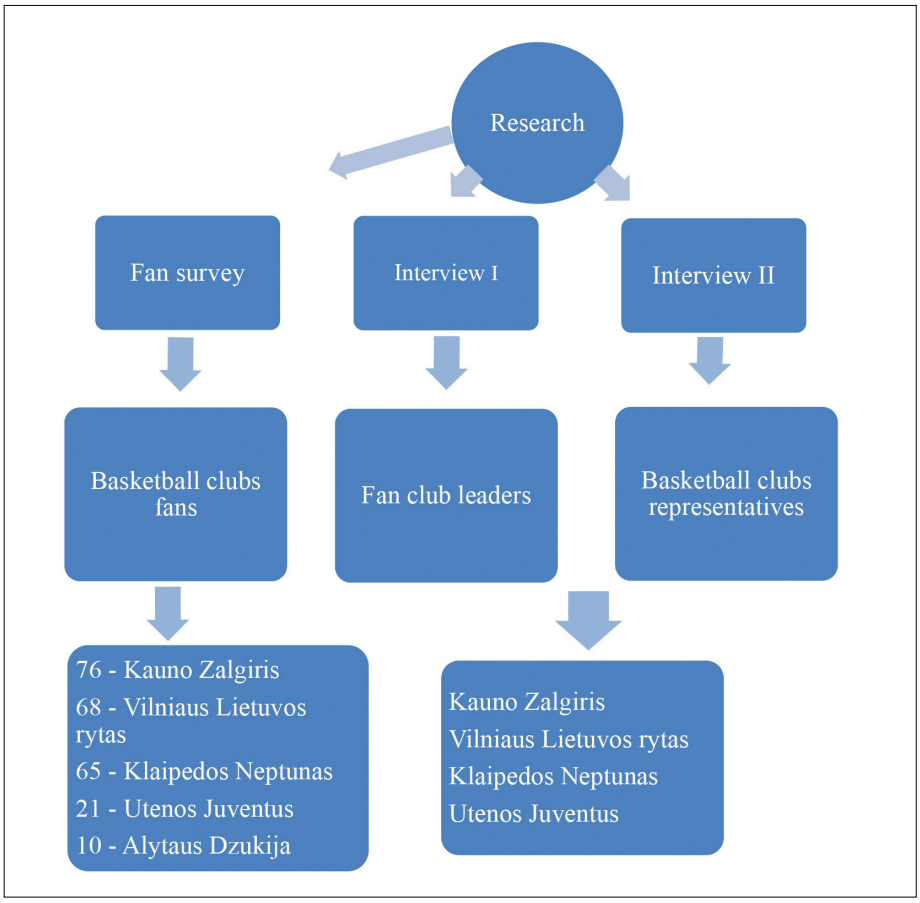


Figure 3. **Study structure made by the authors based on Sandanski, Slavchev, and Draganov (2016)**

the roof of basketball and to reduce violence by increasing the understanding and empathy between them. The project was implemented from January 2015 until the end of 2016. The project involved Basketball Federations in Turkey, Spain, Croatia, Bulgaria and Lithuania.

The study consisted of 3 phases: survey, semi-structured interview I, semi-structured interview II.

Survey. The questionnaire was designed in order to clarify fans' social behavioural patterns, to identify the main factors inducing fans aggression and how it manifests. The authors of the questionnaire were Bulgarian National Sports Academy professor Ivan Sandanski and colleagues (2016). The survey was carried out in 2015, September and October. Target research Group involved fans of five basketball clubs.

Based on the Paniotto formula, 240 fans representing 5 Lithuanian basketball clubs were chosen for the study. The questionnaire consisted of 28 closed questions

Interview I. The main purpose of the interview was to identify the main factors affecting aggression of fans and what actions clubs take in order to prevent fan aggression. The study interviewed representatives of 4 Lithuanian basketball clubs (Kauno Zalgiris, Vilniaus Lietuvos rytas, Klaipedos Neptunas, Utenos Juventus). Each of the club representatives were asked 7 questions, each interview lasted up to 30 minutes. During the interviews, 8 representatives were interviewed, each of them was given 17 questions.

Interview II. Interviews with basketball clubs' representatives were conducted in November and December of 2016 at the end of the project "Fans against violence". Interviews were conducted with the purpose to establish the outcome of the project. The interview included 9 open questions. Interview questions were sent by e-mail to 4 basketball clubs' representatives.

RESULTS

Survey. A total of 240 questionnaires were received representing 5 different fan clubs. As it can be seen in Figure 4, it was mostly "Kauno Zalgiris" club fans (76).

Most of the respondents were male, majority of them were 20–24 years old. The majority of respondents were official fan club members, most of them became fan club members encouraged by the other devoted fans. The survey revealed the reasons why fans attended matches. One of the most common reasons was "I have fun", this option chosen by 13.5% of respondents, and "I like the atmosphere in the arena" (11.6%). The majority of the fans asked about ways they supported their team said "I attend the home games of the team" (19.1%) and "I wear the colours and the symbols of the team" (17.1%). The majority of respondents, when asked about main reasons to see the other team fans as rivals, argued that that was determined by a feud between the cities (27.6%) and the clubs (27.4%). The main reasons for aggressive and violent behaviour of the fans during the basketball games can be distinguished as follows: provocations and offensive chants of the fans of the other team (15.0%) and alcohol consumption (11.4%). Although it considered that alcohol consumption is one of the main reasons for promoting fans aggression, only a small percentage of the respondents were strongly against the consumption of alcohol (7.0%). Meanwhile, the majority of respondents (35.0%) answered "It is acceptable only if it is occasional".

