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# EDUCATIO ARTIS GYMNASTICAE

3/2016

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## EDUCATIO ARTIS GYMNASTICAE

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## 3

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## CONTENT – SOMMAIRE – INHALT – CUPRINS

STUDIA UBB EDUCATIO ARTIS GYMN., LXI, 3, 2016, pp. 5-16
(RECOMMENDED CITATION)

# SHOT ANALYSIS OF ELITE WOMEN HANDBALL PLAYERS DURING ORGANISED OFFENSE ATTEMPTS

**ATHANASIOS YIANNAKOS**[1]

**ABSTRACT.** During the last years and as a result of the recently adopted rules, handball has evolved to a very fast game, with goal-attempts transposing to an important factor influencing the final result of the game. The aim of the present study was to evaluate the performed shots according to a) the total number of attack attempts, b) the adopted offensive formation, c) the positioning of the thrower, d) the final positioning of the ball within the goalpost and e) their efficacy among elite women handball players. All matches of the eight finalists women's National Teams competing at the 2008 Olympic Games, were recorded. The total number of attacks (n=3,264) was evaluated with video-analysis software. Non-parametric Chi-square tests were used to assess differences ($p<0.05$). The results revealed a variation in the goal-attempt shots positioning inside the court, with the majority being performed in areas with inadequate defence. Among the goal-attempts that reached the goalpost 31.4% were successful, 16.0% were saved by the goalkeepers and 9.8% ended outside the post.

***Keywords:*** *handball, women, shot, offense formations; shot positioning; efficacy*

## Introduction

Handball is a dynamic sport involving body contact between opponents, with a continuous alternate between rapid and slow movements (Amin, Horyd and Bober, 1985). Additionally, it consists of one of the most popular sports in the European continent, with a great number of women participants.

The recently adapted changes concerning the sport's rules have resulted in an accelerated play mode (Christer, 2010). In further detail, the number of goal attempt shots has been significantly increased since the match is resumed immediately after each goal. Hence, goal attempt shots evolved to the most pivotal movements performed among offensive players, requiring skilled efforts involving the whole body of the thrower (Homberg and Papageorgiou, 1995), while consisting of a factor of great importance concerning the final result of the game (Mavridis *et al.,*

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2006; Skoufas *et al.,* 2003). The execution of goal attempt shots is not a "simplistic" offensive movement, but entails complex technical and tactical integrations in order to put an offensive player in a more advantageous position opposite the goal post. On the other hand, goal shooting is highly dependent on proper targeting and execution precision, the velocity of the released ball and the power output needed to disposition the goalkeeper and succeed in scoring (Milanovic, Vuleta and Sisic, 2012; Kajtna *et al.,* 2012).

It has been suggested (Kastner, Pollany and Sobotka, 1978) that different shooting techniques should be selected depending on the position, timing and distance from the goalpost. However, proper selection of the best technique does not always ensure success, because, irrespectively of the number of defenders, there is also the goalkeeper who is ultimately guarding the post.

Nowadays, in every sport coaches are searching for the parameters and techniques that will boost the chances for winning (Oscar and Pascual, 2011). Among team sports, video analysis has been deemed useful in identifying individual weaknesses of each player, evaluating and improving performance through training adaptations and improving technical and tactical knowledge (Mullen, 1992; Yiannakos, 2005; O'Donoghue, 2006).

On the other hand, recording, studying and analysing the components of large-scale sports events through video analysis has also provided data concerning the evolution of the playing characteristics of each sport. Such data are extremely useful to both coaches and players, in providing information on the playing characteristics and behaviour of elite teams, as well as in identifying the modern playing trends prevailing in each sport (Sampaio and Janeira, 2003; Taylor, Mellalieu and James, 2004; Zakas *et al.*, 2002). As far as handball is concerned, the recent adaptation of new playing rules and the similar ratio in sports participation between the two sexes (Taborsky, 2008), provided a chance to re-evaluate specific playing indexes.

Thus, the aim of the present study was to assess the performed shots in relation to a) the total number of offensive phases, b) mode of adopted offense, c) positioning of the thrower, d) final positioning of the ball within the goalpost and d) the efficacy of the performed shots among elite female handball players.

## Material & methods

### *Sample*

The sample consisted of eight elite women handball national teams competing at the 2008 Olympic Games in Beijing, China. All the games of the eight finalist teams were recorded and the offensive attempts were analysed, involving a total of 3,264 phases. The shots performed by each team, on every match were evaluated thoroughly.

*Procedure*

The Sport-Scout video analysis software was used to analyse the phases, using a handball-specific standardised observation and record protocol. The observer has the ability to input important aspects of the play in the software and analyse them using a P/C.

In further detail, the protocol involved the record of all shots performed during different offensive formations (either organised or fast-break), the positioning of the thrower, their efficacy (goal/saved/or out), as well as the final positioning of the ball within the goalpost, such as the height and side of the post.

*Statistical Analyses*

The 19th version of the Statistical Package for Social Sciences (SPSS Inc., Hong Kong) was used for data analyses. Crosstabs was applied and statistically significant differences were observed with the non-parametric Chi-square test. Significance was set at 5%.

## Results

The analysis identified 3,264 offensive phases (Fig. 1), with 94.6% of those being completed (n=3,088) and the remaining 176 being incomplete mainly due to player errors ($X^2$=159.132, p=0.000).

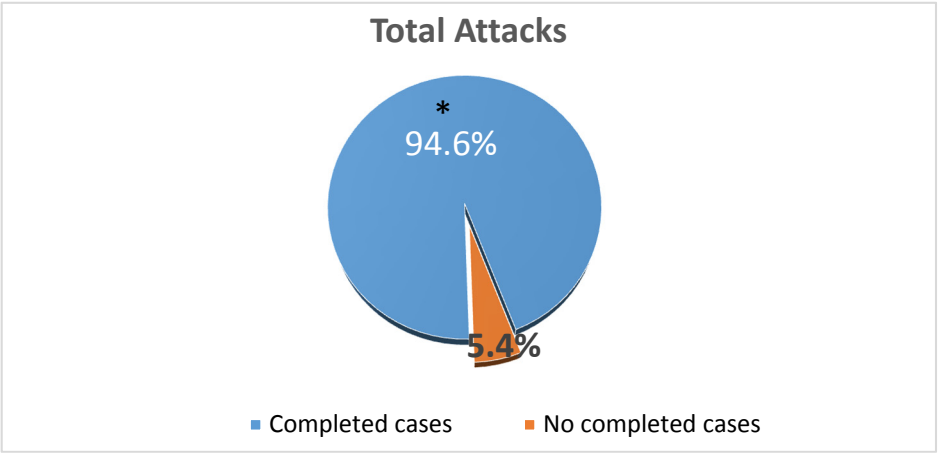


**Fig. 1.** Rates of attack attempts and non-completed attacks
*Attack attempts *vs.* non-completed attacks (p=0.000)

Among the total number of attack attempts, a great majority involved shots (66.9%) whereas a lower percentage was completed without involving shots (33.1%), ($X^2$=22.848, p=0.000) (Fig. 2).

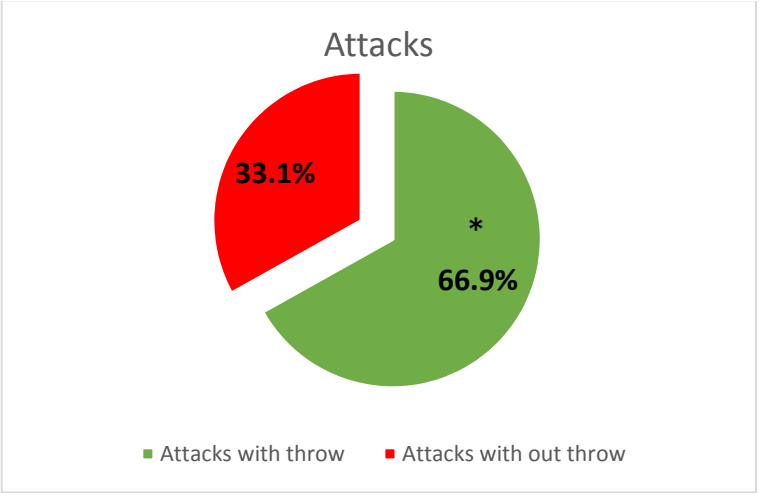


**Fig. 2**. Prevalence of attacks with and without goal-attempt shots
Attacks with goal-attempt shots *vs.* attacks without goal attempts shots (p=0.000)

The majority of the attacks (78.0%) were performed during organised offensive efforts, whereas a statistically lower percentage (16.6%) involved fast-break attacks ($x^2$=75.619, p<0.000). The latter consisted mainly of second wave (11.4%) and first wave attacks (5.2%) (Fig. 3).

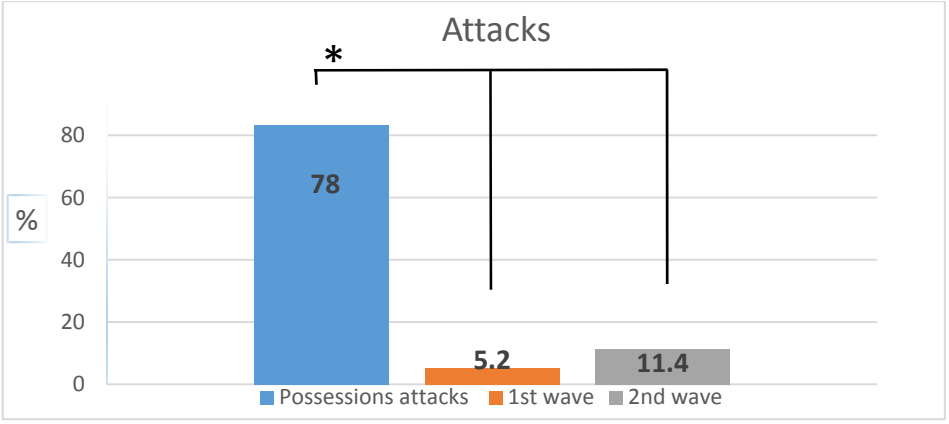


**Fig. 3.** Possession and fast break attacks
*Possessions attacks *vs.* fast breaks (1st & 2st wave) (p=0.000)

As seen in Figure 4, shot attempts during organised offense possession were performed mainly from the periphery of the court (40.8%), with a lower percentage originating 6m from the goal post (26.4%), 15.9% being shot from the wings and the remaining 11.5% consisting of 7m throws. Data analysis revealed a statistical difference between shots originating from the periphery *vs*. those from the 6m ($X^2$=4.647, p<0.03), wing-throws ($X^2$=15.261, p=0.000), as well as with the 7m throws ($X^2$=22.227, p=0.000). Additionally, the shots thrown from the 6m line were significantly different compared to the 7m throws ($X^2$=7.227, p=0.000), whereas no difference was observed among wing-throws, despite the difference recorded in their prevalence ($X^2$=3.305, p<0.06).

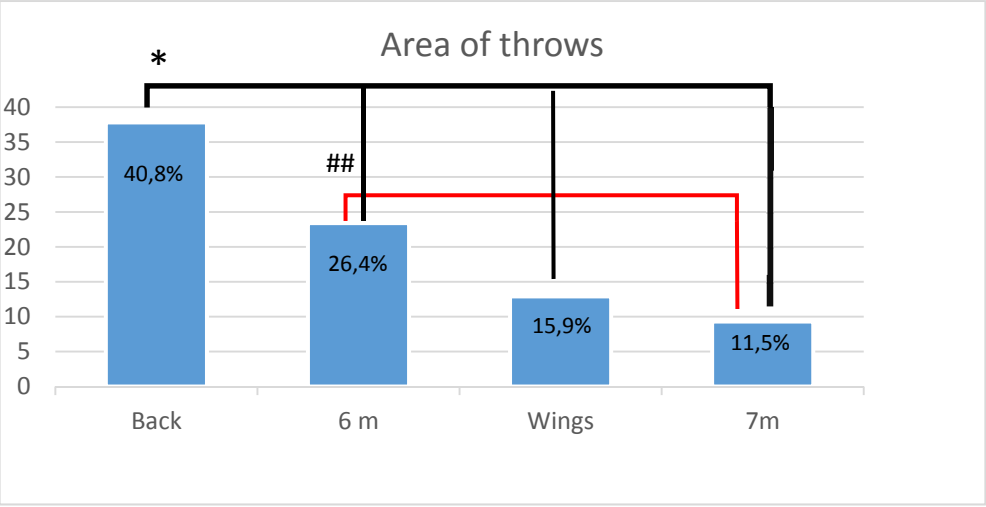


**Fig. 4**. Percentage of shots depending on the throwing position
* Back area throws *vs.* 6m, wing and 7m. throws; ##6m throws *vs.* 7m. throws (p=0.000 for all)

As stressed in Figure 5, the majority of the goal-attempt shots performed during organised offensive formations reached the goalpost (56.7%), with a mere 37.4% being unsuccessful. Among those that reached the goalpost, 31.4% ended in successful scoring, 16.0% were saved and 9.8% were misplaced. Attempted shots that failed to be executed were either interrupted from fouls (28.1%), considered penalties (5.7%), or blocked by the opponents' defence (3.6%). The statistical analyses revealed a significant difference among shots that reached the goalpost, compared to the unsuccessful ones ($X^2$=7.863, p<0.005), between the successful goals and the goalkeepers' deflections prevalence ($X^2$=5.733, p<0.01), as well as between successful and unsuccessful goals ($X^2$=13.733, p=0.000). Comparison of the fouls to the penalty charges and the defence-blocked attempts also revealed

statistical differences ($X^2$=17.863, p=0.000 and $X^2$=22.501, p=0.000, respectively). No difference was observed between the prevalence of goals and fouls ($X^2$=0.188, p<0.664).

