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ORIGINAL RESEARCH PAPER

THE RELATIONSHIP BETWEEN IMAGERY AND PHYSICAL SELF-EFFICACY IN ATHLETES

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Abstract

The world's greatest athletes have very well-developed imagery skills. They use imagery every day to improve skills during training, to prepare for competitions, to adjust in technical performance and to image success, thereby strengthening their confidence and beliefs for higher achievements. Previous research has shown that the use of imagery for athletes has helped to achieve the desired goals. Physical self-efficacy has received a lot of attention in sports, and it is associated with the use of imagery. High physical self-efficiency means that athlete enjoys sports-related activities and has a constant desire for improvement and development. The aim of this study is to examine the relationship between athlete's imagery abilities and physical self-efficacy. It was assumed that athletes who have a higher physical self-efficacy level would have higher imagery abilities than those who have lower physical self-efficacy level. The study included 69 athletes from various kinds of sports (female and male). The following research methods were used: research and analysis of literature sources, Sport Imagery Ability Questionnaire (SIAQ), Self-Efficacy to Regulate Exercise scale (SERES), mathematical statistical methods. Study findings suggest that athletes who have higher physical self-efficacy use imagery more and have better imagery abilities than athletes who have lower physical self-efficacy level.

Key words: *imagery, self-efficacy, athletes*

Introduction

Imagery is one of the most important psychological skills in sport. Imagery in sport is the ability to create an image or series of images related to the sport. Imagery includes the use of all senses to create or recreate an experience from an event and use this mental feeling to better prepare oneself for a competition (Cumming, & Ramsey, 2009; Slimani, et al., 2016). Imagery is a useful tool for improving the performance of athletes in a variety of sport settings. Imagery is mainly used in the training process to improve the quality of athletes' movements, increase concentration, reduce competitive anxiety, and promote athlete's self-confidence and physical self-efficacy (Broeck, et al., 2010, Mousavi, & Meshkini, 2011). Imagery is widely studied and many studies in sport psychology have been conducted to explore the use of imagery among athletes. By using imagery athletes can create and experience situations that are like real life. By repetition, an athlete can develop sensory reflexes that will help to boost performance in trainings and competitions (Filgueiras, & Hall, 2017).

Physical self-efficacy has been the focus of research in sport psychology for many years. It is very often associated with increased effort, perseverance and improved athletic performance by athletes of all ages and levels of competition (Beauchamp, et al., 2012; Sitzmann, & Ely, 2011). Physical self-efficacy refers to confidence in the ability to learn or perform physical activities (Feltz, 2007). An athlete's level of physical self-efficacy greatly influences his or her performance and determines motivation. Athletes with higher physical self-efficacy will set more difficult goals to achieve than those with a lower level of physical self-efficacy. The level of physical self-efficacy will affect an athlete's effort. There are several psychological strategies, such as imagery, that lead to positive changes in athlete's physical self-efficacy (Williams, & Cumming, 2012). High self-efficacy means that the athlete enjoys sports-related activities and has a constant desire for improvement and development. In addition, high self-efficacy leads to positive changes, such as working with greater returns, being able to assess one's skills more objectively, finding a willingness to overcome difficulties, and emphasizing the ability to solve problems that arise on the path to success (Yilmaz, et al., 2010; Carter, 2013; Beauchamp, et al., 2012).

Imagery can increase athletes' self-confidence and physical self-efficacy. Many researchers argue that imagery experience is a source of self-efficacy. Seeing other people's successful actions or visualizing them in imagery can boost physical self-efficacy (Majlesi, et al., 2013). Athletes can create their effectiveness by imagining themselves being successful. If all the senses and emotions are included in the process of imagery, then this

type of imagery will be an even stronger source of physical self-efficacy. Physical self-efficacy can help to explain and describe the imagery associated with sports performance. Imagery leads to success in terms of performance and increases an athlete's expectations of success in terms of his or her performance. By imagining yourself successfully completing a task, an athlete's physical self-efficacy and hope for success are promoted. Every athlete has a desire to feel effective and to show their abilities (Broeck, et al., 2010).

With the help of imagery, athletes can develop physical and psychological skills. Mental training techniques, such as imagery, are associated with shifting athletes' attitude towards themselves, resulting in increased athletes' self-confidence and physical self-efficacy, as well as their performance (Moraru, et al., 2015). This study aims to examine the relationship between athlete's imagery abilities and physical self-efficacy.

Materials and Methods

Participants. The participants of the study were 69 individual and team sports athletes (female and male) from the Latvian Academy of Sport Education. Participants' ages ranged from 19 to 25 years. All study participants have at least 7 years of experience in their sport, have achieved success in their sport, and experience in Latvian and/or international competitions.

Tools. Sport Imagery Ability Questionnaire (SIAQ) (Williams & Cumming, 2011) in Latvian language (Volgemute et al., 2019) and Self-Efficacy to Regulate Exercise scale (SERES) (Bandura, 2006) in Latvian language were used to determine and analyse the indicators of athletes' imagery abilities and physical self-efficacy.

Imagery abilities were assessed and analysed from the results of the 15-item self-assessment SIAQ. The items are grouped into five scales: skill (training-oriented imagery abilities), strategy (competition-oriented imagery abilities), goal (goal-oriented imagery abilities), affect (emotion-oriented imagery abilities), and mastery (mastery-oriented imagery abilities) imagery abilities. Participants were asked to rate on a 7-point scale (1-rarely and 7-often) each statement.

The physical self-efficacy indicator was determined and analysed by using SERES. SERES is an 18-item questionnaire designed to measure the physical self-efficacy of an athlete. Participants were asked to record the strength of their belief on a 100-point scale, ranging in 10-unit intervals from 0 ("Cannot do") to 100 ("Certain can do").

Procedure. Participants were asked if they would agree to complete questionnaires as a part of a research study. After obtaining their consent,

the athletes were asked to complete the questionnaires by giving an assessment to each subject, as well as, to fill in personal information: age, sport, athletic level, sports experience, and achievements. In the end, the data were collected and analysed using data analyses.

Statistical Analysis. The data obtained were processed using SPSS software. The following mathematical statics were used: descriptive statistics, median split, multivariate analysis of variance (MANOVA).

Results

To determine the relationship between imagery abilities and physical self-efficacy, athletes were categorized as being a high or low level in self-efficacy based on the distribution of SERES results. The mean distribution was determined by the median split. The median value of SERES was set at 59, after which the cumulative percentage was determined – 50.7, which means that 50.7% of the sample of athletes form a group of low self-efficacy level and 49.3% of the sample of athletes form a group of high self-efficacy level. Based on the obtained results, 37 athletes whose SERES results exceeded 59 points (inclusive) were qualified with a high level of physical self-efficacy, while 32 athletes with a score below 59 points were qualified with a low level of physical self-efficacy (Tab. 1.).

Table 1

Means and Standard Deviations for SIAQ Subscale Results for Hight and Low Physical Self-Efficacy Athletes (*n=69*)

	High self-efficacy (*n=37*)		**Low self-efficacy (*n=32*)**	
Indicators	**M**	**SD**	**M**	**SD**
Physical self-efficacy	6.93	.92	4.99	.66
Skill imagery abilities	6.32	.12	5.48	.13
Strategy imagery abilities	5.96	.13	4.78	.14
Goal imagery abilities	6.25	.17	5.06	.18
Affect imagery abilities	6.47	.08	5.88	.09
Mastery imagery abilities	5.82	.16	4.78	.17

Table 1 presents the means and standard deviations for SIAQ subscales results for the high and low physical self-efficacy athletes. Physical self-efficacy indicators vary widely between groups of athletes. The arithmetic means value for the group of athletes with high self-efficacy is 6.93 (SD=0.92), while for the group with low self-efficacy this value is 4.99 (SD=0.66). Imagery abilities indicators arithmetic means show a tendency that the group with a high level of physical self-efficacy has higher scores on all SIAQ scales than the group with low physical self-efficacy level. This indicates that athletes with a higher level of physical self-efficacy also have higher imagery abilities.

For the group of athletes with high physical self-efficacy, the highest arithmetic means are for affect imagery abilities (M=6.47, SD=0.8). The group of low physical self-efficacy also has the highest arithmetic means of affect imagery abilities (M=5.88, SD=0.9). For both groups, these abilities are the easiest to apply in sport. The rate is significantly higher for the high physical self-efficacy group compared to the low physical self-efficacy group (Fig. 1.).

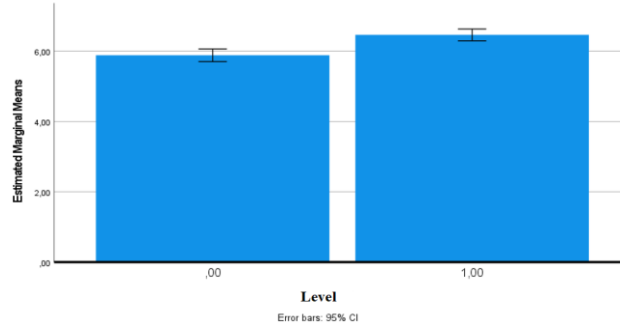

Figure 1. Estimated Marginal Means of Affect Imagery Abilities

For both groups, the second highest arithmetic means are in skill imagery abilities. The arithmetic means for the group with high physical self-efficacy (M=6.32, SD=0.12) is much higher than for the group with low physical self-efficacy (M=5.48, SD=0.13) (Fig. 2.).

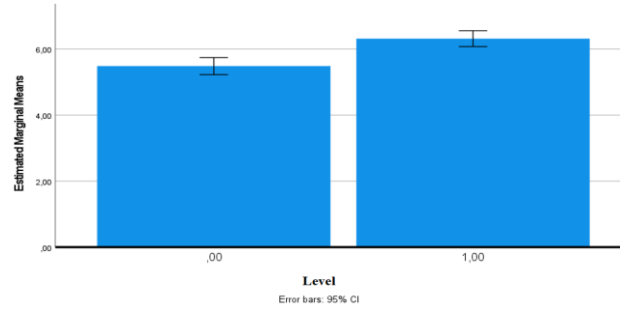

Figure 2. Estimated Marginal Means of Skill Imagery Abilities

The third imagery abilities with the highest arithmetic means are goal imagery abilities for the high physical self-efficacy group (M=6.25, SD=0.17) and the low self-efficacy group (M=5.06, SD=0.18). These imagery abilities are closely related to physical self-efficacy. This scale shows the largest difference in the arithmetic means between the two

groups. For the group of high self-efficacy arithmetic means are significantly higher (Fig. 3.).

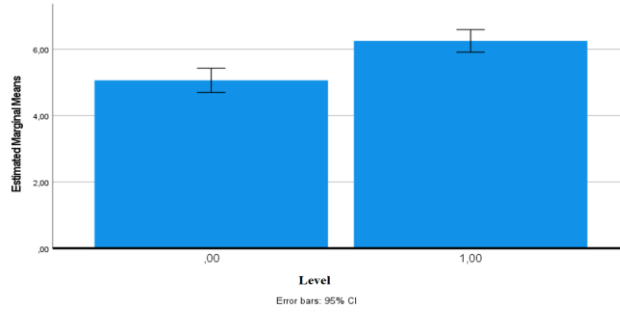

Figure 3. Estimated Marginal Means of Goal Imagery Abilities

Strategy imagery abilities has one of the lowest arithmetic means for the high physical self-efficacy group (M=5.96, SD=0.13) and low self-efficiency group (M=4.78, SD=0.14) (Fig. 4.).

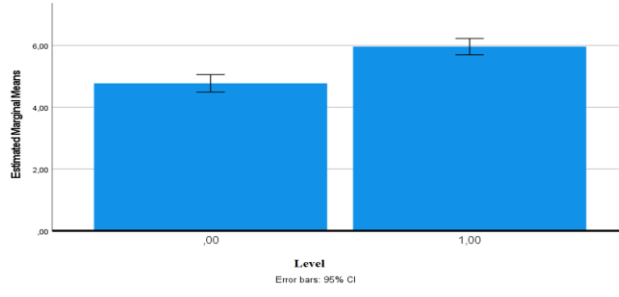

Figure 4. Estimated Marginal Means of Strategy Imagery Abilities

The lowest arithmetic means for the high physical self-efficacy group (M=5.82, SD=0.16) and low self-efficacy group (M=4.78, SD=0.17) are in strategy imagery abilities (Fig. 5.).

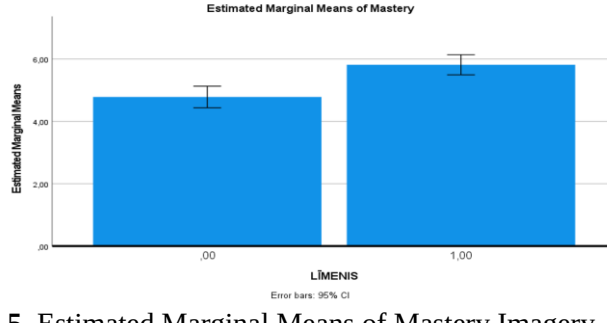

Figure 5. Estimated Marginal Means of Mastery Imagery Abilities

To test the reliability and validity of the results obtained, a two-level (high-level versus low level self-efficacy) MANOVA (multivariate analysis of variance) was performed using SIAQ scales as dependent variables. Based on obtained results from MANOVA, it was concluded that there is a significant multivariate effect between the level of self-efficacy and imagery abilities of athletes. According to ***Hotellings T2*** (0.863) =8.93 ($p<0.01$), the arithmetic means values of the groups differed significantly and this confirms that the differences between the groups are statistically significant. To determine how a dependent variable differs from independent variables, the Test of Between-Subjects Effect must also be considered. The obtained results show that the level of physical self-efficacy has a statistically significant effect on skill imagery ($F (1.67) =22.23$; $p<0.01$), strategy imagery ($F (1.67) =37.48$; $p<0.01$), goal imagery ($F (1.67) =22.62$; $p<0.01$), affect imagery ($F (1.67) =22.05$; $p<0.01$) and mastery imagery ($F (1.67) = 19.09$; $p<0.01$) abilities. This means that athletes with higher physical self-efficacy use different imagery abilities to achieve higher results.

Discussion

The results of the present study indicate that athletes who have higher physical self-efficacy use all imagery abilities more than athletes who have lower physical self-efficacy level. These findings are consistent with previous research (Munro-Chandler, Hall, & Fishburne, 2008). There is a statistically significant correlation between physical self-efficacy and imagery abilities ($p<0.01$). Athletes with a higher level of physical self-efficacy also have higher levels of imagery abilities. The level of physical self-efficacy interacts with skill ($F=22.23$; $p<0.01$), strategy ($F=36.48$; $p<0.01$), goal ($F=22.67$; $p<0.01$), affect ($F=22.05$; $p<0.01$) and mastery ($F=19.09$; $p<0.01$) imagery abilities. From obtained results shows that athletes with higher physical self-efficacy use different imagery abilities to achieve higher results.

Previous studies have repeatedly confirmed that imagery influences the physical self-efficacy of athletes (Callow, et al., 2017; Williams, Cumming, & Balanos, 2010). There is an obvious and undeniable relationship between imagery and physical self-efficacy in sport. Well-developed imagery can help athletes to promote their physical self-efficacy, and in turn, high physical self-efficacy helps athletes to create effective imagery scenarios. An essential precondition for imagery and physical self-efficacy is self-confidence and confidence in one's ability to perform specific tasks.

Conclusions

The present study confirms that there is a relationship between imagery abilities and physical self-efficacy in sport. This relationship has important implications for athletes, sport psychologists and coaches. Imagery can influence athlete's self-efficacy.

The athletes in the present study reported higher scores in affect, skill and goal imagery abilities and lower scores in strategy and mastery imagery abilities.

From obtained data, it can be concluded that the group of athletes with high physical self-efficiency has much higher scores in all imagery scales than the group of athletes with low physical self-efficiency. Athletes with higher self-efficiency levels use different imagery abilities to achieve higher sports results.

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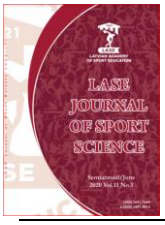

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ORIGINAL RESEARCH PAPER

THE EFFECT OF PERCEIVED AUTONOMY SUPPORT FROM THE COACH AND EGO- AND TASK-INVOLVEMENT UPON EGO AND TASK ENVIRONMENTS IN JUNIOR ELITE ICE HOCKEY

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Abstract

Based on the self-determination and achievement goal theory, we have investigated the effect of autonomy support from the coach and task-oriented and ego-oriented athletes on a task versus an ego environment. We expected a positive relationship between perceived autonomy support from the coach together with task involvement from the athletes on a task environment. Furthermore, we expected a negative relationship between task environment and ego-involved athletes and a negative relationship between perceived autonomy support from the coach and an ego environment. Among ego-involved athletes we expected a positive relationship with an ego environment and a negative relationship between task-involved athletes and an ego environment. Participants consisted of 401 young Norwegian ice hockey players aged 14 – 18 years. We used three different questionnaires to measure perceived coach autonomy support, task- and ego-orientation in sport and perceived motivational climate in sport. We conducted two regression analyses, one with task environment and one with ego environment as the dependent variable. The independent variables were perceived autonomy support from the coach and task- and ego-involvement. We conclude that a task environment derives from perceived autonomy support from the coach and task-oriented athletes. An ego-oriented environment, on the other hand, is created when there is a lack of autonomy support from the coach and ego-involved athletes.

Key words: *autonomy support, task environment, ego environment, task involvement, ego involvement*

Introduction

For most participants in sport, their participation in sport is intrinsically motivated. People participate in sport due to intrinsic motives, such as enjoyment and interest, more often than due to extrinsic goals (Ryan & Deci, 2017), whereas exercisers are more likely to have extrinsic motives, such as improving their appearance. Contexts that foster autonomy and perceived competence enhance enjoyment and sustain motivation (Hancox et al., 2018). Sustained exercise is more likely to occur when a person has well-internalised extrinsic motivation and intrinsic motivation both (Vlachopoulos et al., 2011).

Optimal motivational function is achieved through the satisfaction of a person's needs for autonomy, competence, and relatedness. Cognitive evaluation theory describes the environmental contingencies that lead to the adoption of intrinsically or extrinsically motivated behaviours. Organismic integration theory identifies the quality of motivation on a scale of perceived locus of causality. These causalities are ranked from highly autonomous to highly controlling (Ryan & Deci, 2017).

In Vallerand's (2007) hierarchical model of intrinsic and extrinsic motivation, Vallerand claims that different motivations exist on three levels of generality: global, contextual, and situational. These social factors are mediated by perceptions of self-determination, competence, and relatedness, which lead to different types of motivation (intrinsic motivation, extrinsic motivation and amotivation). The consequences are global, contextual, or situational in respect of affect, cognition, and behaviour. Participation in sport is at the contextual level.

Intrinsically motivated behaviour includes activities people engage in only for enjoyment, pleasure and fun, where no rewards or discernible reinforcements are involved (Hagger & Chatzisarantis, 2008). Those who adopt a controlling style are characterised as having a highly directive style of interaction (Mageau & Vallerand, 2003). Perceived autonomy support from friends is positively associated with identified regulation and intrinsic motivation (Wilson & Rodgers, 2004). Perceived autonomy support from exercise instructors positively predicts relatedness, autonomy, competence need satisfaction and intrinsic motivation (Chu & Zhang, 2019; Chu et al., 2021). Research has demonstrated the value of perceived autonomy support from the coach and a task-involving climate for predicting intrinsic motivation in athletes (Jöesaar et al., 2012). The study by Jöesaar et al. (2012) suggests that perceived autonomy support from the coach can facilitate the development of a task-involving peer motivational climate in the future.

Satisfaction of psychological needs is positively correlated with identified and introjected regulation and intrinsic motivation (Stanley et al., 2012). In terms of competence satisfaction, introjected and identified regulation can positively predict strenuous exercise behaviour, whereas external regulation is more a negative predictor of strenuous exercise behaviour. Competence satisfaction also has both direct and indirect effects on behavioural investment (Chu et al., 2021).

People are driven to achieve for different reasons. According to achievement goal theory, the reasons why they strive to achieve pertain to the standards by which they judge their own competence (Dweck & Leggett, 1988). They orient themselves towards meeting these competence standards. If people endorse mastery goals, then they are concerned with learning, growth or understanding. In a sense, they are immersed in the achievement task itself and preoccupied with their own expertise in the domain. If they endorse performance goals, they are concerned with achievement in relation to others or with how competent they appear to others (Kaplan et al., 2002). Task orientation focuses on self-referenced mastery or improvement in relation to one's own standards. Success is perceived as occurring when learning, improvement and mastery are achieved. Ego-oriented athletes are concerned with gaining positive judgements from others and compare their performance to that of competitors (Duda & Balaguer, 2007) Achievement goal theory assumes that goal orientations are not bi-polar opposites of the same construct but, rather, are independent of each other. This means that an individual can have both high and/or low levels of task orientation and ego orientation at any given time (Duda & Balaguer, 2007).

The achievement goal theory talks about ego- and task-oriented athletes. Ego-oriented athletes who rate their ability as inferior to that of competitors are vulnerable to somatic and cognitive anxiety before and during performance (Duda & Balaguer, 2007). Athletes are more likely to drop out of competitions, set standards for their performance that are unrealistically high or low and rate competitions or evaluations as unimportant if they have a low estimate of their ability and are ego-oriented (Duda & Balaguer, 2007). Ego-oriented athletes are often under pressure from coaches and parents to reach specific goals and worry about making mistakes. Task-oriented athletes may also set specific goals, but these goals conform to the athlete's own standards (Donovan & Williams, 2003). Athletes who are task-oriented are less vulnerable to somatic and cognitive anxiety. They have more control over factors that lead to failure and success, which contributes to heightened enjoyment and intrinsic interest in sport (Roberts et al., 2007). Many athletes have multiple goal orientations. Optimal performance may result from the endorsement of moderate to high

levels of ego orientation and task orientation (Burton et al., 2011). Top ten athletes in major track and field championships are often driven by both ego and task goals (Mallet & Hanrahan, 2004). A high level of task orientation may buffer the negative effects of a high level of ego orientation (Burton et al., 2011).

As was the case for task and ego orientations, achievement behaviour patterns can be explained by how participants view their ability. Participants in sport who are characterised by an entity view adopt an ego goal focus, where they see their ability as fixed and unable to be changed through effort, or an incremental focus, where they adopt a task goal perspective and believe they can change their ability through hard work and effort (Dweck, 2008).

Participants in physical activity who adopt an ego goal focus as described above have negative thoughts and feelings about themselves (Li & Lee, 2004). Entity beliefs are also associated with increased anxiety, whereas incremental beliefs are associated with lower anxiety. Athletes who feel their natural ability is evident in their high-level performance tend to adopt an incremental view of ability.

Elite British adolescent athletes with moderate ego/higher task goal orientation levels use more self-talk than do athletes with higher ego/lower task and moderate task/lower ego goal orientation levels (Harwood et al., 2003). Coaches create motivational climates that encourage the development of task and ego orientations. Task-oriented athletes are more likely to play for coaches who emphasise the mastery of enjoyment and skills. Effort results in success and improvement in task-involving climates. Ego-involving climates lead to unequal recognition of participants, intra-team rivalry and punishment for mistakes. Normative ability and deception are the most important factors in success (Vazou, 2010).

A study of young Japanese ice hockey players demonstrated that a task-involving climate created by coaches may influence not only players' task goal orientations but also their ego orientations. An ego-involving climate created by coaches may also influence players' ego goal orientations (Saotome et al., 2012).

Task-oriented environments are likely to provide athletes with positive emotional experiences. Ego-oriented climates evoke unpleasant emotional states. Ego-involving climates are also associated with negative personal development, which leads to strategies that are unproductive for enhancing skills, such as avoiding practice and claiming handicaps such as fatigue and lack of preparation (Chu & Zhang, 2019; Chu et al., 2021).

In these climates, young athletes worry about success and failure and are less content with team membership (Ntoumanis et al., 2012). A study of

Finnish junior ice hockey players found that a motivational climate emphasising effort, personal development and improvement and the achievement of goal-mastering tasks are significant for enjoyment in junior ice hockey (Jaakkola et al., 2015).

In this study we consider the effect that autonomy support from the coach and task- and ego-oriented athletes have on a task versus an ego environment. We expect a positive relationship between, on the one hand, perceived autonomy support from the coach together with tasked involvement from the athletes and, on the other, a task environment. We expect a negative relationship between a task environment and ego-involved athletes.

Conversely, we expect a negative relationship between perceived autonomy support from the coach and an ego environment. As regards ego-involved athletes, we expect a positive relationship with an ego environment. As regards task-involved athletes and an ego environment, we expect the relationship to be negative.

Material and Methods

In this study we will consider the relationship between perceived coach autonomy, motivation, task and ego orientation, and perceived motivational climate among young ice hockey players.

Participants. The participants comprised 401 young Norwegian ice hockey players 14 – 18 years of age, probably around one-third of the players in this age range. They were all voluntary participants in the Norwegian Ice Hockey federation talent camp. There was no selection of the players for the camp. They should therefore be representative of the whole population. Of the players, 49% were 15 or 16 years of age. There were 49 girls and 352 boys. Ninety-four of the players were in the Norwegian national U – 20 and U – 18 teams. All the players who were later selected to be part of the U – 16 team also participated. Only 59 players competed in another sport in addition to ice hockey. There were 59 goalkeepers, 127 defenders, 201 forwards and 19 players who were both forwards and defenders. We obtained parental consent for the participants to participate in the study. This study was approved in advance by the Norwegian Centre for research data NSD**.**

*Measures.*To examine the perceived coach autonomy support, we used the short version of the Sport Climate Questionnaire (SCQ) (Deci & Ryan, 2016) with six items (α=0.82) worded in terms of "my coach". They were answered in a Likert-type scale from 1 to 7 (1 = do not agree at all, 7 = completely agree). A high average score represented a high level of perceived autonomy support.

To measure the dispositional goal orientation, we used the Task and Ego Orientation in Sport Questionnaire (TEOSQ) (Duda & Hall, 1998). The TEOSQ has a two-factor structure representing task (7 items, $\alpha = 0.82$) and ego (6 items, $\alpha = 0.87$) orientations. As the questionnaire was administered in an ice hockey context, players were encouraged to think about how successful they felt in relation to their team. They then indicated on a five-point Likert-type scale (1 = strongly disagree, 5 = strongly agree) whether they agreed or disagreed with items reflecting a task orientation (e.g., "I feel successful when I work really hard") or an ego orientation (e.g., "I feel successful when others cannot do as well as me").

The Perceived Motivational Climate in Sport Questionnaire-2 (PMCSQ-2) was created to determine athletes' perceptions of goals operating in an athletic setting (Newton et al., 2000). The PMCSQ-2 has six subscales, which are transformed into two higher-order scales labelled as "task-involving" (17 items, $\alpha = 0.88$) (including cooperative learning $\alpha = 0.74$, important role $\alpha = 0.80$ and effort/improving $\alpha = 0.79$ scales) and "ego-involving" (16 items, $\alpha = 0.91$) (including punishment for mistakes $\alpha = 0.80$, unequal recognition $\alpha = 0.89$ and intrateam rivalry $\alpha = 0.54$). Confirmatory factor analysis revealed that the six-factor model is marginally acceptable (with an intrateam rivalry subscale of $\alpha = 0.54$ (Newton et al., 2000). To complete the PMCSQ-2, the players were asked to consider their participation in ice hockey and to indicate, using a five-point Likert-type scale (1 = strongly disagree, 5 = strongly agree), whether they agreed with claims reflecting a task-involving (e.g. "in my team, players are encouraged to work on weaknesses") or ego-involving (e.g. "in my team, players are encouraged to outdo their teammates") climate.

Statistical Analyses. IBM SPSS Statistics 26 was used for calculation. Descriptive statistics, means and standard deviations were obtained for all variables. Simple correlations were calculated to test relationships among all variables (Tables 1 and 2). We conducted a paired sample t-test to ascertain whether the differences between task and ego environment and between ego and task involvement were significant. We also conducted two regression analyses. The first model had task environment as the dependent variable and perceived autonomy support from the coach, task involvement and ego involvement as the independent variables. The second model had ego environment as the dependent variable and the same independent variables as the first model. We tested for correlations between residuals with the Durbin–Watson statistic. Collinearity diagnostics were conducted by using the variance inflation factor (VIF) (Hair et al., 2018).

Results

A high score was obtained for task environment (Table 1). The mean for ego environment is significantly lower (Table. 2). There is also a significant difference between ego involvement and task involvement. The mean for task involvement is not very high. We can also see that the mean for perceived autonomy from the coach is medium (4.19 out of 7). There is a significant (1%) positive relationship between task environment, perceived autonomy support from the coach and task involvement.

Table 1.

Correlations, means, standard deviations and Cronbach's alpha values between task environment, perceived autonomy support from the coach, and ego involvement and task involvement

1		2	3	4
Task environment				
Perceived autonomy support from the coach	.53**			
Ego involvement	-.07	.04		
Task involvement	.41**	.21**	.07	
N	372	381	391	377
Mean	4.19	4.73	3.01	2.73
Std	.54	1.35	.92	.81
α	.88	.87	.83	.90

** < 0.01

There is also a significant negative correlation between ego environment and perceived autonomy from the coach. Ego involvement shows a significant positive relationship with ego environment (Table 2).

Table 2.

Correlations, means, standard deviations and Cronbach's alpha values between ego environment, perceived autonomy support from the coach, and ego involvement and task involvement

	1	2	3	4
Ego environment				
Perceived autonomy support from the coach	-.39**			
Ego involvement	.31**	.,04		
Task involvement	-.05	.21**	.07	
N	377	381	391	377
Mean	2.73	4.73	3.01	2.73
Std	.81	1.35	.92	.81
α	.90	.87	.83	.90

** < 0.01

Perceived autonomy support from the coach as an independent variable account for 28% of the dependent variable of task environment (Table 3).

Table 3.

Regression analysis with task environment as the dependent variable, and perceived autonomy support from the coach and task involvement and ego involvement as the independent variables

Task environment			
Variable	Model 1 β	Model 2 β	Model 3 β
Perceived autonomy support from the coach	.53 **	.46**	.47**
Task involvement		.31**	.31**
Ego involvement			-.13**
R^2	.28	.37	.38
F	139.78**	104.39**	74.12**
Δ R^2		.09	.02
Δ F		49.87**	8.93**

** < 0.01

Task involvement from the athlete is positively related to the dependent variable, accounting for 9% of the dependent variable. Ego involvement also accounts for 2% of the dependent variable. The relationship with task environment is negative.

Table 4.

Regression analysis with ego environment as the dependent variable and perceived autonomy support from the coach and task involvement and ego involvement as the independent variables

Ego environment			
Variable	Model 1 β	Model 2 β	Model 3 β
Perceived autonomy support from the coach	-.41**	-.42**	-.43**
Task involvement		.04	.02
Ego involvement			.32**
R^2	.16	.16	.27
F	71.79**	36.19**	44.59**
Δ R^2		.00	.10
Δ F		.66	51.31**

** < 0.01

Ego environment as a dependent variable is explained only by a negative relationship with perceived autonomy support from the coach (16%) and by a positive relationship with ego involvement (10%) (Table 4).

Discussion

Scientific literature has shown that perceived autonomy support from exercise instructors positively predicts relatedness, autonomy, competence need satisfaction and intrinsic motivation (Chu & Zhang, 2019; Chu et al., 2021). The values for perceived autonomy support from the coach and task-involving climate predict intrinsic motivation in athletes (Jöesaar et al., 2012). Perceived autonomy support from the coach can also facilitate a task-

involving peer motivational climate in the future. Task-oriented environments are likely to provide athletes with positive emotional experiences. Ego-oriented climates evoke unpleasant emotional states (Chu & Zhang, 2019; Chu et al., 2021).

We hypothesised that there would be a positive relationship between perceived autonomy support from the coach together with task involvement from the athletes on a task environment. We also expected a negative relationship between a task environment and ego-involved athletes. As this relates to our reported findings, this hypothesis has been fulfilled, as we have been able to demonstrate that perceived autonomy support from the coach and task-involved athletes have a positive effect on the dependent variable of task environment and a negative relationship with ego involvement.

Our second hypothesis is not fulfilled, as we found a negative relationship between perceived autonomy from the coach and the dependent variable of ego environment. Among ego-involved athletes, we found a positive relationship with ego environment, as expected. Task-involved athletes did not demonstrate a relationship with ego environment, where we had expected a negative relationship.

The results of the study underscore the importance of supporting athlete autonomy to create a task environment. They also emphasise the importance to of creating tasked-involved athletes in junior ice hockey.

We have seen that ego-oriented athletes who rate their ability as inferior are vulnerable to somatic and cognitive anxiety before and during performance (Duda & Balaguer, 2007). They are also more likely to set standards for their performance that are unrealistically high or low and to drop out of sport (Duda & Balaguer, 2007). Ego-oriented athletes are often under pressure from coaches and are worried about making mistakes. Task-oriented athletes more often set goals which conform to the athlete's own standards (Donovan & Williams, 2003). Athletes who are task-oriented have more control over factors that lead to failure and success and are less vulnerable to somatic and cognitive anxiety. They also have heightened enjoyment of and intrinsic interest in sport (Roberts et al., 2007)

We have also seen that coaches can create motivational climates that encourage the development of task and ego orientations. Coaches who emphasise the mastery of enjoyment and skills create task-oriented athletes. The improvement of task-involving climates leads to athletes who improve. Ego-involving climates cause intra-team rivalry and unequal recognition (Vazou, 2010). Task-involving climates created by coaches may influence not only players' task goal orientations but also their ego orientations (Saotome et al., 2012).

Autonomy support from the coach leads to more intrinsically motivated athletes. Intrinsic motivation leads to more sustained practice from the athletes and less drop out from sport.

A limitation of the study is the impossibility of establishing cause-effect relations to determine the effect that the application of different strategies may have on the variables in the study.

Conclusion

Based on the self-determination and achievement goal theory, it was concluded that task environment derives from perceived autonomy support from the coach and task-oriented athletes. An ego-oriented environment, on the other hand, is created when there is a lack of autonomy support from the coach and ego-involved athletes. The importance of training junior ice hockey coaches to create a task environment and give autonomy support to players is emphasised, as this will lead to more intrinsically motivated players and, hopefully, a longer career for the players in ice hockey.

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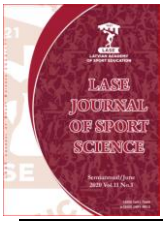

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ORIGINAL RESEARCH PAPER

KNEE ANTERIOR CRUCIATE LIGAMENT INJURY IN SPORTS

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Abstract

Anterior cruciate ligament (ACL) tears are very common in sports, and accounts for a great number of athletic knee injuries. The injury rate is increasing from year to year, creating a long period of inactivity for athletes. It can be career ending and "return to sport" period takes almost a year. Purpose:The purpose is to overview the latest information about the most common ACL injury mechanisms in sports, the biomechanical and other risk factors that can increase the risk of ACL injury, and to review what does "return to sport" exactly mean and to summarize the best preventive measures. Methods: This systemic review was performed using PubMed search engine by searching specific keywords about ACL injury and team sports, the scientific articles were published from January 2015 to August 2021. Non-English articles were excluded. Results: A total of 25 sources and 2 books were included, summarized, and divided into 4 topics: anatomy, epidemiology (subdivided into injury mechanism, biomechanical and other risk factors), "return to sport" (RTS) and prevention. It was found that most often the injury mechanism is "non-contact", occurs more during competition compared to practice, female athletes are at greater risk and that RTS criteria must be assessed individually. Conclusion: The best preventive measures include improving the technique of sports specific athletic movements (jumps, landing & cutting motions), involving proprioceptive & neuromuscular training exercises and by strengthening muscles of the leg.