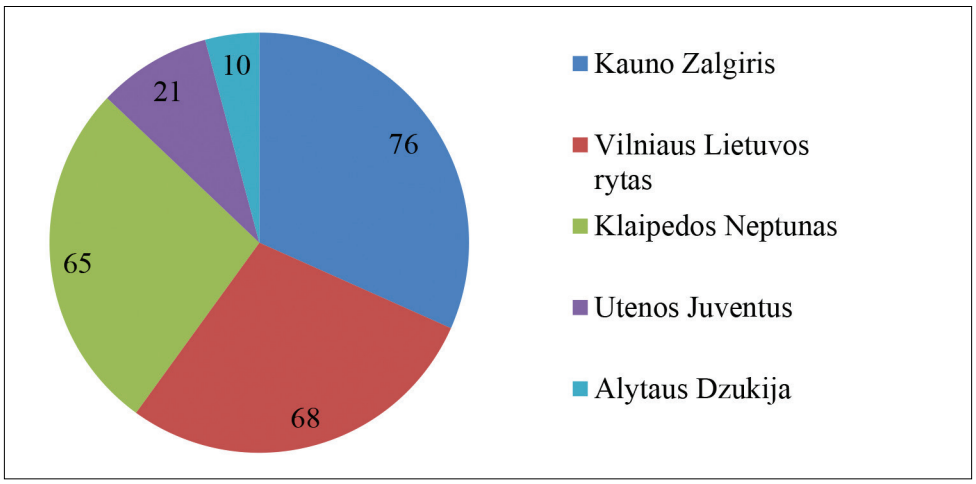


Figure 4. **Distribution of the basketball club fans**

Interview I. It was found during the interview that two different fan groups dominated in the largest Lithuanian basketball fan clubs – youth (students, etc.) and elder persons (businessmen, employees, etc.). the interview clarified predominant attitudes to the fans in Lithuania (Figure 5).

During interviews with representatives of clubs and fan leaders it was possible to distinguish the essential factors inducing fans' aggression (Figure 6).

During the interviews preventive measures were suggested which should be taken to reduce conflicts between fans (Figure 7).

Interview II. The main purpose of interview II was to find out the outcome of the project, understand club opinions concerning the image

Figure 5. **Predominant attitudes to the fans in Lithuania**

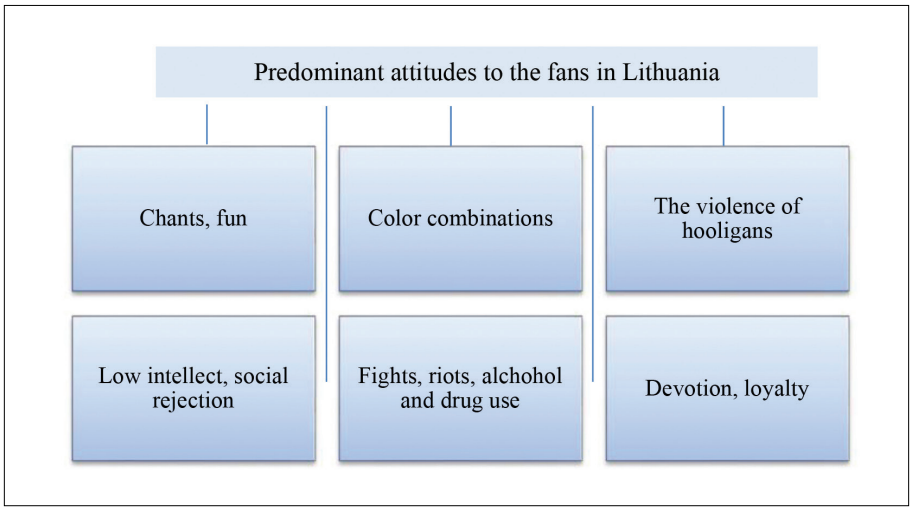


Figure 6. **The main causes of aggressive fan behaviour**

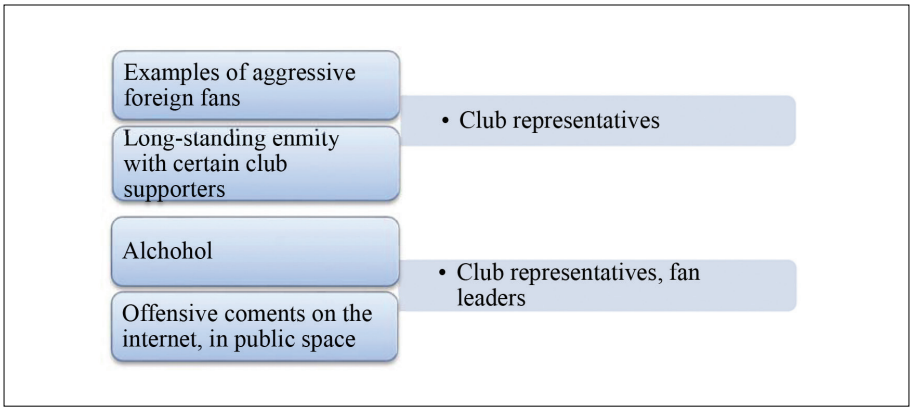
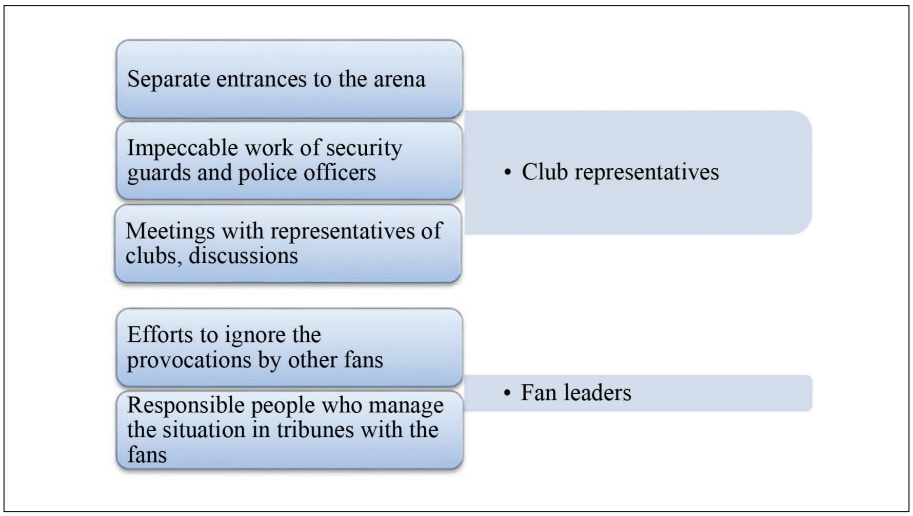


Figure 7. **Fan aggression preventive measures**



and attitudes towards fans. Summarizing interview II, it can be concluded that the clubs continuously tried to increase the club popularity and cultivate new fans. Clubs admitted that the image was mostly influenced by the results of the team, players' image and communication with supporters and the club's public relations. Project "Fans against violence" was a good start to begin the debate between supporters of different clubs. Basketball clubs admitted that during the project there was not enough time to completely solve the problem, however, they were going to continue to meet with fans to promote tolerance and mutual understanding.