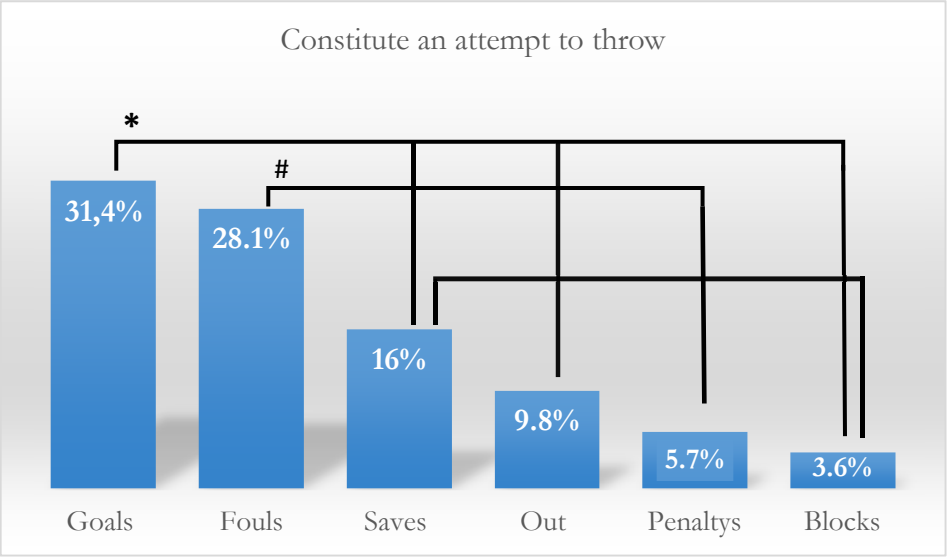


**Fig. 5**. Shot result, according to prevalence
*Goals *vs.* saves, outs and blocks; #Fouls *vs.* penalties; *#Saves *vs.* outs and blocks. (p=0.000 for all)

Examination of the goal-shots' height revealed that the vast majority consisted of high-shots (46.4%), 41.7% were low-shots and a smaller percentage involved medium-height shots (11.9%) (Fig. 6). The statistical analysis showed a difference between the number of high and medium-height shots ($X^2$=26.510, p=0.000). As far as the side of the goalpost is concerned, most of the shots ended on the right side (45.2%), fewer on the left side (32.3%), and the remaining on the centre of the goal (22.5%). The amount of goal-shots ending on the right side of the goalpost was significant greater compared to those aiming in the middle ($X^2$=11.506, p=0.000) and the left side of the post ($X^2$=3.505, p<0.06). No difference was observed between the number of goal-shots aiming the left and the middle of the goalpost ($X^2$=2.413, p<0.120).

Among the goal-shots that ended inside the goalpost, the majority was positioned on the right side of the post (30.6%), a smaller ratio had aimed on the left side (21.5%) and an even smaller percentage involved shots in the middle of the goalpost (11.3%), with the differences between the right and left axis being statistically significant ($X^2$=11.246, p=0.000).

| Total | | L | C | R | |
|---|---|---|---|---|---|
| ** 46,4% | H | 13,5 | 10 | 22,9 | |
| 11,9% | M | 4,5 | 3,5 | 3,9 | |
| ** 41,7% | L | 14,3 | 9 | 18,4 | |
| 100% | | 32,3% | 22,5% | * 45,2% | |

**Fig. 6.** Shot result in reference to the height and width of ball positioning within the goalpost
*Right and Left areas *vs.* Middle area; High and Low areas *vs.* middle areas (p=0.000 for both)

Additionally, the observed differences between the left side and the middle of the goalpost were also of statistical importance ($X^2$=3.794, p<0.05), whereas no differences were observed between the number of goal-shots positioned on either the right or the left side of the post ($X^2$=2.149, p<0.142). The majority of successful goal-shots aiming on either side of the post landed either on the upper (28.4%) or lower points of the goal (27.8%), with a smaller number (7.2%) ending on the middle height of the goalpost.

As seen in Figure 7a, the difference between upper and lower sides of the goalpost compared to the middle was statistically significant ($X^2$=15.358, p=0.000 and $X^2$=14.696, p=0.000, respectively).

Figure 7b stresses the goal-attempts that were saved, most of which took place on the right side of the goal (14.6%) compared to the middle (11.2%) and the left side (10.8%). The statistical analyses did not reveal differences between the observed saves within the different goal sides ($X^2$=0.514, p<0.473 for the right, $X^2$=0.008, p<0.927 for the middle and $X^2$=0.651, p<0.419 for the left side of the post, respectively).

According to the results, the saves were greatly affected by the height of the shots (Fig. 7b). The majority of goal-shots were fended-off on the upper (18.0%) and the lower part of the goalpost (13.9%) and fewer were saved while at middle height (4.7%). Although no difference was observed between higher and lower shots ($X^2$=0.626, p<0.428), goal-shots of middle height were fended-off in smaller percentage compared to the higher ($X^2$=8.790, p<0.0.03) and lower throws ($X^2$=5.017, p<0.025).

**Goals** (7a)

| Total | | L | C | R | |
|---|---|---|---|---|---|
| * **28,4%** | **H** | 9,0 | 3,7 | 15,7 | |
| **7,2%** | **M** | 3,0 | 1,6 | 2,6 | |
| # **27,8%** | **L** | 9,5 | 6 | 12,3 | |
| **63,4%** | | **21,5%** | **11,3%** | *** 30,6%** | |

**Saves** (7b)

| Total | | L | C | R | |
|---|---|---|---|---|---|
| * **18%** | **H** | 4,5 | 6,3 | 7,2 | |
| **4,7%** | **M** | 1,5 | 1,9 | 1,3 | |
| # **13,9%** | **L** | 4,8 | 3,0 | 6,1 | |
| **36,6%** | | **10,8%** | **11,2%** | **14,6%** | |

**Fig. 7**. Efficacy of the shots, regarding successful scoring or save from the goalkeeper, in reference to the height and width of the goalpost.
*Right and Left areas *vs.* middle area; #Higher and Lower areas *vs.* middle areas (p=0.00 for all)

## Discussion

The present study analysed the general characteristics of goal-attempt shots performed by elite women handball players, members of National teams. Undeniably, the goal-attempt shots consist of the most important technical element moulding the final result of a handball match. In the study herein, this technical element was studied in association to different offense formations, the positioning of execution and the final positioning of the ball within the goalpost.

The analysis revealed that the majority of offensive attempts were successful (94.6%), with a very small prevalence of unsuccessful ones, due to player errors or other causes (5.4%) a same percentage of attacks was recorded to Pournara (2012). However, among the successful attempts, only 66.9% ended with a goal-attempt shot, whereas the remaining 33.1% were interrupted due to fouls or other reasons. During the 2006 women's ECh, a lower percentage of successful attacks (86.0%) was recorded (Aagraard, 2007).

The results showed that among the total number of offensive phases, a great majority involved organised attacks (78.0%). This is in full compliance to Hianik (2007) who reported that organised offense counted for 80.0% of the cases during the 2007 women's ECh. Among these attempts, fast-break 1st and 2nd wave attacks involved a low percentage (17.6%). Similarly, Aagaard (2007) reported that 18.2% of the organised offense attempts involved fast-break attacks during the 2006 women's ECh, whereas Arvidsson and associates (2002), recorded a higher prevalence during the 5th women's ECh (23.4%). These discrepancies in the fast-break attacks could be attributed to a more successful opponent defence, or even to a greater prevalence of unsuccessful shots performed during organised attacks. In agreement to Hianik (2007), the results herein showed that among the fast-break attacks, 1st wave attacks involved a lower percentage (5.7%), whereas 2nd wave attacks were more prevalent (11.9%).

As far as the positioning of the thrower is concerned, the majority of the shots were performed from the periphery of the court (40.8%) (center, left and right backcourt), fewer were performed from a 6m distance (26.4%) and even fewer from the wings (15.9%) and the 7m position (11.5%). Ohnjec *et al.* (2008) reported a higher prevalence of back shots (52.5%) during the 2003 WCh in Croatia, whereas according to Hianik (2007), during the 2006 ECh the mean goal-attempt shots from the back of the court reached 35.0%, a ratio significantly greater compared to the wing-shots (18.0%).

From the attempts shots, a great majority reached the goalpost (57.2%) and were either successful, deflected or out, whereas 37.4% of the attempts were interrupted due to a variety of reasons (fouls, penalties, blocks). As far as the goal attempts are concerned, 31.4% of those were successful, 16.0% were deflected by the goalkeepers and 9.8% were unsuccessful. Aagaard (2006) examined women competing in the ECh and reported fewer successful goal-shots during the years 2006 (26.7%) and 2004 (27.0%). Additionally, she recorded a greater prevalence of fend-offs (35.0%) compared to the present study. Similarly, according to Krokhin (2003), women participating at the ECh were successful in fending-off by 33.0%.

The percentage of shot-attempts that were interrupted due to fouls reached 28.1%, those with fouls and additional penalty charges involved 5.7%, whereas blocking by the opponent's defence was successful in 3.6% of the cases.

A similar blocking prevalence (2.6%) has been reported by Aagaard (2006) during the 7o women's ECh, but a greater number (12.0%) was recorded during the 2003 women's ECh (Krokhin, 2003). As far as 7m throws are concerned, they involved 6.6% of the shot-attempts herein, in contrast to 9.3% suggested by Macovei (2004) during the 2004 ECh. The vertical distribution of the shots landing inside the goalpost involved high-shots (46.4%), low-shots (41.7%) and fewer medium-height-shots (11.9%). As far as the horizontal distribution is concerned, most of the shots landed either on the right or the left side of the goalpost (45.2% and 32.3%, respectively), whereas 22.5% reached the middle of the goal. A greater prevalence of right/left sided goals was reported in the women's ECh (Hianik, 2007) (39.0/47.0%), with an even smaller ratio concerning shots that landed in the centre of the goal (5.0%). However, the same study revealed a lower number of high-shots (34.0%) and a relatively higher prevalence of low-shots (49.0%), with the remaining 18.0% being medium-height shots. These differences could be either the result of an enhanced goalkeeper efficacy regarding low-shots or in some cases, mistakes on behalf of the shooters. Another explanation could be the tactic followed by the defence players of the opponent teams, who, in cooperation with the goalkeeper "forced" the shooter to aim to a specific angle, side or even spot, within the goalpost.

## Conclusions

The study herein reveals a deviation among shots performed from different positions within the court, possibly due to the fact that the majority of shots are initiated at the areas with less occupancy from the opponent's defenders. Additionally, the far left and right defenders adopted a pressing style of play towards the wingmen, aiming to increase their domination at the court's wings. This could be the reason for the relatively high prevalence of wing-throws. According to Krokhin (2003), shot efficacy equally depends on the amount of preparation performed during the training sessions and the space left from the opponent's defence in order to perform the goal-attempts.

As far as goalkeeper's efficacy is concerned, we conclude that any observed variability is attributed to the different offensive formations adopted, as well as to the personal ability to fend-off goal-shots performed from different positions within the court.

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# BEHAVIOURS OF STUDENTS OF PRIMARY SCHOOL AS REGARDS OUTSIDE OF SCHOOL SAFETY IN RELATION WITH DEMOGRAPHICS CHARACTERISTICS

**MAVROPOULOU ANGELIKI[1*], HATZIMANOUIL DIMITRIS[1], KANIOGLOU ANGELOS[1]**

**ABSTRACT.** Introduction. The outside of school safety is an important factor of insurance of student's health in primary school. Objective: The purpose of the study was to present, to compare and to estimate the behaviours of child's of fifth and sixth class of elementary schools in regards the outside of school safety in relation with the demographics characteristics. Method: In the research was used the division of adolescent and school health (DASH) questionnaire from CDC (Centres for Disease Control and Prevention) that was given to 247 school students of Thessaloniki, Ioannina and Edessa anonymously and voluntary. Specifically, there were questions in the questionnaire on personal characteristics, demographic data and questions about outside of school safety. Results: From the total students 96% answered the questionnaire. The results showed that students who live in city with more population showed bigger safety as regards the use of helmet when they bicycle. Girls in comparison to boys have more awareness as regards the use of helmet. Age is conversely analogical with the use of helmet. The school achievement is analogical with the use of helmet and the use of the belt in the car. Parents' educational level also plays an important role for the use of helmet when bicycle and for the use of the belt and safety to the transportation by car. Conclusions: In conclusion, the demographic characteristics play an important role for the children of this age for the configuration of the behaviours as regards the outside of school safety.

***Keywords***: *student's health, behaviours, primary school, accidents*

## Introduction-Objective

The safety and accidents of pupils outside of school is a very important issue in the area of education and health. Childhood is one of the stages of human development in which beliefs, attitudes and behaviours related to health and safety are consolidated and adopted. These beliefs, attitudes and behaviours

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usually follow the person into adulthood (Grunbaum, Kann, Kinchen et al., 2004). The behaviour configuration of avoiding negative habits is one of the goals of health promotion in the child population (Laggas, 2002). This behaviour configuration has the purpose of passing on a foundation of positive beliefs and attitudes into adulthood (Toundas, 2000). However, to determine the current situation, to evaluate needs and to plan interventions to promote health, requires reliable and accurate recording of the behaviours that people of this age tend to adopt (Alexopoulos, 1998; Gouvras, Kyridis and Mavrikaki, 2003; Makri-Botsari, 2001).

Accidents are the major problem for the health and the safety of children. The European Report on Child Injury Prevention (2008) from the World Health Organization and the European Child Safety Report Card, from the data of 24 countries of the European Eurosafe Agency, report that traffic accidents are the leading cause of injuries among children with respect to their gravity. It should be noted that in recent years children's accidents in Greece have reached epidemic proportions. The occurrence of an accident in the external environment is a public health problem that can be limited and controlled. The term “accident” involves among other things, traffic accidents. Road accidents are considered unintentional accidents (Petridou, 2005). In primary school and for the pre-teen age group the accidents that happened are primarily related to traffic, with the child usually either the passenger in a car or riding a bicycle (Tsoumakas, 2006). According to data from the World Health Organization (WHO) and the Statistical Office of the European Office (Eurostat), more than 1,800 Greek children are injured each year in and out of schools, and more than 75 children aged up to 14 years annually lose their lives on the roads from a total of about more than 1500 people.

Road accidents are usually due to children’s propensity towards movement and their tendency towards autonomy and independence. This fact shows the great need for supervision and proper training in traffic education. However, this issue can be addressed if a successful prevention program is implemented. Setting aside other reasons that cause childhood accidents, failure to use protective measures such as safety belts and helmets, as well as driver behaviour, are the basic reasons for such accidents. Even the child's environment can be said to be responsible and particularly parents and teachers who do not care about giving proper education and information to the children in their care. More specifically, information on the prevention of road accidents should be presented at three levels. Initially to the child, after this to the immediate environment (parents and teachers) and finally to the community which is responsible for informing and educating children about the systematic use of safety belts belt and helmets, and also the avoidance of the risky behaviour of citizens on the road (Petridou 2005). The ultimate goal of prevention is to eliminate the risk of accidents, so as to ensure the health of children (WHO, 2005). The purpose of this study was to

present, compare and evaluate the attitudes of children of fifth and sixth grade elementary school with respect to their out-of-school safety and in relation to their demographic characteristics.

## Material & method

*Data collection and analysis*

For the recording of data a questionnaire was used from DASH (Division of Adolescent and School Health) – part of the CDC (Centres for Disease Control and Prevention). This is used in YRBSS (the Youth Risk Behaviour Surveillance System). The translation of the original questionnaire for the Greek version was made by D. Gennimata K. Merakou, E. Ktena, M. Diamantopoulou and T. Kourea Kremistinou, all members of the Department of Public and Administrative Hygiene and the Department of Epidemiology and Biostatistics of the National School of Public Health. The questionnaire was weighted and showed high reliability and validity.