Keywords: *anterior cruciate ligament, injury, team sports, return to sport*

Introduction

Anterior cruciate ligament (ACL) injuries are one of the most common injuries in musculoskeletal system in physically active individuals and can happen to anyone – young or old, male or female, professional or amateur. It is a debilitating injury, with a long "*return to sport*" period and sometimes even can end the professional career of an athlete (Grassi et al., 2020). Alarmingly the number of ACL injuries in paediatric setting is rising and that is a significant concern, especially for children involved in various athletic programs and that has been found to be true worldwide. (Werner et al., 2016; Shaw & Finch, 2017; Weitz et al., 2020). In sports, especially pivoting sports, the ACL is exposed to huge amount of stress – jumping, landing, cutting motions, changes of direction, sudden deceleration, and other specific movements, dramatically increase the load on the knee joint, therefore the injury rate is quite high, and the risk of re-injury remains, especially after returning to sport. In the past decade there is a rise in ACL research, main topic undoubtably being ACL reconstruction (ACLR) and different kinds of grafts to choose from for the ACLR (Herzog et al., 2018). Other less popular topics include reviews of the injury mechanism, where video analysis has proven to be more advantageous in complex situations, compared to cadaver and MRI analysis (Waldén et al., 2016). Treatment can be non-operative or operative, depending on the individual situation of the athlete, his or her goals and the main activities, with the surgical treatment considered to be more favourable (Paschos & Howell, 2016). It is estimated that about 200'000 ACL reconstructions (ACLR) are done annually in the United States (Kaeding et al., 2015), some sources estimating even close to 350'000 ACLR in the US and a 1-2 million worldwide (Davies et al., 2017), and from 2002 to 2014 the number of surgeries in the USA had increased by 22% (Herzog et al., 2018). Despite that it has been reported that surgical treatment has good outcomes, the injury increases the risk of other injuries, like meniscal tears and is linked to early-onset osteoarthritis. Injury can also affect long term health of the knee joint and the quality of life for the individual affected by the ACL injury (Davies et al., 2017). It is not uncommon to get reinjured, tearing an ACL graft or injuring the ACL of the contralateral knee, which may be devastating to the athlete (Kaeding et al., 2015). The aim of this review is to gather the latest information on ACL anatomy and epidemiology, overview the criteria for "*return to sport*" and to summarize the best preventive measures available to date.

Material and Methods

A systemic review was performed on ACL-related scientific articles published between January 2015 and August 2021. The main search engine

used was PubMed, the search terms were *anterior cruciate ligament* or *ACL* in combination with *injury*, *sports*, *team sports* or *return to sport (play)*. Research studies and articles were included based on their compatibility with the 4 chosen topics: *anatomy*, *epidemiology*, *return to sport (RTS)* and *prevention*. Only those articles with quantitative research design type and that matched at least 2 of the chosen topics were included. Automatically excluded were those articles not published in English.

Results

Author chose to include only the newest and most related information, from 25 sources and 2 books, that were found using PubMed search engine. Author reviewed and summarized these articles into 4 topics, that were chosen beforehand.

Anatomy:The knee joint, although more complex, is categorized as hinge joint. Three bones articulate in it, creating two separate joints – tibiofemoral and patella-femoral joint, between the tibia and the femur, and between the patella (kneecap) and the femur. The knee joint is enclosed in an articular capsule, creating a cavity that is filled with synovial fluid. Two fibrocartilaginous discs, called menisci, are located above the lateral and medial condyles of tibia, improving the femoral-tibial congruence. The menisci also cushion the compressive force and increase the stability of the knee joint (Affatato, 2015). There are six ligaments that provide stability and anterior cruciate ligament is one of those, primarily preventing hyperextension of the knee joint, by restricting anterior sliding of the tibia. Other intra-articular ligaments are posterior cruciate ligament and transverse ligament, that connect both menisci. Two collateral ligaments, that are extra-articular, on medial and lateral side, prevent abnormal movement in the varum–valgum direction (Fig. 1.)

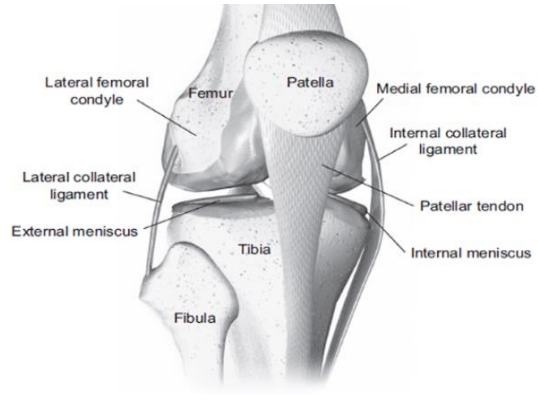


Figure 1. The skeletal anatomy of the knee joint, with the soft tissues, except ACL and PCL (Affatato, 2015)

The knee joint has a wide range of motion together with high resistance to external stress, but the centre of rotation is not fixed during the flexion/extension movement. Due to the complexity, all three anatomical planes should be reviewed and a six degrees of freedom (DoF) system of movement used, including three rotations and three translations, that are restricted by the fibrous capsule, ligaments, and muscles (Fig. 2.)

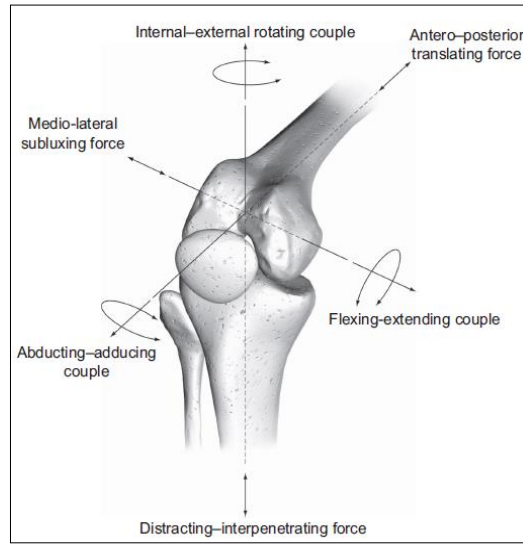


Figure 2. Six DoFs of movement: three rotations and three translations (Affatato, 2015)

The mechanism of knee flexion also implies a combined movement of rolling and sliding of the femoral condyles over the tibial plate, also called *rollback*, allowing a wide rotation on the sagittal plane. Interestingly, a phenomenon called "*screwhome*", means that the rotation depends on the degree of flexion, and in fact during flexion the femoral condyles rotate internally, but in full extension of the knee, an external rotation can be observed (Affatato, 2015).The anterior cruciate ligament (ACL) is a bit triangular, about 30 mm in length (+/- 5mm), 10 mm in breadth and about 5 to 10 mm in width, depending on the individual and it is much thinner in the middle section, compared to the part attached to the bone (Marieswaran et al., 2018). The ACL consists of two functional bundles – anterior medial bundle (AMB) and posterior lateral bundle (PLB), working synergistically and providing stability in the event of complex loads. It is found that PLB is responsible mainly in rotation and in anterior-posterior laxity control (Musahl et al., 2017). Sonnery-Cottet & Colombet, (2016) illustrates the behaviour of these functional bundles during the flexion of knee joint in Figure 3.

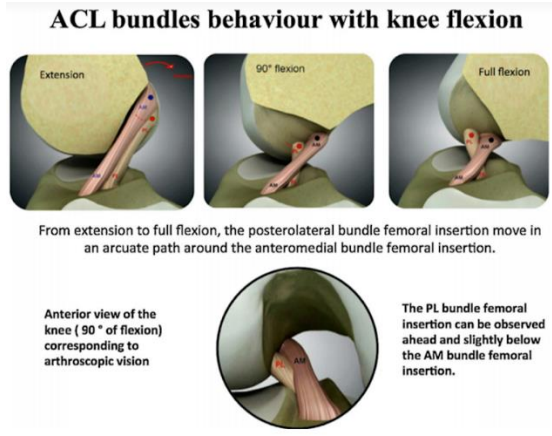


Figure 3. Role of AM and PL bundles during knee flexion

Marieswaran et al., (2018) in their research also compare the anatomical differences between ligaments and tendons, showing the comparison of tensile strength of ACL and patellar tendon provided in Figure 4.

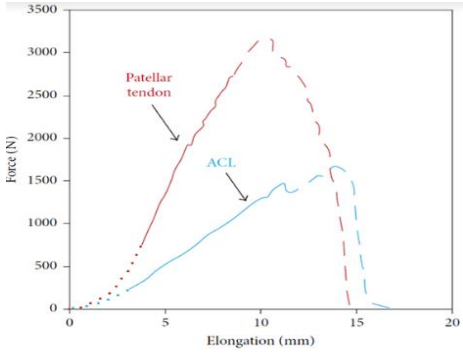


Figure 4. Tensile strength of ACL and the patellar tendon. The dotted lines represent the toe region, continuous lines represent the linear region, and dashed/broken lines represent the field region

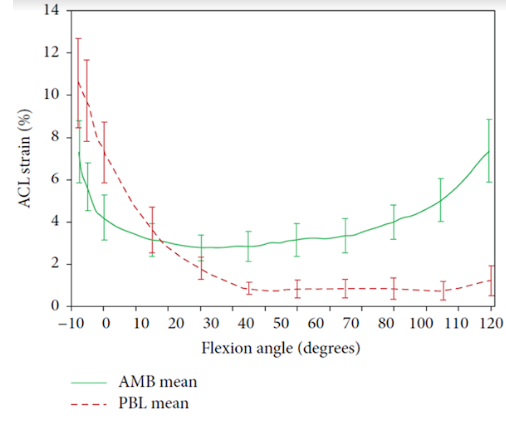


Figure 5. Average strain in AMB and PLB as a function of knee flexion angle; as shown in the figure, AMB is under tension during the extension at the knee joint and PLB is under tension during flexion

Also showing the average strain of AMB and PLB as a function of knee flexion angle provided in Figure 5.

For better understanding of biomechanical factors that can lead to an ACL injury of the knee, it is worth looking at the forces that act on the knee joint, that have been analysed using simulated models on various phases of

gait and has helped to calculate the forces acting on ACL (Marieswaran et al., 2018), shown in Figure 6.

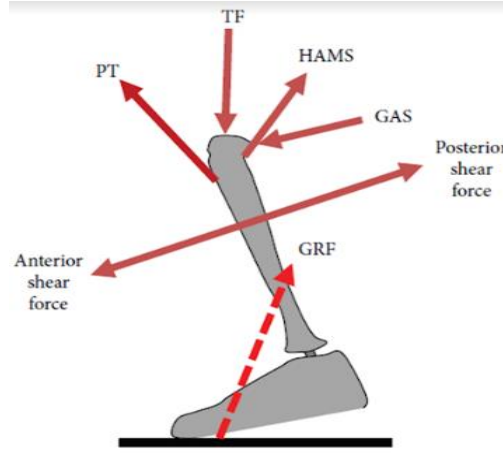


Figure 6. Forces acting on the knee joint. TF: Tibiofemoral force; PT: patellar tendon force; HAMS: hamstring muscle force; GAS: gastrocnemius muscle force; GRF: ground reaction force

Epidemiology: In Italy from 2001 to 2015 analysing past surgeries the conclusion was that ACL surgery count increased each year from ~10'500 to 17'500, respectively, and interestingly 67% of surgeries were performed in North Regional hospitals (Longo UG et al, 2021). Weitz et al., (2020) concluded that the incidence of paediatric ACL injury is increasing and has been steadily growing since 1997 till 2014 in Finland. The increasing incidence is mentioned in many of articles reviewed, some suggesting that it may be due to increased involvement in high school sports activities in paediatric setting and overall increase of people doing more sports in all levels of competition (Kaeding et al., 2017). The incidence rate of ACL injury differs from sport to sport but interestingly with a common conclusion that during competition there is a much higher risk. Kobayashi et al., (2010) overviewed more than 1,700 athletes, and found that ACL injury occurs 49.8% during competition and 34.8% was during practice. Sandon et al., (2021) reported data from 2875 players, and found that 66% of injuries happen during the game, opposite of 28% during practice and Waldén et al., (2016) found that the soccer match injury rate was 20 times higher than the practice injury rate. Grassi et al., (2020) also found that the risk during Series A soccer match is 14 times higher than the injury rate during practice. *Injury mechanism.* In sports it is more common to have an "non-contact" injury than "direct contact", although it does not apply to every type of sport, for example, in a recent research it was found that 99% of ACL

injuries in Judo happen in "direct contact" way (Takahashi et al., 2019). Authors also found that in team sports (e.g., basketball, volleyball & handball) non-contact injury was the more common cause, respectively 67%, 86,5% and 68,5%, especially in female soccer and basketball non-contact injuries were as high as 72.2% and 76.7%. Sandon et al., (2021) reported that in 59% of cases of 2875 soccer players, the injury mechanism was also "non-contact" and Kobayashi et al., (2010) report of 1700 athletes of different sports, also the "non-contact" mechanism was found in 60% of the cases. In a systemic video analysis, it was reported that 85% of professional soccer players had suffered a "non-contact" injury, of which most playing situations were pressing, re-gaining balance after kicking and landing after header, and interestingly that most were while defending and half of the time the players did not have the control of the ball (Waldén et al., 2015). Nevertheless, Parsons et al., (2021) reported that "direct contact" injury rates are higher in boys and men, compared to girls and women, which may be partially explained by participation in different types of sports.

Gender as a risk factor. The higher incidence rate of ACL injury among female athletes has been reported in many articles, with numbers ranging from 1.7- to 2- and even 4- times higher rate than male athletes. Explanations suggested that it may be due to female athletes having a greater exposure in sports or that female athletes may have different muscle group dominance, that joint stability relies more on ligaments than muscle and that there could be an altered neuromuscular control of the trunk compared with male athletes. (Britt et al., 2020; Herzog et al., 2018; Montalvo et al., 2019; Sandon et al., 2021)

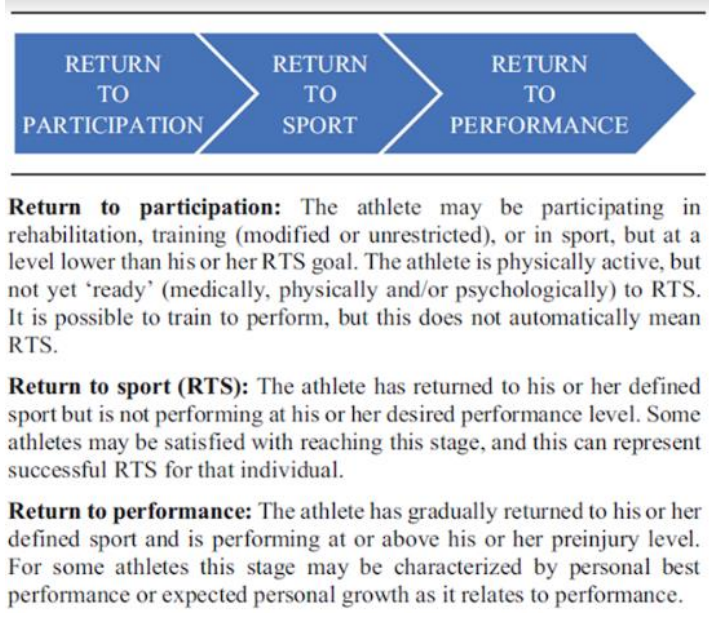
Biomechanical factors. Waldén et al., (2015) found that knee valgus in combination with external rotation was present in most of the cases, but a dynamic valgus collapse was observed in only a few cases. Kobayashi et al., (2010) also reported a dynamic position at the time of injury of 1,603 athletes and it was found that of 793 cases (49.5%) the knee was in internal-external rotation, but the knee in external-internal rotation, was present in 142 cases (8.9%), while hyperextension was reported in 97 (6.1%) cases. Parsons et al., (2021) in their review show a possible categorisation of intrinsic and extrinsic risk factors for "non-contact" ACL injury and one of the factors is also dynamic knee valgus. Shown in Table 1.

Table 1.
Categorization of intrinsic (I) and extrinsic (E) risk factors for "non-contact" ACL injury

Modifiable risk factors	***Non-modifiable risk faktors***
Environmental	***Environmental***
Meteorological condition (E)	Playing situation (E)
Playing surface (E)	Opponent behavior (E)
Rules (E)	Unanticipated events during play (E)
Referees (E)	***Anatomical***
Coaching (E)	Q angle (I)
Equipment	Navicultural drop (I)
Footwear (E)	Structural knee valgus (I)
Knee braces (E)	Postural alignment (I)
Anatomical	Notch size, ACL geometry and propertie (I)
Foot pronation (I)	Tibial slope angle (I)
Body composition and body mass index (I)	Generalised joint hypermobility or laxity (I)
Neuromuscular	***Hormonal***
Dynamic knee valgus (I)	Menestrual phases (I)
Muscle strength (I)	Hormone concentrations (I)
Muscle strength ratios (I)	***Demographic***
Muscle activatin patterns (I)	*Age (I)*
Muscle stiffness (I)	Maturation (I)
Physical fitness and muscle fatigue (I)	Previous contralateral knee ACL injury (I)
Skill level (I)	Familial history and genetics (I)
Neurormuscular contrl (I)	Sex (I)
Proprioception (I)	Height (I)
Psyhological (I)	Race (I)
Personality (I)	Sport played (I)
Stress response (I)	

Return to sport (play). Recovery from the ACL injury has many options and depending on situations it can be operative or non-operative treatment. Both treatment options are acceptable and must be assessed individually. It is worth pointing out that operative treatment is preferred in sports with jumping, cutting and pivoting movements (e.g., soccer, basketball, handball, football) and without operative treatment there is a higher risk for secondary injury. If the individual is involved in straight plane activities (e.g., running, swimming, cycling, weightlifting) than non-operative treatment is an acceptable option. Sometimes progressive rehabilitation before the operative treatment may be offered, to improve impairments and overall function. (The Panther Symposium ACL Treatment Consensus Group et al., 2020). The "*return to sport*" (RTS) commonly is used as a measure for assessment of outcomes after an injury, and Ardern et al., (2016) already purposed to use RTS continuum comprising three elements: "return to participation", "return to sport" and "return to performance" (summarized in Figure 6.). This definition of elements allows

to clearer describe the recovery process of an athlete and components like performance and involvement in competition.



6. Figure Three elements or "return to sport" (RTS) continuum

Grassi et al, (2020) found that average time lost for a professional soccer player is 9 to 12 months and only about 65% of injured players return at the same playing level 3 years post injury. From 71 female soccer players with ACL injury, it was found that only 37% returned to the preoperative level of play, but 66% return to playing soccer at any level (Britt et al., 2020). Although, Lai et al., (2018) showed that in elite athletes average period of "*return to sport*" (RTS) was 6 to 13 months and 83% of athletes did RTS, with elite soccer player rate of 85% and elite basketball player rate of 83%. Similar rate was found in NBA basketball players, 84%, but interestingly only 66.7% of athletes with right leg ACL injury returned, compared to the left leg injury where all of the athletes returned (DeFroda et al., 2021). To assess outcome parameters and establish criteria for "*return to sports*", the First Congress in Sports Physical Therapy outlines five specific recommendations to guide the practitioner when deciding to clear an individual for RTS (Ardern et al., 2016), grouped together as follows:

1. Use a group of tests (aka: a test battery).
2. Choose open tasks (less controlled) over closed tasks (more controlled) when possible.
3. Include tests with reactive decision-making elements.

4. Assess psychological readiness to RTS.
5. Monitor workload throughout the RTS transition.

Even though, every sport is unique and specific "return to sport" criteria must be determined individually. With many similarities between athletes and specific sport elements, such as jumping, landing, cutting, rapid acceleration or deceleration, there is a proposition to include extrinsic criteria to assess "return to sport" readiness (Unverzagt et al., 2021). Criteria summerized in Table 2.

Table 2.

Extrinsic Criterion Used to Assess Return to sport Readiness*

Extrinsic Criterion	*Means of Measuring*
Range of motion	Hip, kneed ankel (tibial shaft angle)
Neuromuscular control	Functional movement Screen Y-Balance Test, Single leg squat, Tuck Jump Assessment, Landing Error Scoring System
Strength	Isokinetic testing time to peak torque, peak torque
Power	Hop testing: Anterior hop, triple hop, triple crossomer hop, timed hop, hop & stop
Agility and cutting	Tranzer lateral agility screen, Trazer Flanker test, reactive agility test
Psychologic readiness	ACL-Return to Sport After Injury, 2000 IKDC Questionnaire**

*Means of measuring should be left to the discretion of the evaluating facility
** IKDC: Internatinal knee Documentation Committee

Prevention. Neuromuscular and proprioceptive training appears to be supported in literature as the main preventive measures and have been found to decrease the incidence of injury to the knee and specifically the ACL, however no specific group of exercises were determined to be better than others (International Olympic Committee Pediatric ACL Injury Consensus Group et al., 2018; Sandon et al., 2021). The components of neuromuscular-control and proprioception include balance training, plyometric (jump) training, strength and resistance training, running-technique training (combined technique training and running exercises [e.g., shuttle run, bounding run]), and stretching (Dargo et al., 2017; Shaw & Finch, 2017). There are many preventive programs that are developed for ACL injury prevention, but the injury rate is still increasing and the disparity between men and women have not change for the last 20 years. The involvement in these programs seem to decrease the "non-contact" ACL injuries but must be delivered in structured and supervised manner (Parsons et al., 2021).

Discussion

The author of this review agrees that the ACL injury of the knee in is a widely researched topic, that is not yet fully understood, and the injury incidence rate still increases, partly due to increasing activity and

involvement in sports by the youth (Kaeding et al., 2017; Weitz et al., 2020). This review also supports previously suggested higher ACL injury risk for women, compared to men and unfortunately the disparity of men and women sustaining ACL injury has not change for the last two decades, with only recently being addressed as a serious issue (Parsons et al., 2021). This review also agrees with previously made suggestions that the "non-contact" injury mechanism is more common in sports but found some situations where "direct contact" is more common (Kobayashi et al., 2010; Sandon et al., 2021; Takahashi et al., 2019; Waldén et al., 2015). Nevertheless, author agrees that the role of opponent or teammate in the sudden change of movement right before the injury happens, must be considered in team sports (Waldén et al., 2016). The review suggests using the RTS three element continuum provided be (Ardern et al., 2016) to better evaluate the recovery process of an athlete and other components associated with it, despite that Davies et al., (2017) argues that, there is no standardized definition for what exactly "*return to sports*" (RTS) mean, in the sense of the playing level that the athlete returns. Suggestion is to use the full continuum and explain RTS term in context with other elements. For better outcome results after the ACL injury and to reduce the possibility of reinjury, author agrees that five RTS recommendations and criteria must be used and assessed individually, preferably done 9 months post-surgery (Ardern et al., 2016; Kaplan & Witvrouw, 2019; Unverzagt et al., 2021). This review also describes preventive measures that may decrease the risk of ACL injury, including neuromuscular and proprioceptive training, as well as modulating game-like situations and incorporating jumping, landing, cutting and pivoting movement exercises into each practice session that have been previously proved to be successful (Dargo et al., 2017; Shaw & Finch, 2017). Parsons et al., (2021) argues that none of the programs have considered different approach regarding gender of the athlete, and preventive programs that include strength training, as well as resistance training, in which women participate less frequent than men, as it may be to masculine, could be one of the reasons why women have higher risk of ACL injury. Thus, there is need for research on optimizing preventive measures and improving "return to sport" outcomes. This review is not without limitations and multiple factors must be considered. Firstly, the search was done only in PubMed database, meaning that there could be a lot more relevant articles if other databases were used. Secondly, this review did not analyse the number of people included in research studies, although the number was mentioned for some studies, nor did it analyse the quality of the selected studies. Despite these limiting factors, the aim of the research was obtained and provides a theoretical knowledge about ACL injuries in sport

and demonstrates a practical value as well for some specialists. Finally, it is worth mentioning that all recommendations in this review should be approached and interpreted with caution.

Conclusion

The ACL injury in sports is very common and can happen to anyone at any age and level of competition. Female athletes are undoubtedly at a greater risk of ACL injury, due to various factors, ranging from biological differences to participating in sports more. Injury mechanism in most cases is "non-contact", with some exceptions were "direct contact" is more common. Another interesting finding is that higher incidence rate is during competition versus training, meaning that not only biological factors play a role in athlete's that sustain ACL injury or re-injury. There is a proposed "return to sport" (RTS) continuum with three elements, that should be used to clearer describe the recovery process of an athlete. Although, there is no one-size-fits-all injury prevention, programs that include neuromuscular-control and proprioceptive training, decrease the incidence of the ACL injury and other knee injuries. Therefore, trainers should consider including these elements, and even can select individual components that they believe are most appropriate for the athlete, regardless the sex or the sport.

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ORIGINAL RESEARCH PAPER

THE EFFECT OF A SINGLE COLLAR ZONE MASSAGE ON SHORT-TERM MEMORY IN PEOPLE OF WORKING AGE

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Abstract

Cervical discomfort affects cognitive function. About 31.9% of people aged 15 to 74 in Latvia experience daily back and shoulder pain that negatively affects their ability to work as well as the productivity of work. Massage is capable to reduce mental fatigue and improve cognitive function. Therefore, the aim of this pilot study was to research the effect of a single massage of the collar zone on the short-term memory of participants of working-age. Materials and methods. A mixed-method research study was used. Research tools: structured interview and short-term memory tests (hearing, vision, combined - hearing and vision, combined - hearing, vision, and motor). The following participants for the study were selected: 30 adults (15 women and 15 men) of working age. The massage of the collar zone lasted 20 minutes. Results. The obtained results show that the short-term memory efficiency coefficient of the study group before the massage fluctuated from 16 to 38, mean (M)=22.5, standard deviation (SD)=5.2, but after the massage, it amounted to 15 to 42, M=23.1, SD=5.8. The differences in the short-term memory efficiency factor before and after the massage were analyzed applying the normal distribution. The average value position was expressed towards the positive direction. Conclusions: massage can be used as one of the tools to boost short-term memory, on the precondition that further research is to determine a more accurate profile of a participant.

Keywords: *short-term memory, memory tests, massage, working-age population.*

Introduction

Approximately 65% of people aged 15 to 74 in Latvia suffer from back pain daily. 31.9% of them have back pain and shoulder pain (Health Behavior among Latvian Adult Population, 2018). The pain tends to manifest not only as physical discomfort it also affects sleep quality, cognitive function, and mood negatively, as well as increases blood pressure and stress level. Nowadays, one of the main widespread factors causing neck and shoulder tension is the excessive use of smart devices. The use of smartphones has a significant effect on the performance of short-term memory. Adverse effects are observed as early as after five minutes that a person spends working on his or her smartphone (Kalafatakis et al., 2017).

A person's cognitive abilities decrease with age. As we age, memory is the cognitive skill that deteriorates most rapidly (Kim et al., 2013). Lack of sleep is also known to adversely affect short-term memory. It must be noted that brain metabolic activity is significantly reduced by lack of sleep and a person's cognitive abilities, including short-term memory, are reduced by neuronal dysfunction (Chraif, 2012). Furthermore, short-term memory is also affected by fatigue. Therefore, to give the brain time to process information, build memory and store it, it is crucial to have proper rest. A study on the association of sleep deprivation with a synaptic function that was carried out in 2019 shows significant impairment in learning and concentration caused by the inability of the brain to process information (Cirelli & Tononi, 2019). Lack of oxygen in the blood and brain has an adverse effect on short-term memory (Joo, 2010). Thus, as the oxygen concentration in the blood increases it has a positive effect on a person's cognitive abilities, including short-term memory (Kim et al., 2013).

Lasting stress and elevated levels of the hormone cortisol in the blood are important factors that cause short-term memory deterioration (University of Iowa, 2014). Elevated levels of cortisol are associated with a lower brain mass and short-term memory impairment in young and middle-aged adults. Women tend to be more prone to this condition (Echouffo-Tcheugui et al., 2018). However, another study on the effects of hormones on cognitive performance found that memory performance is reduced not only by high levels of cortisol caused by chronic stress but also by sex hormones, i.e., estrogen in women and testosterone in men. The study in question also revealed that women suffer from stress-induced memory impairment more than men, and memory also tends to be significantly affected by estrogen fluctuations (Ali, Begum & Reza, 2018).

A meta-analysis conducted in 2017, was based on the research of 113 independent studies on the effects of stress on different phases of memory. Contrary to the above studies, the authors of this meta-analysis

indicate that even though stress is responsible for the constant increase of cortisol levels, its concentration in the blood does not affect short-term memory. Furthermore, a fact of interest is that stress can inhibit memory formation if it occurs before or during encoding (storage of information) (when memory is formed). Yet, if the stress factor is directly related to the material subject of memorization the memory even tends to improve. Stress that occurs after memory formation even can contribute to better memory formation (Shields, Sazma, McCullough & Yonelinas, 2017). These researchers emphasize that there are several inconsistencies in the available literature to date. Therefore, current stress and memory theories have been significantly limited, and ever new questions arise thus confirming the need for future research.

Doctor of Physiology A. Moraska (A. Moraska) et al. conducted a comprehensive literature review of previously published studies on the effects of massage on stress reduction. According to them, considering the rapid growth in the popularity of massage at the time (mainly for stress reduction purposes), it was important to perform such compilation of the information. It was concluded that although the presence of significant improvements after massage therapy has been proved, the overall research framework on this topic lacks the necessary scientific basis and the research data are scarce to provide a conclusive understanding of the effects that massage therapy has on many physiologically related stress factors (Moraska et al., 2010). At the same time, in 2008, an interesting pilot study on the effect of massage on cortisol and prolactin levels in serum in patients that were undergoing intensive chemotherapy was published. It was found that after one 20-minute massage session, there was a significant reduction in cortisol levels and, consequently, a reduction in stress of the patients (Stringer, Swindell & Dennis, 2008). A. Moraska (A. Moraska) et al failed to prove this hypothesis in the subsequent studies in later years. The tendency to prove the positive effect of massage in stress reduction becomes ever more sustainable.

A study published in 2016, showed beneficial findings for office workers who received a scalp massage in two groups with the duration of 15 and 25 minutes. A 15-minute massage alone was enough to see a positive effect on the reduction of the stress hormone cortisol, blood pressure, and heart rate. It has been concluded that scalp massage can be used for stress control without a time limit (Kim, Kim & Ko, 2016). In 2019, a study was published on the effect of massage on work-related stress for emergency medical service employees. Medical specialists received massage therapy of the collar area for 20-25 minutes twice a week after a night shift for four weeks on a regular basis to measure the amount of stress in the same

conditions before and after the massage. The study found that massage considerably lowered the stress levels of emergency medical personnel, establishing massage as a valuable stress-reduction tool (Mahdizadeh, Jaberi, & Bonabi, 2019). There are grounds to suppose that massage can increase short-term memory, based on previously acquired data. If increasing stress levels have a detrimental impact on short-term memory, then massage that relieves stress should help to improve it.

Reduced oxygen levels in the blood and, as a result, in the brain, damage short-term memory. Massage therapy dramatically boosted arterial oxygen levels in babies with respiratory distress syndrome, according to a 2011 study by Iranian medical researchers (Bostani Khalesi, Yaghoubi & Abedinzadeh, 1970). A 2012 study found that classical massage has a good effect on increasing blood oxygen content in adults as well. Furthermore, classical massage has been demonstrated to increase blood circulation to the brain (Sliz, Smith, Wiebking, Northoff & Hayley, 2012). Although it has been previously stated that the cognitive capacities of a person decline with age (Kim et al., 2013), it is worth mentioning a 1998 study that found that even preschool children (particularly temperamental ones) who received a 15-minute massage had their cognitive capacities improved (Hart, Field, Hernandez-Reif & Lundy, 1998).

A single 20-minute mechanical head massage combined with a binaural therapy in a massage chair demonstrated a significant decrease in mental fatigue and a dramatic improvement in cognitive processes such as concentration, short-term and long-term memory in 2018. (Lim, Kim, Jeon & Cho, 2018). A pilot study was conducted to investigate the effect of a single neck massage on short-term memory, given that possible discomfort in the shoulder part of the neck affects cognitive functions and that 31.9 % of people aged 15 to 74 i.e., people of working age in Latvia experience pain in the back and neck part daily and massage has been shown to reduce mental fatigue and improve cognitive functions. Therefore, the aim of this pilot study was to research the effect of a single massage of the collar zone on the short-term memory of participants of working-age.

Materials and methods

For the pilot study, a mixed research strategy was adopted. The study is structured and standardized, with one set of tools for the entire study group variables are pre-defined. The study was carried out in line with the Helsinki Declaration. This study has been approved by the Red Cross Medical College of Riga Stradins University's ethics commission.

A research instrument with four verbal memory tests was used to investigate the effect on short-term memory of a single massage for the

collar zone. Short-term hearing, vision, combined - hearing and vision, and combined – hearing, vision, and motor – verbal memory tests were applied in the study to assess memory efficiency (Jauja & Žilinska, 2003; Plakane et al., 2019). The test was divided into four sections: 15 nouns were read slowly and clearly by the experimenter. Within one minute basing on the hearing memory, the participant had to try to write down the words that he or she heard in the given order after 10 seconds. The experimenter then presented a sheet of paper with 15 more printed nouns. The participant subject to the experiment returned the sheet of paper after 20 seconds and after a 10-second waiting pause attempted to write down the words that he or she had seen on the sheet of paper in the original order. The experimenter then gave a sheet of paper with 15 other nouns printed on it. The experimenter read the nouns aloud while the participant looked at the sheet of paper with the same printed nouns (20 seconds). After one minute of invoking the visual and auditory memory, the person subjected to a test attempted to write down the words read and heard in the correct order after a 10-second pause. The experimenter handed out a sheet of paper with 15 printed nouns on it. The testee read the words aloud with the experimenter and then returned the page and after a 10-second delay attempted to write the words that he or she had read, seen, and heard in the given order within a minute by heart (Plakane et al., 2019).

Each person subject to a test was to complete eight verbal memory tests, four before and four after the massage. 8-word lists were each comprised of 15 nouns. Words from research on the effects of moderate exercise and circadian rhythm on human memory were used to make all word lists equal (Potter & Keeling, 2005). Equally frequently used words in everyday conversation were chosen. All the lists had been pre-tested to ensure that everyone had an equal chance of remembering them. The terms were translated into Latvian before being used in this study.

Upon the completion of the tests, the words written in the correct order were granted 1 point and the correct words that had been remembered but changed their sequence had been granted 0.5 points. The score was counted, and the percentage memory efficiency factor was calculated from the obtained data, as well as the total and individual memory type effectiveness was determined before and after the massage. The memory efficiency factor was calculated using the following formula:

$$K = \frac{a+\frac{1}{2}*b}{c} * 100 \ (\%),$$ were

K – memory efficiency factor.

a – the number of words memorized in the correct order.
b – the number of words memorized in the wrong order.
c – the number of words in the test.

The percentage achieved indicates how much information a person could recall at any time. If the ratio is less than 25%, memory fostering should be given special attention. The total rate of 25 – 50% is an average result for a person with typical ability who is not particularly interested in memory training. The excellent memory rate ranges from 51 to 80%. A person is considered to have a phenomenal memory if his or her coefficient exceeds 80% (Jauja & Žilinska, 2003; Plakane et al., 2019).

The opinions of respondents on the effect of massage on short-term memory were found out through a structured interview and content analysis. Having conducted the interviews, the results of the short-term memory tests were disclosed.

Criteria for inclusion of respondents: proficiency in Latvian, practically healthy without diagnosed dementia or other cognitive disorders, of working age from 18 to 62. Exclusion criteria: diagnosed dementia or other cognitive impairment, alcohol and/or other intoxicant abuse in the last 3 months, night shift work, or medical surgery in the last 3 months. One participant was excluded because he had used intoxicants and one participant was excluded because he had had a night shift. In total, 30 practically healthy individuals (15 men, 15 women) age 18 to 62 (mean (M) = 36.8, standard deviation (SD) = 11.7), (men M = 35.5, SD = 11.0, women M = 38.1) participated in the study, SD = 12.7).

The study was conducted from January to May 2021. The study conditions were preserved as similar as possible for all the study participants: they were placed in the same room, with the same equipment, with the same masseur performing a 20-minute massage of the collar zone for the study participants, using the same therapeutic massage techniques performed in a specific order, basing on the same massage protocol: the patient was in a sitting position. The area subject to the massage: the back surface of the neck to the lower corners of the shoulder blades (Th7) from the occiput bun and the front part from the *m.pectoralis major* and m.*sternocleidomastoideus*. The applied massage techniques: stroking, rubbing, kneading and vibration.

Each respondent completed two short-term memory tests: one immediately before and one 15 minutes after the massage of the collar zone. Before taking part in the study, each participant had to fill out and sign an "Informative Consent Form for Participation in the Study." This form also included questions to determine whether or not the study participant met the

study's eligibility requirements. Each study participant was given a study participant code, which ensured complete anonymity. There was no need to provide personal information. After that, memory tests were administered followed by a collar massage and another round of memory tests. One study participant was given approximately one hour of total time.

SPSS and MS-EXCEL tools were used for statistical analysis. When analyzing the data, the normal distribution law was applied to approximate the distribution. It shows the most likely distribution of memory changes in terms of deterioration and improvement. The graph also shows the points that correspond to the study's minimum, maximum, and arithmetic mean values. Percentage change and analysis of memory efficiency ratios were also performed by splitting them into four parts (quartiles): memory degradation from -20 to -11, a slight deterioration from -10 to -1, a slight improvement from 0 to 9 (also includes 0 when no change), and memory improvements from 10 to 20.

The alpha level used for evaluation margin of error is 0.05.