DISCUSSION

Research results showed that aggressive behaviour of fans was an urgent problem which affected all basketball-related organizations. The research confirms the assumption held by Richelieu and Pons (2011) that basketball fans are not only consumers, but also the co-creators of the final product. All clubs recognize that their image is being developed for the fans.

Literature review showed that the most common reason for riots between fans in Lithuania is historical feud between the cities or the clubs. The survey confirmed assumptions made by the others authors that one of the main reasons for aggressive and violent behaviour is provocations and offensive chants of other fans and alcohol consumption. One thing that was not mentioned in the literature is that Lithuanian fans are influenced by the foreign fans.

Research has proved that fans' behaviour influences all basketball stakeholders. For this reason, each organization's duty is to fight against fans' aggression and to take preventive measures to ensure that in the future this phenomenon would decline.

As noted in the literature, every individual, group of individuals or an organization independently seek it or not, has formed a certain image. Basketball in our country has a special place and it is the most popular sport in Lithuania. Analysis of media leads to presumption that basketball in Lithuania has formed a positive image. Unfortunately, a slightly different situation can be seen in the image which has been formed by the basketball fans. Both because of fans and because of the media, fans have formed "hooligan" image among the society members. As previously noted, basketball club image is directly dependent on the basketball team, sponsors and supporters. So despite the fact that basketball as a sport has formed a positive image, if at least one constituent element (club, supporters, sponsors) has formed a negative image, it will also affect the rest of the components.

The research has shown that there is a lack of information about the influence which fans can make to the sports organization. For this reason future research should focus not only on the causes of aggressive behaviour or the preventive measures, but also on the relationship between the fans and the club image.

CONCLUSIONS

Image is one of the key factors determining the success of any organization. Every organization has some kind of image, but only well planned and systematically developed image will achieve effective results. Unlike other services or goods, consumers, sports consumers tend to use products or services in groups. Sports organizations' image formation is a complex process that is determined by a number of variables, one of them is consumers (fans). The results of the survey confirm the theoretical part of the work. The majority of basketball fans are the 20–24 year-old males who attend games driven by hedonistic factors. Most of them have become supporters because of other fans. Different team fans' feud goes from generation to generation. Meanwhile, the major cause of aggressive behaviour may be considered provocative actions of the opposing fans and alcohol consumption. Although alcohol consumption is recognized as one of the key incentives for aggressive behaviour, most fans tolerate it. The research leads to the conclusion that fans are an important part of the basketball club's image and their behaviour in some way influences all basketball stakeholders.

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Corresponding author **Irena Valantinė**
Department of Sport Management, Economics and Sociology
Lithuanian Sports University
Sporto str. 6, Kaunas LT-44221
Lithuania
Tel. +370 37 302662
Email irena.valantine@lsu.lt

OUTDOOR CAMP EFFECTS ON ATHLETES: ORIENTEERING EXAMPLE

Kadir Yıldız, Pınar Güzel, Fırat Çetinöz, Tolga Beşikçi
Celal Bayar University, Manisa, Turkey

ABSTRACT

Background. In this research, we aimed to investigate the effects of outdoor camps on orienteering athletes.

Methods. The study group consisted of 74 athletes (44 males and 30 females, aged 11.94 ± 1.32 years) who participated in Bolu outdoor camp on the 3rd–13th of August, 2015. Interview technique, which is one of the qualitative research methods, was used as data collection tool and content analysis method was used for data analysis.

Results. Demographic factors were interpreted after the analysis of the obtained data and three main research questions were discussed under the topics of the views of athletes about the concept of Orienteering which is an outdoor sport, themes and codes regarding the purpose of Orienteering by the students who participated in the outdoor camp, and themes and codes about the outcomes of Orienteering for the students who participated in outdoor camps.

Conclusion. It is suggested that a policy must be developed within the Ministry of Youth and Sport and Sport Federations in order to disseminate more deliberate and more comprehensive outdoor education among young people and measures should be taken to provide extensive participation.

Keywords: sport, outdoor education, camp, orienteering.

INTRODUCTION

Today, rapidly growing urbanization has begun to restrict opportunities for individuals to engage in sports in the natural environment. This natural environment is being replaced by artificial recreation and sports complexes. Though these artificial complexes give opportunities to individuals to do sports within the city life, people willingly go the natural environment to do sports. This request to escape from the routine life has many salient reasons such as getting away from the noise and pollution of the city, exploring new places and searching for new thrills and risks. These pursuits have begun to reveal the importance of outdoor camps and education for the people.

Different numerous definitions have been made in terms of focusing on the place, process and goals of the concept of nature education which is sometimes called outdoor education. While outdoor education is generally defined as activities carried out in open areas and for various purposes (Neill, 2008), it is expressed as a challenge, according to Nicol (2002). According to Çelebi (2002), there is a wide range of educational processes, such as planning, conservation and use of natural resources, tending to nature, city comfort and life away from technology. However, it is suggested that a consensus cannot be reached on conceptualization, interpretation and application of outdoor education, which can vary depending on factors such as culture, philosophy and local conditions (Brookes, 2006; Freakley, 1990; Lugg, 1999; Neill, 2008). Moreover, it has been pointed out that nature education plays an important role in teaching participants the necessary knowledge and skills and maintaining healthier and more active lifestyle (Cantrell, 2015). In other words, it is emphasized that outdoor education will develop different feelings with the help of freedom instinct

besides offering different teaching programs to people (Demirhan, 1998).

Participants will be able to interact with outdoor environment through training to be held outdoors. Activities in natural environment such as nature walking, orienteering, camping, fishing, canoeing, skiing, horse riding, golf, water skiing, motor sports, air sports are called outdoor recreation (Cordes & Ibrahim, 1999). It is possible to reduce or control the risks that may be encountered in nature by the help of the education given for any activity to be done within open space recreation.