Therefore, it could be used for recording, comparing and assessing risk behaviours for the health of children attending school. One part of the questionnaire was used in the present study. The questionnaire was given to schoolchildren and filled in in the classroom, in the presence of researchers, who gave the necessary explanations when requested.

The questionnaire included questions concerning personal characteristics of students, questions regarding the demographic data of students and questions concerning the personal safety of students outside of school hours. More specifically for personal child safety outside of school hours, the questions were closed-type and concerned: a) how often a helmet was worn when riding a bicycle b) how often a safety belt was worn in a car that someone else drives and c) during the last 30 days, how many times one was in a car or other vehicle that was driven by someone else who had consumed excessive alcohol.

*Participants*

The questionnaire was given to 247 students aged on average 11.03± in 0.71% of the schools in Thessaloniki, Ioannina and Edessa. The questionnaires were taken anonymously and voluntarily. These students were attending the fifth and sixth grades of elementary school of these three cities.

*Statistical analysis*

For descriptive statistics analysis the average and standard deviation was applied. For the statistical analysis of the results, we used parametric and non-parametric analysis. For parametric analysis, we applied the T-Test analysis of

independent samples and variance analysis (ANOVA). For the non-parametric analysis, we used the Kruskall-Wallis Test and the Mann-Whitney Test.

## Results

From the total of all students, 96% responded to the questionnaire. From the results of demographic characteristics and child safety outside of school hours, for the specific variables focussed on the results were as follows:

1. School: From the ANOVA analysis of independent variables/samples it was found that Thessaloniki, Edessa and Ioannina differ significantly in the variable of using helmets, as shown in Table 1. Specifically, the students of Thessaloniki and Ioannina city in relation to Edessa seem to have better safety regarding the use of helmets.

**Table 1.** Variables of out-of-school safety in relation to school.

| | EDESSA (a) | THESSALONIKI(b) | IOANNINA (c) | | | |
|---|---|---|---|---|---|---|
| | AV.S.D. | AV.S.D. | AV.S.D. | *F* | *p* | *Post hoc* |
| Helmet | 2,05± 0,92 | 2,96 ± 1,73 | 2,92 ± 1,47 | 5,83 | 0,00 | a<b, c |
| Belt | 3,83± 1,14 | 4,16 ± 1,17 | 4,01 ± 1,08 | 1,09 | n.s. | |
| Alcohol | 1,21± 0,75 | 1,55 ± 1,24 | 1,27 ± 0,81 | 2,48 | n.s. | |

2. Gender: From the T-Test analysis of independent variables/samples it was shown (see Table 2) that there was a statistically significant difference between boys and girls regarding to the use of helmets when cycling. It seems girls are more likely to wear helmets often.

**Table 2.** Variables concerning out-of-school safety in relation to gender.

| | Boys | Girls | | |
|---|---|---|---|---|
| | AV.S.D. | AV. S.D. | *t* | *P* |
| Helmet | 2,59±1,39 | 3,06 ± 1,61 | 2,46 | 0,01 |
| Belt | 3,96, ± 1,17 | 4,09 ± 1,08 | 0,93 | n.s. |
| Alcohol | 1,46 ± 1,12 | 1,25 ± 0,8 | 1,62 | n.s. |

3. Grade/Year: From the T-Test analysis of independent variables/samples as shown in Table 3 there was statistically significant difference between the grades relative to the use of helmets. Specifically the pupils of E grade use helmets more often.

**Table 3.** Variables concerning our-of-school safety in relation to grade/year.

| | 5th grade | 6th grade | | |
|---|---|---|---|---|
| | AV.S.D. | AV. S.D. | *t* | *p* |
| Helmet | 3,22 ±1,59 | 2,48±1,38 | 3,91 | 0,00 |
| Belt | 4,11± 1,17 | 3,96±1,16 | 1,08 | n.s. |
| Alcohol | 1,31±0,99 | 1,38±0,95 | 0,54 | n.s. |

4. Academic Performance: From the Kruskal-Wallis Test analysis it can be seen that there is a statistically significant difference in the variable of using helmets, ($p < 0,05$). Specifically, students with an "excellent" mark make more frequent use of helmets and belts than students with a "very good" grade ($p < 0,05$).

5. Father's Profession: From the Kruskal-Wallis Test analysis it can be seen that there is no statistically significant difference in the safety variables (helmet, belt and alcohol).

6. Mother's Profession: The Kruskal-Wallis Test analysis showed that there is no statistically significant difference in the safety variables (helmet, belt and alcohol).

7. Father's Education: The Kruskal-Wallis Test analysis shows that there is a statistically significant difference in the variables helmet, belt and alcohol ($p < 0,05$). More specifically, the Mann-Whitney Test analysis showed that the child whose father was a high school graduate, had travelled more times with a driver that had consumed alcohol in relation to the child whose father was a graduate of primary school ($p < 0,05$) . Moreover, the child whose father was a graduate of the university used the helmet more in relation to the child whose father was a graduate of primary school ($p < 0,05$). Moreover, the child whose father was a graduate of the university, used helmets and belts more in comparison to the child whose father was a high school graduate ($p < 0,01$). Finally, the child whose father was a graduate of the university used seatbelts more in comparison to the child whose father was a graduate of a technological institute ($p < 0,05$).

8. Mother's Education: the Kruskal-Wallis Test analysis has shown there is a statistically significant difference in the helmet-use variable ($p < 0,01$). More specifically, the Mann-Whitney Test analysis showed that the child whose mother was a high school graduate travelled more often with a driver who had consumed alcohol in comparison to the child whose mother was a primary school graduate ($p < 0,05$). Moreover, the child whose mother was a graduate of a technological institute used the helmet more in comparison to the child whose mother was a high school graduate ($p < 0,05$). Moreover, the child whose mother was a graduate of the university used helmets ($p < 0,01$) and belts ($p < 0,05$) more in comparison to the child whose mother was a high school graduate.

## Discussion

The results of the study show that the most significant differences occurred with respect to the variable of using a helmet when cycling. Concerning the individual demographics variables it is found that the population density of cities plays an important role in the use of helmets when the children are cycling. This conclusion has also been reached by another study that reports that in big cities children use helmets more in comparison to medium-sized towns and villages (Kiss, Pótó, Pintér and Sárközy, 2010). In this study, the frequency of bicycle accidents amongst children was particularly high in villages (13%) compared to medium-sized (4.6%) and big cities (9.9%). The same study reported that in the villages the most common injuries were to the head, while in medium-sized and big cities limb injuries were most typical. Therefore, the design of bicycle-injury prevention strategies for children should take into account population density. Also for children who use bicycles, a key role is played by the strict application of the legislation on helmet use. In addition, an important role is played by educational bicycle safety programs and equipment, and the improvement of infrastructure in urban centres (Wang, Li, Chiu, et al., 2009). Demographic factors, socioeconomic status and children's behaviours affect the use of helmets, but the attitude that is adopted by children is the most important factor for the use of the helmet (Lang, 2007).

As regarding gender, the results of the present study show that girls use helmets more often than boys. The child's gender is a determining factor in the frequency of accidents, with boys being the ones who have the most accidents, since they are by their nature more high spirited (Anastasiou, Farmakakis, Desypris, Katsiardanis and Zavitsanos, 2003; KEPA, 2007). As shown by research into the safety of children cycling in America, within the age-range of 10-14 years, and especially amongst boys, there is the highest incidence of deaths from head injuries of all age groups. The National Statistical Service of Greece also says that boys have a higher mortality rate with respect to children's accidents.

As is shown by the results, age is another determining factor for helmet use. In particular, the younger-age children show the greater use. Studies on the safety of children bicycling in America show that 10-14 year old children are more likely to have head injuries in comparison to younger children, probably because of the downward trend of using helmets in relation to increasing age. The age-group with the least use of helmets is 11 to 14 years old.

Regarding the students' academic performance, the results showed that students with better marks made greater use of helmets. Apparently students with higher school performance are more aware of the dangers of road safety and are more sensitized to precautionary measures.

It was also found that the parents' level of education plays an important role in the protective measures adopted by students. Specifically the education

of parents affects the use of helmets, the use of belts and is associated negatively with alcohol use when someone transports children in a car. In America, studies on the safety of children using bicycles found that at the age of 8-12 years old, 53% of children were convinced to wear helmets as a result of parental intervention setting it as a rule. Perhaps parents with higher education levels transfer to their children the necessity of helmet use. The relationship between the use of belts and educational level was also reported in other studies and confirms the findings of the present study (Kulanthayan, Razak, and Schenk, 2010; Shinar, 1993).

The figures confirm that a high percentage of parents forget something basic: the safety of children when travelling, as shown in the material we found at http://ebookbrowse.com/carseatssafetychicco-pdf-d90150248. Parents should give a good example when driving, in other words to be law abiding, respect others, be less rushed, be more responsible and reasonable. Also, they should first wear their own seatbelt before requiring their child to do the same. According to studies in the United Kingdom the use of seatbelts has led to a reduction in deaths among drivers by 17%, to co-drivers by 25% and decreased the number of severely injured by 50% (Schwart, 1987).

In Greece more than 60% of road accidents with injuries or deaths are due to consumption of alcoholic beverages by drivers. Alcoholism is a part of a problem that marks personal unhappiness and failure. However, alcoholics do not live in society alone. Their personal problems can extend misery into society in general.

Regarding the encouragement of safe road transport, training programs should be focused on drivers (especially parents) who are less trained or to members of families who carry children in the car without due respect for safety (Kulanthayan, Razak, and Schenk, 2010). Accidents are a serious public health problem because they are mainly related to the young and healthy population. It is the responsibility of all because it is largely preventable. The education of society is an important measure for the prevention of accidents to children. The state and adults are responsible for the proper infrastructure, so that the environment in which children live and travel is safe.

Furthermore, prevention should be furthered, amongst other means, through the education system. After their parents, the teachers are those who know the children best. They also know the specificity of the region in which the children grow up. Prevention, namely the care of life should be comprehensive, continuous and not fragmented. Prevention should not stop when the student leaves school. The responsibility of teaching staff for accident prevention is not only during educational activities. The teacher should also take care to protect students in their life outside school. The teacher is the one who should be able to transfer and instil safety culture among students and parents who do not have sufficient knowledge regarding safety issues.

## Conclusions

Health is the greatest treasure in one's life. Particularly the health of children is a crucial issue for society in general. Preventing accidents to children helps in handling the problem and creates the right mentality for the future. Proper planning in accident prevention - promoting interventions for children of this age regarding their out-of-school safety and based on specific factors, will play an important role in the quality of life of these individuals, of their parents and society in general.

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# DEFENSIVE PERFORMANCE INDICATORS OF THE GREEK YOUTH NATIONAL HANDBALL TEAM

**ATHANASIOS YIANNAKOS**[1]

**ABSTRACT.** The aim of the present study was to assess defensive tactics among players of the Greek National Youth Team, during the 18thWorld Championship that took place in Thessaloniki. **Methods:** We examined the prevalence of different tactical defensive formations, their efficacy against goal-attempt shots, their outcome, as well as the goalkeeper's ability to fend-off. All games of the Greek National team were recorded and analysed with Sport scout video-analysis software for PC. The statistical analyses were performed with the SPSS 19 statistical software and the use of non-parametric Chi-square tests. Significance was set at $p<0.05$. **Results:** Data analysis revealed that the majority of the offensive attacks performed against the Greek National Team included goal-attempt shots (65.2%), whereas attacks free of goal-attempts involved only 34.8% of the recorded phases. The most prevalent tactical defensive formation applied was the 6:0 (82.1%). Among the recorded phases, defence with a fewer number of defenders was applied in 7.6%, 5:1 defence system was adopted in 4.7% and 5+1 was used on 3.2% of the phases. Goalkeepers were successful in fending-off 24.4% of the organized attacks. **Conclusion:** The use of the 6:0 defence formation is quite common, either in a more offensive manner or with adaptations. It is highly likely that the frequent use of this formation in a passive manner and the application of defence with fewer defenders resulted in a relatively low ranking of the Greek team.

***Keywords:*** *sport; handball; tactical; defensive performance; video analysis; performance analysis*

## Introduction

Defence consists of one of the most important factors in handball, aiming primarily on goal prevention as well as in winning the ball from the opposite team. Improved ball tactics, player physical abilities and between-player cooperation can all enhance the efficacy of an offensive formation and highlight pitfalls in the opponent's defence (Paparizou, 2011). These improvements in the offensive formations

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have resulted in a need for a more adapted and focused defensive response among opponents (charging the offensive players, offensive fouls, shot feinting, stealing the ball, etc.), expressed via an accelerated ball claim (Kandjia, 1979). This accelerated defensive response is likely to change the final outcome of a game and is hence considered crucial for a team's success (Seco, 1999).

Close observation of a team after an offensive attempt reveals that the primary concern of the players is the prompt return to their defensive positions, in order to organize the next effective defence system on time. According to Kotzamanidis (2005), the defence-organizing phase is dependent on the attainment of defensive cohesion. This is expressed when players are attaining their main defence positioning, covering each other through synchronized movements, or confronting the ball-handler as a group instead of individually. This cohesion is adapted and preserved in each new phase of the game, simultaneously.

Each team exhibits a variety of defence tactics, with distinct differences in the way each formation is applied and adapted by the players, according to their skills and abilities to effectively prevent a goal-attempt by the opponents. As noted, the recently adapted changes concerning handball rules have resulted in an accelerated play mode with goal-attempts being performed in various manners. In this perspective, it would be interesting for both coaches and players to be aware of the indicators associated with defensive formations, in order to augment their chances for winning (Oscar and Pascual, 2011).

Video analysis of the games gives an advantage in performance improvement, on both individual and team level (Mullen, 1992; O'Donoghue, 2006). It can provide valuable information on various levels such as technical pitfalls, tactics or strategy. Additionally, the record, statistical analysis and observation of the performance indicators exhibited by elite teams can also provide valuable data on the evolution of handball (Sampaio and Janeira, 2003), useful to both coaches and athletes (Taylor *et al.,* 2004).

From this perspective, the aim of the present study was to evaluate the different defensive systems adopted by the Greek Youth National Team, including the prevalence and efficacy of each defensive formation in halting the opponents' goal-attempts, as well as the on the final outcome of each phase.

## Methods and Procedure

*Sample*

All games performed by the Greek Youth National Team during the 18th World Championship (WCh) were used in the analyses. The 18th WCh took place in Thessaloniki, in Northern Greece.

