

The importance of cognitive functions in youth basketball players considering the players' position

József Horváth¹, Ágota Budavári², Beáta Dobay³

¹University of Physical Education Doctoral School, Budapest, Hungary

²National Sports Health Institute, Hungary

³University of Sopron, Benedek Elek Faculty of Pedagogy, Hungary

Abstract:

The examination of cognitive abilities plays a significant role in increasing performance. On the one hand, it defines the basis of decision-making, and on the other hand, it is a measure of intelligence and creativity. Cognitive abilities can be developed, and motor development in sports affects them. The mechanism for developing cognitive abilities differs for each sport, but each sport has a significant role in the effectiveness. The study examines the mental abilities of youth basketball players in basketball, comparing them with non-athletes of the same age as a control group. We also looked for the answer to whether the cognitive ability of athletes changes in a positive direction as age and training age progress, as well as whether we can find a correlation between the players' position and mental abilities. Raven and Pieron tests were performed for the examined groups under standard conditions. Previous research has shown that there are differences between athletes and non-athletes in cognitive functions, a scientific finding that was not confirmed in the current survey. Based on the results, we found no significant difference between basketball players and non-competitive students, and there was also no difference between the results according to age. No significant differences were found in the positions of the reserve basketball players, nor were there any significant differences in the positions of the point guard, the field, or the center players. The investigation pointed out that although the limitations of the research appeared, such as the low number of elements, the methods of selecting athletes, the scientific results should be assessed in several segments, as well as the previous research results should be repeated.

Keywords: Youth basketball players, mental abilities, age, position of players, performance.

Performance and competitiveness appear in many areas of life, even in sports, in areas that can be separated, be it the competitiveness of the city in sports (Farágó, 2024), among sports organizations (Gósi, Nagy, 2020), in the sports economy, or in the social role of sports, and also in the globality of the sports economy (Farágó et al., 2018). In elite sports, the most important task is to achieve the highest possible performance, to increase performance. There are many factors behind the performances, the totality of which determines the quality of the performance. According to Dubecz (2009), athletes must have a high level of conditioning,

coordination, emotional and cognitive skills necessary for the sport in order to be successful. Physical factors and conditioning abilities are of decisive importance in every ball game. Specialists working in resupply training spend most of their time and energy on developing physical abilities and honing technical and tactical knowledge, while psychological fitness has received less attention in recent decades. although mental factors can significantly influence the performance indicators.

Nowadays, it has been proven that excellent physical and physiological indicators are not enough for good results, technical and tactical knowledge is in vain, in addition, the appropriate psychological factors are also necessary. According to several authors (Barreiros et al. (2011); Csáki et al. (2013); Janelle and Hilmann (2003), athletes must be outstanding in at least four parameters; physiological, technical, cognitive (tactical, strategic, decision-making) and emotional stability. It is important that the athletes react at the right moment with the right answer to the given set of stimuli (Silva, 2006). In several ball games (football, handball), research has been carried out on mental abilities, as well as on issues of concentration, self-confidence and motivation (Thomas et al. 1999).

However, when examining personality traits, we must take into account that cross-sectional studies are not necessarily reliable, since personality traits can be different at different ages and these personality abilities can be developed (Morris, 2000). Williams and Davis (1995) examined the cognitive abilities and game intelligence of players, based on the results, they found a difference between skilled and less skilled players. Skilled players showed better results in the areas of reaction to game situations, situational recognition and anticipatory ability.

The literature focuses on the investigation of the cognitive functions of ball players in the last 3 decades. Especially in basketball, the complexity and speed of the game require continuous movement, situational assessment, decision-making ability, and speed of reaction from the players. Some researchers have examined attention concentration, perceptual perception, working memory capacity, flexibility and creativity as relevant psychological requirements (Scharfen, Memmert 2019). Huijgen et al. (2015) highlight the anticipation ability of soccer players between the ages of 13 and 17, which enables them to "predict" the event that will occur in addition to creativity and inhibitory control (Huijgen et al. 2015). Indian researchers (Banerjee, Reddy 2016) studied basketball and football players and used neuropsychological tests to monitor the athletes' mental development.

Based on the research, the following functions were highlighted, which are essential for playing ball games at a high level:

- spatial orientation,

- divided (distributive) attention performance,
- active memory,
- mentalizing capacity (which corresponds to "game intelligence"),
- the ability to change strategies,
- quick adaptation.