It is very important for the athletes to gain experience in natural environment because of wildlife areas where outdoor sports are done, insufficient control mechanisms and various environmental conditions (terrain, atmospheric conditions, etc.). In the process of gaining experience, development of fighting and decision-making mechanisms with outdoor is ensured with the training to be given by knowledge owners. In this way, participants' challenges with outdoor will be facilitated against possible risks (Chelladurai, 1993).

In essence, it is mentioned that there are four implications which underlie participation of individuals in outdoor camps and their education. These relationships include interpersonal relationships (communication, business association and problem solving, etc.), relationship that one establishes with himself/herself (self-concept, self-confidence, self-efficacy, etc.), relationships with ecosystems (attachment to other creatures), and it is explained as ekistics relations explaining how environment affects human life (Priest & Gass, 1997). Outdoor camps are seen as an experience for individuals to remember for the rest of their lives. Both interpersonal relations and friendships develop in camp life. These developments almost continue their existence throughout lives of individuals (Chenery, 1991).

As a result of the connection established with natural environment, situations where individuals are expected to experience in learning process provide some benefits through activities held in nature. The outdoor activities, in which individuals actively or passively participate, have positive effects on social life as well as supporting their integration with society and their interactions with nature, including the activities affecting their life styles (Ardahan & Lapa Yerlisu, 2011). As a result of interaction with nature, individuals and social benefits come to the forefront. The connection established with nature provides a high motivation for individuals while creating environments in which skills such as decision making, team communication and coexistence, problem solving, idea generation and mutual trust can be used effectively (Dinç, 2006; Dyment & Potter, 2015). It is also suggested that outdoor camps allow individuals with various characteristics (age, sex, environment, etc.) to come together and interact and help to create original ideas, and ensures awareness of nature and environment (Ekici & Çolakoğlu, 2005; Dyment & Potter, 2015; Tekin, Ekici & Çolakoğlu, 2005). In other words, outdoor camps and education allow individuals to be self-aware, to recognize their talents, to establish social relations, to define outdoor, and to be satisfied with the activity that they will freely choose (Mcilraith, 2000). In outdoor camps, individuals' efforts to live in natural environment and their education can be considered as an important factor to get sensitive to environment.

Outdoor camps have some important consequences for the participants. Particularly in camp environments, such features as sharing, solidarity, providing preference option and teamwork are directly related to self-esteem. In addition, individuals' self-awareness, team spirit and decision-making abilities develop in camp environments. While these situations are expressed as psychological consequences of outdoor camps, elements such as group experience and interaction bring about social consequences at the same time (Marsh, 1999). The Outdoor camps and education can cause differences in the level of socialization of the participants through various trainings given. It can be considered that participants and experienced leaders from different regions and opportunities to play with them and to live together are the most important socialization and motivation process of the camps (Ekici & Çolakoğlu, 2005; Munusturlar, Munusturlar Akyıldız, & Özçakır, 2016). Moreover, variable recreational activities improve satisfaction levels of individuals who are involved in leisure, social, cultural and sport activities in the sport education camps (Polat, 2016). Durall (1997) suggests that education in outdoor camps is a successful way of social development, especially for children. It is stated that skills such as communication, leadership, organization and decision-making that are gained in outdoor camps can also be effective in our interactions with people

in our daily lives (Dworken, 1999). However, it has been stated that nature education has come to the forefront of team spirit, leadership, talent development, self-confidence, problem solving, coexistence and taking responsibility (Dworken, 2001; Groves, 1981). In addition, problem-solving could be encountered as a dimension in many forms of leisure education (Munusturlar & Bayrak, 2016). According to Colyn, DeGraaf and Certan (2008), camp training is considered to be an important element in socialization of individuals and provides some gains such as friendship, honesty and communication.

Literature examination shows that similar research has been carried out discussing social, physical and psychological benefits provided by the outdoor sports to individual. Factors such as development of individual decision making, self-development, responsibility, risk management, leadership, self-confidence, team spirit, discovery, interacting with others, and self-realization can be cited as common benefits provided by outdoor sports (Burnett, 1994; Dyment & Potter, 2015; Hilton, 1992; Levi, 1994; McKenzie, 2000; McRoberts, 1994; Wagner & Rowland, 1992; Yerlisu Lapa, Ardahan, & Yıldız, 2010). Moreover, orienteering sport improves self-esteem (Wood, Gladwell & Barton, 2014), health, self-esteem and decision making (Baş & Cengiz, 2016) for participants.

In this research, we aimed to examine the effects of outdoor camps on athletes. For this purpose, the following questions were raised:

Q1. What are the opinions about orienteering sport of athletes who participated in the outdoor camp?

Q2. Why do they do orienteering which is an outdoor sport?

Q3. What do they think outdoor camp contributes to them?

METHOD

Research Model. This study is a descriptive research and phenomenology has been preferred as a qualitative research design since it is thought to be best in determining participants' thoughts, experiences, demands and suggestions about the topic. Phenomenology focuses on what we are aware of but we do not have an in-depth and detailed understanding. In this research design, the data source focuses on individuals or groups that live and reflect this phenomenon (Yıldırım & Şimşek, 2013).

Study Group. A total of 74 athletes, 44 boys and 30 girls, aged between 9–15 (11.94 ± 1.32) years and participating in the orienteering development camp in Bolu on 3–13 August 2015 (Table 1), took part in the research. Face-to-face interviews were conducted with 3 questions prepared in line with expert opinion. Primarily, Turkish Orienteering was informed and asked for permission about the process and scope of the research.

Table 1. **Gender distribution of the research group**

Variables		Frequency	Percentage (%)
Gender	Male	44	59.5
	Female	30	40.5
	Total	74	100

A purposeful sampling method was applied to select the appropriate sample. In the research, convenience sampling strategy was preferred. This method was chosen as it gives speed and practicality to the research and is easy to reach and examine a case for the researcher (Yıldırım & **Şimşek**, 2013).