*Procedure*

The games were recorded and analysed with the use of Sports-scout software (Tsamourtzis *et al*., 2001; Tsimpiris *et al*., 2006), a specialized PC program allowing the reliable optical observation of athletic matches and their point-to-point analysis, with application on many different sports. The observer has the ability to input important aspects of the play in the software and analyse them using a P/C. With regards to the present study, all defensive formations performed by the Greek National team were recorded and analysed.

*Statistical Analyses*

The Statistical Package for Social Sciences v.19.0 (SPSS Inc., Hong Kong) was used for the statistical analyses. In further detail, crosstabs were applied and the Chi-squared test was used to evaluate differences in the prevalence of various parameters. Significance was set at 95% of the confidence intervals ($p \leq 0.05$)

## Results

Data analyses revealed (Fig. 1) that from the total number of offensive attempts performed against the Greek National Team, 79.3% were organised, while a statistically lower percentage involved fast-break attacks 20.7% ($x^2=68.679$, $p \leq 0.001$).

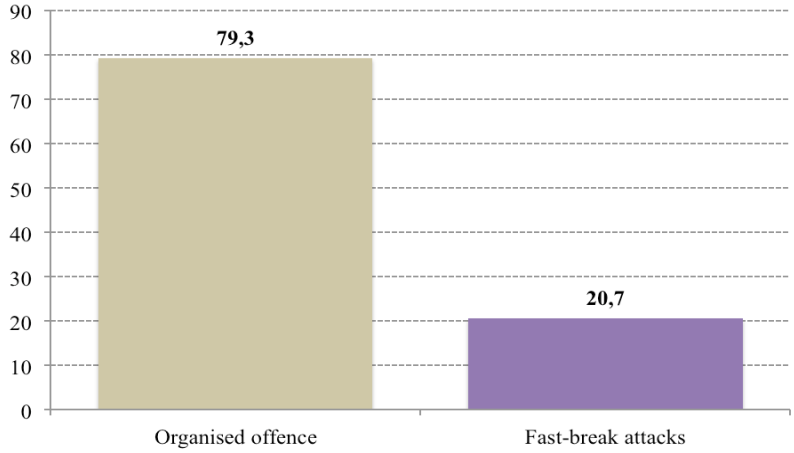


**Fig. 1**. Type of offensive play by the opponents against the Greek Youth National Team ($p \leq 0.001$)

The majority of the organised offensive attempts (65.2%) ended with a goal shot, whereas the remaining 34.8% ended otherwise ($x^2$=18.483, p≤0.001), (Fig. 2).

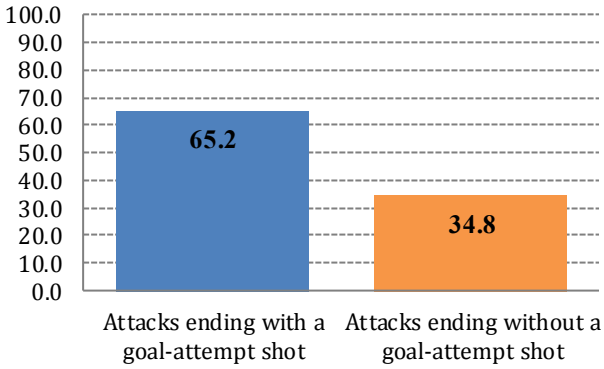


**Fig. 2.** Outcome of the organised offensive phases performed against the Greek National team (p≤0.001)

As far as the adopted defensive formations against the organised offensive attempts are concerned, 82.1% of the phases involved different aspects of the 6:0 defence zone system. In further detail, the 6:0 defence system at 6m was recorded in 65.50% of the phases, the 6:0 formation with «cutting» of the attackers was adopted in 14.53% of the cases, whereas the more aggressive 6:0 zone defence system was selected in 2.1% of the phases. Additionally, 4.7% of the phases involved the 5:1 system, 3.2% the 5+1 zone system and 2.4% referred to other formations such as the 4:2 or the 3:3. In 7.6% of the phases defence was performed with one less player. The statistical analysis revealed that the passive 6:0 defence zone system was the most prevalent ($x^2$=54.187, p≤0.001) towards all 6:0 formations and all other defence systems in general ($x^2$=81.138, p≤0.001). Additionally, the 6:0 defence zone system with «cutting» was also more prevalent compared to the rest of the formations ($x^2$=5.533, p≤0.01), (Fig. 3).

The majority of goal-attempt shots performed during organised defence formations resulted in successful scoring (62.9%), 24.4% were fended-off and the remaining 12.7% landed outside the field (Fig. 4).

When the opponents performed goal-attempt shots against a flat defence system, a great prevalence of successful scoring was noted in all 3 forms of the 6:0 defence formation (66.0% during passive 6:0, 70.0% during the 6:0 formation involving «cutting» of the oponents and 71.0% during more aggressive 6:0 formations). The prevalence of shots fended-off by the goalkeeper reached 20.0% during the passive

6:0 defence zone system, 22.0% while the 6:0 formation with «cutting» was adopted and a smaller prevalence during more aggressive 6:0 formations (4.0%). The goal-attempt shots landed outside the field in 20.0%, 22.0% and 25.0% of the cases in each 6:0 formation respectively.

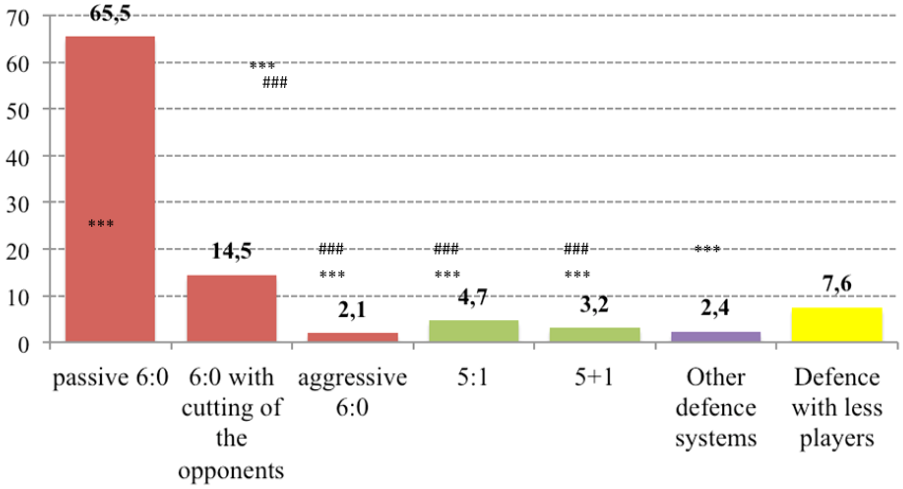


**Fig. 3.** Prevalence of each defence system.
Significantly different compared to the passive 6:0 *** p≤0.001. Significantly different compared to the 6:0 formation with «cutting» of the opponents ### p≤0.001

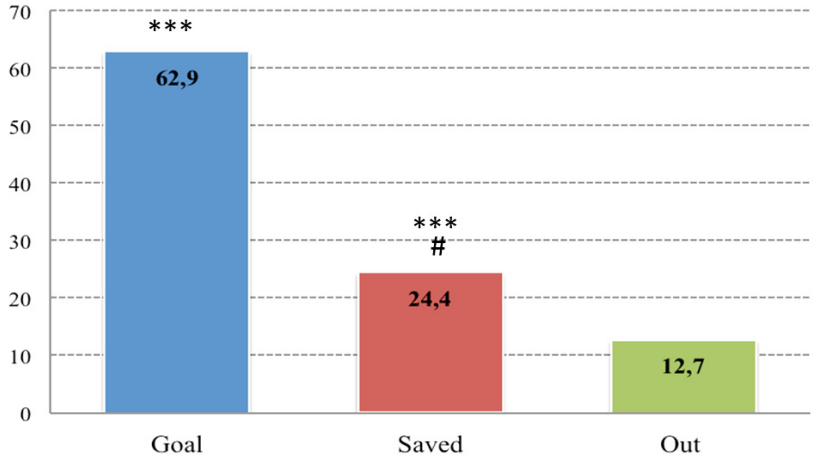


**Fig. 4.** Outcome of the goal-attempt shots during organised offense against the Greek Youth National Team.
Significantly different compared to the successful goal-attempt shots *** p≤0.001. Significantly different compared to the deflected goal-attempt shots # p≤0.05

The statistical analyses revealed that successful scoring was significantly more prevalent among all 6:0 defence formations compared to the fended-off goal-attempts ($x^2$=42.387, p≤0.001), and the latter was more common compared to the goal-attempts that landed outside the field when the 6:0 defence with cutting or more aggressive 6:0 formations were adopted by the Greek team ($x^2$=7.686 and $x^2$=17.785 respectively, p≤0.001 for both). Additionally, goal-attempts of the opponents were more often deflected than out when either the passive 6:0 defence system or the 6:0 with cutting of the opponents was adopted by the Greeks ($x^2$=10.488 and $x^2$=14.323 respectively, p≤0.001 for both and $x^2$=3.854, p≤0.04). No difference was recorded on the three distinct 6:0 formations and the final outcome of the recorded phases (Fig. 5).

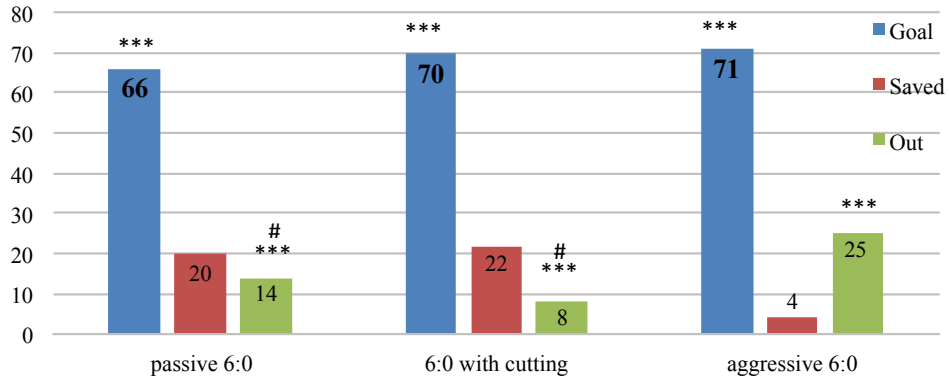


**Fig. 5**. Outcome of goal-attempt shots in each variation of the 6:0 defence system applied by the Greek Youth National Team.
Significantly different compared to the deflected goal-attempt shots when the same defence system was used ***p≤0.001
Significantly different compared to the goal-attempt shots that ended outside the field when the aggressive 6:0 defence system was used #p≤0.05

The analysis of the two-line defensive systems adopted by the Greek National Team (5:1 and 5+1) revealed a similar successful goal (50.0% and 57.0% respectively) and deflected goal-attempt prevalence (50.0% and 46.0% respectively). As far as 5:1 defence zone system was concerned, no difference was observed between successful and deflected goal-attempt shots ($x^2$=2.922, p=0.08), but a difference was noted between successful and non-cadred shooting ($x^2$=33.754, p≤0.001), as well as between deflected and non-cadred shooting ($x^2$=18,026, p≤0.001). The 5+1 defence zone system allowed a greater prevalence of successful scoring compared to saved goal-attempts ($x^2$ =10,666 p≤0.001) or

non-cadred shooting ($x^2$ =52.103, p≤0.001), and a lower prevalence of the latter compared to the saved shots ($x^2$ =18.515, p≤0.001). Comparison of the two defence systems did not reveal any differences regarding the final outcome (Fig. 6).

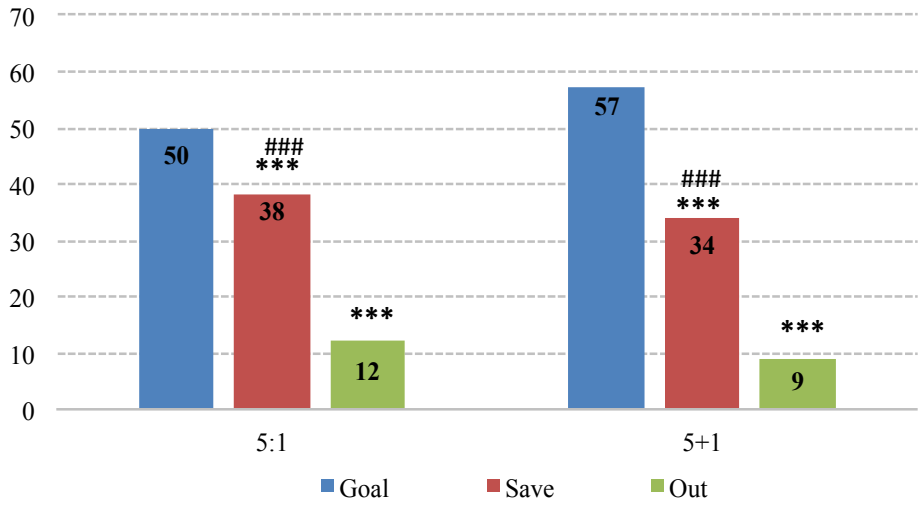


**Fig. 6.** Outcome of the goal-attempt shots when two zone defence systems were applied by the Greek National Team.
Significantly different compared to the successful goal-attempt shots when the same defence system was used ***p≤0.001
Significantly different compared to the goal-attempt shots that ended outside the field when the same defence system was used ###p≤0.001

The analysis of the data concerning the rest of the defensive formations, although their prevalence was relatively low, 58.8% resulted in goals, 29.0% were saved and 13.0% involved non-cadred shooting. The statistical analysis revealed a significant difference between successful scoring and deflected shots ($x^2$ =17.109, p≤0.001), between successful scoring and non-cadred shooting ($x^2$=44.218, p≤0.001), as well as between deflected shots and shots landing outside the court ($x^2$=7.715, p≤0.001). When defence systems with fewer players were adopted, 68.0% of those resulted in successful scoring of the opponents, 24.0% were deflected and 8.0% landed outside the playing field. Successful scoring was more prevalent compared to saved shots ($x^2$=38.969, p≤0.001) or non-cadred shooting ($x^2$=76.400, p≤0.001), and the latter was less prominent compared to the number of deflected shots ($x^2$=9.523, p≤0.001).