Differences between positions within the team have hardly been investigated, despite the fact that there can be differences between the tasks of players playing in different positions in the sport of basketball. The diagnostic examination of the aforementioned abilities can help professionals in the preparation and development of junior athletes and teams. There may be several reasons for the low number of research, one of which is that the opinion of sports professionals is not uniform about the definition of the position of basketball players, while the other is that it was assumed that basketball players must have an equally high concentration of attention and good anticipation skills. With these abilities, they can anticipate the movements of the opponent's players, adapt to them flexibly, and make quick, creative decisions.

In order to be able to examine the differences in the players' positions, we need to be aware of how the positions are defined. According to the classic division, which is also used by Krause (2002), five positions are distinguished in basketball, which are as follows:

1. controller (Point Guard, Facilitator)
2. low thrower, defender (Shooting Guard)
3. high thrower (Small Forward)
4. power forward (Power Forward)
5. center, midfielder (Center)

Today, the expectations for the various positions are much more balanced, especially when looking at the physical and psychological indicators. Several studies (Legg et al. 2017; Štrumbelj et al. 2013) show that, for example, at the women's international level, there is no difference in important conditioning abilities between players playing in different positions. In the game of men's basketball, almost every successful player must have a body height of around two meters. Bianchi et al. (2017) proposed the expansion of the five-part division with additional categories that take into account the difference between individual playing styles and the involvement in different tasks. There are opinions that today we distinguish only three posts. Baker (2017) kept the classic five-position division, but with a different composition. If we examine these divisions in detail, we are actually also close to the triple system. According to Baker (2017), the division is as follows:

1. manager, initiator, organizer (Facilitator)

2. Designated Scorers
3. Three Point Specialist
4. Mobile Bigs
5. Stationary Bigs

Alagappan (TEDxSpokane, 2013) derives the problem of the classic division of five from the fact that the players responsible for the organization of the game (Chris Paul, Steve Nash, Jason Kidd) cannot be placed among the control type players in the old division, as they excel in three completely different indicators. Alagappan (2013) distinguishes several different types of players (e.g.: Inside Outside Scorer, Mid-Range Big Men, Defensive Ball-handlers, 3-Point Ball-handlers, Scoring Rebounders, Jump Shooting Ball-handlers), but he is also the considers a threefold division appropriate. Based on the literature review and experience, we can say that in today's basketball, the positions have become blurred, yet the multifaceted tasks require several players with different profiles, skills and abilities. That is why we can differentiate between the different positions mainly by looking at one outstanding feature:

1. manager, initiator (Facilitator), (player responsible for organizing the team's tactics)
2. pitcher, finisher or defensive player (outfield player most responsible for finishing attacks)
3. center, or tall player (player who plays near the backboard, but in today's basketball, moves at home at all points of the court)

Indonesian researchers (Nanda, Dimiyati, 2019) examined adult basketball players and compared players in different positions (manager, field (defender) and center) according to personality factors. The results of a total of 24 people were examined. A significant difference was found in favor of the controlling players with a psychological "skill" questionnaire (PSIS R-5), which included motivation, persistence and determination in addition to cognitive functions. Dereceli in 2018, professional basketball players were also examined with a self-characteristic questionnaire (Sheard's SMTQ) (concentration, mental strength, self-confidence, control, endurance). The ability to concentrate is better for the field players (guard), but the mental determination is the best for the manager (facilitator). Research was also carried out in football, in which the performance of athletes was compared according to positions. The motivation of elite youth players was investigated, and it was found that age does, but the position typically held on the field does not affect performance (Stewart, Meyers, 2004). Based on the literature examination results, we consider the following cognitive functions to be decisive for basketball players:

- ability to concentrate attention
- working memory, recording the progress and turns of the game

- strategic thinking, ability to anticipate
- quick decision-making
- flexible, creative solution ability

Methods

The male athletes of the Sopron Sports School Basketball Academy, the female basketball players of the Sopron Darazsak, and the students of the Berzsenyi Dániel Evangélikus (Lyceum) High School and College in Sopron took part in the research. Among the athletes of the academies, the players in the number one team by age group participated, while the school students who participated as a control group were included in the research based on voluntary application, with the condition that they did not continue competitive sports activities.