Data Collection Method. In this study interview technique was used as data collection method. The goal of interview method is to be able to carry out information exchange process between interviewer and interviewee (McKenna, 1994). According to Pehlivan (1999), interview is defined as a "purposeful interview". Open-ended semi-structured questions were prepared in line with the opinions of a total of 3 expert academicians, 2 in the field of sports management and 1 in the field of measurement evaluation. Face to face individual interviews were held with 74 athletes participating in the nature camp held by Turkish Orienteering Federation on the 3rd - 13th of August, 2015, in Bolu (Turkey) (between 15–25 min.). The interview form consisted of two parts: the first part included participant information form and personal characteristics of participants and the second part was an interview form including open-ended semi-structured questions developed by the researcher. Semi-structured interviews are often preferred by researchers because of their certain level of standard and flexibility as they are based on writing and filling tests and help to remove limitations in questionnaires and get in-depth information on a particular topic (Yıldırım & Şimşek, 2013). All

participants were interviewed and information about the scope of the study was given to them, afterwards a voluntary consent form was filled in. Participants were asked for permission for voice recording and a commitment was made that records would be used by the researcher only for scientific purposes.

Data Analysis. A descriptive analysis method was first applied for the procession of data that was written by the researcher. The answers given by participants to the same questions were put together before the analysis. In the research process, coding of the data, extraction of the themes as well as arrangement of the sub-dimensions by arranging data according to the themes and codes were alternated. The purpose of this analysis was to convert raw data into a form that readers could understand and use if they wished. At this stage, the data summarized in the descriptive analysis was taken into a more detailed process and coded independently by three researchers in the field. Coding was conducted by two researchers working in the field of Sport Management Sciences using paper in a classical manner, and also by a researcher in the field of measurement and evaluation using qualitative data analysis programme (Nvivo 11 Pro for Windows). Consistency between the codes was confirmed by comparing the codes carried out in a mutually independent manner, and similar codes were put together to formulate problems and recommendations.

Content analysis is a method of scientific research used to make meaningful and necessary conclusions about texts and contexts (Krippendorff, 2004). Four stages are followed to make content analysis: coding of data, detection of themes, organization of codes and themes, and identification and interpretation of findings (Yıldırım & Şimşek, 2013). In content analysis, deduction or induction methods can be used. The purpose of study determines which one is suitable to be used. If insufficient knowledge is available about study case, induction method is recommended (Elo & Kyngas, 2008). The induction method was preferred as a research analysis method due to the lack of structured data array of results, especially in Turkey, although outdoor camps are organized regularly.

Validity and Reliability. Validity studies in qualitative research, which means that a researcher is conducting a study with a whole objectivity (Yıldırım & Şimşek, 2013), is concerned with fulfilling some obligations related to internal and external validity. In this context, researchers pay attention to the following issues in terms of internal and external validity:

- The research findings were defined in a meaningful way, depending on the circumstances.
- The findings are consistent with the previously established theory.
- Findings were checked through both voice recorder and short notes and provided as a whole.
- The research was extensively defined to shed light on possible generalizations.
- The results of the study are consistent with the existing theories about the research question.
- The findings of the research were described as testable in other studies and in similar circumstances.

Since human behaviour has a non-stationary and variable structure, it is very difficult to repeat a research in social studies even in similar groups. In order to minimize this situation and to ensure internal and external reliability of the research, following elements were achieved by the researcher:

- Description and thematization were carried out by using direct quotation from obtained data (supported by voice recordings and researcher notes).
- The research questions were expressed clearly after relevant conceptual framework was prepared.
- The participants in the study were clearly defined as data sources.
- Processes and methods related to the results of the research were explained step by step.
- The raw data obtained in the research were filed in a way that other researchers can reach.
- In the research, the researchers conducted face-to-face interviews with the participants and made necessary explanations to focus on relevant issues.
- In coding of the research data, more than one researcher coded and reliability was checked by Kappa statistic of this coding. In order to ensure the reliability of the research, Kappa reliability coefficient was calculated and reliability coefficient was determined to be .77.

Ethic Clarity. In this research process, importance and attention were paid to realization of main ethical principles. In this direction; *Conscious Consent:* "The *Volunteer Consent Form"* was filled

for volunteer participation at the beginning of the study. *Privacy, respect for private life and not harming*: Personal information of the participants was kept confidential and not deciphered. In order to record the interviews, participants were asked to provide "audio recording permission". *Do not deceive, mislead, and being loyal to obtained data*: Data obtained from the participants were expressed clearly in the research and raw forms of the data were presented as available.

RESULTS

The opinions of the athletes who participated in the research on "Orienteering" were presented as graphics and tables by analysing and interpreting in subheadings according to the results of the research.

Table 2 shows that 93.5% of the participants were primary school students and 6.8% of them were high school graduate students. A large majority of participants (70 students) stated that they devoted 1–3 hours a day for sport. However, according to weekly spared time for sport the distribution of participants was 40.5% for 1–2 days a week; 39.2% for 3–4 days a week; 16.2% for 5–6 days and 4.1% for 1 week and over.

The views of athletes about the concept of Orienteering which is an outdoor sport. Under this heading, students' opinions, frequency distributions and interpretations related to the concept of orienteering were given (Research question 1).

According to Figure 1, participants expressed their views about the concept of orienteering

Variables		Frequency	Ratio (%)
Educational Status	Elementary School	69	93.2
	High School	5	6.8
Is there another sport you do?	Yes	48	64.9
	No	26	35.1
How many hours of daily time do you spend in sports?	Less than 1 hour	17	23
	Between 1–2 hours	35	47.2
	Between 2–3 hours	18	24.4
	More than 3 hours	4	5.4
How many days a week do you do sport?	1–2 Day	30	40.5
	3–4 Day	29	39.2
	5–6 Day	12	16.2
	7 Day and more	3	4.1