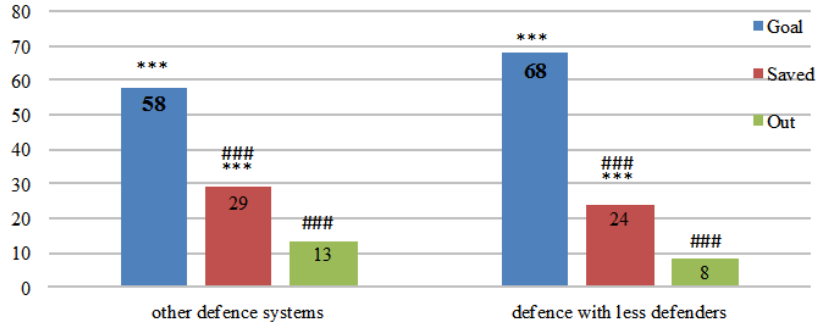


**Fig. 7**. Outcome of the goal-attempts when the Greek National team adopted different defence systems.
Significantly different compared to the goal-attempt shots that landed outside the playing field $^{***}p\leq0.001$.
Significantly different compared to the successful goal-attempt shots $^{###}p\leq0.001$

## Discussion

The aim of the present study was to evaluate the different defence formations used by the Greek Youth National team against organised offensive attempts, the prevalence of each adopted system and their outcome.

Data analysis revealed that a total of 79.3% of the offensive attempts performed against the Greeks were organised. This prevalence is similar to that recorded (76.0-85.0%) by Seco (2008) against the Greek Youth National team after analysis of data concerning the 2004-2008 Olympics and the World Championships that took place during the years 2005, 2006 and 2007. On the other hand, after evaluating data from 3 World Championships (2005, 2007, 2009) Meletakos and associates (2011) reported that the mean prevalence of organised offensive attempts reached 54.2%, whereas Bilge (2011) reported a prevalence equal to 57.5%.

Of these organised offensive attempts, the majority (65.2%) resulted in goal-attempt shots, whereas the remaining 34.8% ended otherwise. Sevim and Táborský (2004) reported a similar prevalence of goal-attempt shots (62.8%) during the 2004 Athens Olympic Games, but a lower prevalence was noted during the European Championship (ECh) in Slovenia (48.0%) on the same year. When data from the 2005 WCh in Tunisia were analysed, the goal-attempt shots during organised offence reached 59.0% (Sevim and Táborský, 2004), similar to the ones reported by Pokrajac (2007) during the WCh hosted by Germany (58.0% and 60.0%). Overall, literature is unanimous in indicating a

steady increase of the offensive formations ending in goal-attempts during the pass of the time (Seco, 2000; Pollany 2003; Táborský, 2007), in both the ECh and the WCh. Any observed differences between WCh and ECh might be the result of different dynamics of the participating teams (Paparizou, 2011), discrepancies in the age of the players or gradual improvements in the defensive attitude of the teams.

The analysis of the defence systems adopted by the Greek Youth National team revealed a preference towards the flat 6:0 defence zone system (66.5%) and less frequent adoptions of the 6:0 defence system with cutting of the opponents (14.5%), the more aggressive 6:0 defence formation (2.1%), the 5:1 defence system (4.7%), the 5+1 formation (3.2%), defence formations with fewer defenders (7.6%) or other defence systems (2.4%).

Researchers analysing the youth and adult EChs and WChs reported that the 6:0 is indeed the most prevalent defence system used (Seco, 2000; Lafko *et al*., 2008; Zidens and Cebrikovs, 2004; Czerwinsky, 2005; Sevim and Bilge, 2005; Pollany, 2006; O'Donoghue, 2006; Visnapuu, 2006; Hergeirsson, 2008). However, in some cases the 6:0 was equally prevalent with the 5:1 defence system. Additionally, adaptations in the defence system have been noted in several games, with more skilled players being used in specific defence positions. Sevim and associates (2006) analysed data from the 2004 Olympic Games and the 2005 WCh and concluded that the most prevalent defence formations included the 6:0, the 5:1 and the 3:2:1, in various adaptations depending on the opponents' offensive play. However, according to Táborský (2007) the two best teams participating at the Youth WCh hosted in Bahrain were using the 5:1 and the 3:2:1 defence systems.

It has been suggested that teams ranking better in competitions are actually aiming for the use of more aggressive defence systems, instead of the 6:0 formation, in order to surprise the opponents. This has been verified by Hagleitner (2006) during the ECh hosted in Austria, Pollany (2006) when analysing data from the ECh that took place in Switzerland, and Abramovic (2010) who evaluated the games of the ECh hosted in Montenegro. Pokrajac (2007) noted that during the Youth WCh in Germany, the most prevalent defence formation was the 3:2:1, whereas the 6:0 defence zone system was only adopted by teams with tall players. When the outcome of the goal-attempts performed by the opponents were accounted for, the majority (62.9%) resulted in successful scoring. Overall, the shooting efficiency of various elite teams appears to range in literature between 53.0 to 58.0%, with the present study reporting an even greater prevalence, exceeding this spectrum. The lowest prevalence has been reported in the ECh taking place in Germany (53.0%) (Valdevit *et al*., 2004), with similar ratios recorded during the 2004 Athens Olympics, the Men's ECh in Slovenia (54.0%)

and the WChs in Tunisia (55.0%) (Sevim and Táborský, 2004) and Bahrein (55.1%) (Táborský, 2007). When data from the ECh in Slovakia were analysed, successful scoring reached 56.8% (Mikuš *et al*., 2003), whereas data from the Youth ECh organised in Latvia, revealed that goal-attempt shots were successful in 58.0% of the cases (Zidens and Cebrikovs, 2004).

In 24.4% of the cases the Greek goalkeepers were efficient in saving the goal-attempt shots of the opponents. According to Czerwinski (1998), distinct differences are apparent when analysing the deflected goal-attempt shots, depending on the efficacy of the goalkeepers. Thus, during the ECh in Italy, the most efficient goalkeepers saved 41.0% of the goal-attempts shots, while the less skilled ones deflected a mere 30.0% of the shots (Czerwinski, 1998). Similarly when the Youth ECh was hosted in Montenegro deflected goal-attempts ranged between 33.0-43.0% (Abramovic, 2010). Seco (2008) pooled the data concerning the 8 finalist teams participating at the Sidney Olympics and calculated the mean fended-off shot prevalence as 35.0%.

When the Youth WCh was hosted in Estonia, the saved goal-attempts of the winning team reached 43.5%, as opposed to a mere 29.8% of saved goal-attempts recorded for the team finishing last (Czerwinski, 2000). Sevim and Bilge (2005) noted a gradual increase in goalkeeper efficacy during the course of time with the lowest prevalence of saved shots during the WCh in Tunisia (32.6%), a slightly greater one during the ECh in Slovenia during the year 2004 (33.0%) and an even greater one recorded later that year, during the Olympic Games hosted in Athens. Overall, participating athletes of younger age appear to attain lower mean goal-keeper efficacy as recorded during the Youth EChs, ranging from 31.0% when the ECh was hosted in Romania (Macovei and Rizescu, 2008), 32.5% in Polland (Kuchta, 2002), to 35.9% of fended-off shots in Austria (Hagleitner, 2006). On the other hand, adult teams tend to exhibit slightly greater goal-keeper efficacy as far as saved goal-attempt shots are concerned, reaching a mean 38.1% of the cases during the WCh hosted in Egypt (Seco, 1999).

Overall, according to literature goalkeepers appear to deflect goal-attempt shots in a prevalence ranging between 29.8-43.5%, with the herein results falling low below this reported range, reaching a ratio of 24.4%. This does not necessarily imply low efficacy of the goalkeepers as it could also be attributed to an increased number of offensive attempts performed by the opponents or the adoption of an less-efficient defence system by the Greek National team.

The frequent use of the 6:0 defence systems by the Greek National team is in agreement to the trend recorded during previous competitions. However, it should be noted that the team appears to lack in athletes' height and between-

athlete cooperation, in order to carry out this defence system effectively. As Norkowski (1997) has noted, the defensive play of the Greek Youth National team appears to be very energetic, when the 3:2:1 or 4+2 defence systems are adopted. Thus, the use of defence systems that appeared to either save the ball or result in non-cadred goal-attempts more often might prove of great advantage for the team and could probably result in better ranking during future competitions.

This increase in the offensive phases resulting in multiple goal-attempt shots consists of a positive element concerning the evolution of handball, since it forces towards improvements in the defensive tactics of the opponent team. Further research in needed in order to evaluate the reason behind the recorded increase in goal-attempt shots, forcing the Greek National team to adopt defensive formations using fewer defenders.

In conclusion, the analysis and study of performance indicators associated with the defensive play in handball is important. It provides the elements needed by coaches in order to design tailored training schedules and educate athletes, all aiming to improve the defensive efficacy of the teams.

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# THE PREVALENCE OF OVERWEIGHT AND OBESITY AMONG CHILDREN IN MIDDLE SCHOOL WITHIN THE BIHOR – HAJDÚ-BIHAR EUROREGION

**NORBERT CSABA LUKÁCS[1*], IACOB HANȚIU[1]**

**ABSTRACT. Introduction.** The early stage of adolescence, between the age of 11 and 14, is accompanied by a great fluctuation of the values of sudden physical growth, of temperament and of personality. Periodical monitoring of somatic indicators and determining the body mass index (BMI) are methods necessary for monitoring the state of health of schoolchildren. **Goals**. The goal of this study is to assess the prevalence of overweight and obesity among children in middle school within the Bihor–Hajdú-Bihar Euroregion and to compare the obtained results with the results of other studies of this nature. **Subjects and methods**. The sample group was made up of 934 middle school students from the Bihor–Hajdú-Bihar Euroregion. The method used was anthropometry. The body mass index was calculated in accordance with the BMI reference chart according to age and gender. The results of the measurements were statistically processed with the SPSS program. The descriptive analysis was performed and the differences between the average values were tested with the independent samples t-test. **Results**. The results of the study have shown increased values of height and weight for both genders, from one grade to the other; for girls higher mean values than for boys. 15.31% of the total number of subjects were overweight and 11.99% were obese, resulting a total percentage of 27.30% of individuals with excess weight. The independent samples t-test: t (933) = -.443, p=0.658, shows that statistically speaking there are no significant differences between the mean BMI values of the subjects from Bihor (M=20.42, SD=4.10, n=474) and the mean BMI values of the subjects from Hajdú-Bihar (M=20.54, SD=4.16, n=460). **Conclusions.** The prevalence of overweight and obesity in Bihor decreases with age, from 35.5% in 5$^{th}$ grade to 19.5% in 7$^{th}$ grade, after which again it tends to increase. In Hajdú-Bihar this decrease is uninterrupted from 34% in 5$^{th}$ grade to 19% in 8$^{th}$ grade.

***Keywords****: overweight, obesity, preadolescence, height, weight*

**REZUMAT*. Incidența supraponderalității și obezității la copiii din ciclul gimnazial din euroregiunea Bihor–Hajdú-Bihar*. Introducere.** Parcurgerea adolescenței timpurii, cu limite între 11 și 14 ani se produce cu o mare variabilitate a indicilor creșterii fizice bruște, ai temperamentului și ai personalității. Supravegherea

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periodică a indicatorilor somatici şi determinarea valorii indicelui de masă corporală (IMC) reprezintă metode necesare de monitorizare a stării de sănătate a şcolarilor. **Obiective.** Obiectivul acestui studiu a fost să evaluăm incidenţa supraponderalităţii şi obezităţii la copiii gimnaziali din Euroregiunea Bihor, Hajdú-Bihar şi să comparăm rezultatele obţinute cu cele din alte studii asemănătoare. **Subiecţi şi metode.** Eşantionul a fost format din 934 de elevi din ciclul gimnazial din euroregiunea Bihor-Hajdú-Bihar. Metoda de lucru a fost antropometria**.** Indicele de masă corporală s-a calculat conform hărţii de referinţă a IMC după vârstă şi gen. Datele măsurătorilor au fost prelucrate statistic cu ajutorul programului SPSS. A fost făcută analiza descriptivă iar diferenţele dintre medii au fost testate cu ajutorul testului t pentru eşantioane independente. **Rezultate**. Rezultatele studiului au evidenţiat valori crescute, de la o clasă la alta, ale taliei şi greutăţii la ambele genuri; valori medii superioare la fete, comparativ cu băieţii. Din totalul populaţiei 15.31% din subiecţi au fost supraponderali şi 11.99% obezi, rezultând o pondere de 27.30% a celor cu excedent de greutate. Testul t pentru eşantioane independente: t (933) = -.443, p= .658, arată că din punct de vedere statistic nu sunt diferenţe semnificative între mediile IMC subiecţilor din Bihor (M=20.42, SD=4.10, n=474) şi ale celor din Hajdú-Bihar (M=20.54, SD=4.16, n=460). **Concluzii.** Prevalenţa supraponderalităţii şi obezităţii în Bihor scade cu vârsta, de la 35% în clasa a V-a la 19% în clasa a VII-a, după care apare din nou o tendinţă de creştere. În Hajdú-Bihar această descreştere este neîntreruptă de la 33% în clasa a V-a la 19% în clasa a VIII-a.

***Keywords****: supraponderalitate, obezitate, preadolescenţă, talie, greutate*

## Introduction

According to recent studies, obesity has reached alarming proportions among adults as well as among children. One of three children in Europe is overweight or obese; in the last 30 years obesity has doubled among children (World Health Organization [WHO], 2013).

The action plan of WHO (2013) for prevention and control of non-communicable diseases and adoption of a healthy lifestyle between 2013-2020, is meant to decrease with at least 25% the rates of premature mortality caused by cardiovascular diseases, cancer, diabetes or chronic diseases of the respiratory system.Overweight and obese people present high risk of developing certain diseases: type 2 diabetes, high blood pressure, osteoarthritis or coronary artery diseases (Lavie et al., 2009). Periodical monitoring of somatic indicators and determining the body mass index (BMI) are methods necessary for monitoring the state of health of schoolchildren.

According to a study of Lobstein & Frelut (2003) the percentage of 11 years old overweight and obese children in some countries is: Serbia 18 %, Croatia 17%, France 19% , Spain 34% or Italy 36%.According to the study called Health Behaviours for School-aged Children (HBSC), in Romania in the 2013-2014 school year, the percentage of overweight or obese girls of age 11 was 14%, of age 13 it was 11% and of age 15 it was 10%. For boys of age 11 this percentage was 33%, for the ones of age 13 it was 26% and for the 15 years old boys it was 21% (Ahluwalia et al., 2015).According to the same study HBSC, in Hungary for the school year 2013-2014, among the 11 years old girls the percentage of those who were overweight or obese was 15%, among the ones of age 13 it was 16% and among the ones of age 15 it was 13%.

Among boys, this percentage was 31% for 11 years old boys, 28% for 13 year old boys and 24% for 15 years old boys (Ahluwalia et al., 2015).Most overweight or obese children will probably be obese in their youth as well (Freedman et al., 2005), or will suffer of non- communicable diseases (Guo et al., 2000). BMI is an instrument that represents the standard in the assessment of the risks, which appear because of the weight excess. People whose BMI is too high or too low are predisposed to develop certain health problems. In order to determine the weight excess the current weight is referred to the ideal weight depending on height, age and gender. In this regard, the Centre for Disease Control and Prevention (CDC) recommends the use of growth charts. In 2004, upon the recommendation of CDC, 15 health care organizations have revised the BMI values.