Results

The coefficient of short-term memory efficiency of the studied group before the massage was from 16 to 38, M = 22.5, SD = 5.2, but after the massage from 15 to 42, M = 23.1, SD = 5.8. Respectively, the short-term auditory memory efficiency ratio before was M = 25.2, SD = 7.9, after M = 25.7, SD = 6.8 (males before M = 22.3, SD = 4.9, after M = 25.1, SD = 5.6, females before M = 28.1, SD = 9.4, after M = 26.3, SD = 7.9); short-term visual memory efficiency ratio before was M = 21.9, SD = 7.5, after M = 20.9, SD = 6.9 (males before M = 19.9, SD = 6.6, after M = 17.9, SD = 5.8; females before M = 23.9, SD = 8.0, after M = 23.9, SD = 6.8); short-term combined auditory and visual memory efficiency ratio before was M = 22.2, SD = 5.8, after M = 23.5, SD = 8.8 (males before M = 20.7, SD = 3.9, after M = 20.9, SD = 8.4, females before M = 23.7, SD = 7.0, after M = 26.0, SD = 8.8); as well as short-term combined - hearing, vision and motor memory efficiency coefficient before was M = 19.8, SD = 7.1, after M = 21.8, SD = 7.9 (males before M = 17.4, SD = 5.5, after M = 21.0, SD = 6.1; females before M = 22.3, SD = 7.8, after M = 22.7, SD = 9.5).

The differential curve of the normal distribution represents the changes in the efficiency factor of short-term auditory memory before and after the massage (Fig. 1). The mean value is somewhat changed in the positive direction, as can be seen (the shift is 0.5 in the direction of improvement and margin of error is 2.5). This is a small deviation. It can be observed that the changes are both positive and negative, and given the tiny

departure of the mean value from 0, both deterioration and improvement are theoretically achievable with equal likelihood.

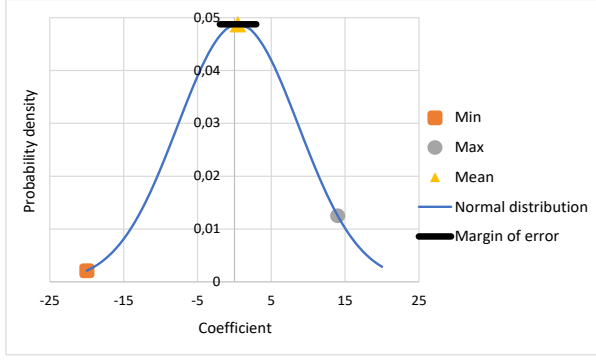

Figure. 1. The changes in the efficiency coefficient of auditory memory efficiency factor

The result was presented by dividing the acquired coefficient values into quartiles after comparing the probable differences between the sexes (Fig. 2). Improvements in short-term hearing memory are more common in men and worsening in women. However, additional studies are required to test the hypothesis and confirm the statistical significance.

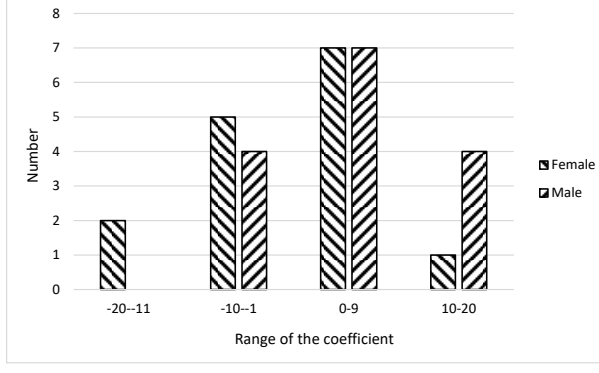

Figure. 2. Differences in short-term hearing memory between the sexes

The differences in the efficiency coefficient of short-term visual memory before and after the massage change can be seen in the differential curve of the normal distribution (Fig. 3). The mean value position was expressed towards the negative direction (the shift is 1.0 in the direction of deterioration and margin of error is 2.7).

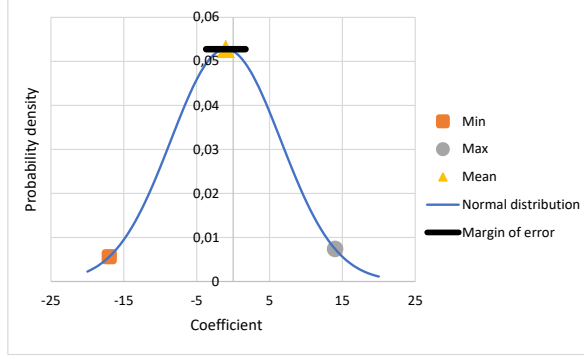

Figure 3. The changes in the efficiency coefficient of short-term visual memory

The probable differences between the sexes were shown by splitting the acquired coefficient values into quartiles to compare the changes in short-term visual memory before and after the massage (Fig. 4). A slight deterioration in short-term visual memory is more common in men whereas women showed both an improvement and deterioration.

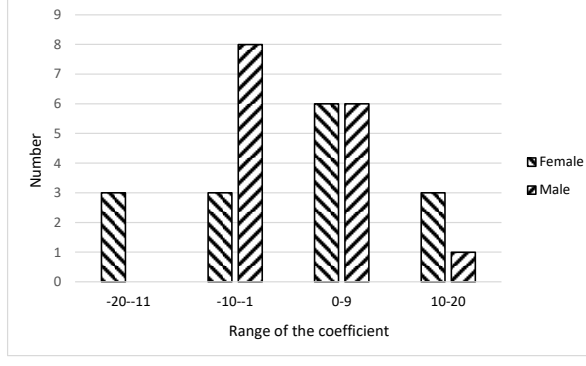

Figure 4. Differences in short-term visual memory between the sexes

Differences in efficiency between the short-term combined auditory and visual memory before and after the massage are shown in the differential chart of normal distribution (Fig. 5). The mean value position was expressed towards the positive direction (the shift is 1.2 in the direction of improvement and margin of error is 2.7).

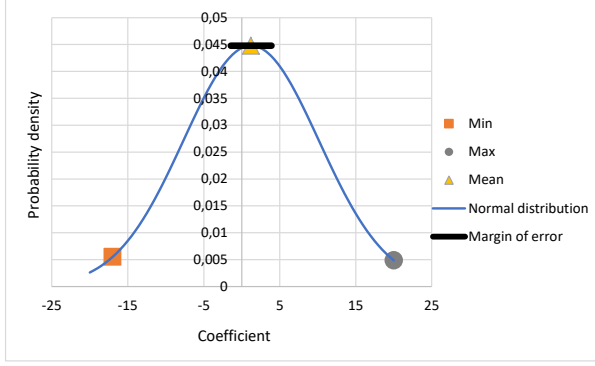

Figure 5. The changes in the efficiency coefficient of combined - hearing and vision memory efficiency

The results were presented by dividing the acquired coefficient values into quartiles and comparing the changes of the short-term combined - auditory and visual memory before and after the massage considering the probable differences between the sexes (Fig. 6). Women displayed to have a modest advantage over men in terms of short-term combined hearing and vision memory.

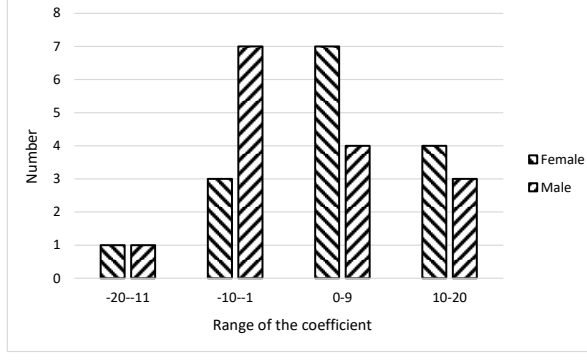

Figure 6. Short-term combined - hearing and vision memory differences between the sexes

Differences between the short-term combined - hearing, vision, and motor memory efficiency coefficient before and after the massage are depicted using the differential law of normal distribution (Fig. 7). The mean value position was expressed towards the positive direction (the shift is 2.0 in the direction of improvement and margin, or error is 1.8).

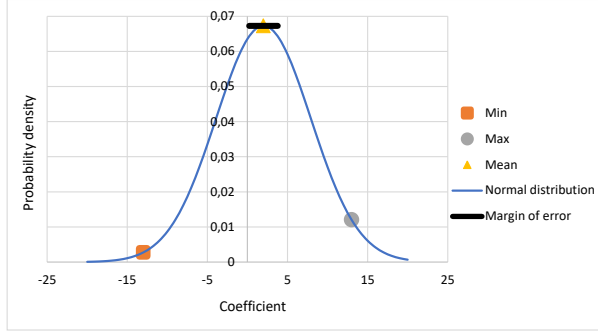

Figure 7. The changes in the efficiency coefficient of short-term combined - hearing, vision, and motor memory

The results were presented by splitting the acquired coefficient values into quartiles to assess the short-term combined - hearing, vision, and motor memory alterations before and after the massage probable variations between the sexes (Fig. 8). It was revealed that men are more likely than women to have a small improvement in short-term visual memory.

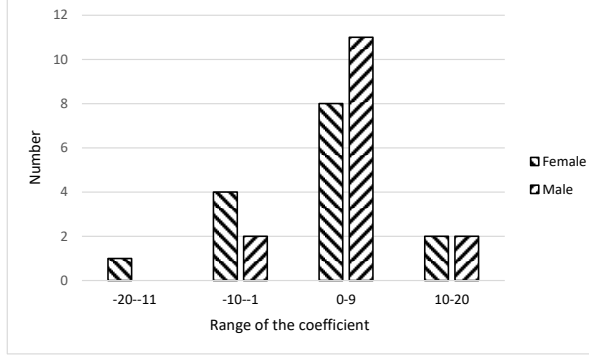

Figure 8. Short-term combined - hearing, vision, and motor memory differences between the sexes

Four categories were identified after analyzing the content items and how the subjects characterized their short-term memory after the massage of a collar zone. Most of the respondents stated that it was easier to remember things after the massage, and so their memory was improved. As they were relaxed, some respondents confessed that they were reluctant to go through the process of recalling. Some respondents confessed that the remembering process is tough for them since they were too relaxed (Table 1).

Table 1

Short-term memory after the collar zone massage

Content units	Category	The concept
"Easier to remember the words", "Easier to concentrate", "I feel calm, relaxed, concentrated, generally the feeling is very good and light, ready for work", "Mind is empty", no other thoughts in the head, so it is easier to concentrate", "New energy reserves have appeared to get to work", "I seem to have received a second breath for more work today", "After the massage, I want to move the mountains", "Workability and work satisfaction improved", "Ready to go to work with new vigor".	Easier to do	Short-term memory after the collar zone massage
"The memory seemed to be better", "Definitely better!", "It's better and quite noticeable!"	Better memory	
"In general, I already have a good memory, only now I have no desire to do anything", "Motivation to remember is much lower", "I am so relaxed and would like to continue to relax".	Without motivation	
"It seems that my ability to concentrate was close to zero", "I floated somewhere in the clouds", "Complete relaxation and peace", "I think this massage would be great at the end of the day, but not in the middle of the day…".	Harder to do	

Discussion

A particularly relevant point is that the use of cell phones has a substantial impact on short-term memory function at a time when most daily activities are practically performed online during a Covid-19 epidemic (Kalafatakis et al., 2017). As it is already known, the use of smartphones has consequences for the health of the shoulder part of the neck, but unfortunately, there are no recent data on the back health of the Latvian population. However, in 2018 about 31.9% of people aged 15 to 74 in Latvia experienced pain in the back and shoulder area (Health Behaviour among Latvian Adult Population, 2018). It is possible that even now more people experience discomfort in the back - neck - shoulders because in this study the coefficients of short-term memory efficiency were low - before the massage from 16 to 38, M = 22.5, SD = 5.2. If the ratio is less than 25%, memory fostering should be given special attention. Normal memory capacity is when the total factor is within the range of 25% to 50% (Jauja & Žilinska, 2003; Plakane et al., 2019).

Analyzing the results of this pilot study, a probability distribution approximation was performed using the normal distribution. This indicated whether the short-term memory had deteriorated or improved. The study's findings revealed that the average value was expressed towards the positive direction. It must be noted, however, that the deviation is insignificant. It

can be observed that the changes are both positive and negative, and given the tiny departure of the mean value from 0, both deterioration and improvement are theoretically achievable with equal likelihood.

Having compared the possible differences between the sexes, the result was presented by dividing the obtained coefficient values into quartiles. Improvements in short-term hearing memory are more common in men and worsening in women. Several studies have already provided evidence that short-term memory disorders are more common in women, and it is very likely that this is related to fluctuations in the female sex hormone estrogen (Ali, Begum & Reza, 2018; Echouffo-Tcheugui et al., 2018). This fact was clearly confirmed in this study.

Looking at the types of memory in more detail, the highest improvement in memory performance is expressed in the combined - hearing, vision, and motor – memory test. According to the definition of the normal distribution, the mean value was expressed towards the positive direction (the shift is 2.0 in the direction of improvement). However, additional studies are required to test the hypothesis and confirm the statistical significance.

One of the theoretical studies on the effects of scalp massage and binaural therapy on short-term memory is positive, as is another study on the cognitive abilities of preschool children (Hart, Field, Hernandez-Reif & Lundy, 1998; Lim, Kim, Jeon & Cho, 2018). The results of this study clearly show that there is not a unified similar effect of massage of collar zone on the short-term memory of different people of working age. The massage had a different effect on each participant - some of the participants got energy, but others experienced problems in concentration on the short-term memory test after the relaxing massage. It is possible that it is necessary to consider the fact that the participants were too relaxed after the massage and the completion of the test did not require extra concentration. Because memory would have increased if the stress factor had been closely connected to the content to be learned (Shields, Sazma, McCullough & Yonelinas, 2017).

We may also infer that a few discrepancies have been discovered, similar to the meta-analysis conducted in 2017 (Shields, Sazma, McCullough & Yonelinas, 2017), thus placing substantial limits on existing massage and memory theories and generating new issues for future study. However, it should be emphasized that the participants in this study had poor starting short-term memory test scores, which actualize this issue and therefore even the positive trend observed in this pilot study advises that definite solutions are required. The data also suggests that in future studies

repeated massage therapy would be beneficial providing that there are more participants and several sessions of massage therapy for each of them.

Conclusions

Massage could be used as one of the aids to improve short-term memory, but further research needs to be carried out to disclose the precise participant profile, as numerous studies revealed that after massage therapy significant improvements in both stress and fatigue mitigation, as well as oxygen increase in the blood concentration have been demonstrated; however, there is a lack of more qualitative research on the subject to provide a definitive understanding of the effects of massage on many physiologically variable factors in the human body that are directly related to cognitive functions, including short-term memory.

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ORIGINAL RESEARCH PAPER

DETERMINING FACTORS OF RIGA STRADIŅŠ UNIVERSITY STUDENTS TO CHOOSE THE STUDY OUTDOOR ACTIVITY COURSES DURING COVID-19

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Abstract

Aim of the study – to find out the determining factors of Riga Stradins University (RSU) students to choose outdoor activity courses during Covid-19. Materials and methods. A qualitative research method was used in the research - survey with open questions and content analysis of the results. Following the conditions set during Covid-19, the interview was conducted remotely during the academic year of 2020/2021. Participants of the study are RSU students who have chosen outdoor physical activity courses. With survey, there were clarified students' opinions, reasons and influencing factors for choosing study course during during Covid-19. Results. The dominant factors that determine students' motivation to choose study courses outdoors during Covid-19 pandemic are physical and psycho-emotional health, interesting and relevant study courses for self-improvement and useful for the profession. Students' internal motives are stronger when choosing study courses with outdoor physical activities, because there are involved the development of professional competence and health. External motives, such as feedback and evaluations about the study course, do not independently influence students' choices, which indicates the persistence of motivation. Conclusions. Especially duing Covid-19 pandemic students felt the beneficial effects of physical activity on health and the undeniable importance of improving their physical and psycho-emotional state. The results of this study reflect

the aspect of student choice. It is important to attract the target audience with the name and description of the study course by professionally emphasizing the possible results of self-improvement.

Key words: *Outdoor physical activity, students, determining factors, choice*

Introduction

Physical activity for all people of all ages is very important in preserving and maintaining health. It is important to look for physical activities that are popular in society, less symptomatic and thus stimulate people's involvement in them (Upeniece, Vinberga & Arnis, 2016). Motivation of Latvians to engage in physical activities: improvement of well-being (54% of physically active population), desire to strengthen health and/or increase work ability (35% of physically active population) (Latvian population's habits of sports and physical activity, 2016).

Changes in physical activity are observed during COVID-19 restrictions. 3800 healthy adults (age 18 – 64 years) residing in Spain participated in the study. To evaluate how self-reported physical activity and sedentary time have changed during confinement in the Spanish population. The international physical activity questionnaire short version (IPAQ-S) twice between 23 March and 1 April was contucted. Overall, it was concluded that physical activity decreased during the pandemic (Castañeda-Babarro, Arbillaga-Etxarri, Gutiérrez-Santamaría & Coca, 2020).

In a study conducted in U.S. on maintaining physical activity during the Covid-19 pandemic, about 69% of the participants had a college bachelor's or a higher degree. The study showed that the Covid-19 pandemic reduces the level of physical activity of the U.S. population by 18.2%. It was also concluded that the motivation to be physically active reduces if chances of being active are limited, for example, in the case of pandemic restrictions (Yang & Koenigstorfer 2020).

A study of 125 students was conducted at two universities in Canada. A survey design consisting of a questionnaire administered pre-COVID-19 and again during COVID-19 pandemic was used to examine university students' dietary intake, physical activity, and sedentary behaviour before and during COVID-19. The COVID-19 pandemic was found to significantly increase students' sedentary behavior, reduce their level of physical activity and negatively affect their nutrient and caloric intake (Bertrand, et al., 2021).

A study of the effects of COVID-19 restrictions on physical activity and sedentary behavior in Spanish university students showed that university students slightly reduced the time spent on moderate and

vigorous physical activity, but they significantly reduced the time spent walking and exercising during the confindment. In addition, during this period, students significantly increased the amount of sedentary time (Rodríguez-Larrad, et al., 2021).

Medical science students represent valuable labour resources for better future medicine and medical technology. However, little attention was given to the health and well-being of these early career medical science professionals. One in three new medical science students were physically inactive along with compromised cardiorespiratory fitness and heart rate recovery, which put them at risk of cardiometabolic diseases. Promoting healthy lifestyle at the beginning of career is crucial in keeping medical science professionals healthy (Fan, Collins, Geng & Li, 2020).

Comparative studies of medical and physiotherapy students in Spain and Germany show that the vast majority of students presented a normal body mass index (BMI) value, but it was not related to high physical activity. More than one-third of all students seldom practised any sports. The Spanish students usually did some form of physical activity outdoors, whereas the German students exercised in a fitness centre. Lack of time was to the Medicine and Physiotherapy students the most significant factor that did not allow them to be more physically active. Medicine and Physiotherapy students should be more physically active in order to promote a good, healthy lifestyle model to society and there should be more physical activity education to encourage more students to practise sports (Zeńczak-Praga, Pluto-Prondzinska & Zgorzalewicz-Stachowiak, 2017).

A study on stress and associated factors among French university students under the Covid-19 lockdown showed that the presence of someone hospitalized or COVID-19 in one's household was one of main risk factors for severe perceived stress. Phisical activity was found to be effective factor for calming down (Bourion-Bédès, et al., 2021).

In a study of the effects of COVID-19 to students mental health in Pakistan 494 students participated in the study: 61% were women and 77.3% of students were in the 19-25 age group. Among respondents, 125 (25.3%), 45 (9.1%) and 34 (6.9%) experienced minimal or moderate, severe and extreme anxiety, respectively (Karasmanaki & Tsantopoulos 2021).

Assessing the effects of lifestyle factors on depressive symptoms in Chinese students, it was concluded that longer sleep, more outdoor physical activity or exposure to sunlight, and eating breakfast are factors that reduce depressive symptoms in college students (Ying, Juan, Yi & Xiaozhong, 2016).

In a study of dederminants of physical activity and sedenary behavior in Belgian university students was concluded that some university

specific characteristics such as including 'sports time' into the curricula, can increase physical activity and decrease sedentary behaviour in university students. Students also pointed out that if physical activity increased, it would reduce sedentary behavior, because if the interest in physical activity is reduced, students replace this time with passive activities (Deliens, Deforche, De Bourdeaudhuij & Clarys, 2015). Another study showed that participants did not compensate a sedentary day by increasing their level of physical activity (Dale, Corbin & Dale, 2000).

In a study of phisical activity and sedentary lifestyle in university students in Spain, the behaviour of health sciences students was observed. The results showed an increase in both physical activity and sitting time. An aspect that could have affected the results is that the students were involved in the health sciences field, so they may have been more prone to exercising during the pandemic than students in other majors such as engineering or literature (Romero-Blanco, et al., 2020).

A study on association of Web-based physical education with mental health of college students during the COVID-19 showed that for college students, web-based physical education is a challenge, as these course are normally offered outdoors. It was concluded mental status was significantly correlated with regular exercise and sufficient exercise duration. Professional physical guidance is needed for college students in selected sports (Deng, et al., 2020).

In a study of benefits of walking and solo experiences in UK wild places examines human-nature interaction and how therapeutic this relationship is by investigating the efficacy of structured outdoor experience. Two walking and solo experiences explored universty students' (aged 20 – 43 years) perceptions of walking through and being in nature. The themes in the findings that illustrated the benefits of the walking and solo experience were: gaining a sense of freedom and escape; gaining a sense of awareness and sensitivity to one's environment and its influence; gaining confidence in being able to cope and take action; gaining a sense of perspective on and appreciation for life (Freeman, Akhurst, Bannigan & James, 2017)

It is suggested that compared with exercising indoors, exercising in natural environments was associated with greater feelings of revitalization and positive engagement, decreases in tension, confusion, anger, and depression, and increased energy. However, the results suggested that feelings of calmness may be decreased following outdoor exercise. Participants reported greater enjoyment and satisfaction with outdoor activity and declared a greater intent to repeat the activity at a later date (Thompson Coon, et al., 2011; Lahart, Darcy, Gidlow & Calogiuri, 2019).

In a study where role of music and social contact on exercise benefits were examined 229 participants were randomly asigned to one of 6 conditions: biking alone with iPod or friend in a laboratory, walking alone with iPod or friend outdoors, or biking or walking alone in control conditions. All participants completed 20 minutes of exercise at 70% of their maximum target heart rate. The study showed that exercising in control conditions indoors resulted in a more relaxed and calm response. Exercising outdoors was more enjoyable and resulted in less tension and stress. Exercise environment impacts psychological benefits of exercise (Plante, Gustafson, Brecht, Imberi & Sanchez, 2011).

The aim of the study is to to find out the motivation of Riga Stradins University (RSU) students to choose outdoor activity courses during Covid-19. To meet the aim, dominant factors that determines students motivation of choosing study courses related to outdoor physical activities were identified, motivating factors to engage in outdoor physical activities were analyzed and compared, the persistence of motivation and the desire to continue engaging in outdoor physical activities after completing a study course at Riga Stradins University has been determined.

Material and Methods

In this study a qualitative research method - survey with open questions and content analysis of the results were used. This research method was chosen because, when conducting qualitative research, researchers can better understand the views and values of the participants and how these views and values form the context in with they have been studied (Sawatsky, Ratelle & Beckman, 2019). This aspect was particularly important during the pandemic, which is a new experience for all of us.

Following the conditions set during Covid-19, the data collection was conducted remotely during the 2020/2021 academic year. The participants of this study were RSU students who have chosen physically active outdoor study courses. Initially, students were informed about the research, its purpose, structure of used instrument, anonymity and that the obtained information wilould be used only in an aggregated way. The protocol of the research instrument was available in e-studies. The students who agreed to participate, provided written answers to the questions, and uploaded the document anonymously to OneDrive folder. Participation in the study was voluntary and respondents were informed about the right to opt out of further participation in the study at any time, and this would not affect their future activities in any way.

This study was conducted in accordance with the basic principles of research ethics. The study used data protection and confidentiality of

participants in accordance with Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of individuals about the processing of personal data and on the free movement of such data and repealing Directive 95/46 / EC (General Data Protection Regulation) (Text with EEA relevance) and other applicable legislation. The data obtained in the study would not be disclosed outside the EU / EEA Member States.

The protocol of the research instrument consisted of two parts. The first part contained socio-demographic questions about the respondent's gender, age, year of study and faculty. The second part contained questions about the aspects that were important when choosing elective study courses; what the expectations from outdoor study courses were; how the choice was influenced by Covid-19 time; which aspects motivated to attend these study courses; what different changes in body, well-being, and emotional state the student observed during Covid-19 and after outdoor activities.

The study was conducted in 2020/2021 study year. During Autumn semester from November 30 until december, 12 of 2020 the survey was completed by 23 students out of 45 who had chosen the outdoor activity study course - Nordic walking. During spring semester from April 22 until May, 06 of 2021 the survey was completed by 26 out of 57 students who had chosen outdoor physical activity study courses – Nordic walking and Outdoor physical activity (in a nature gym). In these semesters all the places of these elective study courses were filled.

The study involved 43 women and 6 men, aged between 19 and 41 years from the Faculty of Medicine, the Faculty of Public Health and Social Welfare, the Faculty of Rehabilitation, the Faculty of Communication, and the Faculty of Pharmacy. Almost 60% of the total number of participants are students of the Faculty of Medicine.

The answers provided by students for each question were summarized in content units. When analyzing the content units, categories were distinguished - a reflection of the meaning of the answers, which provides an answer to the question raised by revealing its concept. The results section includes only the most characteristic content units that most clearly reflected the distinguished category.

Results

When analyzing the content units, which were summarized as aspects that students indicated when choosing elective study courses, five categories were distinguished. The most important aspect can be highlighted – interesting and relevant for self-improvement. An important aspect was also mentioned: useful for the profession. In turn, the description of the

study course, lecturer, references, time, place, and type are less important aspects when choosing study courses. Essential aspect when choosing elective study courses was also that it is easy to learn compared to the basic study courses (Table 1).

Table 1

Aspects when choosing elective study courses

Content units	Category	Concept
"Interesting, productive, will provide knowledge and skills in a new field", "Is this topic relevant to me and do I want to learn it in more depth", "Improve knowledge in practice" "It could be useful in the long run"	Interesting and relevant for self-improvement	Aspects when choosing a study course
"Relatedness to the profession", "Could also be used in your daily work as a trainer", "Useful in practice", "Useful in the future"	Useful for the profession	
"It is possible to combine with my current work and study schedule", "Outdoor practical lessons"	Time, place, type	
"Teachers' attitude" "The description of the specific study course is important", "Course content", "Relevance, interesting description of lessons", "Feedback"	Lecturer, description, reviews	
"There may be less workload than in the basic courses", "In order not to take a lot of time and learn something new", "In order not to be too complicated and time consuming", "Relevant and does not require more time than basic study courses".	Easy to learn	

Analyzing students' responses on the impact of COVID-19 on the choice of study courses, four categories were identified: unaffected, related to physical activity, practically in person and in the fresh air. Although a large proportion of the content items corresponded to the first category, the other categories show the importance of physical activity in person and outdoors (Table 2).

Table 2

The influence of COVID-19 on the students' choice of study courses

Content units	Category	Concept
"Actually, it did not affect, because I try to choose B courses related to physical activity, to learn the right technique."	Did not affect	Influence of COVID-19 on the choice of study courses
"The lifestyle has become more passive, because you have to spend long hours sitting," "Strain the body instead of the mind", "The pandemic has changed my choice and I want to return to the active lifestyle that it was before, and the tasks of the course will help to keep myself in shape."	Associated with physical activity	
"Although partly will take place in person", "Practical lessons realized", "Hope that it will take place in person".	Practically in person	
"Sports in the fresh air", "Go outside and do some physical activity", "To be able to leave the house", "To finally be able to go outside and compensate for the damage done from home sitting".	Outdoors	

Analyzing the content units that motivated to choose study courses related to outdoor physical activities in this study year, three categories were distinguished. Here we can see the difference from the basic aspects of students when choosing elective study courses, because more emphasis is placed on such motives as self-improvement, the desire to share the acquired knowledge with others, both relatives and professionals. Also, a great emphasis is placed on the opportunities to engage in outdoor physical activities and improve one's health and well-being in the chosen study course, rather than the fact that the study course is easy to learn (Table 3).

Table 3

Motivation to choose study courses related to outdoor physical activities in this study year

Content units	**Category**	**Concept**
"To become a requirement and help the inhabitants of their city, who do Nordic walking wrong, to help to learn how to do it properly", "To learn the right technique for myself and to be able to teach my family members how to do Nordic walking properly, and to recommend it especially to the elderly", "Good feedback, relatives also choose this activity, could recommend to others, give advice within my competencies", "People I know have started to do Nordic walking, the sports teacher has already recommended to use it in a doctor's practice"	Self-improvement and share with others	Motivation to choose
"Do something active", "Sports activities (in this adventurous time of covid-19)", "Walking is a great pleasure for me", "Choose a physical activity in a strenuous learning process", "Provides a small amount movement minimum", "Desire to move and improve my health", "Motivate to go outside and move because it is difficult to motivate yourself to go outside"	Outdoor physical activity	
"Keep myself in shape", "Take my thoughts away from exams", "Improve health", "Ventilate my head", "Mom and cousin has good feedback about the lecturer"	Health, wel being, reviews	

Summarizing the students' answers to the question about the expectation of the outdoor phisical activity study course, three categories were distinguished, which show that the most important factor students expect from this elective course is not only knowledge and skills, but also the ability to move physically in the fresh air and thus gain positive emotions and relaxation during the stressful COVID time. (Table 4).

Table 4

Expectation from study courses related to outdoor physical activities

Content units	Category	Concept
"Proper Nordic walking technique and information about its beneficial effects on posture", "Opportunity to learn practical skills that could be taught to others", "Ability to teach others"	Knowledge and skills	Expectation from study course
"Improving physical fitness", "Interesting techniques for performing physical activities", "To spend your time in the fresh air in order to be as active as possible"	Physical activities in the fresh air	
"Relieving the mind from problems", "Relax", "Get good ideas, good thoughts and enjoy spring", "Improve quality of life and health during COVID-19".	Positive emotions and relaxation	

Analyzing the answers to the question what motivated the choice of study course, only two categories were distinguished, according to which, it was assessed whether a person is internally or externally motivated. There was even more internal motivation in the students' responses, which indicates that a person's behavior was motivated by an internal desire for an activity by its very nature. In essence, the same behavior is the same reward (Table 5).

Table 5

Motivation to participate in study courses related to outdoor physical activities

Content units	Category	Concept
"Desire to focus more on physical activity, there is a great lack of physical activity at the moment", "To improve your body", "Improve your skills and abilities", "Learn correctly to be able to teach and show to others", "Rejuvenates and fresh air provide well-being", "I have a good company, meeting classmates, doing something with other people"	Internal motivations	Motivation to participate
"There will be a grade", "No need to buy your own sticks", "The teacher is very competent", "Interesting lessons".	External motivations	

When analyzing the content units, five categories were identified for the changes in physical well-being observed by the student during COVID-19, indicating that most of them experienced energy deprivation, demotivation, physiological (physical) changes, decreased physical activity during COVID-19, and only a small portion of the content item could be included in the category without change. Some respondents indicated that there is more time for physical activity during COVID-19 (Table 6).

Table 6

Changes in physical well-being during COVID-19

Content units	Category	Concept
"Depression takes over", "It has been and is challenging", "Lessen strength and energy", "Weaker physical well-being", "I can't attend the usual trainings", "It was hard to get used to and I felt tired", "Demotivation", "Drop out of your daily rhythm", "Not all of us are able to cope with it and adapt to the situation", "Overload", "Increase in stress".	Lack of energy, demotivation	Physical well-being
"Tight neck", "Sleep disturbance", "Back pain", "Physical fatigue", "Tension in the body", "Difficulty breathing while wearing a mask", "Increased stress", "Discomfort in different parts of the body from sitting at the computer", " Reduction of load tolerance ", " I feel weaker"	Physiological (physical) changes	
"I have remained less athletically active and spend more time at home", "I have developed a sedentary lifestyle", "We need to think more about incorporating physical activities into everyday life"	Reduction of physical activity	
"I don't feel any specific changes in well-being", "In physical well-being not really", "No change"	No changes	
"I spend more time in the fresh air, so my well-being improves", "There is more time to do physical activities"	Time for physical activity	

Analyzing the content items on the changes in psycho-emotional well-being observed by students during COVID-19, four categories were distinguished: emotional exhaustion, passivity, stress and irritability, impaired mood, depression. Also in this question, as in the previous one, there could be distinguished one category considered positive, because the respondents' answers showed that students feel calmer, can devote more time to the values that are important to them, or do not feel any change (Table 7).

Table 7

Changes in psycho-emotional well-being during COVID-19

Content units	Category	Concept
"Anxiety and emotional fatigue", "Apathy", "Reluctance to do something, creative deficit", "Apathetic", "Laziness", "Tired of sitting at home", "Noticeable loss of motivation", "More often I feel depressed and tired"	Emotional exhaustion, passivity	Psycho-emotional well-being
"Aggressiveness, negativity", "Tension, anxiety", "Easier irritability", "Less stress resistance", "Anxiety", "Anger", "Stress about learning", "The onset of a pandemic caused uncertainty and increased stress levels", "Difficult to switch to reality "	Stress and irritability	
"Mood is often changing", "Often in a bad mood", "Stress", "I don't feel safe anywhere", "Sometimes depressed", "Increased seasonal depression"	Deteriorated mood, depression	

Table 7 continue

“No change”, “I spend time with my family, so I stay well”, “I feel better, less stress in everyday life”, “No change, I am calm”, “This period of time has brought peace and balance”, “More opportunity to think about mental health” .	No change or calmness	

Summarizing the students 'answers to the question about changes in physical well-being after physical activities outdoors, there were distinguished revealing students' positive physical feelings, pleasant fatigue and relaxation. Only a few respondents found that they did not feel the change, but one respondent admitted that he had concluded that there is weight gain (Table 8).

Table 8

Changes in physical well-being after elective study course classes

Content units	**Category**	**Concept**
"Pleasant general physical and mental condition", "Shoulder tension decreases", "Significantly improves physical well-being", "You can feel how other muscle groups are engaged", "Energy inflow, the body feels great", "I feel “fresher”, a little stronger, I wouldn’t get so tired ”	Positive bodily sensations	Changes in physical well-being
"Practical classes allow you not to think about Covid time", "Not thinking about day-to-day running", "Pleasant fatigue", "Feeling relaxed", "I feel better, I like the feeling of tiredness"	Pleasant fatigue, relaxation	
"I haven't noticed any changes yet", "I don't really feel the change in my physical well-being"	No changes	
"I have gained weight and exercised less"	Weight	

Summarizing the students' answers to the question about changes in psycho-emotional well-being after physical activities outdoors, the categories were distinguished - improved mood and positive emotions, vivacity, energy inflow, positive aspects of socialization, peace, relaxation, motivation and without changes (Table 9).

Table 9

Changes in psycho-emotional well-being after elective study course classes

Content units	**Category**	**Concept**
“Pleasant well-being”, “Elevated mood”, “Good mood”, “Positive emotions”, “There is always joy”, “Improved psycho-emotional well-being”, “Positive mood”, “Great feeling”, “I feel very good and free”	Improved mood and positive emotions	Changes in psycho-emotional well-being
“Positively charged”, “Extra vivacity and vigor”, “Energy influx”, “I feel positively charged”, “The feeling of fatigue caused by Covid-19 time decreases”.	Vigor, influx of energy	
"Opportunity to socialize with classmates", "Creates uplifting feelings in nice company and fresh air", "Gives us competencies as coaches", "Raises self-esteem"	Positive aspects of socialization	

Table 9 continue

"Feeling relaxed", "I feel calmer, thoughts get better", "The mind "switches" from everyday worries", "Problems seem less important", "Satisfaction"	Peace, relaxation	
"The joy of moving out and exercising", "Nordic walking promotes the emergence of various ideas", "Motivated to go for more walks"	Motivation	
"There was no change"	No changes	

Discussion

Previous studies on changes in physical activity during Covid-19, carried out in Spain, USA, Canada, Germany, France, and China, show that physical activity decreased overall during the pandemic (Castañeda-Babarro, Arbillaga-Etxarri, Gutiérrez-Santamaría & Coca, 2020); Bertrand, et al., 2021), pandemic restrictions reduce the opportunity to be physically active (Yang & Koenigstorfer 2020) and increase sedentary behaviour (Rodríguez-Larrad, et al., 2021). Also, in this study, students pointed out that during Covid-19, the lifestyle has become more passive, more time is spent sitting, so there is a desire to be physically more active, and that this study course provides such an opportunity. Due to the restrictions of the pandemic, including the appeal to stay at home, more time is spent indoors, which increases sedentary behaviour. More than half of the participants indicated that the choice of these study courses was influenced by Covid-19 time, emphasising the opportunity to attend a physically active course in the fresh air as an important criterion for selecting the course. Important aspects of choice are the opportunity to leave the house, to spend time outdoors in the fresh air and to compensate the time spent staying at home. Some students point out that they experienced demotivation and unwillingness to do sports during Covid-19, but by choosing physical activities outdoors, one's being motivated to go outdoors in the fresh air and to move, which results in changes in both physical and psycho-emotional state of health.