Table 2. **Some socio-demographic information about the participants**

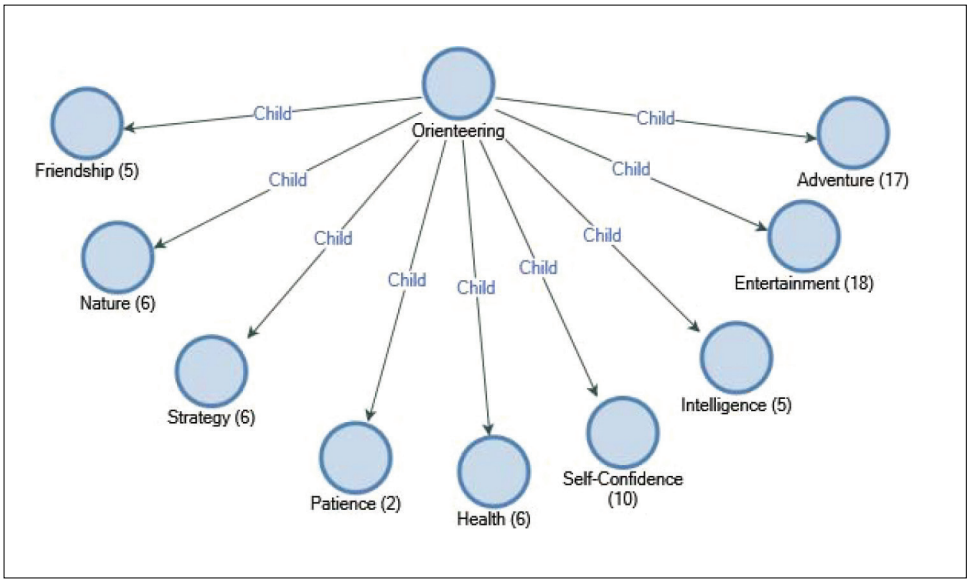

Figure 1. **The views of research participants about "Orienteering"**

through the terms of entertainment, adventure, self-confidence, nature, strategy, health, friendship, intelligence and patience. It is seen that orienteering concept, which is an outdoor sport, is perceived as entertainment (n = 18), adventure (n = 17) and self-confidence (n = 10) by the participants. It is an important indicator that these concepts are related to socialization, which is a part of individuals' lives. It can be argued that the views put forward from another point of view are generally focused on socialization, individuals' life quality, self-confidence, decision-making and mental development.

Findings related to goals of doing orienteering of students participated in outdoor camp. Under this heading of the research, the opinions of athletes about doing orienteering, frequency distributions and interpretations were given (Research question 2).

Participants' views about the question "Why do you do Orienteering which is an Outdoor sport?" came under the themes of mental development (n = 12), health (14), socialization (22), love of nature (2), career development (19) and leisure time activity (6). Participants indicated that orienteering had positive effects on their physical, mental and social development. In the light of participant's views, it has been stated that outdoor camps and education have an important role in socialization of individuals in particular. Individuals who participate in outdoor camps can acquire a new friend environment in a new atmosphere and fulfil their needs. This environment can be seen as an important factor in socialization of individuals.

Some of the participant's views about these themes are:

K6: *"I have started to do this sport because it's fun to get rid of stress and useful to decide by yourself."*

K32: *"I do this sport in order to be an elite athlete, to represent Turkey, to convey information I have learned to younger people and to be a role model for them."*

K39: *"Orienteering is an outdoor and mental sport. I do orienteering to live the pleasure of transformation of intelligence into nature challenge."*

K46: *"I have started to be a good athlete and have a better life in the future."*

K62: *"I think it has a great benefit in development of intelligence."*

K69: *"I have canalized orienteering in order to be a good athlete and to build my body."*

As a result of the opinions obtained from the research, it can be asserted that outdoor camps may be effective in eliminating physical and physiological disorders of individuals. Allsop,

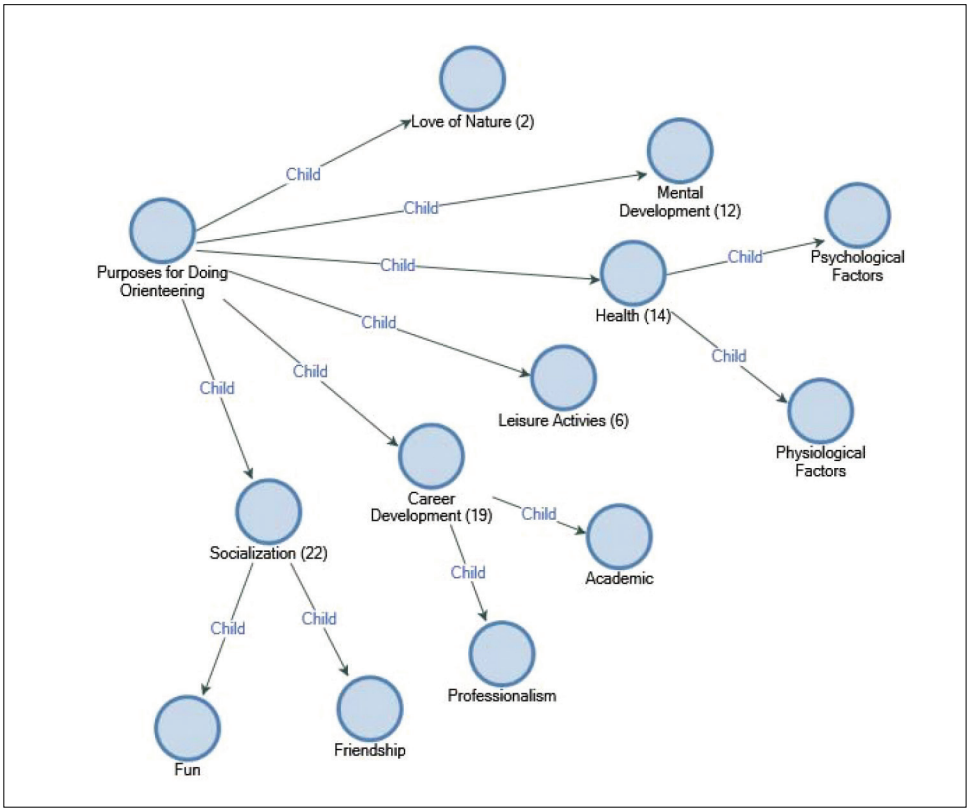

Figure 2. **Themes, codes and statements about individuals' purposes for doing "Orienteering" according to research participants' opinions**