Children whose BMI by age and gender was located between the 85$^{th}$ - 95$^{th}$ percentile, were considered as overweight and those with higher values were classified as being obese (Barlow, 2007).The goal of this study is to assess the prevalence of overweight and obesity among children in middle school within the Bihor–Hajdú-Bihar Euroregion and to compare the obtained results with the results of other studies of this nature.

## Subjects and methods

The study was conducted over a sample group of 934 students, 474 from Bihor county and 460 from Hajdú-Bihar county, that were gathered from nine schools from Romania and six from Hungary. The schools were selected from urban regions as well as from rural regions, the measurements being performed in the 2014-2015 school year.

In this study, the anthropometric method was used to measure the two somatic indicators: height and weight using a Seca 213 (Marsden, UK) height measure and an Omron BF511 (Omron Corporation, Kyoto, Japan) digital scale. The body mass index was calculated according to the BMI reference chart based on age and gender, the percentile categories being the ones in Table 1 (Barlow, 2007).

**Table 1.** Percentile categories regarding body mass index (Barlow, 2007)

| BMI Percentile | Nutritional status |
|---|---|
| BMI<5 percentile/gender/age | Underweight |
| BMI between 5-84 percentile/ gender/age | Normal weight |
| BMI between 85-95 percentile/ gender/age | Overweight |
| BMI ≥ 95 percentile/ gender/age | Obese |

It is known that genetic inheritance and growth and development rates are different for every individual. Thus, after the BMI is calculated, the obtained results are compared with the reference values observing the growth lane that corresponds to the respective gender and age. In order to determine these values the EXCEL BMI by Barlow (2007) was used. The program analyses and interprets the results according to the reference values by age and gender, giving us this way a true image about overweight and obesity among the sample group. The data of the individual measurements were processed statistically on computer with the Statistical Package for Social Sciences: version 20.0 SPSS Inc. (SPSS) program. The descriptive analysis was performed (weighted arithmetic mean (Xp), standard deviation (τ)) and the differences between the means were tested with the independent samples t-test.

## Results

The processing of the gathered data showed that the measurements were performed on 473 girls and 461 boys from the Bihor – Hajdú-Bihar Euroregion. The numbers and percentages of the subjects are presented in Table 2 by grade, gender and county.

**Table 2.** Distribution regarding the number and percent of the subjects by county, grade and gender

| | Girls | | Boys | |
|---|---|---|---|---|
| **Grade** | **N** | **%** | **n** | **%** |
| Bihor | | | | |
| V | 65 | 13.71 | 62 | 13.08 |
| VI | 73 | 15.41 | 64 | 13.50 |
| VII | 62 | 13.08 | 48 | 10.12 |
| VIII | 49 | 10.34 | 51 | 10.76 |
| Total | 249 | 52.54 | 225 | 47.46 |
| Hajdú-Bihar | | | | |
| V | 57 | 12.39 | 66 | 14.34 |
| VI | 68 | 14.78 | 68 | 14.79 |
| VII | 61 | 13.26 | 56 | 12.17 |
| VIII | 38 | 8.26 | 46 | 10 |
| Total | 224 | 48.69 | 236 | 51.31 |

The descriptive analysis was not performed for boys of age 10 and girls of age 10, 15 because of the low number of subjects. The mean values of height for boys of age 11 from Hungary is 0.9 cm higher than the ones of the boys from Romania, and the difference increases: 1.3 cm at age 12; 3.6 cm at age 13 and 5.8 cm at age 14. The differences of weight of the boys from the two countries follow the same tendency to increase in the favour of the boys from Hungary: 0.8 kg at age 11; 0.1 kg at age 12; 3 kg at age 13 and 2.4 kg at age 14. According to WHO (2007) standards of growth in height of the subjects depending on age and gender, we find that the mean values of the subjects are close to each other (Table 3).

**Table 3.** Mean values and standard deviation values of weight and height for boys of age 11-15

| Age | N | Height M (SD) | Weight M (SD) | WHO Height M (SD) |
|---|---|---|---|---|
| Bihor | | | | |
| 11 years | 47 | 147.4±6.7 | 43.7±11.1 | 145.7±6.8 |
| 12years | 61 | 154.6±7.6 | 48.8±12.0 | 152.1±7.2 |
| 13years | 50 | 159.3±8.6 | 53.3±12.5 | 159.3±7.5 |
| 14years | 43 | 163.7±6.6 | 55.8±13.5 | 165.9±7.7 |
| 15years | 18 | 171.2±6.5 | 62.9±12.6 | 170.9±7.8 |
| Hajdú-Bihar | | | | |
| 11years | 50 | 148.3±8.7 | 44.5±13.5 | 145.7±6.8 |
| 12years | 65 | 155.9±9.3 | 48.9±12.5 | 152.1±7.2 |
| 13years | 56 | 162.9±7.7 | 56.3±15.0 | 159.3±7.5 |
| 14years | 47 | 169.5±7.4 | 58.2±11.6 | 165.9±7.7 |
| 15years | 12 | 171.0±8.1 | 58.1±11.4 | 170.9±7.8 |

Note. WHO height =standards regarding growth in height WHO (2007)

The mean values of height for female students of age 11 from Hungary are higher than the mean values for the ones from Romania by 1.3 cm and it increases gradually: 2.6 cm at age 12; 6.7 cm at age 13 and 4.9 cm at age 14. Regarding the mean values of weight, the female students from Romania have lower weight values and the difference increases gradually: 2.2 kg at age 11 ; 3.9 kg at age 12; 5.3 kg at age 13 and 6 kg at age 14 (Table 4).

Starting with the age of 10, no reference charts can be applied regarding weight values. This indicator cannot distinguish a relation regarding height and body mass for each age separately. The explosion in height during and after puberty is different for each person and it can be found at girls and boys as well (WHO, 2007). According to the growth chart of CDC, the mean BMI value for girls from Bihor was 20.26 and for boys it was 20.59. For girls from Hajdú-

Bihar the mean BMI was 20.79 and for boys it was 20.30. With small exceptions, in Bihor we find that the BMI tends to increase along with the increase of age (Table 5).

**Table 4.** Mean values and standard deviation values of weight and height for girls of age 11-14

| | | Height | Weight | WHO Height |
|---|---|---|---|---|
| **Age** | **N** | **M (SD)** | **M (SD)** | **M (SD)** |
| Bihor | | | | |
| 11 years | 64 | 149.6±7.1 | 44.7±12.4 | 147.89±6.7 |
| 12 years | 67 | 155.2±7.2 | 48.0±11.7 | 153.71±6.8 |
| 13 years | 53 | 155.1±6.5 | 48.6±11.9 | 158.07±6.9 |
| 14 years | 45 | 158.8±5.7 | 53.7±9.2 | 160.75±6.9 |
| Hajdú-Bihar | | | | |
| 11 years | 52 | 150.9±7.8 | 46.9±13.7 | 147.89±6.7 |
| 12 years | 61 | 157.8±6.7 | 51.9±12.0 | 153.71±6.8 |
| 13 years | 66 | 161.8±7.3 | 53.9±11.7 | 158.07±6.9 |
| 14 years | 39 | 163.7±6.0 | 59.7±12.6 | 160.75±6.9 |

Note. WHO Height = standards regarding growth in height WHO (2007)

**Table 5**. BMI by county, gender and grades

| | Girls | | Boys | |
|---|---|---|---|---|
| **Grade** | **N** | **M (SD)** | **n** | **M (SD)** |
| Bihor | | | | |
| V | 65 | 20.12±4.7 | 62 | 20.12±4.2 |
| VI | 73 | 19.73±3.8 | 64 | 20.18±4.0 |
| VII | 62 | 20.01±3.5 | 48 | 20.82±4.0 |
| VIII | 49 | 21.56±3.5 | 51 | 21.46±4.4 |
| Hajdú-Bihar | | | | |
| V | 57 | 19.68±3.7 | 66 | 20.23±5.0 |
| VI | 68 | 21.03±4.6 | 68 | 20.25±4.0 |
| VII | 61 | 21.37±4.0 | 56 | 20.22±3.6 |
| VIII | 38 | 21.11±4.0 | 46 | 20.56±3.4 |

Comparing the mean values of the data of the subjects from the two regions using the independent samples t-test - (933) = - 0.443, p = 0.658 – it results that there is no significant difference between the mean BMI values of children from Bihor (M = 20.42, SD = 4.10, n = 474) and those of the children from Hajdú-Bihar (M = 20.54, SD = 4.16, n = 460) (Table 6 and 7).

**Table 6.** BMI mean values and standard deviations for the two counties

| County | N | M | SD |
|---|---|---|---|
| Bihor | 474 | 20.4190 | 4.10254 |
| Hajdú-Bihar | 460 | 20.5388 | 4.16615 |

**Table 7.** Comparing the BMI using the t-test

| t | Df | P | Mean difference | Std. Error Difference | 95% CI | |
|---|---|---|---|---|---|---|
| | | | | | LL | UL |
| -.443 | 933 | .658 | -.11984 | .27042 | -.65054 | .41086 |

The recorded data show that 322 subjects out of the 474 from Bihor had a normal weight for their age. A number of 71 subjects were overweight and 57 students were categorized as being obese. In addition, 315 subjects out of the 460 from Hungary had normal weight for their age. 72 subjects from Hajdú-Bihar were overweight and 55 were categorized as being obese (Table 8).

**Table 8.** BMI distribution by the gender of the subjects from the Bihor-Hajdú-Bihar Euroregion

| BMI percentile/ Nutritional status | Bihor | | | | | | Hajdú-Bihar | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | G | | B | | G+B | | G | | M | | G+B | |
| | n | % | N | % | N | % | n | % | n | % | N | % |
| Underweight BMI< 5 percentile | 10 | 74 | 14 | 6 | 24 | 5 | 4 | 2 | 14 | 6 | 18 | 4 |
| Normal weight BMI 5-85 percentile | 183 | 74 | 139 | 62 | 322 | 68 | 157 | 70 | 158 | 67 | 315 | 68.5 |
| Overweight and obesity BMI >85 percentile | 56 | 22 | 72 | 32 | 128 | 27 | 63 | 28 | 64 | 27 | 127 | 27.5 |
| Obesity BMI ≥ 95 percentile | 25 | 10 | 32 | 14 | 57 | 12 | 22 | 10 | 33 | 14 | 55 | 12 |
| Total | 249 | 100 | 225 | 100 | 474 | 100 | 224 | 100 | 236 | 100 | 460 | 100 |

Note: G=girls, B=boys

The BMI distribution of children from the Euroregion based on their residency area is presented in Table 9. In Bihor, we can notice a bigger prevalence of overweight and obesity within the urban regions 30% in comparison to the rural regions with 24%. On the other hand, in the schools from the neighbouring country the difference between the urban regions and the rural regions is only 1%. In both counties the number of children with normal weight is bigger in the province areas (RO: 71%; HU: 69%) compared to those living in cities (RO: 65%; HU: 68%). Comparing the mean BMI values of the students from the urban regions (M = 20.44, SD = 4.20, n = 525) and the values of the students from rural regions (M = 20.52, SD = 4.04, n = 409) from the Euroregion, we found that there is no significant difference in this regard: t (933) = -.295, p = 0.77.

**Table 9.** BMI distribution by residency area from Bihor-Hajdú-Bihar Euroregion

| BMI percentile/ Nutritional status | Bihor | | | | | | Hajdú-Bihar | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | U | | R | | U+R | | U | | R | | U+R | |
| | n | % | n | % | n | % | n | % | n | % | N | % |
| Underweight BMI< 5 percentile | 12 | 5 | 12 | 5 | 24 | 5 | 13 | 5 | 5 | 3 | 18 | 4 |
| Normal weight BMI 5-85 percentile | 170 | 65 | 152 | 71 | 322 | 68 | 180 | 68 | 135 | 69 | 315 | 68.5 |
| Overweight and obesity BMI >85 | 78 | 30 | 50 | 24 | 128 | 27 | 71 | 27 | 56 | 28 | 127 | 27.5 |
| Obesity BMI ≥ 95 percentile | 34 | 13 | 23 | 11 | 57 | 12 | 34 | 13 | 21 | 11 | 55 | 12 |
| Total | 261 | 100 | 213 | 100 | 474 | 100 | 264 | 100 | 196 | 100 | 460 | 100 |

Note: U= urban area, R= rural area

According to the recorded data, we found that simultaneously with the increase of the age, there is an almost continuous increase in the number of children with normal weight and the decrease of the number of overweight or obese children. The most spectacular decrease we can find at the Hungarian students in 8$^{th}$ grade, where the percentage of those with BMI > 85 percentile has gone under 20% (Table 10).

**Table 10.** Distribution of BMI by grades from the Bihor-Hajdú-Bihar Euroregion

| | V | | VI | | VII | | VIII | |
|---|---|---|---|---|---|---|---|---|
| **BMI percentile/ Nutritional status** | **% BH** | **% HB** | **% BH** | **% HB** | **% BH** | **% HB** | **% BH** | **% HB** |
| | n=127 | n=123 | n=137 | n=136 | n=110 | n=117 | n=100 | n=84 |
| Underweight BMI< 5 percentile | 5 | 3 | 4.5 | 2 | 6.5 | 6 | 5 | 6 |
| Normal weight BMI 5-85 percentile | 59.5 | 63 | 69.5 | 67 | 74 | 70 | 69 | 75 |
| Overweight and obesity BMI >85 | 35.5 | 34 | 26 | 31 | 19.5 | 24 | 26 | 19 |
| Obesity BMI ≥ 95 percentile | 17.5 | 18 | 13.5 | 11.5 | 8 | 11 | 8 | 6 |

Note. BH=Bihor, HB= Hajdú-Bihar

## Discussions

According to a study performed in Timişoara in 2004, the average height for boys of age 11-14 was 153.25 cm and for the same age category in Oradea in 2015 it was 157.64 cm. In 2004 in Timişoara the average weight for boys of age 11-14 from Timişoara was 41.82 kg and in Oradea for the same category of age, in 2015 it was 52.45 kg. The evolution regarding the prevalence of overweight and obesity in Romania seems to increase. According to a study performed in Dâmboviţa in 2007 to a sample group of 718 subjects of ages between 10 and 16, the percentage of children with weight problems was 17.68% (Preda, 2011).