The field of education and the inclusion of physically active study courses can reduce sedentary behaviour and increase motivation to be physically active (Romero-Blanco, et al., 2020; Deliens, Deforche, De Bourdeaudhuij & Clarys, 2015). This study involved students of the field of health who indicated that are glad to choose study courses which are linked with physical activities. Medical and physiotherapy students should be more physically active to promote a good, healthy lifestyle in society (Zeńczak-Praga, Pluto-Prondzinska & Zgorzalewicz-Stachowiak, 2017). As one of the aspects, when choosing a physically active study course, students mention the importance of promotion of healthy lifestyle and physical activities. Understanding the benefits of physical activity in improving health, promotes students' desire to choose physically active study courses to be

used in their future professional activities, such as “use in medical practice”, “offer the activity to future patients”, “learn and demonstrate to others”, “physical skills to teach family members”.

Most of the study participants indicated that they had experienced negative changes in physical and psycho-emotional well-being during Covid-19, including emotional exhaustion, stress, irritability, impaired mood, and depression. Previous studies have shown that exercise can be an effective sedative (Bourion-Bédès, et al., 2021), physically active outdoor activities can reduce symptoms of depression (Ying, Juan, Yi & Xiaozhong, 2016), reduce tension, confusion, anger, and depression and increase energy (Thompson Coon, et al., 2011; Lahart, Darcy, Gidlow & Calogiuri, 2019). Students' answers show the importance of psycho-emotional state of health when choosing study courses that are implemented outdoors in the fresh air. Staying in the fresh air and physical activities provide positive emotions and help to reduce stress. The observed changes in psycho-emotional well-being after physically active outdoor activities are good mood, positive emotions, inflow of energy, peace and relaxation, the stress caused by high study workload, as well as depression and anxiety are reduced, the concentration is being improved. In general, a calmer and more balanced mood is being achieved. Feelings of joy and relaxation arise.

Study courses outdoors improve mental and physical health, motivate you to go outdoors in the fresh air and to enjoy spring. When choosing outdoor study courses, students as the most important aspects mention the following: “opportunity of self and professional development”, "opportunity to learn in practice the specifics of outdoor physical activity: forms, methods, techniques", "opportunity to spend time actively in the fresh air", "opportunity to improve mood", "opportunity to gain positive emotions", "opportunity to gain well-being", "energy", "peace" and "motivation to learn". Students' responses indicate that physical activities improve not only physical, but also psycho-emotional well-being, accepting the importance of physical activity in maintaining and improving both physical and mental health. "Great physical activities, unique with its availability and ability to keep fit in time during Covid-19."

Conclusions

The dominant factors that determine students' motivation to choose study courses related to outdoor physical activities during Covid-19 are physical and psycho-emotional health, interesting and relevant study courses for self-improvement and useful for the profession. Students' internal motives are stronger when choosing study courses with outdoor physical

activities, as they are related to the development of professional competence and health.

External motives, such as feedback and evaluations about the study course, do not significantly influence students' choices, which indicates the persistence of motivation. The results of this study reflect the aspect of student choice. It is important to attract the target audience with the name and description of the study course by professionally emphasizing the possible results of self-improvement.

In the study group, there were noticeable changes in physical and psycho-emotional well-being during Covid 19 and after physical activity study courses. Students indicated that choosing outdoor study courses related to physical activity experienced positive changes in their emotional state, provided by the opportunity to move and contact with others. The time of Covid 19 made the lifestyle sedentary, thus various disturbing signs of physical health, which changed positively after engageing in physical activity study courses outdoors.

During this time of Covid-19 pandemic students especially felt the effects and significance of physical activity in particular. This may strengthen not only confidence in the effectiveness of physical activity, but also internal motivation. Internal motivation ensures long-term sustainability and it forces to look for solutions to offer even more study courses related to outdoor physical activities, as it is important both for the health of students and for the professional activity of future specialists for successful implementation for the benefit of society.

For this research, a qualitative research method was successfully chosen, which allowed to gain an in-depth understanding of students' determining factors and motivation. It is important that the data were collected during the study year, which was one of the first at Covid-19, when part of the study courses could be implemented in person. As the Covid-19 pandemic is still ongoing, the data from this study need to be confirmed and investigated in the future with larger population studies.

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ORIGINAL RESEARCH PAPER

PARENTAL COMPETENCE STRUCTURE IN INFANT FLOATING

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Abstract

Reduction of drowning deaths is one of the objectives of Latvia's National Development Plan for 2021-2027 as drowning is one of the most common external causes of death in Latvia (Olševska, 2020). Considering the statistical data, it is very important to pay attention to swimming in early childhood and further acquisition of swimming skills in children. When teaching infant floating to parents, it is important to help them learn appropriate infant floating skills so that they can use them safely and confidently in further development of their child (Meredith et al., 2001; Jovanovich, 2002). The aim of this study was to develop parental competence structure in infant floating. The questionnaire survey was conducted from the beginning of September 2017 until the end of October 2017 and organised at different branches of Riga Health Centre LLC: "Ķengarags", "Imanta", "Bolderāja" and "Iļguciems". 33 professionals (swimming and physiotherapy specialists) and 112 parents (who attend to pool and infant floating lessons with their infants) participated in the parental competence assessment survey. The selection and compilation of the questionnaire questions was based on works, opinions and methodological instructions of scientists and authors. The results obtained in the experiment were processed using the STATISTICS add-in for MS EXCEL developed by J. Dravnieks, Professor of the Latvian Academy of Sport Education (Dravnieks, 2004), and the IBM SPSS mathematical statistics software where several statistical analysis solutions were used (IBM, 2020). According to the multiple linear regression for the specialist survey results, it was concluded that, according to specialists, the parental competence skills component is equally related to both the practical skills

and knowledge components, while the knowledge component has a slightly smaller impact on the skills component. It was also concluded that, according to specialists, the parents' knowledge about infant floating must be higher than their practical skills to be able to achieve a similarly high level of competence skills in infant floating. Based on the parents' opinion, a trend like that in specialists is observed: the parents' knowledge about infant floating must be higher than the practical skills to achieve a similarly high level of skills in infant floating.

Keywords: *parental competence in infant floating*

Introduction

Reduction of drowning deaths is one of the objectives of Latvia's National Development Plan for 2021-2027 as drowning is one of the most common external causes of death in Latvia (Olševska, 2020).

Analysis of the latest information shows that in Latvia there were 96 drowning deaths in 2019 and 61 – in the first six months of 2020. While the average death rate from drowning in the EU is 1 per 100,000 population and in our country – 6 per 100,000 population, the Swimming Federation of Latvia has developed a drowning prevention strategy which aims to halve the number of water accidents by 2025 (Olševska, 2020).

Considering the statistical data, it is very important to pay attention to swimming in early childhood and further acquisition of swimming skills in children.

Nowadays, activities involving children and parents are becoming more popular. It is a good opportunity to spend time together, socialise and promote healthy infant development (Freedman, 2014), but there is not always time, place, and eagerness for that. At this point, emphasis should be laid on the child's age as infants, for example, cannot act independently without the help and presence of their parents (Meredith, Hicks & Stephens, 2001).

The knowledge, skills, and attitudes of parents during infant floating speak of their competence in this field (Stallman, 2014). Hence follows the necessity to ensure that parental competence in infant floating is enhanced in line with the parents' abilities and interests as well as in compliance with the stages of teaching infant floating.

The aim of this study was to evaluate parental competence in infant floating in order to develop structure of parental competence in infant floating.

Based on results of the study, it is possible to create parental competence development model and recomendations for increase of parental competence more accurately.

Material and methods

The questionnaire survey was conducted from the beginning of September 2017 until the end of October 2017 and organised at different branches of Riga Health Centre LLC: "Ķengarags", "Imanta", "Bolderāja" and "Iļguciems".

The questionnaire survey was used to find out the specialists' evaluation and opinion about the factors affecting parental competence in infant floating and significance thereof. For this very reason, parental competence in infant floating was assessed along with the need for additional components to increase parental competence (McClelland, 1973; Rychen & Salganik, 2001).

At the same time, parents carried out self-assessment of their competence in infant floating. When answering the questions, parents self-assessed the aspects affecting their competence in infant floating, evaluated their competence in this field, and considered the need for additional components to be learned or improved to increase their competence to be able to do infant floating exercises successfully and independently.

To fairly evaluate the specialists' and parents' answers to the self-assessment questionnaire questions and perform mathematical statistics, five answer options were given for each question with a point value assigned to them (Raščevska, 2004; Kroplijs & Raščevska, 2010).

33 respondents (swimming and physiotherapy specialists) participated in the parental competence assessment survey. After the questionnaires were processed, it was found that three questionnaires were invalid because they were not filled out according to the instructions given. As a result, 30 questionnaires were processed and analysed. The respondents (specialists) were on average 40.3 ± 2.8 years old with an average length of service of 15.5 ± 2.6 years. In specialists surveyed, 94.7% were females and 5.3% were males of whom 19 were physiotherapists and 11 – swimming specialists (the first three questions of the questionnaire).

To evaluate and analyse the parents' self-assessment of their competence in infant floating more fairly and statistically reliably, a questionnaire survey in which a total of 107 respondents participated (parents attending pools and infant floating lessons with their infants) was conducted during the research. The respondents (parents) were on average 30.8 ± 0.5 years old. In parents surveyed, 91.8% were females and 8.2% were males representing a wide range of industries. The selection and compilation of the questionnaire questions was based on the works, opinions and methodological instructions of the scientists and authors.

The results obtained in the experiment were processed using the STATISTICS add-in for MS EXCEL developed by J. Dravnieks, Professor

of the Latvian Academy of Sport Education (Dravnieks, 2004), and the IBM SPSS mathematical statistics software where several statistical analysis solutions were used (IBM, 2020), namely: Descriptive statistics; Correlation analysis; Multiple linear regression.

Results

To develop the structure of parental competence in infant floating more precisely a correlation analysis was performed after the specialist survey to determine the correlation between parental competence components and the most important competence components in infant floating, and the correlation between the parental competence components and the specialists' opinion on the need of competence improvement (Lasmanis & Kangro, 2004; Web Research, 2020).

The correlation between parental competence components and the most important competence components in infant floating mostly shows that the correlation is insignificant ($| r | < r_{\alpha}$, where $| r_{\alpha} | = 0.196$), and in several cases a weak correlation is also observed ($0.2 < | r | < 0.49$). The correlation between the parental competence components and the specialists' opinion on the need of competence improvement in infant floating shows to be insignificant or weak, and only in one case a moderately strong correlation is observed $0.5 < | r | < 0.69$). It is interesting that a negative correlation is observed in about 50% of these two correlations.

Upon analysis of the correlation between the self-assessment of parental competence components and the most important competence components in infant floating, it can be observed that there is a strong correlation between the knowledge about the use of aids, skills, and practical skills to use different aids during floating and all parental competence components ($0.7 < | r | < 0.99$).

The components of the need to improve parental competence in infant floating – knowledge about the use of aids, skills, and practical skills to use different aids during floating and all parental competence components – have a strong correlation ($0.7 < | r | < 0.99$).

Before development of the parental competence structure in infant floating, the multiple linear regression was used for its interpretation. When creating component interactions, the equation used as a basis is as follows:

$y = a + bx_1 + cx_2$, where:

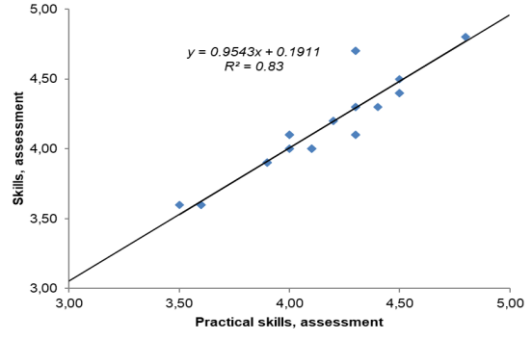
- y – parental competence skills component,
- a, b, c – linear equation coefficients,
- x_1 – parental competence practical skills component,
- x_2 – parental competence knowledge component.

The average value of each factor among the respondents' assessments is calculated according to the question categories: knowledge, skills, and practical skills. Using the multiple linear regression, the competence component interaction equations were worked out and multifactor determination coefficients R^2 were calculated separately for specialists and parents.

Based on the specialists' assessment R^2= 0.955 shows a strong correlation with the significance level α = 0.95.

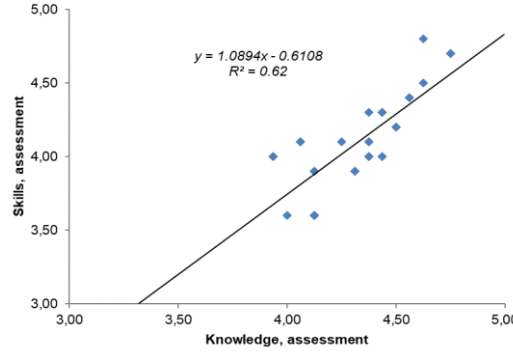
The assessment of the two correlation curves together shows that the coefficient of determination is higher for the parental competence practical skills component (R^2 = 0.83) rather than for the knowledge component (R^2 = 0.62) against the parental competence skills component.

The skills-practical skills, skills-knowledge correlation curves were also created and shown in the figures (Figure 1 and Figure 2).



Practical skills **Theoretical regression line (Practical skills)**

Figure 1. Correlation Curve of Parental Competence Skills and Practical Skills in Infant Floating (Specialists' Opinion)



Knowledge **Theoretical regression line (Knowledge)**

Figure 2. Correlation Curve of Parental Competence Skills and Knowledge in Infant Floating (Specialists' Opinion)

Based on the parents' assessment, $R^2 = 0.992$ shows a strong correlation with the significance level $\alpha = 0.95$. The skills-practical skills, skills-knowledge correlation curves were also created for parents and are shown in the figures (Figure 3 and Figure 4).

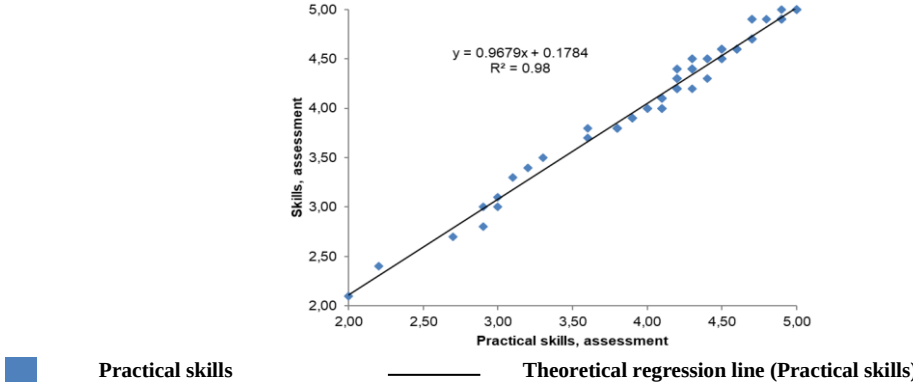


Figure 3. Correlation Curve of Parental Competence Skills and Practical Skills in Infant Floating (Parents' Opinion)

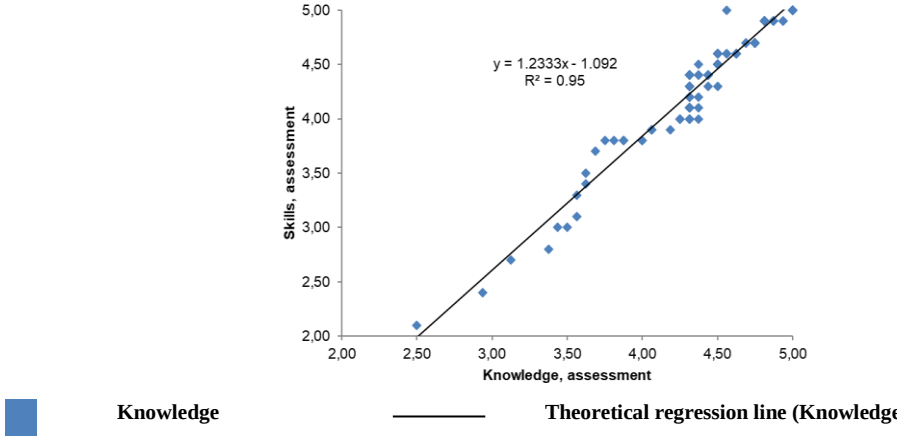


Figure 4. Correlation Curve of Parental Competence Skills and Knowledge in Infant Floating (Parents' Opinion)

Based on the survey results summarised in Figures 1, 2, 3, 4, as well as the summary of the correlation analysis, the parental competence structure in infant floating developed by the Author of this Doctoral Thesis includes the structural components of knowledge, skills, and attitudes (Table 1).

Table 1

Parental Competence Structure in Infant Floating

Parental competence in infant floating	
Knowledge	Skills and attitudes in infant floating
Knowledge about infant floating	Ensuring a safe environment
Knowledge about the effects of floating on the infant's body	Responsible use of infant floating skills depending on the circumstances
Knowledge about floating contraindications	Use of aids and equipment depending on the circumstances
Water safety and awareness during infant floating	

Discussion

Strong correlation between the most important competence components in infant floating - between the knowledge about the use of aids, between skills and practical skills to use different aids during floating - means that, according to parents, the use of different aids is very important when doing infant floating. The most insignificant correlations are observed in infant floating contraindications. The parents' self-assessment of their competence components shows that the basic knowledge, skills, and practical skills have a strong correlation with the required competence components. The next components having many strong and moderate correlations are the skills and practical skills to use them independently in the presence of specialists and to adhere to water safety rules during floating.

There is a strong and moderate correlation between the skills and practical skills to perform exercises and ensure security during floating which implies that these components also play a very important role in improving parental competence. As before, in this case, the parents' self-assessment of parental competence components also shows that the basic knowledge, skills and practical skills mostly have a strong correlation with the need for additional components to increase parental competence. And again, the other components having strong and moderate correlations are the skills and practical skills to use them independently in the presence of specialists and to adhere to water safety rules during floating with the need for additional components to increase parental competence. In the development of the model, all these components must play a key role.

Based on the specialists' assessment and comparing two correlation curves, it was observed that the coefficient of determination in both cases exceeds 0.5 threshold and shows a strong correlation. In both

equations, the coefficient a is close to 1 implying a proportional increase in the curve – the assessment of skills will proportionally increase with the increase in the assessment of practical skills or knowledge. It is also significant that the coefficient b in the skills-practical skills equation is 0.1911 and, if the practical skills' rating is "3", the skills' rating will be close to "3" (also considering the coefficient a 3.05). In turn, in the skills-knowledge equation, the coefficient b is 0.61, so, if the practical skills' rating is "3", the skills' rating will be less than "3" (also considering the coefficient a 2.66).

Based on the parents' assessment and comparing two correlation curves, it is observed that the coefficients of determination for both the practical skills and knowledge components against the skill components are almost equally high – 0.98 and 0.95, respectively. In both equations, the coefficient a is close to 1implying a proportional increase in the curve – the assessment of skills will proportionally increase with the increase in the assessment of practical skills or knowledge. It is also significant that the coefficient b in the skills-practical skills equation is 0.178 and, if the practical skills' rating is "3", the skills' rating will be close to "3" (also considering the coefficient a 3.08). In turn, in the skills-knowledge equation, the coefficient $b = -1{,}092$, so, if the practical skills' rating is "3", the skills' rating will be less than "3" (also considering the coefficient a 2.61).

Conclusions

According to the multiple linear regression for the specialist survey results, it was concluded that, according to specialists, the parental competence skills component is equally related to both the practical skills and knowledge components, while the knowledge component has a slightly smaller impact on the skills component. It was also concluded that, according to specialists, the parents' knowledge about infant floating must be higher than their practical skills to be able to achieve a similarly high level of competence skills in infant floating.

Based on the parents' opinion, a trend like that in specialists is observed: the parents' knowledge about infant floating must be higher than the practical skills to achieve a similarly high level of skills in infant floating.

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ORIGINAL RESEARCH PAPER

IMPACT OF PHYSICAL ACTIVITY LEVELS OF ALGERIAN FOOTBALL PLAYERS DURING CONFINEMENT (COVID19) ON THE PHYSICAL PERFORMANCE ONCE THE RESUMPTION OF COMPETITIONS

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Abstract

Aim: The aim of this study is to evaluate the physical activity of Algerian football players during the confinement due to Covid 19 pandemic and its impact on physical performance along with the risk of injury once the championships resume activity. Materials and Methods: An online questionnaire was developed to evaluate physical activity levels. which we adapted for athletes, consists of 3 parts, A and B are evaluated by a score, and part C is added to characterize the training load of football players during confinement. Results: The results showed higher scores for professionals and international players, whereas the scores for regular women and men remained statistically insignificant. When it comes to elite athletes, professionals and female footballers for instance, they manage their training sessions at home under the guidance and supervision of a coach or personal trainer, in addition to using online applications. The majority of footballers work at least up to 75% of what they used to do before the confinement, while female footballers do much lower training loads, around 50%. The majority of male and female footballers work on

muscle strengthening exercises. Conclusion: The results obtained differ according to gender and level of sport practice. Specialists and officials are called upon to address this issue, as part of a consensus for a better resumption of training, and especially competitions.

Keywords: *covid-19, confinement , football players, injuries.*

Introduction

The World Health Organization (WHO) has declared the emerging coronavirus pandemic (COVID-19; formerly 2019-nCOV) to be a global public health emergency (Chen et al., 2020). To date, as of June 30, 2020, more than 10434835 people have been infected with the virus, with 509,779 deaths, in 204 affected countries, according to the data presented by the Johns Hopkins University (JHU).

For the first time since World War ^{II}, almost all championships in the world have been postponed, suspended, or cancelled. Even the Olympic Games in Japan (2020) have been postponed by one year. Although the virus appears to be more dangerous for the elderly, older people and athletes were not spared. In the absence of treatment and vaccines, various countries have taken precaution measures, such as barrier gestures, social distancing and home quarantine.

The partial or total confinement imposed by the states is one measure among others to fight against the spread of this deadly virus. More than three billion people have been confined, half of the world's population. This unforeseen isolation of the population has created an extreme situation both psychologically and physically. This state of confinement, lasting from several weeks to several months, could be detrimental to the population, through increased behavioural sedentary behaviour, and the loss of physical fitness for athletes, who are into a competitive sport specialty (Charles-Yannick, 2020) (Owen et al., 2010). Depending on the strategy adopted, the number and speed of contaminations and the number of deaths recorded, the type of confinement has not been the same for all countries. Like most countries, Algeria has introduced total or partial confinement or quarantine depending on the virus spread level in the cities, in addition to restrictions on all unneeded activities. A curfew was even decreed in the evening for most of the affected cities. Official measures restricting movement do not necessarily mean restricting physical activity. On the other hand, specialists (Chen et al., 2020) (INSEP, 2020) (Boukhris et al., 2018) recommended avoiding physical activity outside home, especially in cities, to protect the athlete and his/her entourage, and to favour physical activities at low and moderate intensities at home during confinement. Due to the lack of scientific documentation on the multiple cares of athletes in this situation, a

number of diligences from different sports institutions around the world have provided athletes with a variety of strategies and behaviours to follow during this period of confinement. Players have received recommendations for training in the form of running and weight training (Hammami et al., 2020), while others were advised to limit high-intensity training intervals to avoid deteriorations in the immune system functionalities (Eirale et al., 2020), which remains controversial in the literature (Hull et al., 2020). If the confinement gets extended, the continuation of training becomes more and more constraining on the physical aspect, and specially on the moral side. These individualized training regimes can be particularly difficult in a sport like football, as they lack intensity, synchronization in the intense actions that characterize football, such as headers, shots, tackles and decelerations, as well as the real and multifaceted context of the football practice which is almost non-existent far from the football fields (Mohr et al., 2020).

Who says confinement, less activity or even inactivity is a situation that will continue to plague countries for a few more days or weeks and which leads to a reduction in energy expenditure. Depending on the duration of the training period in isolation, we can expect a decrease in general physical condition, which would be linked to the lack of high-intensity exercise, a change in body composition. Muscle wasting may occur as a result of a decrease in muscle stimulation during this period (Christensen et al., 2011). Excessive long periods of rest and low loads administered over a long period of time don't allow an increase of physical fitness; on the contrary, a decrease in performance, associated with injuries, is inevitable (Silva et al., 2016). This state can weaken the player and expose him/her to a dis-training, also called "discharge syndrome", characterized by a modification of the athlete's state and performance (Weineck, 1997). Deterioration in performance occurs at several levels cardiorespiratory, metabolic, muscular and morphological (Bosquet et al., 2013) and can lead to injuries when training, and competitions are resumed, which has prompted FIFA to make temporary changes to the Laws of the Game once the competitions are resumed, in order to protect players wellbeing, such as increasing the number of player substitutions in a match to five or introducing a refreshment break every halftime (Mohr et al., 2020). In this unprecedented period, many footballers are questioning the content of training sessions but especially the impact of this long period away from the pitch on their physical performance and health.

Material and Methods

Objective. The aim of this study is to evaluate: The physical activity of Algerian football players during the confinement related to Covid.

1-Impact of confinement related to Covid on physical performance and the risk of injury when resuming competitions after the deconfinement.

Participants. Participants were recruited through social networks during the period of confinement, including three weeks during the month of Ramadan. 304 footballers (254 "83.55%" male footballers and 50 "16.45%" female footballers), with an average age of 24.58 ±5.73 years, consented to participate in the study by correctly completing the questionnaire. Athletes have different levels of sports practice, 25 (8.22%) athletes are international players, 78 athletes (25.66%) are professional players, 120 (39.47%) are amateur players and 81 (26.64%) are regional players. All participants were informed of the purpose of the study and gave their agreement to the use of the data for publication. They were reassured that the confidentiality and anonymity of their responses would be respected.

Procedure. An online questionnaire was developed and distributed to the athletes in order to measure the level of physical activity. Ricci and Gagnon's questionnaire (Isabelle G, 2014), the data on the level of physical activity were expressed on a scale of 5 (05 ratings or 5 numerical values) and each was given a score. Part C, comprising 07 questions, was developed to estimate the training load experienced by footballers (content, intensity, frequency, attendance, perception of effort etc.).

Statistical analysis. 304 responses were retained and 37 questionnaires that did not meet the acceptance requirements were rejected. Multivariate analysis (the Test of Equality of Means "T", the Single Factor Analysis of Variance "Anova" and the Minimum Difference Test "LSD") compared subjects by gender and by level (international players, professional players, amateur players, and regional level amateur players).

Results

The results represent the descriptive and analytical analysis of the 3 parts A, B and C of the adapted "Ricci & Gagnon" questionnaire and the comparisons of the physical activity levels of football players during confinement according to the gender and level of athletes. For parts A (daily activities) and B (sports and recreational activities) of the questionnaire, the scores obtained (25.84 ±3.96) reveal that the athletes remained active during the confinement: between 16 and 32 according to the questionnaire standards. We recorded the highest scores among professional and international athletes compared to amateurs and then to regional footballers, however, the scores of the footballers remained very close to each other. Figure 1 illustrates the levels of scores averages from the Ricci & Gagnon questionnaire applied according to the gender and level of the athlete.

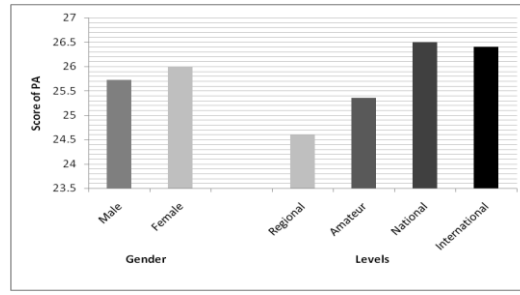

Figure 1. Physical Activity Level Scores

The statistical comparison of athlete results by gender is presented in Table 1:

Table 1.

Assessment of the level of physical activity (part A and B) by gender

	N	Mean ± SD	T test	diff (A-B)
Footballers (A)	254	25,69 ± (3,79)	0.44	0.66
Femal soccer (B)	50	33,31± (5,95)		

Note: **(diff:** differences**; *:** p<0.05**)**

Analysis of the results did not reveal any significant differences between male and female footballers (p<0,05) (Table 1). The comparisons of the athletes, according to the level of sports practice (international players – professional players – amateur players – regional players) are illustrated in the following table.

Table 2.

Comparison of athlete's physical activity (scores) by level of sport participation

			Anova 1 factor					Post Hoc test (LSD)		
								Multiple comparaison		
Practice level's	N	Mean ± SD	Sum of the squares		df	F	diff p<0.05	Level's	Difference in means	diff P<0.05
International's	25	26.4 ± 4.14	Inter groups	164.32	2	3.82	0.01*	Int – Pro	0.08718	0.920
								Ama	1.06667	0.201
								Rég	1.79506*	0.039*
Professional's	78	26.48 ± 3.73	Intra groups	4297.51	253			Pro – Inter	0.08718	0.920
								Ama	1.15385*	0.037*
								Rég	1.88224*	0.002*
Amateurs	120	25.33 ± 3.61						Ama Int	1.06667	.201
								Pro	1.15385*	.037*
								Rég	0.72840	.182
Régional's	81	24.6 ± 3.95	Total	4461.83	255			Rég – Inter	1.79506*	.039*
								Pro	1.88224*	.002*
								Rég	0.72840	.182

Note: **(**diff: differences; *: p<0.05, N: number of samples, df: degree of freedom, F: fisher, Int: international's, Pro: professional's, Ama: amateurs, Rég: regional's).

Using the single-factor "F" analysis of variance test, comparisons between levels of sport participation reported significant differences in physical activity scores during confinement ($p<0.05$). Multiple comparisons using the Minimum Difference Test (MDS) reinforce previous results and reveal significant differences between international and regional levels on one hand and between professional and amateur, professional and regional levels on the other. The results of the LSD test also (revealed) that professionals are the most active with an average score of 26.48, followed by international players with an average score of 26.4, then amateur players with a score of 25.33 and finally regional players with 24.60.

For part "C" of the questionnaire characterising physical effort during training during confinement, the results obtained are shown in Table 3.

Table 3.

Results of the questions in part "C" of the questionnaire expressed as an absolute value and as a percentage "N (%)"

Question	choice		footballers	Female soccer	Inter-nationals	Pro-fessionals	Amateurs	Regional's
Total		N	50	254	25	78	120	81
		%	100	100	100	100	100	100
Question 1: Do you train under the guidance of a coach?	Yes	N	29	105	16	40	45	35
		%	58.14	41.89	63.64	50.57	37.29	42.31
	No	N	21	149	9	38	75	46
		%	41.86	58.11	36.36	49.43	62.71	57.69
Question 2: Do you do the your activity exterior ?	Always	N	30	122	13	47	58	32
		%	92.79	47.17	54.55	57.47	48.31	39.74
	Never	N	6	18	6	3	10	16
		%	32.56	7.92	22.73	6.9	7.63	19.23
	sometimes	N	4	115	6	28	52	33
		%	4.65	44.91	22.73	35.63	44.07	41
Question 3: Do you have an application to train with?	Yes	N	34	142	17	48	71	42
		%	72.09	55.85	68.18	60.92	59.32	51.28
	No	N	16	112	8	30	49	39
		%	27.91	44.15	31.82	39.08	40.68	48.72
Question 4: Have you contracted an injury during your activity recently?	Yes	N	10	34	9	9	13	13
		%	13.95	14.72	36.36	14.94	10.17	14.1
	No	N	40	220	16	69	107	68
		%	86.05	85.28	63.64	85.06	89.83	85.9
Question 5: You work in containment	50%	N	26	85	10	24	48	27
		%	53.49	33.21	40.91	31.03	39.83	33.33
	75%	N	20	115	14	37	48	38
		%	41.86	44.91	54.55	45.98	39.83	47.44
	100%	N	42	54	2	17	24	16
		%	4.65	21.89	4.55	22.99	20.34	19.23
Question 6: your training is in the form of	Running + Reinforcement	N	16	144	8	53	58	42
		%	32.56	56.06	31.82	63.95	48.31	52.63
	Reinforcement	N	23	52	11	14	30	22
		%	45.51	21.21	45.45	19.77	24.58	26.32

Table 3. countinuation

	Jogging	N	11	57	6	11	32	17
		%	20.93	22.73	22.73	16.28	27.12	21.05
Question 7: When you practice sport, can you speak easily?	Yes	N	31	5	13	2	20	13
		%	65.91	2.64	54.55	4.6	9.76	15.38
	with difficulty	N	14	66	9	18	39	27
		%	27.27	26.42	36.36	24.14	31.71	33.33
	No	N	5	183	3	58	61	41
		%	6.28	70.94	9.09	71.26	58.54	51.28

The results of part C of the questionnaire revealed that international players, followed by professional players, do more training under the guidance of a coach fitness or physical trainer than others, while more than half of the football players use an internet application for this purpose, international players are the ones who use it the most.

International players and then professional players who do less training outside home. Few of the subjects suffered an injury during confinement. Nearly the majority of subjects work at a training load of between 50 and 75% of what they used to do.

The majority of athletes work on running and strength training, unlike international players who work much more on strength training. Under these training loads, international players have little or no difficulty speaking compared to professional players, amateur and regional players who have difficulty speaking during training**.**

Most of female football players trained under the guidance of a coach fitness and they worked more with half load focusing on strength training with no difficulty speaking during their training sessions.

Discussion

Confinement was not implemented the same way in Algeria, where the country opted for a less restrictive and less drastic way than that imposed in other countries, which could explain the results of the questionnaire (parts A and B) revealing that athletes remained active during the confinement. It should be noted that the highest scores were for professional players and then international players.

The statistical study revealed an increase in the scores of professional players and international players who are accustomed to training at high loads, enabling them to maintain a high level of physical activity during this period. The level of professional requirements, means, monitoring of professional clubs and the probable and expected resumption of competition could explain these scores. This professional requirement does not allow the professional footballer to lower his level so as not to reset his specific adaptations when resuming play after confinement (Chen et al.,

2020). International athletes, then professionals and footballers are the athletes who train the most under the guidance of a coach. Due to their status, international players and professional players are better supported in their training (the technical staff is more extensive). Female footballers and international players are the sportsmen and women who use an internet application the most, to train. While for women footballers this makes their task easier, international players work at a high level, and therefore they are more organised and already used to working with these kinds of technological tools, especially when they are in national teams, in their clubs, or when they receive specific training instructions from their coaches or when they are on a stopover or when they are injured. If women did more training at home for socio-cultural reasons, international and professional players would be better supported and better able to train at home.

Believe to respect the instructions of doctors and specialists to reduce the intensity of work in the face of the risk of infections (Chen et al., 2020) (Hull et al., 2020) on one hand, and the date of the resumption of competitions, the majority of male football players have trained at less than or equal to 75% of before confinement and around 50% for female football players.

As an indication**,** professionals and internationals train an average of 522 minutes per week according to data from two teams in the Algerian professional division "I".

For their part, Javier Sanchez-Sanchez and all indicated in their study that amateurs train on average 405 minutes per week (Sanchez-Sanchez et al., 2019). Based on these results, football players and professionals train between (260 and 390min) per week and 202 and 304 min for amateurs during confinement, values that remain very low compared to the Brooks et al criteria for injury prevention, which are of the order of (6.2hrs (372min) to 9.1hrs (546min) per week.(Brooks et al., 2008)

The values recorded remain even lower than the recommendations issued by the specialist literature, especially during this pandemic (80% of the theoretical maximum CF) (Chen et al., 2020). This could expose them to untraining, also known as the "discharge syndrome", characterized by a change in the athlete's condition and performance. Deterioration in performance occurs at several levels (cardio-respiratory, metabolic, muscular and morphological) (Bosquet et al., 2013). It has been established that even relatively short periods of rest cause significant changes in the athlete's ability indices and do not allow for an increase in physical fitness. On the contrary, a decrease in performance is inevitable (Weineck, 1997). The untrained player can reset his specific adaptations to the effort. Current knowledge in the field of training and sports physiology should lead coaches

and therapists to be extremely vigilant (Olivier et al., 2005)**.** It is accepted that a period of sporting inactivity totally or partially reduces the adaptations induced following a training phase (Dupont & Bosquet, 2007). The more the players have a high level of performance, the greater the desadaptation. (Mujika & Padilla, 2003). The mechanisms of physical deconditioning are multiple, but it seems that hypovolemia, reduced activity of oxidative enzymes, and decreased muscle glycogen stores are the primary factors responsible for exercise maladjustment (Olivier et al., 2008).