The tests examining cognitive functions were performed in the youth age group, among the players of the Sopron Sports School Basketball Academy for the U14, U16 and U18 teams, and for the athletes of the Sopron Darazsak Basketball Academy, we examined the players of the U16 and U18 teams. The number of players participating in the study was as follows by age group: Among the boys' players of the sports School, 10 people from the U18 age group, 11 people from the U16 age group, and 13 people from the U14 age group participated in the research, a total of 44 players were examined (N=44).

We started the psychological surveys for the boys in the 2019 championship season, the date of the survey was August 2019. The examination of the female players took place in March 2023, (Soproni Darazsak) U18 age group 13 people, U16 age group 17 people (N= 30). When determining the basketball position of the athletes, we took into account the triple division. Based on the suggestion of the head coach of the age group teams, we identified the players from the three variations (controller, outfield, & center). As a control group, non-athletic students of the city's elite high school (constantly ranked among the top 100 high schools at the national level) participated voluntarily, 18 girls and 15 boys from the 18-year-old age group, 7 girls and 7 boys from the 16-year-old age group took part in the study. a total of 47 students (N=47). The test recording took place in December 2022. In all cases, we filled out a parental consent form for the young athletes, in which they agreed to carry out the research. The conditions of the test were the same in all three cases, the participants who worked individually completed the tests in a relaxed state. A maximum of 45 minutes was available to complete the tests.

We chose psychological tests that are known and used in the selection process - validated, standardized, numbered - so they can be evaluated scientifically. The two tests used

are: (1) Pierson's concentration test, measures a 5-minute period, includes a certain working memory task (Czigler 2005); (2) Raven's progressive vignettes – the task is to recognize the relationships of 60 perceptual, visual stimulus groups, the respondent must draw a conclusion under time pressure (Czigler 2005). When choosing the psychological tests, a decisive aspect was that the tasks resembled the special decision-making tasks of the basketball game as much as possible. Accuracy of perception, which is based on the basic phenomenon of attention, is primary in the planning of human behavior. Attention concentration - as an intellectual factor - is highly variable, which is why it is an important characteristic of a ball player. Following, sensing and evaluating events is based on this. Pierson's attention concentration test examines a 5-minute time period, it also includes a certain working memory task, well simulating the requirements of the sport of basketball. We rank the displayed performance according to two parameters: total performance and performance percentage. The examinee is instructed to perform as well as possible, to work accurately, and to progress line by line. The "Progressive Matrices" test developed by John Raven (1954) measures the finding of rules within a complex set of stimuli and the correctness of the conclusion based on this, i.e. how well the person is able to see through situations and find connections between them. It is perceptual intelligence that is independent of language skills and education. The developer of the measure described it as a test of "observation and clear thinking". The word matrices in the name of the measuring device refers to the nature of the tasks, since the ability to think and reason is realized by recognizing the regularities of different matrices. And the word progressive refers to the fact that the tasks follow in an increasingly difficult order, thereby promoting the guidance and training needed to solve problems. In the test, you have to find the corresponding ninth item after eight presented items for each task. With the Raven test, we measured the level of perceptive intelligence evaluating the situation, as well as the ability to quickly decide between alternative solution methods. The task was to recognize the connections of a group of visual stimuli, and the respondent had to draw conclusions under time constraints.

Results

When comparing the cognitive test results of female basketball players and their non-athlete peers, the high school students were significantly better in the perceptive intelligence test, contrary to what we assumed. The condition of normal distribution was not met, therefore the Mann-Whitney test was used, $p=0.007$). So, the average rank of high school students was higher than that of basketball players. There was no significant difference between the two groups in the overall performance in the Pierson test. We used the

independent sample t test on a normally distributed sample, ($p=0.108$). There is no significant difference in the Pieron test performance percentage, with the Mann-Whitney test, $p=0.104$ one-sided.

The cognitive test results of male basketball academics and their non-athlete peers did not show significant differences in any of the cognitive tests. Raven scores were evaluated using the Mann Whitney test, there is no significant difference between the rank averages ($p=0.0712$). The performance in the Pieron test was also evaluated with the Mann-Whitney test, there was no significant difference there either, $p=0.324$. The difference in performance percentage was not significant either ($p=0.086$).