According to a study of Vălean et al., (2009) regarding the prevalence of overweight and obesity, performed in Cluj-Napoca to students of ages between 10-14, 22.54% of the subjects out of 2,568 subjects, had excessive nutrition disorders. According to a current study in Oradea 30% of the children are overweight or obese. Simultaneously with the increase of age, we also witness an almost continuous increase of the number of children with normal weight and the decrease of the number of overweight or obese children. The most spectacular decrease we can find in Hungarian students in the 8$^{th}$ grade, where the percentage of those with BMI > 85 percentile has gone under 20%. In a population of schoolchildren, the chronological variability of maturation depends on: the level of urbanization, environmental factors and individual factors. BMI is an indirect indicator to determine the adipose tissue. Due to the big differences between the biological

age and the chronological age, the body mass index cannot be considered an instrument of diagnosis. It is rather considered a screening indicator and for additional tests, we recommend using simultaneously the skinfold test or the analysis of the adipose tissue by bioimpedance.

### Conclusions

The prevalence of overweight and obesity within the studied group had similar values in both neighbouring counties. The number of children with weight problems was higher among boys (136 cases) than among girls (119 cases) reaching a percent of 27.30 % of the sample group. This number exceeds by far the number of underweight children (42 subjects) representing 4.5%. We notice that the prevalence of overweight or obesity in Bihor decreases with age from 35.5% in 5th grade to 19.5% in 7th grade after which again it shows a tendency to increase reaching 26% in 8th grade. In middle school in Hajdú-Bihar this decrease is uninterrupted from 34% in 5th grade to 19% in 8th grade.

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# AMELIORATION OF INATTENTIVE CHARACTERISTICS IN CHILDREN DIAGNOSED WITH ATTENTION DEFICIT HYPERACTIVITY DISORDER BY FENCING TRAINING PROGRAMS

**LYDIA CZUKERMANN[1*], IACOB HANȚIU[1]**

**ABSTRACT. Background**: Recently influenced by studies on the impact of martial arts on ADHD the self-consciousness of the society prevailed and fencing started spreading its roots into the field of healing methods by making use of the skills important to a warrior, such as speed, strength, accuracy and courage. As a means for developing self-perception, of competence in various areas of ability and function, self-confidence, physical conditioning, and emotional balance, Martial Arts activity was previously found to be a method for ameliorating ADHD symptoms. We appreciate that fencing, as a combat type Physical Activity (PA), can be used for similar purposes. **Objectives**: The present article focuses mainly on the Inattentive aspect of ADHD. The aim of this study was to examine the influence of a fencing training program activated on Attention Deficit Hyperactivity Disorder (ADHD) diagnosed children. **Methods**: The study population of 40 children mean age 10, diagnosed with ADHD, was divided into two groups: one undergoing a fencing training program and the other a control group of about the same age and characteristics undergoing a physical training program. For evaluation, we used ADHD Rating Scale – IV: Home Version questionnaire at the beginning and at the end of the study. Data were processed statistically to evaluate reliability using Cronbach's Alpha. Overtime Inattentive Analysis, we performed 3 Way Anova using the factors time, gender and training and run for all questions followed by a Holm-Sidak Post Hoc test for interactions. **Results**: The performance evaluation disclose consistently positive greater total value for the fencing training program over the control group undergoing only PA training program by 11%. **Conclusions**: The fencing training program has greater total value on moderating ADHD Inattentive symptoms over the control group undergoing only PA training program.

***Keywords:*** *ADHD, fencing, physical activity, inattention, children*

**REZUMAT.** ***Ameliorarea caracteristicilor lipsei de atenție la copiii diagnosticați cu tulburarea hiperkinetică cu deficit de atenție prin antrenamente de scrimă*****. Introducere.** Studii de dată recentă privitoare la impactul artelor marțiale asupra ADHD s-au impus în conștiința de sine a societății, iar scrima a început sa-si extindă influența în sfera metodelor de tratament, făcând uz de însușirile specifice războinicilor, ca viteza, forța, precizia și curajul. Ca mijloc de dezvoltare a cunoașterii de sine, a competenței în diverse domenii de activitate și funcționare a

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încrederii în sine, condiției fizice și echilibrului emoțional, activitatea artelor marțiale s-a descoperit încă mai demult ca fiind metodă de ameliorare a simptomelor ADHD. Considerăm că scrima, ca activitate fizică de luptă (PA) poate fi folosită în scopuri similare. **Obiective:** Articolul de față se concentrează cu precădere asupra aspectelor lipsei de atenție la persoanele cu ADHD. Scopul acestui studiu a fost de a examina influența unui program de antrenament de scrimă conceput pentru copiii diagnosticați cu tulburarea hiperkinetică cu deficit de atenție (ADHD). **Metode**: Eșantionul de studiu, format din 40 de copii cu vârsta medie de 10 ani, diagnosticați cu ADHD a fost împărțit în două grupuri, dintre care unul a urmat un program de antrenament de scrimă, iar celălalt a constituit grupul de control, format din copii având aproximativ aceeași vârstă și aceleași caracteristici, care au urmat un program de antrenament fizic. Pentru evaluare am folosit ADHD Rating Scale – IV chestionare Home Version la începutul și la sfârșitul studiului. Datele au fost procesate statistic folosindu-se Cronbach's Alpha pentru evaluarea încrederii. Pentru analiza suplimentară a lipsei de atenție am efectuat 3 Way Anova folosind factorii timp, gen și antrenament, parcurgând toate cerințele, urmate de un test Holm-Sidak Post Hoc pentru interacționare. **Rezultate**: Evaluarea rezultatelor scoate în evidență o valoare pozitivă mult mai mare pentru grupul care a urmat programul de antrenament de scrimă, față de grupul de control, în procent de 11%. **Concluzii**: Programul de antrenament de scrimă a prezentat o valoare totală mai mare în diminuarea simptomelor lipsei de atenție ADHD prin comparație cu grupul de control care a efectuat numai antrenamente de activități fizice (PA).

***Cuvinte-cheie:*** *ADHD, scrimă, activitate fizică, lipsa de atenție, copii*

## Introduction

According to Diagnostic and Statistical Manual of Mental Disorders (DSM) 5 most widely used in USA "*ADHD is a neurodevelopmental disorder defined by impairing levels of inattention, disorganization, and/or hyperactivity-impulsivity. Inattention and disorganization entail inability to stay on task, seeming not to listen, and losing materials, at levels that are inconsistent with age or developmental level".* The term used by the International Classification of Mental and Behavioral Disorders 10th revision (ICD10)widely used in Europe is hyperkinetic disorder (HKD) and population surveys affirmed that ADHD occurs in most cultures in about 5%of children ( about75,000 children in Israel) and about 2.5% of adults, being about 3 times more common in boys than in girls.

The concurrent validity of the DSM definition for ADHD subtypes was supported by Gaub and Carlson (1996).There are 3 subtypes of ADHD behaviors: the Inattentive type, the Hyperactive-impulsive type, and the combined type. The Inattentive type considered in this article refer to individuals expressing behavior more like daydreamers with their own cosy impeccable world, consistently drawn away by factors that seem more intriguing or interesting them. In order to maintain their interest or to keep them in the physical world it is needed to draw their attention from time to time.

The identification of ADHD is most often performed by pedagogic personnel during elementary school years, and inattention becomes more prominent and impairing, according to Faraone S. (1998) the inattentive type is about 3 times more persistent than the hyperactivity\impulsivity type.

Fencing is sport activity used with three different weapons: Foil (Floret), Sabre and Epee. Each one has a different set of rules and different body target areas. The bouts are conducted by referees according to the weapon rules with the assistance of electronic apparatus displaying the touch on the target area. Different from the past, nowadays boys and girls participate in all three weapons.

Recently influenced by studies on the impact of martial arts on ADHD the self-consciousness of the society prevailed and fencing started spreading its roots into the field of healing methods by making use of the skills important to a warrior, such as speed, strength, accuracy and courage as a means for developing self-perceptions, of competence in various areas of ability and function, self-confidence, physical conditioning, and emotional balance as mentioned by Johnson R. C. (2000).

Lately, Complementary and Alternative Medicine (CAM) therapies are becoming common treatments for ADHD, and research by Searight (2012) implies that stimulant pharmacotherapy is the evidence-based treatment of choice for ADHD. During the past years the relationship between PA and ADHD was deeply investigated from several aspects – Verret (2012) conducted over 10-week moderate to high-intensity PA program on fitness, cognitive functions, and ADHD-related behaviour in children concluded that structured PA program might have clinical relevance in the functional adaptation of children with ADHD and research by Rommel (2015). Matthew B. P. (2013) concluded that single bouts of 20 minutes moderately aerobic exercise might have positive implications in children with ADHD.

Choi (2014) investigated during a six-week methylphenidate treatment and exercise or methylphenidate treatment and education the hypothesis that aerobic exercise might be an effective adjunctive therapy for enhancing the effects of methylphenidate on the clinical symptoms, cognitive function, and brain activity and concluded that aerobic exercise increased the effectiveness of methylphenidate on clinical symptoms, perseverative errors, and brain activity.

Significant difference between fencers & swimmers in the Brixton Spatial Anticipation Test (BSAT) was found by Vetropoulos (2010) during investigation of visual memory task and spatial anticipation ask of 15 to 22 years old athletes concluding that fencers are superior in rule detection, comparing to swimmers. The fencer profile was characterize during a multiple anthropometric variables, Alberto Ochoa (2013) and broad research by Putukian M. (2011) on ADHD management in athletes mentioned of reports from children and teachers suggesting activity may mitigate inattentiveness that characterizes ADHD.

## Research Objective

The main objective of this study was to evaluate the possible effect of a fencing training program on ADHD symptoms among elementary school age children.

## Materials and Methods

The actual research is based on 9 months, 90-min twice a week experiment with study population of 40 children, all diagnosed with ADHD, mean age 10, divided into two groups: one group of 20 children undergoing fencing training program consisting of 10 boys and 10 girls and the second group is 20 children of control group undergoing a PA training program, consisting of 10 boys and 10 girls. Similar research was conducted by Kang K.D (2011) with 13 ADHD children having sport activity evaluated against a control group of 15 ADHD children undergoing education on behaviour control sessions during a 6-week, 90-min twice a week experiment.

The applied Intervention fencing program included three steps:

- Step one: basic fencing skills and general physical condition;
- Step two: tactical fencing skills and physical condition particular to fencing;
- Step three: competitive fencing skills.

First stage in the study was to obtain first assessments evaluation using the well-known ADHD Rating Scale – IV: Home Version questionnaire, DuPaul et al. (1994), McGoey, K. E. (2007), Goodman D. (2010), – Appendix A.

Dually used in the research and completed by the research cadre. The questionnaire was filled for each participant at the beginning of the study and once again at the end of the study after completing the fencing training program for the experiment group or the physical activity program of the control group.

The questionnaire evaluates three disorder parameters: inattention, hyperactivity-impulsivity and combined manifestation. The actual study will concentrate with the Inattentive parameter. For data interpretation, we processed statistically to evaluate reliability using Cronbach's Alpha. Overtime Inattentive Analysis, we performed three Way Anova using the factors time, gender and training and run for all questions followed by a Holm-Sidak Post Hoc test for interactions.

## Results and Discussion

The results enlisted in the following tables and figures comply with the inattentive characteristic of ADHD as reflected from the odd questions of ADHD RS IV questionnaire.

**Table 1.** Inattention characteristic summary

| Group | Test | ADHD RS IV Question | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Q1** | **Q3** | **Q5** | **Q7** | **Q9** | **Q11** | **Q13** | **Q15** | **Q17** | **Total** |
| Fencing | Preliminary | 47 | 42 | 35 | 43 | 23 | 38 | 36 | 55 | 16 | 347 |
| | Final | 23 | 12 | 10 | 18 | 22 | 13 | 22 | 24 | 10 | 154 |
| Control | Preliminary | 49 | 42 | 38 | 38 | 27 | 41 | 36 | 40 | 24 | 335 |
| | Final | 36 | 37 | 31 | 32 | 26 | 38 | 33 | 27 | 23 | 283 |

From the data on Table 1 it can be seen that the preliminary values at the beginning of the research of both fencing and control groups are high and nearly identical (347, 335) indicating of homogeneity between the groups. The final results at the end of the research of both fencing and control groups are lower than the initial values indicating of decisive improvement of both fencing and control activities. Among fencing and control groups at the final stage, the difference is distinctively lower for the fencing group (154) than for the control group (283) indicating a better improvement of the fencing program over the physical activity control program.

**Table 2.** Inattention characteristic data of ADHD as reflected by the questionnaire

| Group | Gender | Test | ADHD RS IV Question | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Q1** | **Q3** | **Q5** | **Q7** | **Q9** | **Q11** | **Q13** | **Q15** | **Q17** | **Total** |
| Fencing | Girls | Preliminary | 24 | 22 | 20 | 21 | 13 | 24 | 14 | 29 | 8 | 175 |
| | | Final | 11 | 5 | 5 | 12 | 10 | 9 | 10 | 12 | 5 | 79 |
| | Boys | Preliminary | 23 | 20 | 15 | 22 | 22 | 14 | 22 | 26 | 8 | 172 |
| | | Final | 12 | 7 | 5 | 6 | 12 | 4 | 12 | 12 | 5 | 75 |
| **Control** | Girls | Preliminary | 24 | 21 | 19 | 20 | 9 | 23 | 17 | 20 | 8 | 161 |
| | | Final | 19 | 18 | 16 | 19 | 9 | 22 | 16 | 13 | 7 | 139 |
| | Boys | Preliminary | 25 | 21 | 19 | 18 | 18 | 18 | 19 | 20 | 16 | 174 |
| | | Final | 17 | 19 | 15 | 13 | 17 | 16 | 17 | 14 | 16 | 144 |

Table 2. reflects the Inattentive data for all subjects regarding ADHD RS IV questionnaire. The research population is divided into two group characteristics – Fencing and Control – and each group is observed by gender at two stages of the research – Preliminary and Final. With the exception of two samples that indicate of no behavioural change – Q9: "Has difficulty organizing tasks and activities", for control girls (9, 9) and Q17: "Is forgetful in daily" for control boys (16, 16) – all data indicate lower values at final stage relative to preliminary stage indicating of greater positive difference. The greatest change of 17 points between preliminary to final stage is achieved by the fencing girls group at two parameters reflected by questions: Q3 (22, 5) "Has difficulty sustaining attention in tasks or play activities", and Q15 (29, 12): "Is easily distracted". Following after is Q7 on fencing boys group with a difference of 16 points (22, 6).

Among the fencing group there is no consistency between the genders regarding the change between preliminary to final stage and the data indicates greater difference for the boys group only at questions: Q3 "Has difficulty sustaining attention in tasks or play activities", Q9 "Has difficulty organizing tasks and activities", and Q13: "Looses things necessary for task or activities" and lower or equal at all other questions.