In this respect, it is important to remember that if the objective of the training is to maintain the level of performance. Increasing the training load also exposes elite athletes to the risk of injury and overtraining. Health monitoring at the individual level can therefore be considered. The answer to question 7 for women footballers, internationals and professionals reinforces this observation. The training content is more oriented towards muscle strengthening work, which seems inevitably linked to the containment, even partial, and also to following the recommendations of specialists on the eve of this unprecedented pandemic.

Conclusions

After the extension of confinement in almost all countries, health and sport experts began to focus on the impact of confinement on athletic activity. The Covid19 crisis and its consequences on the footballer's ecosystem have created a multitude of challenges for football, starting with the preservation of players' health and wellbeing along with the maintenance of their physical fitness until the optimal and safe return to the competition. The various information obtained from this study can serve as a methodological reference for coaches and specialists to better understand the intense resumption of competitions. Specialists and managers are called upon to address this issue to ensure a better resumption of trainings, and above all, competitions. Being aware of the changes that can affect the footballer during confinement, coaches are putting strategies in place to enable footballers to regain a good state of fitness and avoid injuries. However, it is important to remember that before any recovery, it is imperative to make an individual assessment of each footballer (Hughes et al., 2020) and (Nassis et al., 2019). A gradual increase in training is highly recommended (Mohr et al., 2020). Priority should be given to recovery, player nutrition and injury prevention strategies.

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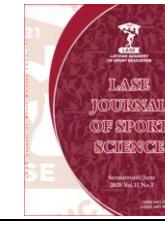

REVIEW PAPER

ENJOYMENT IN SAFETY: PHYSICAL ACTIVITY GAMES ADJUSTMENTS TO COVID REGULATIONS

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Abstract

In the first half of February 2020, the International Committee on Taxonomy of Viruses (ICTV) assigned the definitive name to the new coronavirus: "severe acute respiratory syndrome coronavirus2" (SARS-CoV-2). On February 11, 2020, the World Health Organization (WHO) announced that the respiratory disease caused by the new coronavirus would have been called COVID-19. The pandemic has changed the lifestyle and the routines of Italians belonging to all age groups. A succession of ministerial decrees has drastically reduced the opportunities for organised physical activity, including grassroots sport for children and adolescents. The primary purpose of this article is a review of contemporary literature on the empirical evidence that supports the importance of adequately promoting motor skills in children. The second objective is to identify an operational mode of adapting the motor game that on the one hand, would allow for opportunities to socialise, and on the other hand, would make it possible to practice and exercise the fundamental motor skills (FMS) which consider the need of guaranteeing conditions for health protection and that limit the risk of epidemiological contagion.

Keywords: *COVID-19, children, motor play, sociability, Fundamental motor skills, health.*

Introduction

In Italy, the healthcare emergency resulting from the epidemic spread of COVID-19 necessitated protection measures that severely limited the possibility of movements outside of home and family.

In particular, the suspension of all sports and face-to-face school activities has drastically limited the possibility for children and adolescents to carry out experiences both individually and with peer groups (Decree-Law No. 19 of 25 March 2020).

According to Petter (1992), children's and adolescents' relationships with their peers are of crucial importance in developmental age, for different reasons. Children's behavioural health is influenced by micro factors, such as family, friends, peer groups, and by macro factors, such as institutions and cultures. Infants and young children are totally dependent on the care and support of their parents and families, but early in life, children establish relationships with friends that become significant to them, that are people important to children's well-being and self- concept (Tomporowski et al., 2015, p. 122-123). To them, peers represent an initial form of a horizontal type of social development. Relationships with peers allow children to increasingly acquire interpersonal life skills that will allow them to learn to be with others in the world (Goudas, 2010). Later in the developmental age, the peer group will become an essential point of reference as it will ensure an "equality" that would be difficult to experience with adults. Di Norcia (2006) found evidence that pedagogical contribution of various authors in regards to peer relationships, emphasises the peculiarity of this type of relationship, defining it as the only significant context for social development and skill learning. In this perspective, the December 3, 2020's Prime Minister's decree issued further (and new) implementing provisions, allowing organised opportunities for socialising and for children and adolescents to play in conditions that would safeguard against the risk of epidemiological contagion. In this perspective of optimal balance between the right to socialising and to play, and the need to ensure health protection conditions, it was necessary for the educational staff involved in carrying out the various initiatives to adapt their teaching practices accordingly. Echoing the Swahili proverb that "We should hitch our plough to star" (Pesce, Faigenbaum, Goudas, & Tomporowski, 2018), many operators in the sector, instructors and teachers have worked, modified and promoted an adapted version of physical activity, to encourage the child's right to play.

Classification of games according to functions. Spontaneous play, deliberate play, deliberate practice. Active play is an activity performed for leisure, recreation, pleasure (enjoyment) and for physical and intellectual development. It starts during childhood and carries on onto adulthood.

The acquisition and development of some of the learning and roles typical in adulthood are also common to active play seen in the animal world.

Some conducts aimed at the acquisition of specific skills such as defence, attack and escape, prepare offspring to adulthood, without exposing them to excessive dangers. Games allow a continuous exchange of dominant and submissive displays that train the offspring to face specific conditions encountered in the real world. But not only that. Playful activity, in some animal species, has the function of easing tensions in the group, mitigating the discomforts intrinsic to the dynamics of the herd (group) that could cause attacks, fights and in the long run, exhaust the positive and necessary value of aggression as a survival instinct. In this sense, Biino & Zocca (2009) noted that game has an adaptive function. The ethological contribution explains, albeit partially, the concept of game function. What is a game for? It can have an exploratory dimension, when its purpose is not the intentional search for an outcome, but rather, the action itself. It is characterised by exploratory actions: we don't know what we are looking for, but we want to make contact with reality, or with a "toy". The game can also have an exploratory function when it is characterised by intentional, exploratory actions aimed at generating a probable result, such as running to fly a kite. Repeated shots at the basket, or jumping the rope, are examples of this. The game can then have a representative function and the representation of a fantastic elaboration becomes evident: "*the sheep and the wolf"*, or "*the sleeping dragon"*. In these games, children come into contact with a world that is familiar to them, that of fairy tales. Games can have a construction function and give rise to contexts where the organisational competence of motor sequences or structured relationships with objects or playing fields, emerges. An example of this is the traditional Italian game of *"Un due tre... stella!"*, in an Australian variant of The Statues Game, called *London*. And finally, games with a regulatory function, adapted to rules in which actions are inserted in a dynamic of respect for roles and codes (norms). A spontaneous or deliberate game can have multiple functions at the same time and one does not exclude the other. Contemporary literature (Pesce et al., 2016) defines Deliberate play as activity done for its own sake, characterised by flexibility, intrinsically motivating, which provides immediate gratification and maximum enjoyment. Deliberate play is not designed to make children experts in sports, but it is targeted to bridge young children's spontaneous play and the deliberate practice of structured sports by older children and adolescents. Deliberate practice is a practice that is performed with the primary goal of improving skill and expertise; it is considered the necessary work for becoming highly skilled. It is

characterised by a lot of mental effort and by low levels of enjoyment (Tomporowski et al. 2015, p. 58). In the well-known study on the organisation and duration of deliberate practice to achieve elite performance, Ericsson, Krampe and Clemens Tesch-Romer (1993) showed that expert performance is not the fruit of innate talent, but the product of a decade or more of maximal and deliberate effort to improve performance in a specific field. Learning that distinguish expert performance from normal performance also occurs during childhood. Many people can achieve expert performances, but motivation, individual hereditary differences and environmental conditions are necessary to improve every day practice, for years and decades, while most children and adolescents play and enjoy themselves (Ericsson, Krampe & Tesch-Romer, 1993). And yet, stabilisation and automatism are not the end point of learning (Pesce et al. 2015, p. 83). The development of children's behaviours are the result of a blending of nature and nurture: that is, genetic factors and experiences. A problem solving approach for motor learning emphasises the role played by the environment, with inseparable links between individuals, tasks and environmental constraints (Pesce et al., 2016). To act on the development and learning of the child, it is necessary to deliberately organise a set of playing conditions, creating an environment with opportunities for action (affordances). Pesce and colleagues (2016) adopted a mixture of deliberate play and deliberate preparation to pursue cognitive development goals through motor practice. Physical activity games are games that combine pleasant problem solving conditions, calling for fundamental motor skills (FMS), through diversification and variability of practice. To act on children's learning it is necessary to design PA interventions and games embodying cognition, therefore creating a brain-body-environment system. This ecological approach which emphasises the use of strategies to solve problems and to control behaviours, represents a double positive for children's development as it acts on both the cognitive and socio-affective spheres. *Problem solving* and *Self – regulation*, represent meta-cognitive functions and belong to both cognitive functions (solving problems) and life skills (behavioural control). The World Health Organization recognises them as the cornerstone of personal and social skills against dangerous behaviours in youth.

Scientific evidence on the importance of building enriching environments. Empirical evidence suggests that well-equipped free play is not sufficient to adequately promote the development of gross motor coordination (GMC) and fundamental motor skills (FMS) in children (Iivonen & Saakslahti 2014; Logan et al., 2012; Riethmuller, Jones & Okely, 2009); nor to elicit levels of moderate-to vigorous physical activity

(MVPA) greater than other types of interventions in which children are instead led by educators who have designed specific learning environments (Wadsworth et al., 2020).

It is a commonplace among adults and a strong concern that children no longer play as previous generations did, resulting in a different repertoire of movement skills than the ones that their grandparents possessed. This evidence has led to the restoration (or creation) of opportunities for children to engage in spontaneous and self-directed games (MacNamara et al., 2015). Although the current generation of children is unlikely to engage in PA as significantly as previous generations did (Rudd et al., 2020), scientific evidence has shown that children who have received free play protocols (conditions) even in everyday play, persisted a delay in the development of motor skills (Altunsoz & Goodway 2015; Martin, Rudisill & Hastie, 2009; Valentini & Rudisill 2004). In fact, a lot of children today start nursery school already carrying a deficit in FMS, which are movement skills that are fundamental to learn complex skills. Between the ages of 2 and 7, children should acquire a repertoire of movements that enable them to practice physical activity and sports for the rest of their lives (Gallahue, Ozmun & Goodway, 2012; Seefeldt, 1980; Stodden et al., 2008). Instead, there is a gap in this age group as few early childhood centres employ experts with a professional background to deliver interventions on FMS (Brian et al., 2017). Perhaps it is believed that nature supports the learning of these skills.As a matter of fact, a body of research on the development of motor skills in children shows that when children receive motor skills instruction, they significantly improve locomotor and object control skills, i.e. their motor competence (Bardid et al., 2013; Goodway & Branta 2003; Goodway, Crowe & Ward, 2003; Martin, Rudisill & Hastie, 2009; Robinson & Goodway 2009). And this is all the more true, the older the children are. Contemporary literature (Vandendriessche et al., 2011; Giuriato et al., 2019) shows a decline in gross motor coordination already at the age of 9. This is consistent with a much recent research which revealed that nearly half of children leave school without the basic motor skills required to be successfully involved in sports and PA (MacNamara et al., 2015). According to Goodway and Savage (2001) children need to learn basic motor skills in order to become confident and proficient in the movements and practice of PA, as much as they need to learn the ABC to read and write. If they can't read, they don't read; if they have low levels of motor skills, they do not participate in physical activities and sports (Clark & Humphre 2002; Ericsson, 2011; Stodden et al., 2008); they choose sedentary behaviors instead (Brian et al., 2017), with consequent repercussions on their fitness (Barnett et al. 2008), on their body

composition (Altunsoz & Goodway 2015) and on physical activity practice outside of school (Okely, Booth & Chey, 2004; Fisher et al., 2005; MacNamara et al., 2011). It is evident that children must be provided with systematic education on motor skills to learn and practice FMS during their first years of life. It is equally clear that the environment plays a crucial role in the development of children throughout the entirety of their developmental age, starting from their early childhood. According to Vygotskij (1896-1934) this thought leads us back to the psycho-pedagogical concept of the "zone of proximal development" (ZPD), which is a learning area consisting of the distance between current development and the level of the child's potential development. It can be bridged in several ways, by designing enriched learning environments (Tomporowski et al. 2015, pp. 54-59) with adequate instructions, guides and reinforcements.

Never before this era which combines two pandemics: that of sedentary lifestyle (Rudd, Pesce, Strafford & Davids, 2020) and that of COVID-19, have seen physical educators and scientists alike, challenged to solve the intricate oxymorons that commit them to design learning environments to support children of all ages to develop and maintain a meaningful commitment to play, to motor activity and to maintain a constant development of fundamental motor skills.

Procedures for implementing motor activities in safe conditions. A recent study showed how the immediate impact of COVID-19 restrictions have had a negative impact on movement and game activities in children and young people (Moore et al., 2020), significantly decreasing the time devoted to them. The conditions that allow for safe opportunities are possible in many games played by school-age children. However, a careful planning of the areas to be used is necessary, favouring the outdoors.

Before the pandemic, children could move at school freely and could play with children from other classes in all kinds and order of school. During the pandemic, following guidance from the General Directorate of Health children were organized into small groups socall “bubbles”. Interaction with other groups was avoided and were established spaces for each bubble in which the children should stay for the entire school time. All this is made to combat the spread of the virus. Depite this, a recent study that investigated the experience of playing at school during the pandemic, found that the main motivation of children to participating in a game is that they are with friends. The research reports that: “a child feel sad if is play alone”, or “alone is boring”. The children’s favorite game was running, followed by hide and seek, and those children said they lacked motor games during the pandemic (Lourenço, Martins, Pereira & Mendes, 2021). Gathering is the main risk. A high cardio-respiratory effort causes an

increase in inhaled and exhaled litres of air resulting in emissions of *droplets.* Physical exercise increases the development of aerosol. Indeed, scientific evidence has shown that closed environments encourage the spreading of the virus and have made it necessary to ventilate them 6 time per hour: once every 15 minutes (Dietz et al., 2020). For this reason, Arias (2020) recommended to promote outdoor Physical Activity, to limit the number of participants and to slow the game pace. Games can be divided into groups such as *performance games* where the rule is intrinsic to the game. They arise from the pleasure of putting oneself to the test and their goal is the performance or learning a task. An example of this game is the jumping rope. Performance games can be played in a cooperative form, keeping the distance between players, each using their own rope, but aiming to a common goal. Another group of performance games played collectively are games in which the actions of the players add up to one another. There is no direct interaction between players, but they are all part of a team. An example of this are all types of relay races. Collective games are characterised by flexibility and positive enjoyment. Another group of games are team games, where players' actions are interconnected, and the players organise themselves together to create a network or to form a wall. These games can be adapted to fit COVID-regulations by using an object to touch players instead of their bare hands. For example, in tag-type games, or games in which you must touch players to catch them (games that children love very much), we can replace the action of touching the player with catching them by throwing a ball at them instead, as direct contact among pupils is not currently allowed. Each player will hold a tennis ball (or similar object) and can use it to tag the opponent instead of touching them. Thus, in addition to maintaining the dynamics and function of the game, we work on the action of launching and therefore on an important FMS. Team games that involve using a transitional tool such as a tennis ball are slower, as throwing and dodging is slower than touching, yet in this way children are more attentive and more focused on the purpose of the game and to the precision of movements. The game's nature doesn't get twisted; on the contrary! Tasks that require controlling an object and launching it, are added to locomotive skills like running. This means working on the FMS. An example of this type of games is called “The active neuron”. Each player runs with a ball in hand and tries to tag the other children while avoiding getting touched at the same time. Once tagged, they must squat down and may pop up to resume play only when someone else tags their tagger, which should force them to carefully watch the person who tagged them. So, this is an example of a motor game played in teams that develops the motor aspect, thanks to the actions of running and throwing; the cognitive aspect, thanks

to the need of paying attention to the game and the socio-affective aspect as it is carried out in a group, and it involves social dynamics among players. Collective and team games become object- control- skill games. These games develop the FMS. Exercising and developing FMS is important as FMS are not learnt naturally because of age and maturation (Logan et al. 2012). These skills need to be learnt, practised and reinforced (Goodway & Branta 2003; Robinson & Goodway 2009).

Discussion

The purpose of this study was to analyze the potential of motor play as a crucial tool of child development and to consider the limitations that the pandemic period has imposed.

Now Children are Back to School, but Play is Still in Lockdown, there is a need for time and space dedicated to playing, especially at the school where children spend most of their time (Lourenço, Martins, Pereira & Mendes, 2021).

Play is crucial for the development of the child (Ginsburg, 2007), not only free play, but all types of play, including organized games. Alexander and collegues (2014) opposed to the importance attributed to physically active game, considering that play should not only have the physical health of the child as a primary goal, because this reduces the concept of health which is much wider (OMS, 1986). We know very well the definition of health (WHO, 2009), and the Ottawa Charter for Health Promotion (OMS, 1896) and we are persuaded that the game must affect all the domains of the person, not just the biological one. Physical education teachers agree that play should include fun and enjoyment. These are just two of the ingredients of deliberate play which emphasizes social, cognitive, and motor development (Tomporowski et al. 2015 p. 12-15).

Deliberate play is a type of physically active play, that increases children's chances of being creative and adventurous as much as "simply pleasant" spontaneous play (inactive or active) during which children can grow their psychological emotional and social well-being (Alexander, Frohlich, & Fusco, 2014).

Deliberate play does not have as its purpose the practice of physical activity through to combat obesity, but the practice of physical activity as a tool to intertwine motor skills with cognition and allow both structured learning (Biino, Tinagli, Borioni & Pesce, 2021) and transfer conditions (Davis et al., 2011).

Physical exercice in children, that is physical activity aimed at a goal (Donnelly et al., 2016), organized and conducted by teacher, does not give

the same results as spontaneous activity, often characterized by self-directed play (MacNamara et al., 2015).

Structured instruction and feedback are needed to ensure the development of fundamental motor skills, particularly during early childhood (Stodden et al., 2008; Robinson & Goodway 2009).
Children do not learn movement skills automatically, through to the natural maturation process (Logan et al., 2012).

Although basic movement emerges within the fourth year of life, to acquire motor skills are required object manipulation, balance and stability programs with regard to motor competence are required; children left without specific intervention do not improve their fundamental motor skills (Zeng et al., 2017).

The physical activity directed at children in school or extra school is often inspired by sports or free play pattern. Spontaneous play is certainly powerful but, as demonstrated by substantial scientific research, organized games must necessarily coexist to ensure better development of fundamental motor skills (MacNamara et al., 2015; Stodden et al., 2008; Giblin et al., 2014a; Barnett et al., 2008).

Although children can naturally develop motor patterns, thanks to the accumulation of spontaneous movement experiences, an improvement in motor coordination is much more likely thanks throughout a practice aimed at motor development, with the addition of teachers who know, encourage, stimulate, and correct through targeted and appropriate feedback.

But there's more. Pesce and colleagues (2016) propose the model of deliberate play as a connection between spontaneous play and deliberate practice, providing for a return to spontaneous play, but with new skills learned in deliberate play to enrich it. Deliberate play that integrates the motor domains with the cognitive one, can just offset the limits of spontaneous play and the deliberate practice. Spontaneous play must be placed side by side with deliberate play because it supports the child in knowing his motor skills and sustains him to refine his motor abilities (Pesce et al., 2015; Robinson et al., 2015).

This round trip between spontaneous play, deliberate play and deliberate practice that should accompany the child when he is growing, was missed during the block caused by the lockdown.

In a longitudinal study, Pombo, and colleagues (2021) showed that the levels of motor coordination in children aged 6 to 9 decreased significantly compared to the period before schools were closed.

The school provides a fundamental environment to promote the development of motor coordination for all children, mainly due to two reasons. First, physical education has the potential to improve overall motor

competence in children; secondly, recess is generally considered as a time for pupils to be active (Pombo et al., 2021). During the lockdown, children were encouraged to spend as little time outdoors as possible and to maintain social distance between themselves; short walks and outdoor games were allowed (20 minutes) and this condition did not favor spontaneous play in the natural environment (Pombo et al., 2021; Moore et al., 2020). So overall, children's physical activity decreased significantly between the pre-covid period (Febuary 2020) and the COVID onset period (April- May 2020) in both children aged 5 to 9. In addition, in children aged 9 to 13, the time spent in sedentary behaviors increased (Dunton, Do & Wang, 2020). During the loockdown period children and young people had a significant decline in all physical activity; only a very low percentage of them reached the recommendations of the guidelines (WHO, 2010), but the most dramatic decrease was recorded with outdoor physical activity and sports (Moore et al., 2020). Time spent outdoors is positively correlated to physical activity and negatively to sedentary behavior in children between the ages of 3 and 12 (Figueiredo et al., 2020).

In this pandemic period, among the activities that are not allowed, sports and other physical play were the first activities to be restricted. The study conducted by Lourenço and collegues (2021) showed that physically active games were children's favorite. Both genders expressed a deep interest in active play. Girls demonstrated a wider range of activities at school recess, whereas boys preferred sports and activities that include intense physical exercise. The most used play materials were balls, (especially by boys) and items brought from home. Much of this was severely limited, including the possibility to bring objects or toys from home.

Dunton and colleagues (2020), examined the effects of the COVID-19 pandemic on the quality of physical activity occurred by children aged 5-13 in the United States and showed a significant difference between the physical activities performed before the onset of the pandemic and those from February 2020 to May 2020, a period in which the most restrictive measures were applied to prevent the spread of the virus. In this period occurred the suspension of team sports and activity classes for youth and the decision to close the public parks and playgrounds. This has led on the one hand to decrease in physical activity with related increase in sedentary behavior, expecially in older children, and on the other to a drastic change in the type of physical activity performed. Instead of organized sport, the children played more at home or in the garage and on sidewalks and roads. Stopping sports training activities may also have caused decreased motor coordination levels in children. In fact, it has been shown that organized

increase children's physical activity (Sprengeler et al., 2019) and habitual participation in them improves motor coordination (Vallence et al., 2019). Recent studies had already reported a decline in motor coordination during school age (Vandorpe et al., 2011; Barnett et al., 2016), highlighting a plateau of gross motor coordination levels at the age of 9-10 years (Giuriato et al., 2019; Giuriato et al., 2021).

After this period of increased inactivity, it is reasonable to ask what the current level of motor coordination in children is. The restrictions related to COVID-19 have had a negative impact on the active lifestyles of children. So, it is important to carefully define which shortcomings in the development and maturation of children have emerged. There is a need for future research to adopt measurement tests that evaluate both the process and the product of motor coordination (Ulrich, 2019; Kiphard & Schilling 2007) in such a way that physical education teachers plan ad hoc solutions that fill the gaps caused both by the block and by the pandemic itself. It will be important to determine which aspects of motor competence have been most weakened by the restriction related to COVID- 19 at school and in sport contexts.

Finally, the adaptation of physical activity games to any situation will be recommended so that children are never deprived of it again. Play, health and well-being are closely connected (Ginsburg, 2007), play opportunities at school (all kinds of games) are crucial in helping children to face the pandemic. Play develops children's social and emotional skills and their ability to manage stress, and it promotes resilience and flexibility when facing uncertainty (Hewes, 2014).

Another crucial point of play at school is children's peer interactions: recess can promote healthy relationships amongst children, as well as prevent bullying and social exclusion. Children would rather play with friends than alone, and in this setting several competencies such as negotiation, cooperation, problem-solving, perseverance and self-control are developed.

Conclusion

Deliberate play is often misunderstood because it suggests that children play without appropriate feedback or instruction, but children need to be supported, guided, and encouraged. Physical activity games adapted to train children's motor skills, cognitive skills and life skills. In this way deliberate play helps children to develop problem solving skills thanks to the variability of practice (Pesce et al., 2016). It is important that quality early physical experiences, delivered in an appropriate manner, are necessary to ensure the optimal development of essential movement skills

(EMS) (MacNamara et al., 2015). After the application of COVID regulations the outcome of the games done was positive. A substantial body of research (Stodden et al., 2008; Robinson & Goodway 2009; Giblin et al., 2014a,b) highlights how structured instruction and feedback are required to ensure that EMS develop appropriately. Playing with learning and designing environments of physical activity games is crucial. Adaptation to the games applied by COVID regulations, have forced children to develop additional problem solving skills, promote social dynamics and develop FMS and returned children and adolescents' rights to socialise and play.

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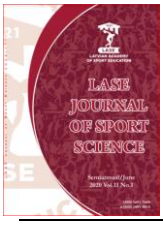

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REVIEW PAPER

MEANINGS THAT LATVIAN CONSUMERS ATTACH TO THE SPORT LICENSED PRODUCTS AND PURCHASE BEHAVIOR

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Abstract

Justification and aim of the study. One of the main sources of revenue for sport teams globally is the licensed merchandize. Research on the meanings that sport consumers embed to sport team licensed products is limited, especially in Baltic countries. In addition, there is lack of knowledge on factors that can influence these meanings. This research aims to respond to these gaps by exploring differences on the meanings that Latvian consumers attach to the sport licensed merchandize based on materialism and purchase behavior. Material and methods. The sample was reached using a self-administered online questionnaire and consists of 67 sport team fans in Latvia. Descriptive statistics, Cronbach's α coefficient and significance of differences (T-Tests) were estimated with the use of the statistical program SPSS. Results. Results indicated average purchase behavior, low amount spending on sport licensed products and low materialism. Experience, socialization, aesthetics, personal history and locality were evaluated by an average degree, while aesthetics, followed by experience gained a higher evaluation. Significant differences emerged on the Latvian consumers meanings towards sport licensed items of their favorite team based on both materialism and purchase behavior. Conclusions. The results of the study offer significant theoretical and practical contributions, for academics, sport teams and marketers in the sport industry as well.

Keywords: *Sport team licensed products, Product meanings, Materialism, Latvian sport consumers, Purchase behavior, Sport consumer behavior*

Introduction

The global market of sport licensed merchandise is a growing market which generated US$35.5bn in 2018 and is estimated to reach US$58.7bn by 2027 (T.M.R. Report, 2020).The licensed merchandise is an important source of revenue for the sport properties worldwide. This phenomenon can be ascribed to the sport team fans affiliation with their favorite sport entities or teams and the emotions they develop towards them, which then lead to the purchase of their licensed items.

Research on the sport licensed merchandize has attracted the interest of marketing researchers in various fields such as branding (Ross, 2006) and in relation with variables such as purchase intentions (Kim & James, 2016) and consumers' impulse buying tendencies (i.e. Chen, Lin & Chang, 2013). An emerging area for research in this line is the exploration of symbolic and other meanings that consumers have embedded in sport licensed merchandize (Papadimitriou & Apostolopoulou, 2015). Indeed, several recent studies have approached this area in countries such as USA (i.e. Kwak, Kwon & Li, 2015; Apostolopoulou & Papadimitriou, 2018) and Greece (i.e. Apostolopoulou, Papadimitriou & Damtsiou, 2010; Papadimitriou, Apostolopoulou, Branvold & Gargalianos, 2020). However, to our knowledge relevant evidence from Baltic countries is missing.

In addition, Papadimitriou and Apostolopoulou in 2015 developed the Meanings of Sport Licensed Products (MSLP) scale which includes seventeen items comprising five factors in order to offer a valid and reliable instrument for estimating the product meanings that sport consumers attribute to licensed products of their favorite teams. These factors are Experience, which "reflects the feelings and enjoyment felt by the use of team licensed items", Socialization, which "indicates the opportunity team licensed products offer to sport consumers to connect with their favorite team and other team supporters", Aesthetics, which "captures the aesthetic appeal and attractiveness of the team licensed products", Locality, which "relates to sport consumers' ties with the local community" and Personal history, which "represents the value of these products for personal self-expression and as a reminder of people and events in one's life" (Apostolopoulou & Papadimitriou, 2018, p. 540).

Finally, an important factor that has been found important on explaining individuals' possessions is materialism (Richins, 1994). It has been defined as the "devotion to material needs and desires, to the neglect of spiritual matters; a way of life, opinion, or tendency based entirely upon

material interests" (Oxford English Dictionary). Literature suggests that the orientation of consumers with low levels of materialism focuses the interpersonal/symbolic values as well as the hedonic potential of possessions, while the orientation of consumers with high levels of materialism focuses mostly utilitarian, appearance and status dimensions (Richins, 1994). Finally, materialism has been proved as a major determinant of purchase intention (Yoo & Lee, 2009).

Based on the above and drawing on the Meanings of Sport Licensed Products (MSLP) scale (Papadimitriou & Apostolopoulou, 2015) the purpose of this research is threefold:

(a) to explore Latvian sport team fans, purchase behavior towards the licensed products of their favorite team and level of materialism,
(b) to explore the Latvian sport consumers' meanings for their favorite team's licensed items, and
(c) to identify possible differences on the embedded meanings based on sport consumers purchase behavior towards the licensed products of their favorite team and level of materialism.

Material and Methods

Research Setting, Data Collection and Sample. For the purposes of this research a quantitative research was conducted with the use of an online survey (questionnaire), which was distributed to Latvian sport team fans. The data collection took place between December 2020 and February 2021. The final sample consists of 67 respondents, sport team fans in Latvia. Table 1 depicts the demographic profile of the sample. The majority of the respondents are male (70,1%), almost half up to 34 years old (47,8%), full or part time employees (67,2%), hold a less than 4 year education degree (32,8%), a university degree (16,4%) or have fulfilled post graduate studies (34,3%).

Table 1.

Demographic profile of the sample

Variables		***f***	***%***
Gender	Male	47	70,1
	Female	20	29,9
	Total	67	100,0
Age	18-24	14	20,9
	25-34	18	26,9
	35-45	29	43,3
	46+	6	9,0
	Total	67	100,0
Educational level	Secondary school	7	10,4
	<4 year education	22	32,8

Table 1. continuation

	University degree	11	16,4
	Post graduate studies	23	34,3
	Total	63	94,0
Employment status	Full or part time employee	45	67,2
	Self-employed	4	6,0
	Un-employed	3	4,5
	Retired	3	4,5
	Student	12	17,9
	Total	67	100,0
f=frequency, %=percent			

Measures. The self-administered online questionnaire consisted of three parts. The first included questions on the demographic profile of the sample (gender; age; educational level; employment status). In the second part respondents had to declare their favorite sport team and to show their purchase behavior by responding to the questions *"In the past 24 months have you bought any licensed products of your favorite team?"* and *"How much money, on average, do you spend on sport licensed items with the logo/colors of your favorite team, in a typical season?"*. Finally, the third part included measures for six variables, five of which (experience, socialization, aesthetics, personal history, locality) constitute the dimensions of the Meanings of Sport Licensed products that have been suggested by Papadimitriou and Apostolopoulou (2015) and the sixth variable was materialism. All measures for these six variables were borrowed from the literature, as shown in Table 3 and a 7-point Likert scale was used to measure all items, where 1 expressed *"strongly disagree"* and 7 *"strongly agree"*. All measures were translated from English to Latvian following the back translation process.

Limitations and actions taken. One limitation often present in research of sport team fans consumers is the bias that comes from the social desirability. Social desirability *"reflects the tendency on behalf of the subjects to deny socially undesirable traits and to claim socially desirable ones, and the tendency to say things which place the speaker in a favourable light"* (Nederhof, 1985, p.264). To deal with this limitation several actions were taken as suggested by the literature (Nederhof, 1985) and these include, the anonymity of the questionnaire, its random distribution and the declaration in the beginning of the questionnaire that the research was academic and that there was no affiliation with any sport team. In addition, efforts were made to increase the size of the sample.

Statistical Analysis. The statistical program SPSS was used for analyzing the research data. First, descriptive statistics were estimated (f, %,

means, SD, medians), followed by a reliability analysis with the Cronbach's α coefficient. Finally, T-Tests were run to explore significant of differences on sport team fans' meanings attributed to sport licensed products based on (a) level of materialism and (b) purchase behavior (whether they had bought licensed products and the amount of money that they spend on average on licensed products of their favorite sport team in a typical season).

Results

Most of the respondents reported that their favorite sport is football (80,6%), followed by hockey (22,4%) and basketball (14,9%). In addition, almost half of them (53,7%) had bought licensed products of their favorite sport team during the last 24 months. The amount that the majority (64,2%) of them spends on average on licensed products in a typical season is up to 50 euro (Mdn=11-50 euro), while 22,4% spend 51 to 100 euro per season (see Table 2).

Table 2.

Favorite sport team, purchases of licensed products and money spent, frequencies, percentages and median

	f	*%*
What is your favorite sport?		
Basketball	10	14,9
Football	54	80,6
Hockey	15	22,4
Beach volleyball	2	3,0
Luge	1	1,5
Fitness	1	1,5
Boxing	1	1,5
Biathlon	1	1,5
Swimming	2	3,0
Stand shooting	1	1,5
Stretching	1	1,5
Handball	3	4,5
In the past 24 months have you bought any licensed products of your favorite team?		
yes	36	53,7
no	31	46,3
Total	67	100,0
How much money, on average, do you spend on sport licensed items with the logo/colors of your favorite team, in a typical season? (Mdn=11-50 euro)		
less than 10 euro	16	23,9
11 - 50 euro	27	40,3
51 - 100 euro	15	22,4
101 - 150 euro	6	9,0
more than 151 euro	2	3,0
Total	66	98,5
f=frequency, *%*=percent, Mdn=Median		

Table 3 shows the means, standard deviations, medians and Cronbach's a coefficients of the dimensions of the meanings that the sample attribute to the licensed products of their favorite sport team and of the materialism, as well. The Cronbach's a coefficient showed high reliability for all 5 constructs of the Meanings of Sport Licensed products (MSLP) scale (experience, socialization, aesthetics, personal history, locality) and materialism.

All 5 dimensions of the Meanings of Sport Licensed products (MSLP) scale were evaluated by an average degree by the respondents. Aesthetics was the one with the higher evaluation (M=4,43, SD=2,07, Mdn= 4,67) and this shows that Latvian sport team fans focus on the characteristics of the licensed products. The second higher evaluated dimension was experience (M=4,08, SD=2,04, Mdn= 4,50). Socialization (M=3,64, SD=1,82, Mdn= 3,50), personal history (M=3,88, SD=1,90, Mdn= 4,00) and locality (M=3,82, SD=1,92, Mdn= 3,67) were evaluated slightly below average. Finally, materialism was evaluated low by Latvian sport team fans (M=2,98, SD=1,41, Mdn= 2,75). Some indicative examples are that they disagreed with the statement "I admire people who own expensive cars and clothes" (M=2,30, SD=1,69). and "My life is better if I buy and own a lot of belongings" (M=2,59, SD=1,66).

Table 3.

Measurement items of MSLP scale constructs and materialism, means, standard deviations, medians and Cronbach's alpha

	M	*SD*	*Mdn*	*α*
Experience (MSLP scale by Papadimitriou & Apostolopoulou, 2015)	*4,08*	*2,04*	*4,50*	*0,93*
Provide me with a sense of pride for myself	4,00	2,32		
Make me feel a stronger attachment to the team	4,24	2,16		
Give me a feeling of warmth	4,02	2,23		
Help me enjoy the games of my favorite team	4,05	2,26		
Socialization (MSLP scale by Papadimitriou & Apostolopoulou, 2015)	*3,64*	*1,82*	*3,50*	*0,85*
Create opportunities to meet people	3,42	2,12		
Allow me to associate with other fans	3,41	2,16		
Allow me to associate with my team	3,53	2,24		
Aesthetics (MSLP scale by Papadimitriou & Apostolopoulou, 2015)	*4,43*	*2,07*	*4,67*	*0,94*
Are attractive items	4,30	2,18		
Have the logo/colors of my favorite team	4,47	2,26		
Have nice design	4,53	2,17		
Locality (MSLP scale by Papadimitriou & Apostolopoulou, 2015)	*3,82*	*1,92*	*3,67*	*0,83*
Reflect the mentality of the region	3,68	2,23		
Identify my connection to the city I live	3,62	2,25		

Table 3. continuation

	M	*SD*	*Mdn*	*α*
Help me cheer for my home team	4,15	2,19		
Personal history (MSLP scale by Papadimitriou & Apostolopoulou, 2015)	*3,88*	*1,90*	*4,00*	*0,86*
Remind me of my family or a beloved person	3,42	2,19		
Remind me of my personal history or a special event	4,17	2,20		
Remind me of fond memories from games/parties	4,06	2,06		
Materialism (Yoo & Lee, 2009 based on Richins & Dawson's, 1992)	*2,98*	*1,41*	*2,75*	*0,89*
I like to own things that surprise people	3,89	2,02		
A lot of things I own say about how well I am doing in life	3,30	1,96		
I admire people who own expensive cars and clothes	2,30	1,69		
I like a lot of luxury things in my life	2,65	1,72		
My life is better if I buy and own a lot of belongings	2,59	1,66		
I would be happier if I could afford to buy more things	3,06	1,89		
My life would be better if I owned certain things that I didn't have	2,98	1,94		
Sometimes it bothers me that I can't afford to buy all the things I want	3,06	2,08		
M=Mean, SD=Standard Deviation, α=Cronbach's α, Mdn=Median, 7-point Likert scale				

T-tests were conducted for exploring any possible differences on respondents' meanings of sport licensed products based on their level of materialism, on whether they had purchased their favorite sport team's licensed products and also, based on the amount of money that they spend, on average, on sport licensed items of their favorite team, in a typical season (see Table 4). The median of materialism and money spend was the threshold for dividing the groups in high and low scores.