In response to our question as to whether 18-year-old male basketball players' attention performance and situational analysis skills (Raven) are improved by training compared to 16-year-olds, the statistical results did not prove a significant improvement, nor were they selected as a result of their success. The Raven scores were evaluated with an independent sample t test - because the condition of normal distribution was met - there is no difference between male basketball players and high school students of the same age ($p=0.205$). Pieron's performance figures were compared using the Mann-Whitney test, but no significant difference was found between the results of the two groups, $p=0.369$. When comparing performance percentages, we did not find a significant difference either, $p=0.118$.

Comparing the performance of female 16- and 18-year-old basketball players, no significant difference was found in the results of the Raven test or in the Pieron performance. In the case of Raven scores, the normal distribution is not fulfilled, therefore we calculated with the Mann Whitney test, there was no significant difference between the rank averages $p=0.993$. Pieron performance results fulfilled the condition of normal distribution and were evaluated with an independent sample t-test, there was no significant difference between the two age groups. $p=0.066$. There was no significant difference in performance percentage either, using the Mann-Whitney test ($p=0.610$).

We also examined the difference between the posts. Among the players, we distinguished three positions: the manager, the field, and the center position. In the case of boys, both the Raven and Pieron tests show that the condition of normal distribution is not met at all positions, so we used the Kruskal-Wallis test and found no significant difference between the positions. In the case of the girls, the normal distribution was met for all players in all positions, as well as the homogeneity of variance, so we analyzed the group with an ANOVA test. There was no significant difference in the results of the competitors for

basketball players in different positions. The following table summarises the results (Table 1).

Table 1. Summarises the results (source: own editing)

	women's basketball players	non-athletes	
Perceptive intelligence test		√	Mann-Whitney test p=0,007
Pieron test	no deviation	no deviation	independent sample t-test p=0,108
Comparing the performance of women's 16- and 18-year-old basketball players	no deviation	no deviation	Mann-Whitney test p=0,993, independent sample t-test p=0,066
	men's basketball players	non-athletes	
Raven pontszámok	no deviation	no deviation	Mann-Whitney test p=0,0712
Pieron test	no significant difference	no significant difference	Mann-Whitney test p=0,324
Do 18-year-old male basketball players improve their attention performance and situational analysis skills (Raven) compared to 16-year-olds	no significant difference	no significant difference	Raven score: p=0,205
Examine posts			
Point guard, swing man (cornerman), center position	no significant difference	no significant difference	Kruskal-Wallis test

Discussion and conclusions

Based on the analysis of the psychological test results of youth ball players, we can conclude that the examined basketball players do not differ from their contemporaries, neither in the task of examining the concentration of attention, nor in recognizing the connections of a given situation. These results were observed for both female and male athletes. In the present research, the basketball athletes did not have better cognitive functions than their peers of a similar age.

Based on the results, we can conclude that although previous research shows a positive difference in the cognitive functions of ball players, including basketball players, in adult athletes, we could not prove this in our own research. Of course, one explanation for this could be that the examined athletes are not a multiple selected group, but also players who are not always selected athletes. The fact that the non-athlete group was composed of students from an "elite high school" with good cognitive results may also contribute to the results.

When examining the difference in the results of the basketball players between positions, we did not find any differences between the athletes. Although experts' opinions

and some research prove that the cognitive abilities of managers are better than those of athletes in other positions, we did not find this proven in the research. Nanda, Dimiyati (2019) also found differences in the differences between the positions and showed a significant difference in favor of the athletes in the management position, a result that was not shown in our survey. In Nanda's research, adult athletes were included, in contrast to our study, where we measured youth players, which may also explain why the previous research was not confirmed.

It is also possible that we did not get a similar result due to the small number of the sample, but it is also possible that the position of the players was not chosen properly for the youth athletes. Dereceli. The results of his research in 2018 showed that, in their study, the ability to concentrate was better in field players (defender, guard), but mental determination was the best in the case of facilitators (facilitator). This result was not shown in our own research. One of the reasons may be the inappropriate selection of positions. The different positions of the players were still being developed, in several cases the head coach was also unsure of the position in which the athlete should be included, and in many cases the player was not playing in the right "place". It often happens that the anthropometric indicators of the players determine the task that the coaches assign to the athlete, as opposed to, for example, psychological attributes. It would definitely be important to be more careful when choosing the position of the players in youth sports. It is advantageous if the professionals decide by taking into account several aspects (psychological characteristics) as opposed to anthropometric indicators, or possibly technical training.