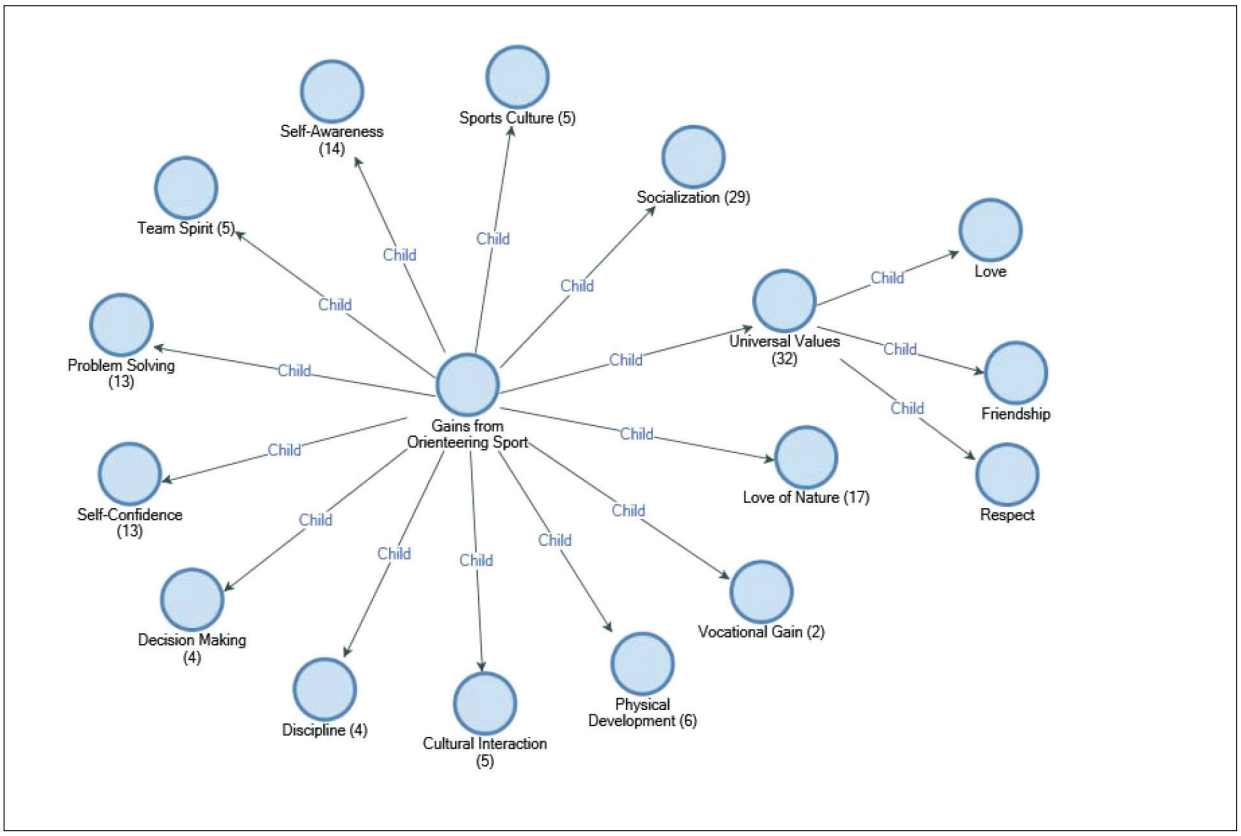

Figure 3. **Themes, codes and statements about the gains of Orienteering sport according to the research participants' opinions**

Negley & Sibthorp (2013) emphasized in their research that outdoor camps could improve some of the problems in young people by socializing.

In another study, it was emphasized that outdoor camps were influential in making new friendships and friendship experiences stemming from the strengthening of social values and domains, often depending on social interactions (Sibthorp, Bialescki, Morgan & Browne, 2013). One of the most important elements in formation of socialization and social interaction areas is that individuals must come and live together in natural environments (Neill, 2008; Wistoft, 2013). According to Ekici & Çolakoğlu (2005), acquiring sporting habits has an important role in feeling good and establishing friendships for individuals. In a study conducted by Preston (2014), it was stated that students perceived sportive activities in nature as adventure, high activity and challenge as well as learning. In another research, it was emphasized that activities in nature were important for health (Neill, 2008).

Findings related to the achievements of students participated in Outdoor Camp in Orienteering. In this part of the study, the themes, frequency distributions and comments on the views of the athletes about their achievements of orienteering in the outdoor camp were included (Research question 3).

Figure 3 shows that participants' opinions about achievements of orienteering were brought together under the theme of universal values, self-confidence, sports culture, problem solving, discipline, decision making, professional gain, love of nature, socialization, self-awareness, team spirit, physical development and cultural interaction. It was pointed out that orienteering camps and education had an important function within the context of universal values (32), socialization (29), love of nature (17), self-awareness (14), self-confidence (13) and problem solving.

The participants' opinions about their achievements of orienteering are given below:

K2: *"Sports done in nature instil love of nature."*

K15: *"Camping environment provides more friendship environment, and allows making friends."*

K56: *"Thanks to this camp, I have had many friends and a lot of fun with all of them. We have to interact with the people in here as we are isolated in outdoor camp."*

Outdoor camps are seen as an important issue to educate and bring up healthy individuals. It is stated that sportive activities in nature are effective factors in the process of socialization and personal development of individuals (Preston, 2014; Wistoft, 2013). However, another study has shown that outdoor camps have important gains such as physical, recreational, educational, therapeutic and environmental effects (Neill, 2008). Especially, it is stated that outdoor camps held during summer are generally attended as recreational activities (Thurber & Malinowski, 1999) and these camps have significant effects on physical development, self-confidence, self-esteem and socialization processes (Goodwin & Staples, 2005; Kiernan & MacLachlan, 2002).

DISCUSSION AND CONCLUSION

According to the obtained findings, conceptual opinions of participants about the concept of orienteering have been brought under nine themes as follows: entertainment (n = 18), adventure (n = 17), nature, strategy, health (n = 6), self-confidence (n = 10), friendship, (n = 2) (Research question 1). These conceptual ideas were presented in the study under the heading of "Opinions perceived by athletes on the concept of orienteering, which is an outdoor sport" (Table 2). It can be claimed that physical activities performed in natural environment create perception of entertainment and healthy life in an individual. The conceptual views perceived by individuals can be expressed as important elements that play roles in their individual development in general.

As a result of the analysis of the themes related to orienteering activities of the students participated in the outdoor camp, six main themes and six codes were determined. These main themes were stated as; socialization (n = 22), career development (n = 19), health development (n = 14), mental development (n = 12), leisure activities (n = 6) and love of nature (2).