The T-tests showed significant differences on sport team fans meanings of sport licensed based on the examined variables. First, sport team fans with higher levels of materialism evaluated experience (M=4,95, SD=1,62), socialization (M=4,42, SD=1,57), aesthetics (M=5,33, SD=1,54), locality (M=4,39, SD=1,76) and personal history (M=4,59, SD=1,59) to higher degree compared with those who expressed lower levels (experience: M=3,26, SD=2,06, t(62,09)=3,70, p<0,001; socialization: M=2,90, SD=1,76, t(64)=3,69, p<0,001; aesthetics: M=3,59, SD=2,18, t(59,49)=3,78, p<0,001; locality: M=3,28, SD=1,94, t(64)=2,41, p<0,05; personal history: M=3,22, SD=1,95, t(64)=3,14, p<0,01).

In addition, results showed significant differences on sport consumers' attributed meanings to their favorite team licensed products based on their purchase behavior. More specifically, fans who had purchased licensed products of their favorite team in the past 24 months evaluated significantly higher the dimensions of experience (M=4,77,

SD=1,66), socialization (M=4,06, SD=1,60), aesthetics (M=5,19, SD=1,66) and locality (M=4,28, SD=1,62) compared to those who had not bought any licensed product (experience: M=3,24, SD=2,16, t(53,75)=3,18, p<0,01; socialization: M=3,13, SD=1,97, t(64)=2,11, p<0,01; aesthetics: M=3,53, SD=2,18 t(53,51)=3,40, p<0,01; and locality M=3,27, SD=2,13, t(64)=2,19, p<0,05). However, results did not show significant difference on sport consumers' personal history evaluation based on their purchase behavior.

Furthermore, T-tests showed several significant differences on respondents' meanings of sport licensed products based on the amount of money that they spend, on average, on sport licensed items of their favorite team, in a typical season. First, sport consumers who had spent 51 euro and more on sport licensed items evaluated to a higher degree experience (M=4,91, SD=1,60) compared to those who had spent less than 50 euro (M=3,63, SD=2,12, t(56,58)=2,77, p<0,01). The same held true for aesthetics, where sport consumers who had spent 51 euro and more on sport licensed items expressed higher evaluation (M=5,25, SD=1,61) compared to those who had spent less than 50 euro (M=4,00, SD=2,18, t(57,51)=2,64, p<0,05). Similarly, sport consumers who had spent 51 euro and more on sport licensed items evaluated personal history to a higher degree (M=4,68, SD=1,44) compared to those who had spent less than 50 euro (M=3,46, SD=1,99, t(58,06)=2,86, p<0,01). On the other hand, there were no significant differences on sport consumer responses based on the amount of money that they spend regarding socialization and locality.

Table 4.

T-test for comparing the Means that sport consumers attach to the licensed products based on materialism, purchase behavior and money spent

	M	**SD**	**M**	**SD**	**t**	**df**	**Sig. (2-tailed)**
Materialism	**Low materialism**		**High materialism**				
Experience	3,26	2,06	4,95	1,62	3,70	62,09	0,000
Socialization	2,90	1,76	4,42	1,57	3,69	64	0,000
Aesthetics	3,59	2,18	5,33	1,54	3,78	59,49	0,000
Locality	3,28	1,94	4,39	1,76	2,41	64	0,019
Personal history	3,22	1,95	4,59	1,59	3,14	64	0,003
Purchase behavior	**No purchase**		**Purchase**				
Experience	3,24	2,16	4,77	1,66	3,18	53,75	0,002
Socialization	3,13	1,97	4,06	1,60	2,11	64	0,038
Aesthetics	3,53	2,18	5,19	1,66	3,40	53,51	0,001
Locality	3,27	2,13	4,28	1,62	2,19	64	0,032
Personal history	3,43	2,09	4,26	1,66	1,79	64	0,079
Average money spent per season	**0-50 euro**		**51 euro and more**				

Table 4. continuation

	M	SD	M	SD	t	df	Sig. (2-tailed)
Experience	3,63	2,12	4,91	1,60	2,77	56,58	0,008
Socialization	3,37	1,81	4,15	1,77	1,69	64	0,096
Aesthetics	4,00	2,18	5,25	1,61	2,64	57,51	0,011
Locality	3,60	2,02	4,23	1,69	1,29	64	0,203
Personal history	3,46	1,99	4,68	1,44	2,86	58,06	0,006
M=Mean, SD=Standard Deviation, t=t-values, df=degrees of freedom,7-point Likert scale							

Discussion

The first aim of this research was to explore Latvian sport team fans purchase behavior towards the licensed products of their favorite team and level of materialism. Empirical results showed that almost half of the fans had purchased licensed products of their favorite sport teams during the last 24 months and the amount that they usually spend annually is up to 50 euro. Very few of them spend a higher amount. An interesting finding was that materialism was evaluated very low by Latvian sport team fans. This finding could be an explanation on the average purchases and the low amount that they usually spend per season on licensed products of their favorite team, as materialism influences purchase intentions (Yoo & Lee, 2009). However, more research is needed to shed light on this.

The second aim of this study was to explore the Latvian sport consumers' meanings for their favorite team's licensed items. Results indicated that all five dimensions of the Meanings of Sport Licensed products (MSLP) scale (experience, socialization, aesthetics, personal history, locality) were evaluated by an average degree by the respondents. Aesthetics, followed by Experience were evaluated higher and this means that Latvian sport consumers take into account the appearance and attractiveness of the team licensed products, as well as, the feelings that they have when using them. On the other hand, the low evaluations on the dimensions of socialization, personal history and locality show that they have not associated to a high degree the licensed products of their favorite team with the opportunity to meet other people members of the team, any relevant personal memories, nor with the locality of the team. These findings respond to the calls of the sport consumer behavior literature for exploring symbolic and other meanings embedded in sport licensed products (Papadimitriou & Apostolopoulou, 2015) and contribute to the existing knowledge by testing the Meanings of Sport Licensed products (MSLP) scale in Latvia.

The final aim of this research was to identify possible differences on the embedded meanings based on sport consumers purchase behavior

towards the licensed products of their favorite team and level of materialism. First, regarding materialism sport team fans with higher levels of materialism evaluated significantly higher all dimensions of the Meanings of Sport Licensed products (MSLP) scale. This result is in line with the previous literature who has highlighted the focus of individuals with high materialism on utilitarian, appearance and status aspects (Richins, 1994). Second, regarding purchase behavior, the results showed that consumers who had bought at least one licensed item of their favorite team during the last 24 months evaluated experience, socialization, aesthetics and locality to a significantly higher extent compared to those who had not. Finally, sport consumers who usually spend higher amount of money on sport licensed items evaluated to a higher degree experience, aesthetics personal history to a higher degree compared to those who spend lower amount.

Conclusions

The present research contributes theoretically to the existing literature of sport licensing merchandize and provides remarkable managerial implications. From a theoretical point of view, the study contributes to the existing theory by (a) testing the Meanings of Sport Licensed Products (MSLP) scale (Papadimitriou & Apostolopoulou, 2015) in the Latvian sport consumer context, (b) by providing empirical results on Latvian sport consumers purchase behavior and money spend on sport licensed merchandize and by (c) highlighting significant differences on the embedded meanings based on sport consumers purchase behavior and level of materialism.

From a practical point of view, the finding are of great importance for sport teams and marketers in the sport industry who are willing to invest in selling sport licensed products.

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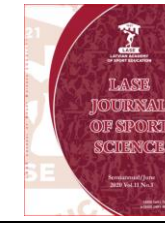

REVIEW PAPER

TECHNICAL SKILLS DEVELOPMENT FOR YOUTH FOOTBALL PLAYERS: THEORY AND PRACTICE

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Abstract

The aim of talent development programmes in football is to provide players with a quality training process that contributes to the growth of success potential in the long run. Previous research show that the development of technical skills for youth football players is an important aspect in the growth of football players' skills for future achievements. However, no research has focused on what approach and content in technical training is optimal for youth football players aged 10 – 12 in order for them to use their technical training potential. The aim of the research is to comparatively evaluate different approaches to the technical training of youth football players aged 10 – 12, so that coaches could better understand talent development in youth football. Research methods: analysis of scientific articles (electronic scientific databases Web of Science Core Collection, ScienceDirect, Google Scholar), search keywords – "football", "soccer", each of these words was associated with the terms – "technical development", "technical skills development", "youth" or "young". The period covered by the research is from 2000 to 2021 and includes content analysis of available technical training programmes and recommendations for youth football players aged 10 – 12 in the European countries leading in football. Main results of the research: the global approach is the most optimal approach to technical training of youth football players (aged 10 – 12), as it promotes both the growth of technical skills of youth players and the holistic development of talent. The research demonstrates the advantages of the global approach compared to the analytical approach, in which the acquisition and development of technical skills is monotonous and

standardized, which can lead to a loss of interest in the training process for youth players.

Key words: *football technical skills development, youth football, approach to the technical training of youth football players*

Introduction

Many sports around the world are putting into practice the Long-Term Athlete Development (LTAD) model (Balyi, et al., 2018) to promote the development of talented athletes (Ford, et al., 2020). The LTAD model states that there are critical phases during a child's physical (Malina, et al., 1990) and psychological development (Stafford, 2005; Malina, 2008), which provide coaches with optimal opportunities to promote the development of certain abilities of athletes. The LTAD model includes seven stages (Balyi, et al., 2018), covering participation in sport and physical activity, teaching, competition, and regeneration in sport and physical activity. Studies show that athletes need at least a decade of practice (Ericsson, et al., 2007) to achieve elite-level performance (Baker, et al., 2017; Pruna, et al., 2018). Research results also suggest that the most successful football players show technical, tactical, anthropometric, physiological and psychological advantages that vary non-linearly with age (Augste & Lames, 2011), maturity and game positions, thus, coaches need to take into account the technical skills (ball control, passing, dribbling and shooting, etc.) (Meylan, et al., 2010) and tactical skills of players as a whole together with the anthropometric and physiological characteristics of football players' age (Sarmento, et al., 2018). Moreover, U9 and U10 boys from a professional football academy have been studied, and the results of the study show that they cover more than 4000 m in competitions but U10 boys tend to cover longer distances at high and moderate speeds than U9 boys. Therefore, the distances and speeds covered during competitions could be an important part of talent identification and development process for these age groups (Goto, et al., 2015).

The importance of technical skills in achieving elite-level performance during football players' careers will be discussed below. Football technique is mainly classified according to the player's actions with or without the ball, the level of difficulty of the technique element, the role of the players and the player's actions on the spot or in motion (Slaidiņš & Fernāte, 2021). Researcher Knapp (1963) created the initial definition of skill, establishing it as the learned ability to achieve predetermined results with maximum certainty, often with minimal time and/or energy consumption. Technical skills with the ball: ball control, passes, crosses, dribbles, tackles, headers, shots, corners, free-kicks and throw-ins (Taylor,

et al., 2008; Rampinini, et al., 2009; Höner & Votteler, 2016; Sarmento, et al., 2018). However, if the technique of youth football players is considered, then research results show that technical skills (dribbling, passing, juggling) showed a statistically significant positive effect on the development of professional players (Sieghartsleitner, et al., 2019), while technical skills (dribbling, ball control, shooting) in early adolescence have a greater impact on the future performance than speed skills (Höner, et al., 2017). For example, speed and accuracy of dribbling play an important role in the crucial moments of a football game, meaning that the fastest players are able to provide dribbling technique when covering shorter distance in a more efficient and economical style. This is achieved by taking shorter and faster steps, as well as increasing the cadence of foot and ball contacts (Zago, et al., 2016). Research results also reflect the importance of passing and centering skills, and agility and motivation in the development of youth players; if the development of these skills in childhood and early adolescence is encouraged, youth football players might have better chances to pursue an athlete career later on (Forsman, et al., 2016).

Taking into account that the technical skills (for example, tackling, heading, passing and crossing (Roberts, et al., 2019), first touch, striking the ball, one-versus-one ability, and technical ability under pressure (Larkin & O'Connor, 2017; Roberts, et al., 2019)) of youth football players is one of the determining aspects in the development of youth players and in having further success in football, it is necessary to evaluate the most optimal ways of implementing technical training for youth football players. The aim of the research is to comparatively evaluate different approaches to the technical training of youth football players aged 10 – 12, so that coaches could better understand talent development in youth football. The article will comparatively evaluate the theoretical viewpoints and the content of football programmes offered by the leading European countries for implementing technical training for youth football players aged 10 – 12.

Material and Methods

In order to comparatively evaluate different approaches to the technical training of youth football players aged 10 – 12, a systematic search and review (Booth, Sutton, & Papaioannou, 2016) of scientific articles was conducted in three electronic databases of scientific literature – Web of Science Core Collection, ScienceDirect, Google Scholar. The inclusion criteria for study selection: the article was written in English. Keywords used for the search – “football”, “soccer”, each of these words was associated with the terms – “technical development”, “technical skills development”, “youth” or “young”. The period covered by the research is

from 2000 to 2021. The search process was repeated 12 times, using each keyword. The results of the research show that the majority of the information is available in the Google Scholar n=47500, Science Direct n=1715, Web of Science Core Collection n=83. As a result, 15 sources were analysed in depth.

In order to comparatively evaluate the implementation recommendations of different approaches to the technical training of youth football players aged 10 – 12 in football programmes for ages 10 – 12, the content of available technical training programmes and recommendations for youth football players aged 10 – 12 in the European countries leading in football was analysed.

Theoretical Approaches to Technical Training of Youth Football Players Aged 10 – 12. Technical and tactical training if often the priority of the training plan, thus, it is largely a prerequisite for other training activities. Such constraints contribute to the need for a more global approach to the player training process**,** planning the training process so that it promotes the simultaneous development of physical, technical, tactical, and mental skills. (Morgans, et al., 2014). Training programmes should include endurance and other mental, physical, technical, and decision-making skills, as well as take into account the ability level and potential for progression; programmes should have long-term aims and include methods that are important for a higher level of achievement and improve youth's ability to learn, develop and progress, as well as continue to practice successfully (Vaeyens, et al., 2008).

Traditional football practice is dominated by a linear approach to the training process, where technical and other skills must be practiced and mastered (Samur, 2019) before players are considered ready to play the game itself (Harvey, et al., 2010). The good practice in the acquisition of football skills suggests that there should be a holistic approach to the development of technical skills in football, which would simultaneously concentrate all skills together, creating a combination of, for example, perceptual-cognitive and technical skills (Larkin & O'Connor, 2017). This is due to the fact that there are differences between selected and non-selected youth players of the professional youth football academy in the performance of football-specific skills and psychosocial abilities; this means that the combination of these skills is important for future growth and selection of youth players (Platvoet, et al., 2020).

In practice, the technical training of young football players mainly involves two approaches to the acquisition of technical skills: the analytical or traditional, which is dominated by the repetition of successive technical exercises, which contributes to achieving the goal set in the technical

acquisition, and the global approach or alternative approach to teaching sports games, which emphasizes the integration of technical exercises into tactical situations (see Table 1). The global approach promotes sports practice based on educational experience, allowing the player to form a creative practice on the playing field, while playing autonomously and taking initiative and responsibility. This type of methodology stimulates real game situations that arise in competitions. The use of the global approach leads to greater understanding, as the exercises offered are tasks involving an opponent, a ball and one or more players. This model is based on simplified and modified games or training situations that reflect small game episodes. These tasks require such cognitive processes as thinking, perception, analysis and decision-making, and the player learns by actively exploring the confrontation in a real game environment (Bernal-Reyes, et al., 2018).

Table 1

Content of the Training Programmes for Analytic and Global Approach (modified according to Bernal-Reyes, et al., 2018)

	10-11 years old	
Sessions	*Analytic approach*	*Global approach*
1	Running	Moves without/with ball in the field
2	Pass	Collectives' games to 1 and 2 touches
3	Reception	Work with number superiority (2vs1) (3vs2)
4	Heading	Small sided games
5	Dribbling	Defence / Attack game transitions
6	Shooting	Free shots and corner shots as offensive plays
7	Control	Ball position
8	Running and shooting	Defence / Attack game transitions
9	Reception and pass	Game amplitude
10	Heading, dribbling and control	Collective games with definitions

Table 1 shows that each programme focused on one approach: analytical or global, and there were similar exercises in the acquisition of each element of the technique. The training programme lasted 40 classes, the classes took place twice a week, where each class lasted 90 minutes, while on weekends friendly matches were played to strengthen the acquired knowledge and motivation of youth football players. The results of this study show that the implementation of both approaches is equally effective in promoting the individual technical skills of youth football players aged 8 to 11 (Bernal-Reyes, et al., 2018). Other studies also show that the results of technical tests of the research groups do not provide clear evidence for the superiority of the differential learning approach in comparison to the classical learning approach, where the differential learning approach was implemented without the repetition of movements to be learned and without error

correction in the skill acquisition process, where youth players independently perform all complex movements in constantly changing conditions, as opposed to the traditional approach, which was dominated by multiple standardized repetitions of movements (Bozkurt, 2018).

In turn, the results of other studies show that there is a correlation between football players' actions in competitions and the implementation of the global approach and individual defence tactics, team attacking tactics and team defence tactics; therefore, it is considered that the tactical aspects of the game should be learned at an early age, as opposed to the traditional approach, where the training process is mostly focused on technique acquisition. In the global approach, the various factors influencing the game are gradually strengthened, taking into account the players' age and the game itself, providing players with a diverse and changing experience (Carlos, et al., 2018). For instance, available research suggests that physiological responses (for example, heart rate, blood lactate levels and perceived load assessment), as well as tactical and technical skill requirements may change during Small-Sided Games by changing such factors as the number of players, size of the field, rules of the game, and encouragement from the coach (Aguiar, et al., 2012).

The analytical approach is mostly used when starting technique acquisition in football; however, for example, the effective technical training of players aged 10 – 11 is characterized by a combination of several techniques (Matyas, 2013), children improve their coordination of movements with the ball, they learn unknowingly, and they depend on the coach's instructions when they play. Nonetheless, the analytical approach is monotonous and standardized, which can lead to a loss of interest for young players about the training process (Bernal-Reyes, et al., 2018).

Youth players reach professional status – gain better dribbling skills at an average age of fourteen. Players improve their technical skills even after a rapid growth spurt, while reaching the plateau in sprint after the growth spurt. There is a correlation between the speed and accuracy of youth football players combined with technical skills (Huijgen, 2013). Faster youth players (aged 12 – 13) were able to run with the ball on a shorter path in a more economical way compared to slower players, therefore, in order to effectively develop dribbling skills, coaches must use exercises that require high frequency of steps and a narrow running trajectory. Coaches need to develop special training that mimic crucial games that require short steps and high step frequency, combined with quick adaptation to environmental factors, for example, task constraints or active opponents (Zago, 2016). In turn, youth players with excellent dribbling

skills at a younger age will be later selected as midfielders (Deprez et al., 2015).

Those players who later become professionals in adolescence are slightly taller, heavier, leaner, fitter, faster and slightly more agile, more skilled and motivated and practiced more when compared to their peers in the development programme (Williams, et al., 2020). It is very important to ensure multi-annual monitoring of all youth players according to the training programme that meets the needs of each youth player (Platvoet, et al., 2020); but in order to implement an athlete-centred coaching, one of the approaches in technique acquisition is Teaching Games for Understanding (Harvey, et al., 2010), where it is very important to practice technique acquisition in an open environment in different contexts. Thus, it is necessary to create practical activities in which coaches involve their players as much as possible in such situations where players have to make decisions and make appropriate technical choices, and which simultaneously develop their perceptual-cognitive and technical skills (Fuhre & Sæther, 2020).

In general, it can be concluded that the use of analytical approach in the acquisition of technical skills of youth football players is equivalent to the use of the global approach; however, the global approach has its advantages, as it promotes the complex development of not only technical, but also physical, tactical and mental abilities. Below we will look at what approaches are recommended for coaches in the process of technical training by the football programmes of the leading European countries for youth football players aged 10 – 12.

Implementation of Theoretical Approaches in Football Programmes for the Technical Training of Youth Football Players Aged 10 – 12. This chapter will comparatively evaluate the available content of technical training programmes and recommendations for youth football players aged 10 – 12 in the European countries leading in football. The "FIFA Youth Football" handbook states that its aim is to create more opportunities for the development of youth football by providing global training process guidelines to all national associations. This handbook recommends to develop training programmes by taking into account the holistic approach to training and education activities, the developmental stage of youth football players and the learning objectives. Four stages of learning are identified: introductory stage (age 6 to 12), basic training (age 13 to 15), intermediate training (age 16 to 18) and advanced training (age 19 to 21). In the introductory stage of technical training it is recommended to: create and deepen the youth player's love for football through the game and allow the player to discover the need to learn a certain football technique, find their position on the field and understand the need to cooperate with teammates

in order to defeat the opponent. Coordination exercises, exercises to develop agility and suppleness, as well as reaction-based game skills and also change of direction are part of the training for this age group. Therefore, the global approach to the acquisition of player technical skills is recommended predominantly, as the traditional approach is no longer appropriate for the technical training of youth football players, as teaching needs to find a balance between specific technical exercises and creativity in free play, allowing creativity to come to the forefront. Tactical aspects alongside technique acquisition are especially important, as the tactical aspect and understanding of the games have proven to be the deciding factor for good team performance. At an early age, it is important for football players to develop a culture of tactical thinking at the same time. For example, see Table 2 on individual ball control in the global approach, showing which technical skills are the focus, what needs to be taught and what needs to be developed.

Table 2

Content of the Training Programmes for Technical Skill Development

"FIFA Youth Football"	*"Croatian Football Federation - Development curriculum" (Joazak & Kepcija, 2017)*	*"Spanish Academy Soccer Coaching - 120 Practices from the Coaches of Real Madrid, Atletico Madrid & Athletic Bilbao" (Moreno, et al., 2012)*	*"Programma di Sviluppo Territoriale"*
Repertoire of technical moves and confidence on the ball	Elementary technique and dynamic technique	Basic technique and specific technique	Activities based on in-game experience with the ball in all forms and shapes
Coordination	Movement technique without the ball	Coordination, running technique	-
Ball control skills: under pressure, at high speed, when tired, under threat from the opponent	- (Functional technique only starting from U-13)	Specific and competition technique	Fundamental techniques – dominated by actions with the ball
Technical skills when moving •*taking the ball, controlling the first pass* • *dribbles, feints; various types of crosses* • *follow-up (head, feet) and finishing* • *direct play (one or two touches)*	Dynamic technique	Specific and competition technique	Fundamental techniques – dominated by game situations (without opponents) using combinations of technical elements and predefined tasks
Speed of execution of move (making the right choice quickly)	- (Functional technique only starting from U – 13)	Competition technique	Dominated by game situations (without opponents) using combinations of technical elements and predefined tasks
Global approach	*Analytical approach*	*Global approach*	*Global approach*

The technical training recommendations from the "Croatian Football Federation – Development curriculum" (Joazak & Kepcija, 2017) will be discussed below. The aim of this development programme is to create a supportive basis for cooperation with football clubs, as well as to formulate a shared plan and programmes to be used worldwide for the optimal development of football players. The optimal period for the development of technical and tactical intelligence: elementary technique: U7 – U15; dynamic technique: U11 – U15; functional technique/ individual tactics U13 – U17; group tactics (2,3,4 players): U13 – U19; team tactics: U15 – U19. Thus, in the age group of 10 – 12 it would be optimal to develop elementary and dynamic techniques. While the aim of elementary technique acquisition is the formation of basic biomechanical movements, the aim of dynamic technique acquisition is to master the application of elementary technique in dynamic situations. The elementary technique is divided into two parts: movement technique without the ball and with the ball. Movement technique without the ball: walking, running, acceleration, sprint, starting speed, running while changing directions and pace, jumping, jumping down, jumping up, falling, sliding. In turn, movement technique with the ball is divided into 9 basic categories: kicking (into the goal and on run); heading; controlling, changes of direction, "shielding"; fake moves and feints; passing and accepting; stealing and intercepting; throw-in (throw from the touchline); juggling; goalkeeper technique. The elementary technique acquisition is dominated by the analytic approach in isolated static or dynamic conditions, while the dynamic technique acquisition is dominated by the synthetic method in isolated dynamic conditions. However, functional technique is developed only starting from U – 13, i.e. the application of elementary technique during decision-making, where the implementation of the synthetic method in facilitated and situational conditions has just begun. Thus, in the age group of 10 – 12 years, the emphasis is mostly on the analytic approach in the acquisition of technical skills.

The book "Spanish Academy Soccer Coaching – 120 Practices from the Coaches of Real Madrid, Atletico Madrid & Athletic Bilbao" (Moreno, et al., 2012) serves as a support material for coaches in order to help improve the technical training of players in the training process. Technical/tactical training is based on both the general concept of football and the specific requirements of each football clubs' team, and it allows the preparation and development of training content for each football player, taking into account both his biological and chronological age. At the age of 10 – 11, individual technique, team technique and ball drills are the mainly developed skills, while at the age of 12 – 13 the main focus is on individual

technique, team technique, individual/team skills (drills). The acquisition of technical skills is divided into three major groups: basic technique (general elements); specific technique (specific elements); competition (specific elements in competitive situations) (see Table 2). As the acquisition of basic technical skills already includes the individual attack, individual defence and support techniques, which indicates the integration of technical acquisition in adapted game situations, it can be concluded that the technique acquisition at this age is dominated by the global approach.

The "Programma di Sviluppo Territoriale" programme provides a useful tool for coaches to offer games and widen experience opportunities to youth football players, thus, ensuring that the child grows into a motivated personality in line with its development. The coach should be focused on the long-term learning of one player in favour of the team's overall result. In the technical preparation at the age of U10 – U11, the development of actions with the ball takes place in all its forms and shapes, providing an intensive experience. In turn, the technical preparation of U12 – U13 takes place in two directions: 1) dominated by actions with the ball (all forms and methods of teaching), which have been designed to ensure activation at the beginning of training; 2) dominated by game situations (where there are no opponents), using combinations of technical elements with predefined tasks (movement technique, functional technique). The programme for football players aged 5 – 12 includes the following essential conditions: 1) The player as the main part of the training process; 2) Organized teaching; 3) Microclimate (mutual relations between the player and the coach, a player and a player, etc.); 4) High motor ability; 5) The game (game means playful, competitive activities that allow players to read situations, make choices and identify motor reactions in search of the most effective solutions)/ Exercises (Exercises mean repetition of gestures, motions or movements in a standardized form without the presence of an opponent); 6) Education linked to movement; 7) Love for the sport; 8) Task-oriented; 9) Inclusion; 10) Variability of practice. The aim of technical training is to provide such technical movements of youth players that are functional and adapted to the changing situations; therefore, they are defined as "open" skills, which means that technical skills are developed in a constantly changing environment. Various fundamental technique methods – ball control, leading, receiving, passing, kicking, head play, throw-ins – practically become functional units. Football technique is considered to be an element transferring players' decisions into movements, thus, it can be considered that the dominant approach to technique acquisition at this age is the global approach.

Discussion

The results of the research show that, comparatively evaluating the theoretical approaches to the technical training of youth football players aged 10 – 12 and the implementation recommendations for theoretical approaches in the technical training of youth football players in football programmes for the age of 10 – 12, two approaches are emphasized: the analytical or traditional (Bernal-Reyes, et al., 2018; Samur, 2019; Matyas, 2013), which is dominated by the repetition of successive technical exercises, which contributes to the achievement of the aim set in technical acquisition, and the global approach or alternative sports game learning approach (Harvey, et al., 2010; Morgans, et al., 2014; Larkin & O'Connor, 2017; Carlos, et al., 2018; Bernal-Reyes, et al., 2018; etc.) or the differential learning approach (Bozkurt, 2018), where the emphasis is on integrating technical exercises into tactical situations; the global approach is dominant.
From the point of view of sports science, the research results deepen the understanding of the global approach as the most optimal approach to the technical training of youth football players (aged 10 – 12), which promotes a holistic talent development for youth players. The results also prove its advantages compared to the analytical approach, in which the acquisition and development of technical skills is monotonous and standardized, which can lead to a loss of interest in the training process for youth players.

Research limitations: a systematic literature search and review was performed by selecting three databases – Web of Science Core Collection, Science Direct and Google Scholar. The selected keywords and the order of their application can be considered as limitations to systematic search, and they provided the previously mentioned results. The authors assume that if they had used other databases and other keywords and / or used them in a different order, the results of the research would have been different. The research can be continued by conducting a systematic literature search and review, selecting other scientific databases and languages.

Conclusions

Main conclusions: by comparatively evaluating the analytical and global approach to the acquisition of technical skills for youth football players aged 10 – 12, it can be concluded that both approaches to the acquisition of technical skills are equally effective; however, looking at it in the context of integral training of youth football players, the global approach is more effective. On the other hand, comparatively evaluating the content of available technical training programmes and recommendations for youth football players aged 10 – 12 in the European countries leading in football, it can be concluded that the global approach is dominant, which includes

gradual increase of complexity of technical exercises in changing conditions, for example, starting the acquisition and development of technical skills with the elementary technique (basic technique), continuing by acquiring the dynamic technique (specific technique), and, as the technical skills in football increase, promoting the acquisition and development of the functional technique (game technique).

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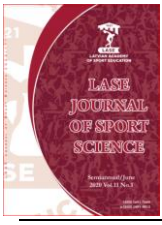

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REVIEW PAPER

IMPACT OF ENERGY'S QUANTUM PROPERTIES ON THE PROVISION OF BIOLOGICAL PROCESSES WITHIN THE HUMAN BODY

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Abstract

Cognitions in quantum physics and epigenetics suggest that the quality of life of a person, including the health of the physical body, may be directly derived from the content of thoughts of the particular individual (Bird, 2007). In turn, research in medicine, cell biology, neurobiology, etc. reveal that only one's own beliefs, convictions and attitudes are the determining impulses for the functioning of mechanisms of not only the emotional but also the physical body, including in the activation or deactivation of health or disease (Colloca, Sigaudo & Benedetti, 2008). At a time when the world is experiencing another crisis, this time in the form of a Covid-19 pandemic, it is very important to identify opportunities, methods and techniques by which a person can help oneself to maintain and preserve good health and a positive emotional state. Understanding of how thoughts can affect the body is one of the opportunities to maintain or restore mental well-being and health of the physical body. The publication discusses scientific theories on energy properties, constants and behaviour from the quantum to the molecular level. This publication includes a part of the theoretical review of the Doctoral Thesis on "Influence of Thoughts on the Intensity of Pain in the Lumbar Spine in People Aged 25-55".

Keywords:

Introduction

"Spirituality is physics we don't know yet", Nassim Haramein (2016).

Nowadays, every day more and more of the invisible becomes visible, the impossible becomes possible and the "mystical" becomes scientifically proven. Due to research in quantum physics, we are beginning to understand that all energetic processes in our cosmic space, incl. the human physical body, work according to the same principle (Haramein, Brown & Baker, 2016). According to the law of conservation of energy, this movement is infinite, never-ending and evolving (Einstein, 1979). As a person's consciousness expands, the limits of the individual's emotional and physical possibilities also open up (Tangney, & Fischer, (1995). In 2019, the World Health Organization recognized that a person's mental health also determines their physical health. Thus, a person's physical body is only as healthy as their psyche. The human body is a unique biological system in which various psychophysiological processes take place at the same time. In a healthy body, the cooperation between structures of all levels (cell – organ systems) is in balance. However, as a result of stress, viruses, bacteria, physical and emotional overload, and other harmful external factors, the balance of the functioning of this system is broken, leading to a decrease in immunity and a possible illness (Guzzetta, 1989; Dossey, 1997). Research over the past 50 years have confirmed the importance and effectiveness of a number of alternative and complementary methods and approaches of orthodox treatment to improving a person's physical and emotional state, incl. colour and sound therapies, meditation, specialized movement therapies, e.g. yoga, dancing, etc..

Objective of the study: to research scientific literature on the quantum properties of energy and their impact on the provision of biological processes within the human body.

ENERGY RESEARCH IN QUANTUM PHYSICS. Thanks to Rene Descartes and Sir Isaac Newton, for centuries the study of the universe was divided into two categories – matter and mind. The study of matter or material world was declared a sphere of science, because the laws of the universe that affect and govern the objective part of the world can be calculated and predicted. The world of mind (inner, spiritual world), on the other hand, was considered too unpredictable and so it was left for religion. Thus, over time, matter and mind strengthened as two different units, and dualism was born. Newtonian physics, also called classical physics, deals with mechanisms of object functioning in time and space, while also studying their interactions in the physical, material world. However, there are limitations to energy research in classical physics. It is incapable of studying the non-material world and its operation outside space and time, nor of studying the behaviours of the atom, which is one of the smallest particles in the universe that also forms matter. Quantum physics studies the

behaviour of the finest elementary particles, incl. electrons and photons, and it has been concluded that the behaviour of these particles significantly differs from the behaviour of things in the material world. From the point of view of astrophysics, there is an infinite amount of space in this three-dimensional space (Zel'dovich, Novikov, 1971). According to this theory, space is eternal in the sphere of spacetime – it has no edge or end, it continues indefinitely. But what about time? Time is usually felt by moving the body in space. This is because it takes a while to get from the moment when we think about what we need to do or what we will do to the moment when we actually do it, moving from one point to another. The greater the space and distance between two points, the more time it takes to get from one point to another. Accordingly, the higher the speed at which the movement will take place, the less time will be required (Karshenboim, Peik, 2004).

In the material three-dimensional world, senses are used to find path in space, so most of the attention is focused on people, objects, spaces (Rynasiewicz, 2004). All of this consists of matter and occupies a certain place in space and time. In physics, it is called locality (Mashhoon, 1990). One of the essential features of locality is separation, or partition, which in today's world obviously acquires the meaning of inconsistency or of a disturbing effect. Edgars Imants Siliņš (1999) explains this with the following example: "When observing something apart from ourselves, e.g. another person on the street or a car in the parking lot, we see and feel the space that separates us from the object of perception and, thanks to this, we feel detached from it. We are located at one point, while the observed object is located at another. The same principle applies to us having dreams or goals. The point where we are at the moment and the point where our dreams or goals are creates a sense of separation. The principle of localization is also the basis of orthodox medicine, when treatment is applied only to the physical body or the part of it in which complaints, pain or other unhealthy processes have been found. Its essence is the manipulation of the "visible", or the fight with the consequences.

If Newton's laws of physics are based on space more than time, then quantum laws are the opposite. The quantum sphere is an inward expression of the laws of nature: an invisible field of information and energy that unites everything material. Moreover, this field is the basis of all material things and phenomena (quantum field theory). This non-material field organizes, binds and controls all the laws of nature. The quantum sphere explains the fundamental nature of things on the most basic scale – the atomic and quantum scale. In the quantum world, there is no division between the two points of consciousness, contrary to the basic principles of Newton's world.

In comparison, it could be said that Newton's world deals with the objective – where the mind and matter are separated. In turn, the quantum world – with the subjective, where the mind and matter are so united that they are indistinguishable (Woolf, Hameroff, 2001). According to quantum field theory, elementary particles and the space around them are inseparable. Quantum space is a sphere of unity or unity consciousness (Kaku, 1993). Therefore, in the material world of things, as we move through space, we feel time, while in the non-material world of energy (vibration and frequency) everything goes the opposite way. If we increase of decrease the frequency of energy or the speed of vibration in the world of spacetime, we can move from one space to another, or from one dimension to another (Zeilinger, Svozil, 1985). In other words, states of consciousness are changing at this moment in order to access the united field of information (energy). Further on the discussion will focus on why this is so important and necessary for the well-being of the physical body and prevention of diseases.

QUANTUM ATOM STRUCTURE. An important discovery was made in 1907, when Ernest Rutherford (University of Manchester), the innovative physicist of that time, discovered that an atom can be split into a nucleus with its subatomic particles (protons and neutrons) and electrons which form an orbit around the nucleus. Rutherford assumed that the atom was, in fact, an empty space, not matter, as was previously believed in classical physics. He showed that electrons are connected to nuclei by electromagnetic fields. Further research in quantum physics focused on the study of the atomic nucleus. The more closely the nucleus was studied, the more indetermined and unclear the atom became until it completely disappeared.