It may also happen that the blurring observed for the physical parameters proven in the literature can also be observed for the mental factors between the posts, however, due to the small number of the sample, we cannot state this as a fact. The subject of further research could be the examination of a larger number of players in different positions from a mental point of view. It would be interesting to first conduct the investigation on adult or older youth players, where the positions have already been clarified. It should definitely be considered that the academic training is done with selected groups in basketball. For the selection, we need to assess not only the anthropometric indicators, physical abilities, and technical and tactical knowledge, but it is also advisable to observe and examine the mental abilities of the players. It is also worth giving help to the youth coaches in the selection of positions, so that they also take into account the mental factors when selecting a player for a position. The results of the research point out the limitations of the survey, as well as the fact that it is worthwhile to review the research results, as well as to repeat what properties and

environments can be demonstrated in the previous studies, or what changes need to be made in the research methods.

References

1. BAKER, E., 2017. Redefining Basketball Positions with Unsupervised Learning. *Towards Data Science*, 06.19
2. BANERJEE, K. & REDDY K., 2016. Sports and cognitive functioning among college football and basketball players. *Indian J. Neurosciences*, 2(1), 11-15.
3. BARREIROS, A.N., DA SILVA, J.M., DARTE, D.T. & DA FONSECA, A.M., 2011. What Portuguese premier league coaches think about the importance of psychological intervention in professional Soccer? *Motriz Revista de Educacao Fisica*, 17, 128-137
4. BIANCHI, F., FACCHINETTI, T. & ZUCCOLOTTO, P., 2017. Role revolution: towards a new meaning of positions in basketball. *Electronic Journal of Applied Statistical Analysis*, 10(3), 712-734.
5. CSÁKI, I., BOGNÁR, J., RÉVÉSZ, L. & GÉCZI, G., 2013. Elméletek a gyakorlatok a tehetséges labdarúgó kiválasztásához és beválasztásához *Magyar Sporttudományi Szemle* 53, 12-18.
6. DERECELI, C., 2018. A examination of concentration and mental toughness in professional basketball players *Journal of Education and Training Studies* 7(1), 17.
7. DUBECZ, J., 2009. *Általános edzéselmélet és módszertan*. Önkormányzati Minisztérium Sport szakállamtitkárság.
8. FARAGÓ, B., 2024. Competitiveness indicators of sports cities in Central-Eastern Europe. *Theoretical and Empirical Researches in Urban Management* 19(1), 30-53.
9. FARAGÓ, B., KONCZOSNÉ SZOMBATHELYI, M. & BÉKI, P., 2018. A világ sportpiacának dinamikusan fejlődő területei a 21. század világgazdasági és világpolitikai folyamataiban. *Multidiszciplináris kihívások, sokszínű válaszok* (2), 94-125
10. GŐSI ZS. & NAGY, J., 2016. Sportvállalkozások gazdálkodási jellemzői, 2016. In: HAMAR, P., KÖPF, K. (szerk.) *Mozgás - biológia - sport - tudomány: Tanulmányok a 47. Mozgásbiológiai Konferencia előadásaiból*. Budapest, Magyarország: Magyar Edzők Társasága (2018) 204 p. pp. 100-110., 11 p.
11. HUIJGEN, B. C. H., LEEMHUIS, S., KOK, N. M., VERBURGH, L., OOSTERLAAN, J., ELFERINK-GEMSER, M. T. & VISSCHER, C., 2015. Cognitive functions in elite and sub-elite youth soccer players aged 13 to 17 years. *PLoS ONE*, 10(12), e0144580.