When examining data about the gains of individuals besides their reasons for doing this activity, thirteen (n = 3) themes were found. These themes are; universal values (n = 32), socialization (n = 29), love of nature (n = 17), problem solving (n = 13), self-awareness (n = 14), self-confidence (n = 13), sports culture (n = 7), physical development (n = 6) team spirit (n = 5), decision making, discipline (n = 4), and professional career (n = 2). Socialization, self-esteem, love of nature and professional career are the main themes that were revealed as a result of analysis of research questions. Kraus & Scanlin (2003) stated that in the age range between 13–19 year-old individuals, outdoor camps and education have important roles in social, psychological and physical development, consciousness participation to sport, decision making, and socialization as well as group activities. In addition, Palhares (2011) asserted that outdoor camps had significant gains in terms of socialization and social values (respect, equality).

According to the participants' views, one of the themes related to the goals of individual for doing "Orienteering" is socialization (n = 22). Moreover, in the direction of participants' views socialization (n = 29) is among the themes related to achievements of orienteering. It is known that outdoor camps provide personal pleasure, happiness, friend environment, socialization and team spirit (Temel, Namlı, Doğruer & Balcı, 2015). In addition, coming together in outdoor education offer the opportunity to interact and socialize in camp environments (Clancy & McClement, 2012; Fine & Glover, 2011). It is also stated that trying to maintain their individual existence away from the family (Kraus & Scanlin, 2003), satisfied and having interactions with other people (Palhares, 2011, 2015; Polat, 2016) are other goals of individuals. It can be considered that individuals are happier in environments where they feel free, satisfied and interacted as socializing opportunities with other individuals are easier. It can be claimed that the findings of the present study are similar to those mentioned in other studies.

According to the participants' views, one of the themes related to the gains of individual for doing "Orienteering" is physical development (n = 6). Sheard & Golby (2006) stated that individuals who participate in outdoor activities such as rock climbing, canoeing, outdoor camping, and orienteering can have improvements in their physical condition and self-confidence. In another study, it was reported that qualities such as physical development and self-confidence were developed in individuals who actively participated in outdoor recreational activities (Fine, 2013; Fine & Glover, 2011; Wistoft, 2013). When the related literature is examined, it can be claimed that activities performed in natural environment have important roles in physical, physiological and social developments of individuals.

Camps (Guthrie, Cavins & Gabriel, 2012), one of the most popular outdoor programmes in the world, can be considered as a good educational tool when carried out in suitable environments

and conditions. It can be stated that supporting trainings held in natural environments in the framework of theoretical planning and practical applications considering existing conditions can be an important achievement. It can be regarded that outdoor camps have significant influences on the physical and social development of individuals especially in the age range between 13 and 19. Moreover, outdoor camps can be effective in educating conscious individuals about sports and sports activities. As a result, in order to popularize planned and wide-ranging outdoor education among young people, measures should be taken to raise awareness of teachers, coaches, managers and their families, to create policies at the Sports Federations and the Ministry of Youth and Sports and to promote wider participation.

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Corresponding author **Kadir Yıldız**
Celal Bayar University
45040 Manisa
Turkey
Tel. +90 555 290 81 47
E-mail kadir.yildiz@cbu.edu.tr

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All papers undergo the regular review process by at least two members of the Editorial Board or by expert reviewers selected by the Editorial Board.

The author (reviewer) has the option of the blind review. In this case the author should indicate this in their letter of submission to the Editor-in-Chief. This letter is sent along with the article (review).

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  Title Page File:
  Include the title of the article; the authors' names and surnames and their institutional affiliations (indicating the city and the country); mailing address, telephone and fax number, and e-mail address for the corresponding author.

  Article File:
  The main text of the article, beginning from the title of the article and Abstract till References (including tables and figures) should be in this file. Do not include your names and affiliations in this file.
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The manuscript must be written in English. The guideline for the preparation of manuscripts is the *Publication Manual of the American Psychological Association (6th edition)*.

The title page should contain the title of the article; the authors' names and surnames and their institutional affiliations (indicating the city and the country); mailing address, telephone and fax number, and e-mail address for the corresponding author.

Page 2 should include the **abstract** (250 words) revealing the scientific problem and providing the major data of the research. It must be structured into the following sections: Background. Methods. Results. Conclusion. Keywords (from 3 to 5 informative words and/or phrases).

The full text of the manuscript should begin on page 3. It should be structured as follows:

Introduction. It should contain a clear statement of the problem of the research, the extent of its solution, the new arguments for its solution (for theoretical papers), most important papers on the subject, the aim, the object and the original hypothesis of the study.

Methods. In this part the choice of specific methods of the research should be grounded. The research participants, methods, apparatus and procedures should be identified in sufficient detail. If the methods of the research used are not well known and widely recognized the reasons for the choice of a particular method should be stated. References should be given for all non-standard methods used. Appropriate statistical analysis should be performed based upon the experimental design carried out. It is necessary to indicate the methods of mathematical statistics applied (statistical reliability, statistical power, confidence interval, effect size), and to explain the estimation of the sample size. Information that will identify human subjects must not be included. Research involving human subjects should be carried out following the principles of the Declaration of Helsinki.

Results. The findings of the study should be presented concisely, consistently and logically, not repeating the chosen methods. The statistical significance and statistical power of the finding should be denoted.

Discussion. At the beginning of the discussion section the authors should provide major original research statements that are supported by the data. We recommend structuring the discussion of the findings into subsections (each original research finding should be discussed in a different subsection). The data and the conclusions of the research are compared to the data obtained by other researchers evaluating their similarities and differences. Authors should emphasize the original and important features of the study and avoid repeating all the data presented within the Results section.

Conclusions. The conclusions provided should be formulated clearly and logically avoiding excessive verbiage. The most important requirement for the research conclusions is their originality in the world. It is advisable to indicate the further perspectives of the research.

Acknowledgements. On the Acknowledgement Page the authors are required to state all funding sources, and the names of companies, manufacturers, or outside organizations providing technical or equipment support (in case such support had been provided).

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Chapter in a book:

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Author, A. A., Author, B. B., & Author, C. C. (year). Article title. *Journal Title, volume number* (issue number), page numbers.

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THE WORLD
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AND ITS HISTORY

June 28, 2017
Kaunas, Lithuania

The aim of the conference is to discuss the potential of Lithuanian sports history research which can be useful for further Lithuanian sports development. During the conference, all participants will have an opportunity to share their experiences how Lithuanian sports history is presented in different countries around the world and what kind of factors can help further Lithuanian sports development and promotion.

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