The way how a person looks, feels and what their state of health is depends directly on what information creates and maintains this matter or – a person experiences what he/she thinks! (Tribus, McIrvine, 1971). Accordingly, if we understand that information forms matter, then changes in the information field or changes in the person's thoughts are necessary to change the matter. In order to make changes in the information field, it is necessary to collapse the space by changing the state of consciousness and the frequency of brain waves. In practice, this means making a conscious change in one's own thoughts! (Engström, Mårtensson, Avventi, Norbeck, Skare, 2015).

FOR THE BRAIN WAVE FREQUENCY, Alpha waves are 7.5 – 12 fluctuations per second, and they are generated by the right hemisphere of the brain. They are most common in children aged 6–12. The alpha frequency of the brain is very important in training and learning new

information, developing imagination, as well as it is related to solving creative issues, creativity and mental work. When a person has a normal alpha rhythm, the person is in a good mood and sees the world positively. Being in the alpha waves is a very relaxed, meditative state of mind. In this state, a person has visions while being awake. These same waves are responsible for dreams and fantasies. Alpha waves are involved in many types of healing practices where the visualization method is actively used. Alpha rhythm training creates balance, promotes self-control, develops abstract thinking and the ability to consciously direct attention. On the other hand, people whose brains are not working well enough in this range usually have memory issues. (Tiago-Costa, Quelhas-Costa, Santos-Baptista, 2016).

BEHAVIOUR MODEL OF THE INFORMATIONAL FIELD OR HOW DOES THE THOUGHT "LOOK LIKE"? Although atoms contain some small amount of matter, when quantum physicists tried to study it, they discovered that low-atom matter behaves differently in the quantum world compared to the matter we are used to deal with. It turned out that at the quantum level, matter is a volatile phenomenon and exists only as an opportunity, probability, variant (Ford, 2009). This is based on the discovery that it is possible to influence the elementary particles of matter or change their behaviour by observing them. They appear and disappear, depending on the observer's attention, which is focused on the appearance of a particular elementary particle. Only when the observer focuses attention on the location of a particular electron does the electron actually appear at that location. When the observer looks away, the elementary particle disappears again, turning into energy (Meier, 1999). According to this phenomenal effect, physical matter cannot exist or manifest itself until it is observed. Is it possible to assume that by focusing attention on a particular thought, it is possible to "see" or materialize it? Accordingly, without observation or focus on it, will the thought not materialize? (Matthews, 1996). In the quantum space, the elementary particle returns to where it came from – thus, a thought that does not have a focused attention "comes and goes" as a probability of possibility, without manifesting itself on the physical plane. This makes it possible to state that matter is constantly changing, fluctuating between a possible manifestation in the form of matter and disappearance (transformation) into energy. Scientists estimate that this process occurs 7.8 times per second (Matthews, 1996).

This energy is not a fixed reality in the quantum space, it exists as an infinite number of possibilities, or a "wave of possibilities", from which probabilities arise. Theoretically, each of the infinite possibilities could become a reality, but only one does. One of the important factors that determines in which direction the wave of many possibilities will collapse is

the act of observation. In the quantum space, the observer influences phenomena, space and time, and causes infinite probabilities to collapse. Quantum physicist Dr. phil. Amit Goswami has said: "In the realm of possibility, the electron is not separated from us, from consciousness. It is a possibility of consciousness itself, a material possibility. When consciousness collapses the possibility wave by choosing one of the electron's possible facets, that facet becomes actuality. The agency that transforms possibility into actuality is consciousness. It is a fact that whenever we observe an object, we see a unique actuality, not the entire spectrum of possibilities. Thus, conscious observation is sufficient condition for the collapse of the possibility wave." (Goswami, 2012).

WAVE COLLAPSE. Wave collapse is the moment when an observer finds, sees, fixates a thing. The moment when the probability is minimized and fixed at a certain point, event. In 1924, Louis de Broglie, the developer of the Wave theory, received the Nobel Prize for this discovery. According to the discoveries of quantum physicists, light constantly behaves in accordance with the expectations of the experimenters. In experiments designed to detect particles, it appears in the form of particles, while in experiments designed to detect waves, light always behaves like a wave. In both cases, the result confirms the experimenter's expectations. Lynne McTaggart notes that: "living consciousness is somehow central to this process of transforming the unconstructed quantum world into something resembling everyday reality. Reality is not fixed, but fluid, and hence possibly open to influence." *(McTaggart, 2008).* Dr.phil. Dean Radin, Head of the laboratory at the Institute of Noetic Sciences in Petaluma (California), claims that one of the most important tools for influencing matter is intention. Intention can have a measurable physical effect on matter down to the subatomic level. When thinking about one or another result for more than 30 seconds a day, the cumulative results really can affect "fate" in one direction or another. (Radin, 2008)

QUANTUM ENTANGLEMENT. The principle of quantum entanglement essentially provides an understanding of how remote communication is possible between intention and event, between the human body and quantum space, between a thought and its materialization, manifestation. What is this connection that is able to ensure the perception of external impulse and the transmission of information to the body? Is it possible to influence it, change it? The quantum entanglement theory supposes that everything is connected in space and time. Separate particles, even if separated by a long distance, still behave as if they were connected, and without any time delays. Erwin Schrödinger, the founder of modern quantum physics, said: "I would not call that (entanglement) one but rather

the characteristic trait of quantum mechanics." Not only atoms of the matter, but also whole systems can become entangled (Moehring, 2007). Grinberg-Zylberbaum, a researcher at the Vienna University of Technology, says: "Entanglement could coordinate biochemical reactions in different cells or parts of an organ. It could allow correlated firings of distant neurons. And...it could coordinate the actions of a species, because it does not depend on distance and does not require a physical connection." (Grinberg-Zylberbaum, 1994).

CONNECTIVE SEMICONDUCTOR CRYSTAL. Although the connective tissue of the human body does not occupy a leading position in the range of research objects so far, it is possible that a large part of the missing information or the "missing pieces of the puzzle" can be found here points out an interesting and logical sequence of connections (Oschman 2009). He presumes that, in general, connective tissue could be thought of as a system of sheaths or bags, which contains each organ, giving it shape and connecting with each other by a system of ligaments. The ligaments, in turn, wind through skeletal junctions that support the structure of both the ligaments and connective tissue. Organs are surrounded by fascia – connective tissue sheaths. In turn, myofascia that surround muscles end in the ligaments and tendons attached to the bone. Tendons consist of twisted collagen bundles formed by collagen fibres. Collagen fibres, in turn, consist of collagen nerve fibres or molecular bundles that are form outside of the fibroblasts of specialized connective tissue cells. In general, as Oschman presumes, the connective tissue system is the largest organ of the body. However, the simplicity and ubiquity of the connective tissue system hides an important feature. It turns out that the fibres of connective tissue are arranged in a very regular manner. This means the following: a very regular arrangement of molecules in the form of a liquid or solid-state is a crystal!

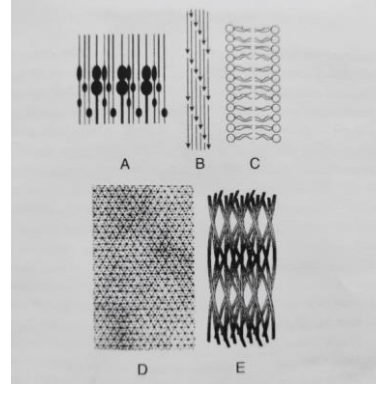

Figure 1.Tissue With a Distinctly Regular Molecular Arrangement (Lipton, 2018)

Crystals are distinct regular molecular arrangements found in a number of different tissue types, including a chromosome of a DNA molecule, light-sensitive cobs and sticks inside the eye, myelin sheath of nerve cells, collagen molecules that form connective tissue, dense actin and myosin molecules of muscle tissue, cell membrane phospholipids .

Collagen molecules that surround all organs act as a liquid crystal system (Oschman, 2009). The term "liquid crystal" was introduced by the German physicist Otto Lehmann in the second half of the 19th century to describe a state of matter that is neither liquid nor crystalline, but the substance itself has both of these states at the same time. For many years, almost half a century, this discovery remained in the scientific community without any special practical application, just as an interesting fact. Starting from 1958, German physicists V. Mayer and A. Zaupe developed a theory based on the assumption that each molecule is in the middle field, which is determined by adjacent molecules, and their interaction takes place only through this field, ignoring the effects of the close interaction. The most important feature of this crystalline structure of collagen molecules that forms connective tissue: it acts as a semiconductor. Semiconductors are not only able to conduct energy in the same way as electrical wires, rapidly transferring energy from one point to another, but also to conduct information, store energy, amplify signals, filter information and transfer it (Oschman, 2003).

The connective tissue system is well suited for conducting both energy and information, as it connects every part of the body with all other parts. From the point of view of communication, every organ of the body belongs to the largest organ of the body, which acts as a liquid crystal semiconductor in the form of a connective tissue system (Pickup, 1978).

Figure 2. Sheath of Connective Tissue Surrounding Blood Vessels, Nerve Bundles and Muscle Tissue (Dispenza, 2019)

SEMICONDUCTING IN CONNECTIVE TISSUE. The semiconductor property of the connective tissue system is very important because it explains the principle of resonance, which is also used in acupuncture: how stimulation of one point of the acupuncture meridian, e.g.in the ear, can affect another point, e.g. in the spleen. Researcher Mae-Wan Ho, who studied the crystalline nature of connective tissue, has concluded: "Liquid crystallinity gives organisms their characteristic flexibility, exquisite sensitivity, and responsiveness, thus optimizing the rapid silent intercommunication that enables the organism to function as a coherent and coordinated whole." (Ho, 1999). Intercommunication explains how touching or innervating one part of the body, producing a piezoelectric signal, triggers a reaction in another remote part of the body or in the whole body. Dr.phil. James Oschman, summarizing a variety of research from many disciplines, has concluded: "The signals produced by the piezoelectric effect are essential biological communication that "informs" cells and tissues." In turn, by reductively studying collagen, it is impossible to observe the phenomenon of the piezoelectric effect, because such electrical movement is hindered in connective tissues, which are divided into separate collagen molecules. In order to be able to conduct and store energy, they must be arranged in parallel rows.

PIEZOELECTRIC BODY. "I am absolutely convinced that we will never be able to understand the essence of life if we limit ourselves to the molecular level... The surprisingly subtle biological reactions are determined by the movement of electrons, and this can only be explained from the point of view of quantum mechanics.", Albert Szent-Györgyi, Nobel Prize laureate, 1968.

Not only modern medicine, but also ancient medicine is based on electricity and magnetism. The electric impulses of electrocardiostimulators regulate and affect the heartbeat of tens of thousands of people – heart patients. Such electromagnetic devices as magnetic resonance imaging devices, electroencephalographs and electrocardiographs allow medical professionals to look into a patient's body without using risky or invasive surgical methods. Piezoelectricity is one of the most interesting forms of electricity and it is very essential and significant in understanding the healing mechanisms. Piezoelectricity is the result of mechanical impact. By subjecting certain structures to pressure, these structures acquire positive and negative polarization, thus generating electricity (Pillatsch, Yeatman, Holmes, 2014). It is important to understand that all interactions in nature take place through energy. The human body is also a piezoelectric generator. Furthermore, the main function of some anatomical structures is to conduct piezoelectricity from one part of the body to another. Many types

of tissue in the body have piezoelectric properties, incl. bones, actin, dentin, tendons, inner surfaces of the trachea and intestines, as well as nucleic acids of individual cells. *THE ROLE OF MICROTUBULES IN THE TRANSMISSION OF INFORMATION INSIDE A CELL*. Each cell also has its own skeletal structure – the cytoskeleton. The shape of the cell itself is partly determined by a system of cylindrical proteins, which consists of microtubules and a network of thin protein filaments. These are the protein structures that give cells firmness, support. However, microtubules themselves are not structures that are created during cell division and retain their place throughout the life of the cell. One of the less studied properties of microtubules is the short duration of their existence. They are rebuilt very often and quickly, in some cells even several times an hour. Researcher John McCrone notes that the life of brain microtubules is very short-lived, just 10 minutes (McCrone, 2004). The microtubules do not change the cell structure at random, they are tuned to the energy field in which the cells live. Chen notes that these microtubules are not only the determinants or supports of the cell structure, but also the antennas that receive signals from the environment and are completely reconstructed in response to these signals. Cell cytoskeletons are also piezoelectric conductors. Electric fields change their shape and mechanical stimuli change their state (Théry, Racine, Piel, Pépin, Dimitrov, Chen, Bornens, 2006).

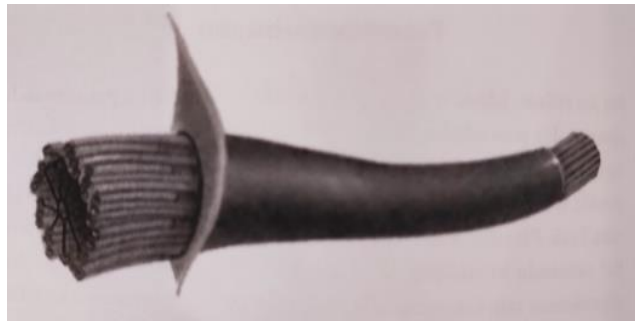

Figure 3. Microtubule Bundles in a Limb of a Simple Organism (Lipton, 2018)

Microtubules can be a resonator that aligns itself with this energy field, and several researchers have suggested that they play a key role in receiving information from the field of consciousness (Savva, 2007). British doctor Dr. Robin Kelly in his work “The Human Antenna” (Kelly, 2008) has compiled a wide range of research on the properties of microtubules, or tiny, cylindrical protein scaffolds in our cells. Kelly questions, if they are resonant structures, then with what signal do they resonate? They receive signals from the quantum field and they play an important role in intercellular communication, as well as in communication between all cells

and the quantum field. The brain contains a particularly high concentration of microtubules. In his work, Kelly refers to the views and conclusions of Sir Roger Penrose and American anaesthesiologist Stuart Hameroff on the function of microtubules. It is possible that the microtubules can be equated to an information processing system. The system processes information obtained from the quantum space. Furthermore, Penrose and Hameroff also hypothesized that these tiny, empty spirals could act as antennas that connect time- and space-limited cells with the infinite and eternal world of quantum space. Kelly believes that microtubules could be physical structures through which purpose and consciousness can be transmitted over long distances. The first significant experimental evidence for intercommunication from a distance, which could be equated to "telepathy", took place in 2008 between two strands of DNA. In it, researchers report that the DNA strands, which had no contact between them and no information exchange between proteins that could facilitate their communication took place, were able to remotely recognize similarities with other DNA strands and connect with them. Identical strands connected to each other twice as often as those with different molecular sequences. At the time, researchers could not explain the mechanism by which this phenomenon occurs, although it could be observed that it exists (Baldwin, 2008).

Discussion

We live in a very interesting, complex and at the same time responsible time, when the world around us seems to be changing. This applies both to the global climate change at the planetary level and to the internal and external changes of each individual. They affect both the relationship with the world around us and the state of physical and mental health and well-being (Lang, 2013). Sometimes change just happens, whether we like it or not. Many questions arise – why? What affects all this? What is the role of us humans in this "game" and can we and are we able to consciously participate in the process? Is it necessary? What can change from that? Mankind has been searching for answers to these questions for thousands of years and it must be concluded that what was found was in accordance with the level of human consciousness of that time. Until now, it has been customary to assume that worldly processes have taken place according to some seemingly higher plan, for which various names, designations or concepts can be found in the spiritual world – the Creator, God, Oneness, Universe, etc. Historically, this "Supreme Power" has always been given a mystical mood, quality, feature. This mystical power has been viewed with awe, piety, and later with trust and faith (Macquarrie, 1966).

Nowadays, every day more and more of the invisible becomes visible, the impossible becomes possible and the "mystical" becomes scientifically proven. Thanks to research in quantum physics, we are beginning to realize that all energy processes in our cosmic space, incl. the human physical body, work according to the same principle. Therefore, it is important to understand and study the diverse nature of energy from the quantum to the molecular level, as well as to develop an understanding of human ability to make changes in the energy flow when necessary, which affects a person's emotional and physical well-being (Haramein, Brown, Baker, 2016).

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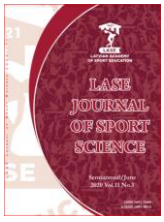

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SCHORT COMMUNICATION

CHANGES IN EMG AND H-REFLEX CHARACTERISTICS OF KNEE FLEXOR MUSCLES FOR ATHLETES UNDER THE INFLUENCE OF CENTRAL NEURAL REGULATION

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Abstract

Applied kinesiology (AK) diagnostic test is a manual muscle testing and technique widely used within the Integrative Medical community by sports doctors and sports physiotherapists. Empirically defined functionally weak muscle are the cause of a particular dysfunction of the organism, but it is not clear if there are physiological findings. Objective: Does a functionally altered state of central neural regulation (CNR) affect H-reflex and EMG characteristics? Material and methods: 34 (16 H-reflex measurements and 18 EMG measurements) healthy LASE students, 21± 0.3 years old, average height - 174 ± 2 cm and the average weight – 63±2 kg, was performed EMG and H-reflex measurements in normal and altered CNR functional states was done on the muscles of the gastrocnemius (GM) and biceps femoris (BF). Results: statistically significant changes (p<.05; .01) are observed in EMG and H-reflex characteristics in normal and altered CNR functional states. Conclusion: there are tendencies that a qualitatively assessed CNR condition can be assessed by quantitative measurements. The groups have a small number of participants, so research in this field should be continued. *Keywords: applied kinesiology, normal and altered central neural regulation, functional state, EMG, H-reflex.*

Keywords:

Introduction

Due to technical possibilities, neurophysiologists have started to focus on the analysis of neural modelling of movement control and its relation to the quality of movement. Mainly, the influence of the pathological conditions (stroke, CNS trauma, etc.) of the central nervous system's (CNS) structures on the motor control of movement is analysed, but the studies should continue adaptability of movement organization models when changes are experienced in the somatic or autonomic structures of the organism. In experimental studies, the Applied kinesiology (AK) method is empirically defined as the influence of the functional changes in various body structures on neuromuscular regulation of muscles, leading to functional changes in movement organization models (*Walther,* 2000; *Frost,* 2002).

AK tests are increasingly applied as a functional diagnostic tool in the training process involving sports doctors and sports physiotherapists. Empirically defined functionally weak muscle are the cause of a particular dysfunction of the organism (*Walther,* 2000). It is not clear, whether prevention of the functional weakness of a particular muscle will directly affect the identified organism's dysfunction or adaptive changes will take place in the organism impacting the specific dysfunction. The explanation of such correlations allows using the AK methods in a more purposeful way to improve the functional abilities of the athletes' body.

In AK, a diagnostic test is a manual muscle testing and technique widely used within the Integrative Medical community (*Schwartz et al.*, 2014). The research object of AK is the functional (dynamic) neurology (*Goodheart,* 1964 - 1998, 1998; *Schmitt, Yanuck,* 1991). Changes during a muscle test are related to changes in the central or peripheral nervous system, but the treatment is effective only if it is focused on the exact neural disorder (*Schmitt, Yanuck,* 1991*).*

To control the functional state of a particular muscle, the organization of movements and dynamic anatomy of the joint must be strictly observed. The examination of the muscles involved in the action of the joint must be carried out with the joint in a precisely fixed position, i.e., in the appropriate angle at which the muscle acts as an agonist. The vector of the counteraction force applied by the examiner must be directed in a precisely defined direction for the active fibres of the test muscle would function, creating an optimal force vector in the physiological mode corresponding to the movement being tested (*Schwartz et al.*, 2014).

Many scientific publication results show the usefulness of AK method in relation to various illnesses of the body systems and options for their treatment - joint dysfunctions, lymphatic system disorders, circulatory

system disorders in a muscle or related organ, mineral or vitamin deficiency or overdose, disturbed balance in the meridian system, abnormalities in the digestive system, psycho-emotional stress – these are factors that can lead to formation of a functionally weak muscle (*Walther,* 2002; *Jensen,* 2015). All these systems are mutually interconnected and affect each other (*Frost*, 2002). It can be concluded that this method is adopted as empirically good qualitative method for diagnostics, but little is known about the changes of quantitatively measurable physiological parameters and their effectiveness for assessing various body systems to make conclusions on dysfunctions of neural regulation.

For this study, the author has chosen empirically measurable parameters as the H-reflex and EMG characteristics and a qualitative evaluation criterion – the functional changes in the CNR system assessed by AK method to obtain the information about the muscle: is the muscle normal or functionally weak tested.

The functional changes in CNR may vary – starting from the cerebral cortex torsion and ending with the stroke. In this article, by using the term "muscle with altered central neural regulation" (CNR), the author means the activity of the muscle with functional dysfunctions.

Materials and Methods

Participants. The group of research participants consisted of 34 (16 H-reflex measurements and 18 EMG measurements) practically healthy Latvian Academy of Sports Education (LASE) 2nd and 3rd year full-time physiotherapy students, who are physically active on amateur level, from which the research sample was selected, and the number of participants varied in each stage of research. The average age of participants was 21± 0.3 years, average height – 174 ± 2cm and the average weight – 63±2kg.

The organization of the study took place in several stages, and the students from LASE master's and physiotherapy bachelor's study programmes were also involved in organization and implementation of the study. The diagnostic experiment stages for the article took place from October 2015 to November 2016.

Prior to each research stage, the participants were introduced with the research routine and conditions, the information about data usage, storage and confidentiality was explained, as well as about the possibility to terminate their participation in the research study at any time. Each participant gave his/her consent to voluntary participation in the research. The author asked participants certain questions to determine the inclusion/exclusion criteria. The research was conducted in accordance with

the norms of the Ethical Commission of LASE and the local institutions, and permission was obtained.

Prior to each measurement, the research subject had to answer the questions related to the exclusion criteria. If a participant did not mark any of the exclusion criteria, the measurements could take place. Thus, participants were included or excluded in this study according to certain criteria. *Inclusion criteria:* functionally normal neuromuscular regulation (functionally strong) in GM; appropriate age; physically active lifestyle - engages in regular sports activities at least 2 times a week; motivation to expose oneself to physical activity; motivation to expose oneself to the effects of electrical stimulation. *Exclusion criteria:* no GM reflex response to epigastric irritation; muscle pain; edema; diseases or complaints of peripheral blood regulation; radiologically diagnosed diseases of the spine with effects on neurological structures; problems of organizing and managing movements; acute or chronic CNS diseases (including mental illness); knee disease or injury; alcohol or other intoxicants have been used in the last 72h; the last 72h has been a high-intensity or high-volume load (strength load, hypertrophy training, high-intensity interval training, etc.); Feeling sick (nausea) or being sick (vomiting) on the epigastric region; acute or chronic diseases of the internal organs (gastritis in the acute or subacute phase, gastric ulcer, inflammation of the duodenum, diseases of the pancreas, liver or gallbladder, irritable bowel syndrome, etc.).

For each participant, the tests were performed in five states (resting before the test, isometric load at 60 degrees in the knee joint, maximum voluntary isometric contraction (MVIC), isometric contraction with 5% load from the MVIC at 60 degrees in the knee joint, after the test) for the EMG measurements and two (BEFORE 1&2 and POSITION 1&3) for the H-reflex with two different qualitatively observed functional states of CNR. Schematically it is shown in Fig.1.

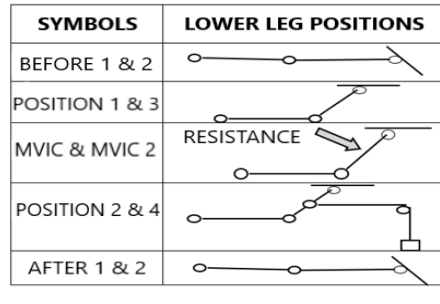

Figure 1. Lower leg positions and symbols during tests

In all research phases, when the load measurements were taken, a standardized testing position was used – lying on the stomach with the knee flexed in 60 degrees, as in this position. In turn, the indicators of muscle tone and electrical activity at resting position were obtained with the participant lying on his/her stomach. For the plantar flexion of the foot not to affect the muscle tension, the front part of the ankle joint rested on an elevation with a diameter of 15cm. Schematic representation of the research tests can see in Fig.2.

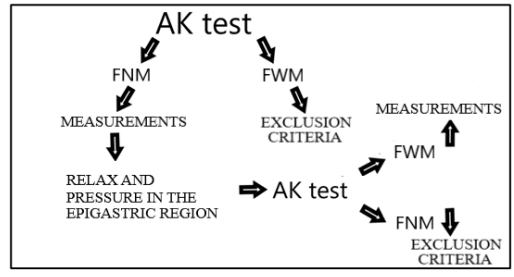

Figure 2. Schematic representation of the research tests

Applied kinesiology (AK) manual muscle testing. In the test when lying on the stomach, the examiner bends the patient's leg in a 60-degree flexion at the knee joint and asks the patient to perform a plantar flexion at the ankle joint. The examiner places one hand on the patient's pelvis, fixing it, and another hand on the distal part of the lower leg. The test takes place, when a participant performs a lower leg flexion, but examiner – resistance in the direction of extension. The therapist maintains resistance for three seconds against the research participant's isometric flexion and performs small amplitudes, but a sharp lower leg extension. If the myotatic reflex immediately appears in a muscle, the muscle is considered normal (FNM), in turn, if the myotatic reflex does not immediately appear in the muscle, the muscle is considered as functionally weak (FWM) or with altered neural regulation - following the findings of the authors of the AK method (*Goodheart,* 1964 - 1998, 1998; *Schmitt, Yanuck,* 1991, *Walther,* 2000; *Frost,* 2002; *Schwartz et al.*, 2014; *Jensen,* 2015). Additional activities, such lifting the pelvis, seizures in *hamstring* muscles, are also considered as signs of a functionally weak GM.

To induce functional disturbances in CNR, a hard ball of rubber material was left in the epigastric region, i.e., against the abdominal cavity below the ribs on the left side, which created pressure. Following this irritation, functional disorders in CNR were induced and GM remained functionally weak. It should be noted that these are functional disorders and have no lasting consequences.

Dynamometry. The method was used to determine the static maximum forces of knee flexors, i.e., MVIC for the muscle with a normal and altered CNR before EMG characteristics to calculate 5% load. We used manual dynamometer *Lafayette Instrument Model: 01165 Manual Muscle Tester* (*Lafayette Instrument, Ltd.,* U.K.) for measuring the static force. Test was performed on standard position on the stomach. The dynamometer is placed against the heel bone. The respondent performs the flexion of the lower leg in the knee joint, but the physiotherapist, to ensure the static contraction, fixes the lower leg keeping the dynamometer and the lower leg still for three seconds after which the result is read (*Kendall et al.,* 1952*; Kendall et al.,* 2005). Three repetitions were performed, and the best result was recorded. The pause between measurements was 20 seconds. The result is read in kilograms to calculate the load at test POSITIONS 2 and 4.

EMG and Electrostimulation. Electromyography (EMG) is a technique for recording the biopotential of skeletal muscles with an electromyograph. The electrical activity of GM was measured by placing the electrode on the medial belly of the muscle and BF muscle.

To measure EMG on both muscles (see Fig.3A & 3B) and H-reflex (see Fig.4) of the GM, a 16 channel EMG telemetry system ME6000 (Mega Electronics Ltd., Kuopio, Finland) was used with standard bipolar electrodes (Noraxon, USA). The electrodes were placed on the medial belly of GM and the long head of BF. EMG activity was registered after 10-second interval with two functionally different states of CNR. Root Mean Square (RMS) was assessed from EMG characteristics.

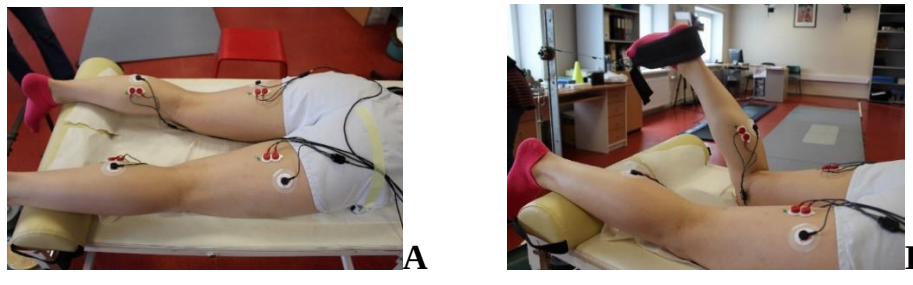

Figure 3. EMG test positions and electrode placement on muscle: A-rest BEFORE; B - in test position POSITIONS 2 and 4 (60-degree flexion of the lower leg in the knee joint with 5% load of MVIC) (photo from the author's archive)

Electrostimulation is an electric stimulation of a peripheral nerve with pulsed direct current. The electrical stimulation signal spreads through the nerve both efferently and afferently. The efferent wave causes an immediate muscle contraction with a corresponding M signal wave, but the afferent signal, passing through the spinal cord segment, returns to the

muscle, causing repeated muscle contraction, which is recorded (EMG) as H-reflex of biopotential, about 28-35 ms after stimulation. The H-reflex, both in terms of a time lag and amplitude, characterizes the quality of the reflex circle (*Burke*, 2016).

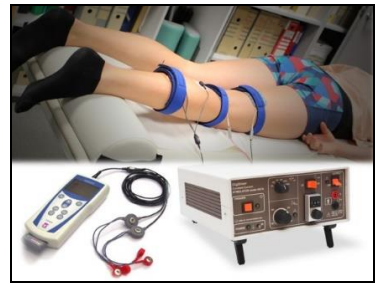

Figure 4. Electrostimulation of the popliteus nerve by measuring the H-reflex at rest with EMG (photo from the author's archive*)*

To measure the H-reflex, 20-40V strong and 1ms long once-only current wave impulses were performed, using electrostimulator *Digitimer* (Digitimer, Ltd., UK). An electrode was placed under the knee to stimulate *n. popliteus*, but the surface electrode of electromyography was placed on medial belly of GM to record the biopotential changes. This method with various protocols has been described in several scientific publications (*Thompson et al.,* 2009; *Groisman et al.*, 2014; *Burke,* 2016). The electrostimulation was performed for research participants both with and without CNR functional disorders.

Data analysis. The processing of data obtained in research experiments was calculated with "Microsoft Office Excel" program and mathematical data processing computer program “SPSS". This method analyses the interaction of two proportionally dependent factors. A Mann-Whitney U test was used for comparison of two samples (data not normally distributed). It was determined the samples are statistically different at different levels (p<.05; .01). The standard error of the results of the research participants and the homogeneity of the group results – the coefficient of variation of the results were evaluated by the methods of mathematical statistics.

Results

Impact of changes in CNR on knee flexors EMG characteristics. Analysing the group’s overall results of GM and BF, the statistically significant differences can be observed in several cases, but it should be noted that the results data not normally distributed. Applying inclusion and exclusion criteria and grouping young healthy athletes by age and CNR

functional state, the results suggest that adaptation of the organism to CNR irritation may be multifactorial and the search for a linear relationship may be insufficient. Clearly demonstrated by the results – they can be divided into three groups: the RMS activity 1) increase; 2) not change; 3) decrease.

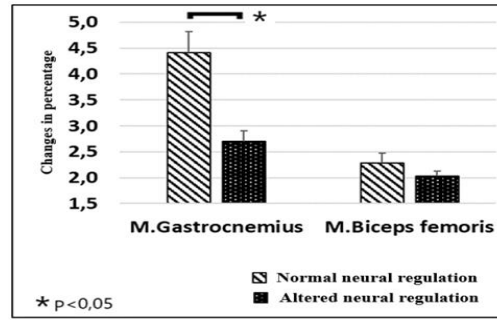

Figure 5. Changes in group's RMS results in lower leg flexor muscles at rest before test (BEFORE 1 and 2).

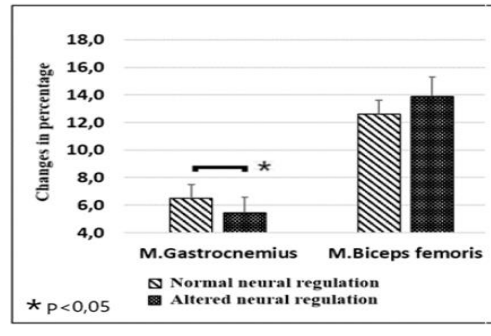

Figure 6. Changes in group's RMS results in lower leg flexor muscles at knee flexion of 60° (POSITION 1 and 3)

Analysing the group's mean results shows significant differences in the following EMG characteristics: in GM testing positions BEFORE 1 and 2 (p<0.05), POSITION 1 and 3 (p<0.05), MVIC 1 and 2 (p<0.01), and AFTER 1 and 2 (p<0.01); in the BF at testing position MVIC 1 and 2 (p<0.05). The results can be viewed in Figure 5., 6., 7., 8., 9.

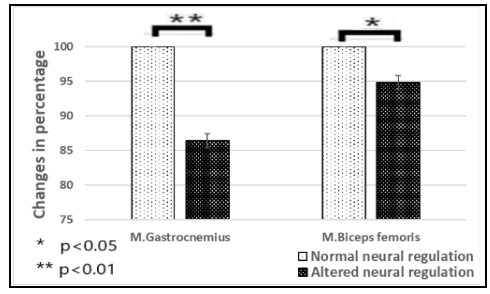

Figure 7. Changes in group's RMS activity results in lower leg flexor muscles at knee flexion of 60° (MVIC 1 and 2)

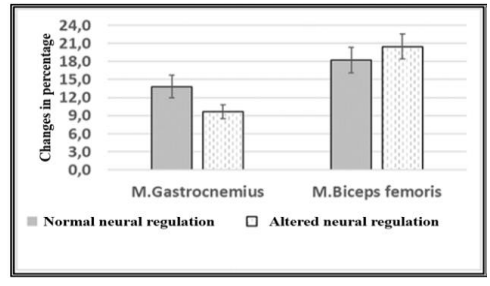

Figure 8. Changes in group's RMS activity results in lower leg flexor muscles at knee flexion of 60° with 5% load from MVIC

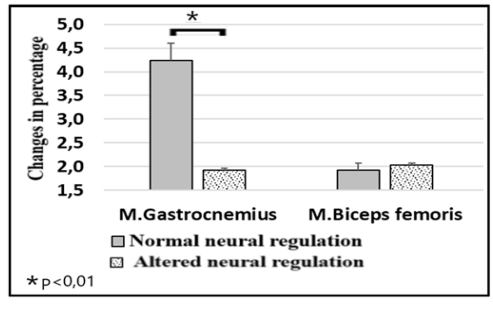

Figure 9. Changes in group's RMS activity results in lower leg flexor muscles at rest after the load (AFTER 1 and 2)

Impact of changes in CNR on GM H-reflex. At rest (BEFORE 1 and 2), statistically significant (p <0.01) differences can be observed in GM. H-reflex activity with altered CNR is 58.1±8.4% in comparison to the muscle with normal CNR. The results can be viewed in Figure 10.

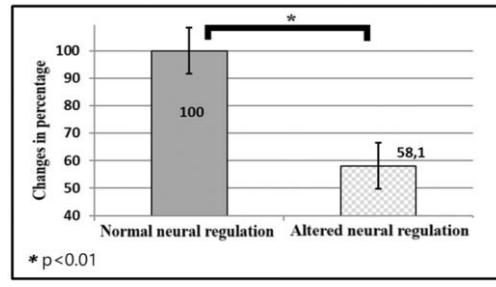

Figure 10. Changes in group's H-reflex mean results on gastrocnemius muscle at rest (BEFORE 1 and 2)

Analysing the group's mean results of the knee at 60° flexion (POSITION 1 and 3) with normal and altered CNR, not statistically significant (p> 0.05) differences were found.

Discussion

Analysing the obtained mean data in all researched positions, a large dispersion of parameter results can be observed – the variation coefficient >10%. This indicates that the results presented by the subjects are very different and that is why the dispersion are so large in the group. For several parameters the neuromuscular regulation functional disorders are manifested either as a decrease, or remain unchanged, or as an increase of the characteristics.

This may suggest that the adaptive mechanisms for CNR functional disorders are not unambiguous. This fact again indicates that the impact of CNR functional disorders on the functional activity of the studied muscle is not linearly causal, but different mechanisms may be involved in the adaptation process. It corresponds with the findings of several authors (*Васильева*, 1999(a)); *Frost*, 2002; *Ramšak, Gerz*, 2005; *Myers*, 2014), who have indicated that the functional weakness of muscle can occur if there are local and segmental, visceral, endocrine, or psychological disorders in a connective tissue network. In such cases, it is more useful to analyse the reaction types of each individual and, if possible, to group the individuals according to them.

Generation of mechanical pressure in epigastric region, causing the functional CNR disorder of GM, mostly influences the tissues in left side under the ribs, creates a mechanical irritation for the place where diaphragm is attached to ribs, also causes irritation of colon segment fascia and, possibly, the stretch of pancreatic fascia (*Standring*, 2015). In any case, it causes neural regulation functional disorders of GM, which also manifest itself in the decreased H-reflex and various changes of adaptation mechanism in muscle EMG. As published above blood circulation

redistribution disorders in the lower leg muscles (*Gavrona et al*., 2015), as well as in various changes of adaptation mechanism in muscle tonus indicators (*Varpa et al*., 2016) can be identified.