12. JANELLE, C. M., HILMANN, C.H., 2003. *Expert permormance in sport:current perspectives and critical issues*. In STARKES, J. & ERICKSON, K. *Expert performance insports: advances in research on sport expertise* Champaign, Human Kinetics, 19-49.
13. KRAUSE, J., 2002. *Coaching Basketball* NABC Drill Book
14. LEGG, J. S., WILLIAMS, K. J., PYNE, D. B., STUART, J., SEMPLE, S. J. & BALL, N., 2017. Physiological profile of Australian elite female basketball players according to playing position *Journal of Australian Strength and Conditioning*, Issue 2.
15. MORRIS, T., 2000. *Psychological characteristics and talent identification in soccer*. *Journal of Sport Science*, 18. 715-726.
16. NANDA, F. A. & DIMYATI, D., 2019. The psychological skills of basketball athletes: are there any differences ased ont he playing position *Jurnal Keolahragaan* 7(1), 74-82.
17. RAVEN, J., RAVEN, J. C. & COURT, J. H., 2004. *Manual for Raven's Progressive Matrices and Vocabulary Scales*. Section 3: The Standard Progressive Matrices. San Antonio, TX: Harcourt Assessment.
18. SCHARFEN, H.E. & MEMMERT, D., 2019. The relationship between cognitive functions and sport-specific motor skills in elite youth soccer players. *Frontiers in Psychology*, 10, 817.
19. SILVA, J. M., 2006. *Psychological aspects in the training and performance of team handball athletes* In *The Sport Psychologist s Handbook: A Guide for Sport-Specific Performance Ehancement*. John Wiley & Sons West Suxxes, 211-243
20. STEWART, C. & MEYERS, M., 2004. *Motivational Traits of Elite Young Soccer Players*, *Physical Educator*, 61: 4.
21. TEDxSPOKANE, 2013. Muthu Alagappan: *The new Positions of Basketball* Retrieved:10.06.2020 from: <https://www.youtube.com/watch?v=E-gpSQQe3w8>
22. THOMAS, P. R., MURPHY, S. M. & HARDY, L., 1999. Test of performance strategies: Development and preliminary validation of comprehensive measure of athletes psychological skills *Journal of Sport Sciences*, 17, 697-711.
23. WILLIAMS, A. M. & DAVIS, K., 1995. Declarative knowledge in sport: A byproduct of experience or a characteristic of expertise? *Journal of Sport and Exercise Psychology*, 17, 259-275.

Abstrakt

Význam kognitívnych funkcií mladých basketbalistov vzhľadom na hráčsku pozíciu

József Horváth, Ágota Budavári, Beáta Dobay

Skúmanie kognitívnych schopností zohráva významnú úlohu pri zvyšovaní výkonnosti. Na jednej strane definujú základ rozhodovania a na druhej strane sú meradlom inteligencie a tvorivosti. Rozvoj kognitívnych schopností je možno športom rozvíjať a ovplyvňovať. Mechanizmus rozvoja kognitívnych schopností sa v jednotlivých športoch líši, ale v každom športe zohráva významnú úlohu v efektívite. Štúdia skúma mentálne schopnosti mladých basketbalistov a porovnáva ich s nešportovcami rovnakého veku ako kontrolnou skupinou. Hľadali sme odpoveď na otázku, či sa kognitívne schopnosti športovcov menia pozitívnym smerom s vekom a športovým vekom, ako aj či môžeme nájsť súvislosť medzi postavením hráčov s ich mentálnymi schopnosťami. Aplikovali sme Ravenove a Pieronove testy za štandardných podmienok. Predchádzajúce výskumy ukázali, že medzi športovcami a nešportovcami existujú rozdiely v kognitívnych funkciách, čo je vedecky dokázané no v predložennom výskume sa to nepotvrdilo. Na základe výsledkov sme nezistili signifikantný rozdiel medzi basketbalistami a nešportovcami a nebol zistený ani rozdiel z hľadiska veku. Neboli zistené významné rozdiely v pozíciách záložných hráčov, ani významné rozdiely v pozíciách rozohrávača, hráča v poli a stredového hráča. Výskum poukázal na to, že hoci sa objavili limity, ako napríklad nízky počet participantov a metódy výberu športovcov, vedecké výsledky by sa mali posúdiť vo viacerých segmentoch, a tiež by sa mali zopakovať výsledky predchádzajúceho výskumu.

Kľúčové slová: Mládežnícki basketbalisti, mentálne schopnosti, vek, postavenie hráčov, výkonnosť.

JÓZSEF HORVÁTH – a PhD. Student, within the field of Sport Science, his research interests are training theory, dosing and monitoring of training load, examination of external and internal training components.

ÁGOTA BUDAVÁRI, PhD. – Adult clinical psychologist, psychotherapist, supervisor, Method-specific training relaxation and symbol therapist, ECP holder. She conducts research in sports psychology.

Dr. habil, PaedDr. BEÁTA DOBAY, PhD. – Within sports science, his research areas are sports tourism, recreation, physical education teaching methodology – among schoolchildren and kindergarteners, the effect of sports camps on the healthy lifestyle of adults.