Rosner (*Rosner*, 2012) writes that a functionally weak muscle will cause changes in the adaptive processes both locally, segmentally, as well as for the system, but the problem is in the fact that it is not correct to compare such individual CNR functional disorders with average values of quantitative parameters of any group studied. In such cases, the nature of the adaptive changes of each individual parameter is lost as well as the direct link to the CNR functional disorders.

Analysing the EMG activity results obtained by the author, the changes for participants mainly take place in two directions – RMS results in the muscles either decrease or increase, which indicates that the body as a system is trying to adapt to the stimuli. Which way will it happen – it is difficult to predict, therefore each subject's individual adaptability should be researched in-depth to clarify under the influence of which body system it takes? The distribution of fibres in the muscle bundle works differently, and the muscle activation of the researched subject will depend on several factors, which must be kept in mind when evaluating the mean results. In this study the author used the surface electrodes, which provide information on electrical activity generated by muscle biopotentials, which has reached the surface of the body with EMG surface electrodes, obtaining interference signals of all different biopotential impulses of heterogeneously distributed muscle fibres. Therefore, a Fourier analysis was employed, which leads to the conclusion that the obtained data demonstrate the electrical activity changes of different tissues and their layers – not only of muscle tissue (*Novotny, Sedlacek*, 2008; *Vieira et al.*, 2017). According to the findings of this study, if there are qualitative changes in the muscle – changes that are perceptible by therapist's hand, then the quantitative measurements of respondents need to be grouped in accordance with the reaction types, and only then it is possible to compare it with the muscle that has normal CNR. In this case it is not correct to expect linear cause-and-effect changes in the group results, because the muscle CNR system is not subject to the following correlations.

Studying changes in H-reflex activity in a muscle with normal and altered CNR, there is a significant difference between the testing positions. If in the resting position all participants experience a decrease in H-reflex activity, then in the 60° of knee flexion during low-intensity aerobic loading three different adaptation types can be observed for the participants: activity decreases, activity increases, and activity remains unchanged. Looking at various H-reflex research studies in scientific databases, it can be observed

that most of them are on the impact of central and peripheral nervous system on H-reflex in various trauma/post-trauma cases related to the functional state of peripheral nervous system (*Burke*, 2016; *Andrewsa et al.*, 2016; *Mitsuyama et al.*, 2016). In the context of this study, this does not provide sufficient information on changes in H-reflex quality under the influence of CNR changes, because all participants of this research were practically healthy people who do not have a history of injuries or pain, besides, they were students of LASE, enthusiasts of active lifestyle, and athletes. There are studies on changes in H-reflex under the influence of alcohol consumption, which could change the mechanisms of the central regulatory system. In such cases, alcohol affected H-reflex activity by reducing it (*Cho et al.*, 2013).

In this study, a discomfort was created for research participants with a small solid ball in epigastric region, changing the myotatic reflex of knee flexor muscles, which then where observed using a qualitative testing method, after which it was assumed that the CNR of the muscle was disturbed on subcortical level of central nervous system, and the movement execution was carried over to the cortical level, as described by various authors (*Lundy-Ekman*, 1998; *Frost*, 2002; *Hochman*, 2007). This means that a muscle or a group of muscles works at a conscious CNS level, and in such cases the research studies do not unequivocally indicate a decrease in functionally weak muscle strength (*Cuthbert, Goodheart*, 2007; *Schwartz et al.*, 2014). It must be noted that all the changes, that research participants had in resting position and which occurred as decrease of the reflex, possibly can be explained with the fact that such testing position does not require muscle contraction in conscious (cortical) level, and it mainly takes place in subcortical level, but, keeping the lower leg in testing POSITION 1 and 3, the motor control mechanisms were required, which strongly involve the level of consciousness. As recognized by Lundy-Ekman *(Lundy-Ekman*, 1998) and Hochman (*Hochman*, 2007), the nerve impulse, in this case under electrostimulation of *popliteus* nerve, does not stop at the level of reflex arc, but afferently goes to CNS level, and on its way there are very many synapses including also from the organs, which have a reflectory connection to a specific muscle (*Goodheart*, 1964-1998, 1998; *Scoop*,1979; *Васильева,* 1996; *Carpenter et al.*, 1997; *Ramšak, Gerz,* 2005; *Conable*, 2010), then, by causing stimuli with a small solid ball and influencing the body's homeostasis, which causes the altered neural regulation of the muscle, it was achieved that the body must use other regulatory mechanisms in order to deal with the load imposed. During the low intensity aerobic exercises, three different variants of the changes of H-reflex results can be observed. This fact must be remembered by sports professionals, especially in sports where

the stretching reflex is needed for performing fast, accurate movements. The results indicate that the adaptation of the organism is not developed by linear correlations, and further studies are needed on which adaptation mechanisms get activated in each individual case.

In general, the author emphasizes that the adaptation of the organism to a specific state takes place multifactorial, i.e., adaptation to external influences is realized in very different ways, depending on everyone's activities of potential regulatory functions (and they are very many). Therefore, to look for one cause-and-effect chain would not be logical. With a greater or lesser probability, it is only possible to talk about the relationship of subjective empirical results with quantitative measurements of physiological parameters for everyone separately. Also, there is a need for a larger research group for more significant results.

The author repeatedly concludes that adaptation takes place throughout the body and is nonlinear and multifactorial. The author Siliņš (Siliņš, 2008) formulates it as a system that operates within the framework of a determined chaos. This means that when changing any parameter and judging by the chaotic nature of regulation, the changes will not always be in the direction as planned, but judging by the determined nature of regulation, there are certain possibilities for the system to adapt to the irritation caused.

Conclusions

1. Statistically significant ($P<0.05$) changes in EMG results are at different test positions with normal and altered CNR on GM and BF muscles ($p<.05$; .01). The data are not a normally distributed because the types of CNR ablation do not form linear relationships. The groups have a small number of participants, so research in this field should be continued.
2. The impact of changes in CNR on GM H-reflex, in group's mean results statistically significant ($p<0.05$) differences were observed in rest position. Changes in the quantitative parameters with normal and altered state of CNR in GM under the aerobic load and on rest are different, indicating that the adaptation of the body system is not linear in one direction and that the changes depend on self-regulatory systems.

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SCHORT COMMUNICATION

PHYSICAL ACTIVITY AVAILABILTY DURING THE PANDEMIC

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Abstract

2020/2021 season Latvian youth basketball season started in September and lasted for a month without an audience. The championship's regular season games were stopped for all Youth basketball league's teams, as well as "BJBS Riga/Centrs" boys' teams. Starting with 2020 October physical preparation workouts were happening in a park as well as 1:1 workout session – a trainer and a trainee. The country issued many regulatory documents for organizing workouts. Starting with the 21st of December 2020 it was prohibited to organize a workout indoors. Trainers and trainees continued to keep their physical shape in outdoor workouts and hoped, that the season will continue. At the time when the study was conducted, from October 2020 till February 2021, the situation did not change, and the season did not continue. During the study it was discovered what the key challenges were during training sessions. During the study a chance to attend 30 outdoor and 28 indoor workout sessions was given to group MT5 and MT6 students. During workout sessions the students developed their physical abilities and basketball technique mastery. The workout sessions provided communication, a chance to work practically, to move. During the 1:1 basketball workout with the coach, the students: developed the basketball technique elements they have already learned, learned new technique elements, learned to work on their own, and there was individual approach for each student. During outdoor workout sessions the students developed their exercise execution, were learning new exercises and developed their physical properties.

Keywords: *pandemic, COVID-19, workout process, challenges.*

Introduction

2020/2021 season Latvian youth basketball season started in September and lasted for a month without an audience. The championship's regular season games were stopped for all Youth basketball league's teams, as well as "BJBS Riga/Centrs" boys' teams. Starting with October 2020 physical preparation workouts were happening in a park as well as 1:1 workout session – a trainer and a trainee. From the 17th of October 2020 until the 6th of November 2020 trainings were organized outdoors, individual or online. In outdoor group trainings, it was prohibited to use locker rooms (Alterations to the Regulations of the Cabinet of Ministers dated 9 June 2020, Nr. 360, 2020). Starting with the 21st of December 2020 it was prohibited to organize a workout indoors (Alterations to the Regulations of the Cabinet of Ministers dated 9 June 2020, Nr. 360, 2020).

I worked with MT5 and MT6 BS Rīga/Centrs trainees as physical conditioning coach, and it was a challenging period. The study was conducted to develop outdoor trainings: improving physical conditioning in the period when it was not known to which competitions the players were preparing and when the next competitions will take place. It was the time for which no textbook explains how to plan the process of training.

Aim of study – to evaluate the physical activities for" BJBS Riga/Centrs" department group MT5, MT6 students. Tasks: to evaluate workout options and availability from October 2020 to February 2021. To find out the opinion about options and benefits of workouts from group MT5 and MT6 students.

The first instructions from the sport school's administration were given on the 16th of October 2020 which stated that because of COVID-19 restrictions:

1. Workouts can happen online, outdoors (without using locker rooms) and indoors only 1:1 (Student: Coach).
2. Multiple individual (1:1) indoor workouts can happen at the same time but in a way that the students and coaches do not overlap – cannot be together in locker rooms, on the court, doing exercises – mandatory requirement – 4 square meters per person and 2m distance. As well as – if you were indoors with one student, the rest of the students had to be sent remote work information.
3. It was prohibited to participate in any competition.
4. During this time, we could not use any paid halls (for example, OSC, BA, LSPA etc.).
5. We had to forget about organising camps – indoor workouts for groups would not be allowed anyway – so there iwas no point (Ierobežojumi sakarā ar Covid-19 sporta jomā, 2020)

"BJBS Riga/Centrs" department group MT5, MT6 boy's workout process from October till November was organized in Grizinkalns and indoors (1:1). On Monday, Wednesday and Friday coaches invited students for individual workouts indoors from 17:00 – 21:00. On Tuesday and Thursday in the park of Grizinkalns team's physical preparation workouts for unlimited number of students were organized, from 18:00 – 19:20. On the 16th of November 2020 new restrictions were introduced about the number of participants allowed in outdoor workouts – 10 people. As a result, the boys went to the workouts according to a coach's made schedule. This work schedule remained until 21st December 2020, when an order was made, that indoor workouts are banned. From 21st December 2020 till 31st January 2021, when the study was concluded, each week only outdoor workouts were happening 3 times a week – Monday, Wednesday, and Friday. Students were divided into groups of 10 boys. On the remaining days of the week – Tuesday, Thursday, and Saturday an online workout was sent to the students.

Material and methods

"BJBS Riga/Centrs" department group MT5, MT6 students – 40 boys participated in the study. A questionnaire was used to find out the availability of workouts during the COVID-19 pandemic. MT5 group consists of trainees aged 13 – 14, and MT6 group of trainees aged 14 – 15. The questionnaire was distributed among the trainees in paper format, and it included 6 questions about the training process during the pandemic and the challenges that the trainees encountered. The trainees who could not attend the trainings were sent the questions in electronic format and submitted their answers electronically. Before the study was begun, an oral consent of the coaches and parents of the trainees was received. The questionnaire helped the coaches in their daily coaching process, especially in that they could foresee the number of the attendants in case of adverse weather conditions.

Results

The study is based on 6 responses to the questions in the questionnaire. Because of the COVID-19 restrictions, only a student and the coach were allowed to be indoors during the workout session. In the questionnaire we found out that from the 40 boys only 24 boys were able to attend workout sessions. The coaches did not have workout time for 16 more boys because of the court's workload. In the questionnaire we found out that the 24 boys attending the individual workouts – became stronger; improved already existing basketball technique elements; learned new basketball technique elements; learned to work on their own while the coach was watching all the time and could immediately correct mistakes (see

Fig.1). 10 boys thought that a significant benefit was that the coach can see the student all the time and can immediately praise him.

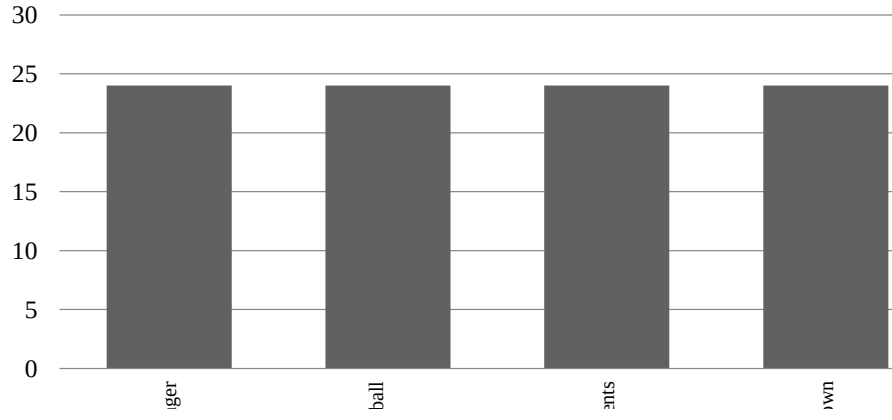

Figure.1. Boys' answers about the 1:1 workout session with the coach

During the study the coaches made and sent an online workout programme to the students (see Fig.2.). From the data of the questionnaire, 38 out of the 40 students have done the athletic exercises that the coaches sent. The exercises that were in the programme were the same exercises that the students had done in previous physical preparation workouts, summer camps and in-person workout sessions.

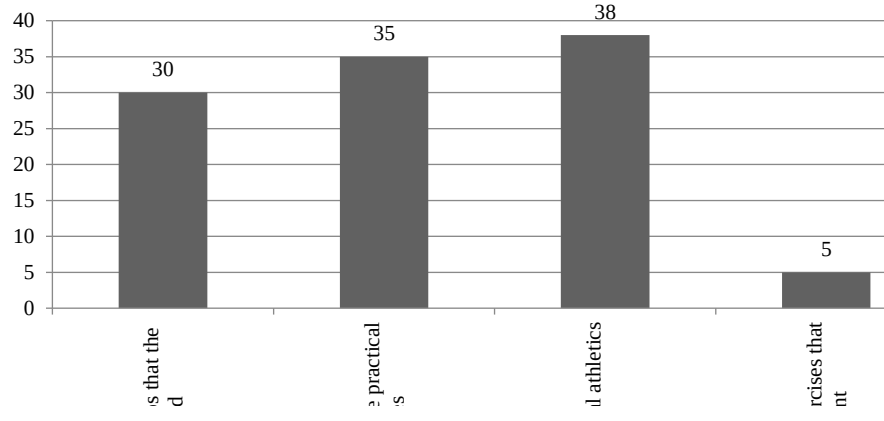

Figure 2. Feedback about the workout completion

In the questionnaire it was discovered that 30 students watched all the sent video materials (see Fig. 2). 35 students completed all the practical exercises

– basketball technique learning exercises and physical conditioning exercises.

After "BJBS Riga" administration's instructions, the coaches had to make each day's workout plan for online work. Monday's workout session material, when the in-person workout is planned in a park in Grizinkalns, from the 1st table we can see that for the students who could not make it to the in-person workouts they had an online material. For the completion of this material, they had to send a report in WhatsApp by grading the completion.

Table 1

Online workout content for Monday's (25.01.2021) workout

Lesson's theme	1.Overall Physical Conditioning for Outdoors group in person workout. Coach A. Brigmanis, Coach S. Škutāne, Coach A. Kallaste 2.Basketball.Warmup for basketball (video length 02:33 min.) 3.Basketball. Dribble exercises together with the player Aigars Šķēle (video length 03:23 min)
Workout type (practical, theoretical)	PRACTICAL
LESSON'S CONTENT INTRODUCTION/ MAIN PART/ ENDING (Exercice description)	1.1. U14 born in 2007 (10 students) 17:50-19:10; 1.2. U15 born in 2006 (10 students) 18:00-19:20
	Grizinkalns park, Pernavas street 42
	2. Carefully watch the whole video. Watch repeatedly each exercise individually and do them https://www.youtube.com/watch?v=wAfg4x-fT-s&list=PLGweNqJZmv-2-AJmkyHqUNcACvLx4xuxS&index=10
	3. Carefully watch the whole video. Watch repeatedly each exercise individually and do them. The best way is to do it together as the video is playing. https://www.youtube.com/watch?v=8Wv4Xbqzk5k&feature=emb_title
	After each practical online workout:1. slow run 800-900m; 2. flexibility and stretching exercises 12-15min
Communication (email, whatsapp, social media etc.)	WHATSAPP
Feedback (check after every workout)	Day's workout rating (difficult / average/ easy)
	◯ ◯ ◯
Photograph (at least one per week, from any day's workout), Recommendations for the coach (was everything doable, which exercise did you like, which didn`t)	

One of the questions in the questionnaire was – what opportunities do in person workouts give you, here the emphasis was on the attendance in physical preparation workout session. All 40 of the questioned boys answered that it is a chance to go outside; to work practically; to move (see Fig.3). 35 boys noted that it is a chance to see your teammates; to train, talk, work together with your teammates (see Fig.3). These answers solidify the fact that socialization is essential for students of this age group.

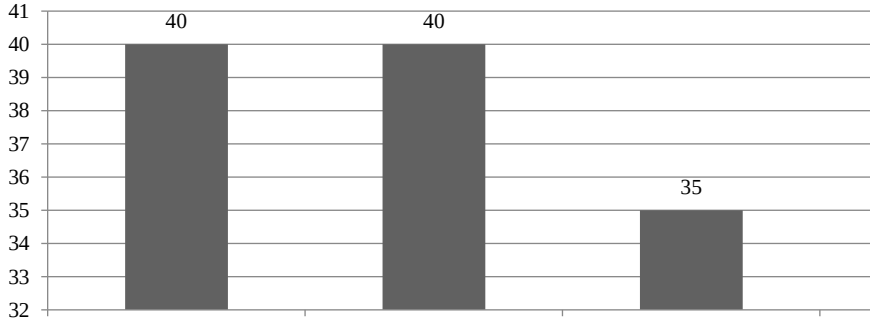

Figure 3. Feedback about attendance of the in-person workouts

Tuesday's workout content was different (see Table 2). The Tuesday workout session was dedicated to basketball workout thematic and content learning. From the questionnaire we can see that 35 boys completed all the practical exercises (see Fig. 2), thereby we can conclude that the boys also did this workout in winter. The coaches received feedback about workout's content completion.

Table 2

Online workout content for Tuesday's (26.01.2021) workout

Lesson's theme	1.Basketball.Warmup for basketball (video length 15:50 min.) 2.Basketball. Workout together with a player Mareks Meijers No 1 (video length 02:47min)
Workout type (practical, theoretical)	PRACTICAL
LESSON'S CONTENT INTRODUCTIO N/ MAIN PART/ ENDING (exercise escription)	1. Carefully watch the whole video. Watch repeatedly each exercise individually and do them https://www.youtube.com/watch?v=WBsmpXlZvAU&list=PLGweNqJZmv-2-AJmkyHqUNcACvLx4xuxS&index=7&t=0s
	2. Carefully watch the whole video. Watch repeatedly each exercise individually and do them https://www.facebook.com/arvo.kallastelv/videos/2856548377748300
	After each practical online workout:1. slow run 800-900m; 2. flexibility and stretching exercises 12-15min

Table 2

Communication (email, whatsapp, social media etc.)	WHATSAPP
Feedback (check after every workout)	Day's workout rating (difficult / average/ easy) ◯ ◯ ◯
Photograph (at least one per week, from any day's workout)	
Recommendations for the coach (was everything doable, which exercise did you like, which not)	

As mentioned before, workout sessions for "BJBS Riga/Centrs" department's students were done in person 1:1 with the coach, and they also had outdoor workouts and were sent an online workout plan.

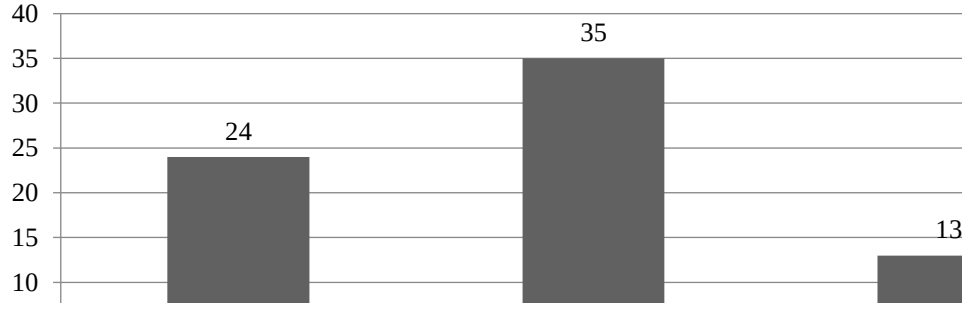

Figure 4. Workout options during the pandemic

To remind what was mentioned before, 24 boys were given a chance to attend workout sessions 1:1 with the coach; in Fig. 4 we can see the attendance during the pandemic. 35 students have attended the outdoor workout sessions which the weather – rain, snow, wind, frost, and other natural factors could not affect. 13 boys noted that they did the online sent workout materials at home on their own (see Fig.4).

In Table 3 Saturday's workout session's content which was supposed to be done on your own is shown.

Table 3

Online workout content for Saturday's (30.01.2021) workout

Lesson's theme	1. General Physical Conditioning (GPC) Special Physical Conditioning (SPC) 2. Basketball.Warmup for basketball (video length 02:33min 3. Basketball.Workout No 9 together with coach Arturs Visockis-Rubenis (video length 23:30min)
Workout type (practical, theoretical)	PRACTICAL
LESSON'S CONTENT INTRODUCTION/ MAIN PART/ ENDING (exercise escription)	1. Carefully read the whole programme. Read each exercise individually again and do them Coach Sandra Skutane General Physical Conditioning and Special Physical Conditioning Workout Programme No 8 04.06.2020.(In January 30 do this workout programme again). Workout programme is sent and available on WHATSAPP
	2. Carefully watch the whole video. Watch repeatedly each exercise individually and do them https://www.youtube.com/watch?v=wAfg4x-fT-s&list=PLGweNqJZmv-2-AJmkyHqUNcACvLx4xuxS&index=10
	3. Carefully watch the whole video. Watch repeatedly each exercise individually and do them https://www.facebook.com/Basketbols/videos/530274254330697/
	After each practical online workout:1. slow run 800-900m; 2. flexibility and stretching exercises 12-15min.
Communication (email, whatsapp, social media etc.)	WHATSAPP
Feedback (check after every workout)	Day's workout rating (difficult / average/ easy)
	◯ ◯ ◯
Photograph (at least one per week, from any day's workout)	
Recommendations for the coach (was everything doable, which exercise did you like, which not)	

While attending the outdoor workouts the boys encountered many benefits and challenges. The benefits from outdoor workouts are displayed in the Fig.5. 35 boys noted that they developed their physical properties and learned correct exercise performance, which is the most important thing in these sessions.

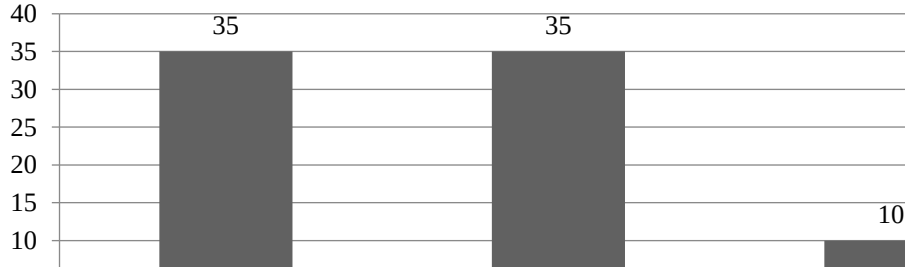

Figure 5. Outdoor workout benefits

While attending the outdoor workouts the boys faced many challenges. During the winter the flooring was slippery (sidewalks, stairs), which made the quality of the workouts complicated (see Fig.6). Another complication was that the boys had to wear a lot of clothes which makes it harder to move around, 28 out of the 40 boys noted that. The cool weather as a complication was mentioned in 20 answers.

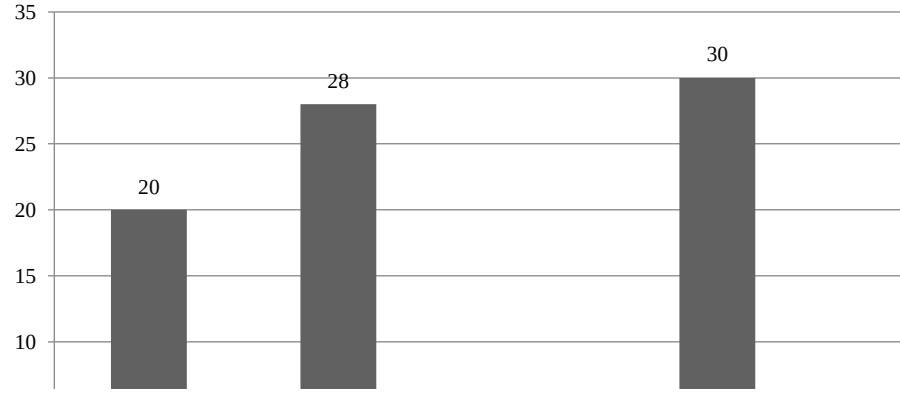

Figure 6. Outdoor workout challenges

5 boys noted that safe arrival to and from workout (including public transport) was a challenge, due to the students' age, when it was not mandatory to wear masks and the full public transport in the evening. The boys mentioned other park visitors as a challenge because they had to avoid them. Those were mostly little kids who did not look and ran in front.

The study showed that it is possible to work outdoors and workout 1:1, even though it is not sports game specific. The obtained 1:1 basketball skill were lost during this time. The outdoor physical preparation workout sessions were organized to keep their physical fitness and successfully return to basketball workout routine. The coaches and students learned to

plan workout sessions, their time, and do physical activities even without instructions on how to train during the pandemic and without the knowledge if the season will continue.

Discussion

Based on the Cabinet of Ministers Regulations, safe training environment in 2020 and 2021 encompassed parks, woods, and other natural objects, where a single training group could include up to 10 trainees (Covid-19 related restrictions in the field of sport, 14 October 2021). During the study, these regulations of the Cabinet of Ministers were considered, and, before each training, the trainees would apply for the training to comply with the Cabinet of Ministers Regulations on the safe process of training. The training methods used targeted the improvement of general physical conditioning. Elements of basketball technique were performed by the trainees individually, without the coach's supervision during distance trainings from 21 December 2020 until July 2021 (the study took place until 31 January 2021).

Conclusions

1. From October 20, 2020, till December 20, 2020, 28 basketball workouts took place and from October 20, 2020, till January 30, 2021, 30 outdoor workouts (physical preparation workouts) took place.

1.1. 1:1 basketball workout with the coach were attended by 24 students or 60% from the overall student count.

1.2. The outdoor workouts were attended by 35 students or 87.5% from the overall student count.

1.3. For each week the coaches made online workouts according to "BJBS Riga" requirements and provided in person workouts.

2. During workout sessions the students developed their physical properties and basketball technique mastery. The workout sessions provided communication, a chance to work practically, to move.

2.1. During the 1:1 basketball workout with the coach, the student's: developed their already learned basketball technique elements, learned new technique elements, learned to work on their own, individual approach for each student.

2.2. During outdoor workout sessions the student's developed their exercise execution, were learning new exercises and developed their physical properties.

2.3. The student's learned to dress up for outdoor workouts so they can properly workout, as well as use the outdoor environment (stairs, benches, sidewalks), which you could use while doing the online workout exercises.

Acknowledgements

I would like to thank the coaches and parents of BS Riga/Centrs trainees for the opportunity to conduct this study and to use a questionnaire to find out about the training process during the pandemic as well as to participate in the training process itself.

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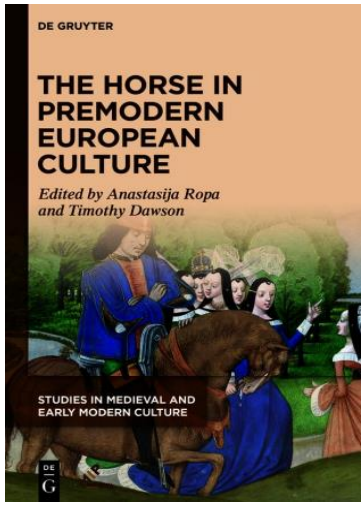
Submitted: May 31, 2021
Accepted: December 27, 2021

SCHORT COMMUNICATION

Anastasija Ropa, Timothy Dawson

THE HORSE IN PREMODERN EUROPEAN CULTURE

(eds. De Gruyter, MIP, January 2020) https://www.degruyter.com/view/product/ 534240



This volume provides a unique introduction to the most topical issues, advances, and challenges in medieval horse history. Medievalists who have a long-standing interest in horse history, as well as those seeking to widen their understanding of horses in medieval society will find here informed and comprehensive treatment of chapters from disciplines as diverse as archaeology, legal, economic and military history, urban and rural history, art and literature. The themes range from case studies of saddles and bridles, to hippiatric treatises, to the medieval origins of dressage literary studies. It shows the ubiquitous – and often ambiguous – role of the horse in medieval culture, where it was simultaneously a treasured animal and a means of transport, a military machine and a loyal companion. The contributors, many of whom have practical knowledge of horses, are drawn from established and budding scholars working in their areas of expertise.

SCHORT COMMUNICATION

REVIEW TO JĀNIS LANKA`S BOOK "BIOMECHANICS OF THROWS AND STROKES"

The book "Biomechanics of throws and stroke" by Jānis Lanka, Professor of Latvian Academy of Sports Education, is very voluminous and unique in that it describes in detail the principles of movement realization, summarizing data and findings from many of the world. leading specialists and professionals in sports biomechanics. This type of literature on the biomechanics of throw and stroke movements is in short supply, but in Latvian this is the first and so far the only book.

The book is intended for everyone who wants to understand the organization of sports movements, including the biomechanics and in detail the mechanisms of realization of stroke and throw movements – for all types of sports specialists – sports teachers, students, coaches, athletes, physiotherapists, etc. The book consists of four parts. In the first the author has described the basics of sports biomechanics, in the second - the basics of throw and stroke biomechanics, in the third – the basics of stroke mechanics and in the fourth - the basics of body flying mechanics and aerodynamics. Any activity is based on the laws of fundamental physics, the author presents and shares not only the classical, but also the contemporary view on the training and performance of the technical element of stroke-throw. The human body is a complex multifunctional biomechanical system; its action to achieve the goal is strictly coordinated and body works in integrity. All body segments and systems are closely related. The author explains that the understanding of sports biomechanics can help to achieve higher results in the performance of movements: "Biomechanical substantiation of sports technique is not only its measuring and assessment, but also its explanation, research of the interrelationships of causes and effects, development of future models of technique and forecasting of sports achievements, conducting of the process of acquisition of technique and operative and objective control of the level of performance. It is not enough to know what it takes to achieve a high score. Athlete must be able to achieve it; coach must be able to conduct the process of technical and physical preparation of the athlete. "

The training material in the book is not only theoretical, but also the result of practical and scientific research. The School of Theoretical Biomechanics, the foundations of which for the author were laid by Vladimir Zatsiorsky, a world-renowned scientist, sport biomechanist and leading researcher in sports theory. For Lanka, the biomechanical understanding of movement comes not only from the vast amount of scientific literature the professor reads on a daily basis, but also from the personal experience of the Olympian – training at a high level in decathlon gave a perfect sense of movement organization, which was later supplemented by a theoretical basis.

In conclusion, I would like to thank fate for not only knowing Jānis Lanka as a knowledgeable professor, responsive colleague, and a real family man, but also being lucky enough to write my doctoral dissertation under the supervision of Professor Lanka. I would like to express my gratitude for continuous support and productive cooperation!

LSPA Health Care in Sports Research Center and
Head of Sports Science Research Laboratory
Dr.paed., Leading researcher Anna Zuša

CONGRATULATION

We congratulate Alīna Kurmeļeva, the doctoral student of the Latvian Academy of Sport Education, with the defence of her Thesis "The Development of Parental Competence Model in Infant Floating" (in the field of Health and Sports science in the Sub-branch of Sport pedagogy) at the Latvian Academy of Sport Education on July 22, 2021.

The research accomplishments are as follows: Definition of the terms "infant floating", "infant swimming skills" and "parental competence in infant floating". Development of the structure of parental competence in infant floating and definition of its structural elements. Development of the model to improve parental competence in infant floating. Practical significance of the research: A questionnaire for parents "Self-Assessment of Parental Competence in Infant Floating" was developed and tested to determine their competence in infant floating. The developed 7 questionnaire can be practically used by both infant floating specialists and parents involved in it. A questionnaire for infant floating specialists "Assessment of Parental Competence in Infant Floating" was developed and tested for them to assess the competence of parents in infant floating and customise infant floating in line with the assessment obtained. To implement the model to improve parental competence in infant floating, a sequence of practical exercises in each phase of model implementation was developed. The said model can be used in infant floating practice and, to implement it, recommendations were given both to swimming specialists and parents.

Supervisor Prof. A. Fertnāte. PhD Alīna Kurmeļeva is a lecturer in the Department of healthcare.

Alina Kurmeļeva has been developed by ESF support withim the project "Strengthening of the Academic Staff of the Latvian Academy of Sport Education in the Field of "Health Care"

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CURRENT NEWS

Latvian Academy of Sport Education

LASE International Scientific Conference in Sport Science
January 31, 2022, LASE, Riga, Latvia

LASE 14th PhD and Master Students Conference
"UNITED FOR THE FUTURE OF SPORTS"
March 21, 2022, LASE, Riga, Latvia

LASE 74th Student Scientific Conference

The official languages of the Conferences for oral and poster presentations are Latvian and English. The information is placed on the website: www.lspa.lv

14th Baltic Sport Science Conference
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http://osress.weebly.com/

GUIDELINES FOR CONTRIBUTORS

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- ✓ *letters to the Editor* delivering an opinion or a comment to published manuscripts (maximum 2 standard pages of typescripts),
- ✓ *current news* (information on conference, abstracts of PhD. theses and post-Doc. theses, book reviews, biographical notes),
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Research or project reports, case studies of practice, action research reports, and reports on teaching practice or techniques will be accepted.

Research reports should include a description of the practical application(s) of the ideas tested, while reports of teaching practice or techniques should contain an explanation of the theoretical foundation underlying the practice or technique in question.

Material in the form of illustrations or photos is welcomed. This material should be accompanied by text clearly setting out its philosophical or practical origins or implications. All material should be clearly referenced to its sources.

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The manuscripts should be arranged as follows: title page, abstract and body text

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Abstract (up to 250 words) consisting of the following sections: justification and aim of the study, material and methods, results, conclusions, as well as 3 – 6 key words, should be provided before the body text.

Body text should be sectioned into: Introduction, Material and Methods, Results, Discussion, Conclusions, Acknowledgements (if necessary) and References. In articles of other types, the text should follow in a logical sequence and headings of its sections should reflect issues discussed therein.

Introduction – should be short and concise; it should introduce readers into research problems addressed in the study as well justify undertaking the research and specify its aim.

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Discussion – should emphasize new or important aspects of experimental results and discuss their implications. Results of own studies are to be compared with findings described in the respective domestic and international references used by the Authors.

Conclusions – should be started in points or descriptively and should be logically connected with objectives stated in the *Introduction*. Statements and conclusions not derived from own observations should be avoided.

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References should follow the instructions for Authors on References (APA style).

This document describes standards for preparing the references in the APA style.

Citing in-text. Following artificial text shows different types of in-text citation:

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Claessens (2010) found 6evidence that attention will be given to multi-compartment models, such as the 3-water, 3-mineral and 4-compartment models, to assess percentage of body fat.

However, Raslanas, Petkus and Griškonis (2010) noted that Aerobic physical load of low intensity got 35.1 % of total trainings time. Research on physical loading also focused on identifying the basis of much years' research of physical activity (Bytniewski et al. 2010). According to Ezerskis (2010), "… heavy physical loads had the undulating character depending on the dynamics of workloads…" (p. 71) yet girls are more ascertained that the Track & Field training helps to develop courage.

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Please provide all the required elements in the references to your paper. Please pay particular attention to spelling, capitalization, and punctuation. Accuracy and completeness of references are the responsibilities of the author. Before submitting your article, please ensure you have checked your paper for any relevant references you may have missed.

A complete reference should give the reader enough information to find the relevant article. If the article/book has DOI number, the author should include it in the references. And most importantly, complete, and correct references may allow automatic creation of active links by the MetaPress technology that we use for making the electronic version of our journal. Active reference linking is regarded as the greatest benefit of electronic publishing, and it adds a lot of value to your publication.

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