Among the control group there is either no consistency between the genders regarding the change between preliminary to final stage and the data indicates greater difference for the boys group only at questions Q3: "Has difficulty sustaining attention in tasks or play activities", Q15: "Is easily distracted" and Q17: "Is forgetful in daily" and lower or equal at all other questions.

The results of the fencing group relative to the control group vividly indicate greater difference of the fencing group at all questions regardless gender.

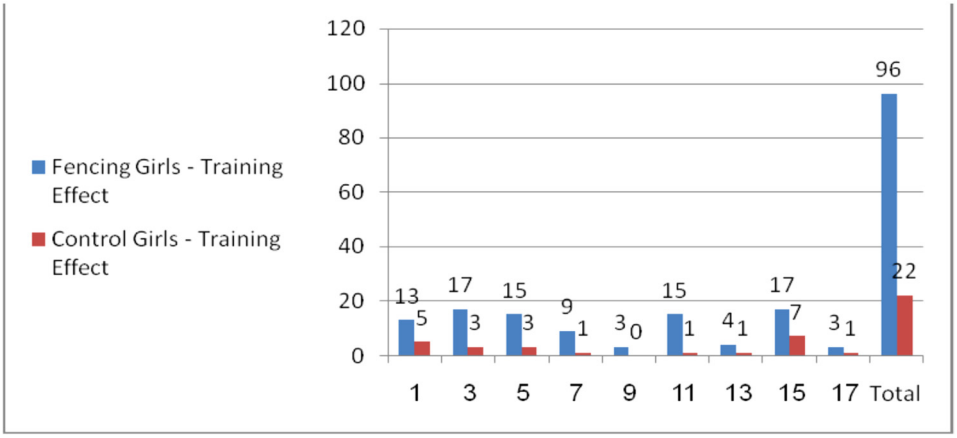


**Fig. 1.** Training effect on the subjects' girls

Fig. no. 1 represents the girl's gender training effect of the program as resulting from Table 2 namely the difference between ADHD RS IV question values at the preliminary stage to the value at the final stage of the research. The evaluation of girl's gender is accomplished between the fencing group undergoing the fencing training program to the control group undergoing PA program. It is vividly seen from the data that the total value of the Fencing group (96) is much greater than of the control group (22).

Questions no.9: "Has difficulty organizing tasks and activities", Q13: "Looses things necessary for task or activities" and Q17: "Is forgetful in daily" indicate insignificant changes on the fencing group while questions Q7:" Does not follow through instructions and fails to finish work", Q9: "Has difficulty organizing tasks and activities", Q11: "Avoids tasks (e.g. schoolwork, homework) that require sustained mental effort", Q13: "Looses things necessary for task or activities" and Q17: "Is forgetful in daily", indicate insignificant changes on the control group.

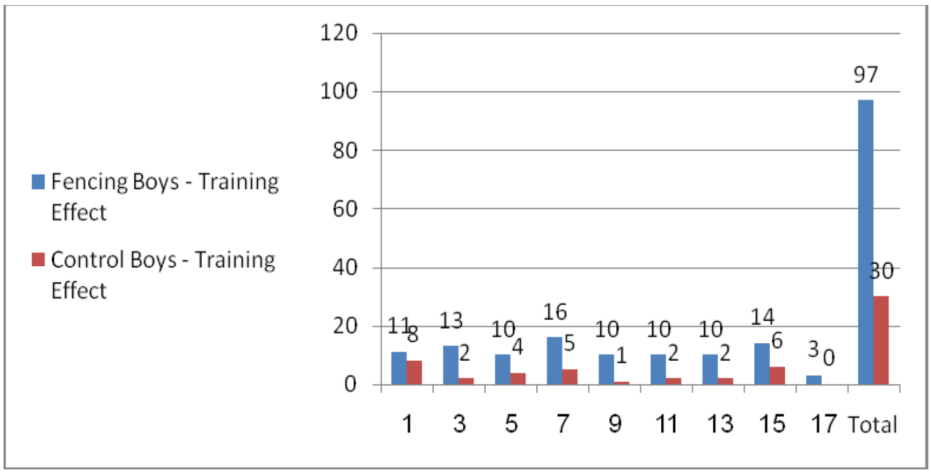


**Fig. 2.** Training effect on the subjects' boys

Fig no. 2 represents the boy's gender training effect of the program as resulting from Table 2 namely the difference between ADHD RS IV question values at the preliminary stage to the value at the final stage of the research. The evaluation of boy's gender is accomplished between the fencing group undergoing the fencing training program to the control group undergoing PA program. As in the previous Fig no 1 of girl's gender training effect, it is vividly seen from the data that the total value of the Fencing group is much greater than of the control group and actually in all questions the superiority of fencing group persist.

Q17: "Is forgetful in daily", indicate insignificant changes on fencing group while questions Q3: "Has difficulty sustaining attention in tasks or play activities", Q9: "Has difficulty organizing tasks and activities", Q11: "Avoids tasks (e.g. schoolwork, homework) that require sustained mental effort", Q13: "Looses things necessary for task or activities" and Q17: "Is forgetful in daily", indicate insignificant changes on control group.

**Table 3**. ANOVA 3-way analysis

| Source of Variation | DF | SS | MS | F | p |
|---|---|---|---|---|---|
| Time | 1 | 750.313 | 750.313 | 98.924 | < 0.001 |
| Intervention | 1 | 171.112 | 171.112 | 22.560 | < 0.001 |
| Gender | 1 | 1.512 | 1.512 | 0.199 | 0.657 |
| Time x Intervention | 1 | 248.513 | 248.513 | 32.765 | < 0.001 |
| Time x Gender | 1 | 1.013 | 1.013 | 0.133 | 0.716 |
| Intervention x Gender | 1 | 7.813 | 7.813 | 1.030 | 0.314 |
| Time x Intervention x Gender | 1 | 0.612 | 0.612 | 0.080 | 0.777 |
| Residual | 72 | 546.100 | 7.585 | | |
| Total | 79 | 1726.987 | 21.861 | | |

Table 3 is ANOVA 3 Way analysis for the total data whereas the Normality Test (Shapiro-Wilk) passed (p=0.236>0.050) indicating the data came from a normally distributed population.

The main effects for Time and Intervention cannot be properly interpreted since the size of the factor's effect depends upon the level of another factor. The difference in the mean values among the different levels of Gender are not great enough to exclude the possibility that the difference is just due to random sampling variability after allowing for the effects of differences in Time and Intervention. There is not a statistically significant difference (p = 0.657).

The effect of different levels of Time depends on what level of Intervention is present. There is a statistically significant interaction between Time and Intervention (p<0.001). The effect of different levels of Time does not depend on what level of Gender is present. There is not a statistically significant interaction between Time and Gender (p = 0.716). The effect of different levels of Intervention does not depend on what level of Gender is present. There is not a statistically significant interaction between Intervention and Gender. (P = 0.314)

For Overtime Inattentive Analysis, we performed 3 Way Anova using the factors time, gender and training and run for each question individually followed by a Holm-Sidak Post Hoc test for interactions. The results describes below:

- Q1: *"Fails to give close attention to details or makes careless mistakes in schoolwork"* (e.g., overlooks or misses details, work is inaccurate). There is a significant difference between the 2 time point (p<0.001). There is also a difference between the control and the fencing group (p=0.013) and this is independently of the gender (p=0.865). But it doesn't appear related as the effect of the training does not have a significant effect over time (p=0.065).

- Q3: *"Has difficulty sustaining attention in tasks or play activities"* (e.g., has difficulty remaining focused during lectures, conversations, or lengthy reading). There is significant difference overtime (p<0.001) and this is due to the Training Regimen (p<0.001) independently of the gender (p=0.879). Furthermore, there is no difference between group at the initial time point (p=1.000) but the Fencing Group is different from its initial value (p<0.001) and from the Control Group at the final time point (p<0.001).

- Q5: *"Does not seem to listen when spoken to directly"* (e.g., mind seems elsewhere, even in the absence of any obvious distraction). There is significant difference overtime (p<0.001) and this is due to the Training Regimen (p=0.021) independently of the gender (p=0.601). Furthermore, there is no difference between group at the initial time point (p=1.000) but the Fencing Group is different from its initial value (p<0.001) and from the Control Group at the final time point (p<0.001).

- Q7: *"Does not follow through instructions and fails to finish work"* (e.g., starts tasks but quickly loses focus and is easily sidetracked). There is significant difference overtime ($p<0.001$) and this is due to the Training Regimen ($p=0.006$), independently of the gender ($p=0.058$). Furthermore, there is no difference between group at the initial time point ($p=0.299$) but the Fencing Group is different from the Control Group at the final time point ($p=0.005$).

- Q9: *"Has difficulty organizing tasks and activities"* (e.g., difficulty managing sequential tasks; difficulty keeping materials and belongings in order; messy, disorganized work; has poor time management; fails to meet deadlines). There is no time effect ($p=0.061$) or group effect ($p=0.589$) but there is a difference between Boys and Girls ($p<0.001$) independently of the time ($p=0.281$) and the Training ($p=0.418$)

- Q11: *"Avoids tasks that require sustained mental effort"* (e.g. schoolwork or homework; for older adolescents and adults, preparing reports, completing forms, reviewing lengthy papers). There is a difference between initial and final time point ($p<0.001$) and it depends on the training factor ($p=0.009$). While there was no difference between the groups at initial time point ($p=0.604$), there was one at the final time point ($p<0.001$). A difference between the girls and the boys is also present ($p=0.002$) but independently of the time or the training ($p=0.625$ for both).

- Q13: *"Looses things necessary for task or activities"* (e.g., school materials, pencils, books, tools, wallets, keys, paperwork, eyeglasses, mobile telephones). A time difference exists ($p=0.012$) but it is independent of the groups ($p=0.099$) and the gender ($p=0.052$).

- Q15: *"Is easily distracted"* (e.g., for older adolescents and adults may include unrelated thoughts). There is significant difference overtime ($p<0.001$) and this is due to the Training Regimen ($p=0.001$), independently of the gender ($p=0.450$). While there was no difference between the Boys and the Girls ($p=0.705$), the groups were different at the initial time point ($p<0.001$) but not at the final time point ($p=0.423$). Both Groups also were found different from their initial value ($p<0.001$).

- Q17: *"Is forgetful in daily activities"* (e.g., doing chores, running errands; for older adolescents and adults, returning calls, paying bills, keeping appointments). No time effect was found ($p=0.235$). The differences observed between the groups ($p<0.001$) is related to the gender ($p=0.005$) and while the boys and the girls were not different within the Fencing group ($p=1.000$) a difference was found within the Control group ($p<0.001$).

## Conclusions

Supporting evidence that exercise may have positive effects on children with ADHD as found by Berwid O. G. (2012) is consolidated. From the results it can be evidently seen that both fencing and PA training of the control group contribute to ameliorating IA symptoms of ADHD by decisive lowering the value data of the subjects being tested during the elapsed time between the beginning to the end period of the program, however it is not vividly seen which one of the programs has greater benefit. The answer to the latest showing a much lower value at the final stage for the fencing group (154) than for the control group (283).

In order to conceive an undoubted decision regarding the contribution of a fencing training program on all aspects of ADHD symptoms it is required to investigate also the influence on the hyperactivity-impulsivity factors of ADHD.

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# "DUAL CAREER": CASE STUDY IN ELITE SPORTS

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**ABSTRACT.** During their high performance sports career, athletes commit themselves to fulfil several roles, being at the same time students, family members or employees, being challenged to meet the requirements of a dual career: an active, sportive and educational/professional one. The timespan of a "dual career" for a sportive is a complex one and requires effort and sacrifices, as well as support from the family, school and sporting environment that should help in the achievement of a balanced development. The present endeavour is a case study which wishes to present a global image of the educational, professional formation route, developed in parallel with the high performance sports activity, all framed within the concept of "dual career". It is a qualitative research in which the interview method has been used, the analysed case being considered a model of success in high performance sports. The conclusions of this study emphasize the complexity of the phenomenon, as well as the need to responsibly manage the two careers, involving both the sportive and educational/professional formation.

***Keywords:*** *dual career, high performance sport, elite sport, education, professional formation.*

**REZUMAT.** ***"Dual Career": studiu de caz în sportul de elită.*** De-a lungul carierei sportive de performanță, sportivii își asumă angajamentul de a îndeplini mai multe roluri, putând fi în același timp elevi/studenți, membri de familie sau angajați, fiind provocați să gestioneze cerințele unei duble cariere: sportivă și educațională/profesională. Perioada "dublei cariere" pentru un sportiv este una complexă care necesită efort și sacrificii, dar și suport al mediului familial, școlar sau sportiv care trebuie să susțină o dezvoltare echilibrată. Prezentul demers este un studiu de caz ce își propune să prezinte o imagine de ansamblu al traseului educațional, de formare profesională, dezvoltat în paralel cu activitatea sportivă de performanță, încadrat sub conceptul de "dublă carieră". Este o cercetare calitativă în care s-a folosit metoda interviului, cazul analizat fiind considerat un model de reușită în sportul de înaltă performanță. Concluziile acestui studiu scot în evidență complexitatea fenomenului, dar și nevoia de gestionare cu responsabilitate a celor două cariere – sportivă și educațională/formare profesională.

***Cuvinte-cheie:*** *dublă carieră, sport de performanță, sportiv de elită, educație, formare profesională*

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## Introduction

In the contemporary society, high performance sport has experienced a great expansion, being assessed as a phenomenon with important functions in the human development through the implied socio-economic implications, contributing to the accomplishment of Europe 2020 strategic objectives. The complexity of life and the challenges of the contemporary world have as consequence the rethinking of the role and importance of factors which contribute to the achievement of education throughout the lifespan. The European Union admits and supports the role of sports in the domain of education, the year 2004 being proclaimed as the year of education through sports.

The concept of "dual career" in high performance sports was "conceived out of the necessity help the athletes in planning and time management between sport, education, gaining financial resources and social life" (http://www.dualcareer.com) and promoted by institutions concerned to support athletes in the development of high performance sport in parallel with education and professional formation.

The importance of "dual career" is emphasized by the European Commission (2011) and the *White Book of Sports,* where aspects are approached referring to the sports development in the context of social, cultural and economic changes "in order to ensure the integration of professional athletes on the labour market at the end of their sportive careers… to provide to the young athletes a formation for a "dual career" (The White Book of Sports, 2007, p. 6).

The purpose of this study is to explore the complex process of "dual career" in high performance sports, to line out an overall image of this phenomenon experienced by elite athletes.

The objective of the research aims at identifying the factors that interfere in the management of the high performance sportive activity and the educational, professional formation one, with the description of the specific stages, covered coherently in successfully combining the two careers.

## Method

The methodological approach of this research finds its place in a pilot study that explores the sportive activity period in parallel with the educational and professional formation period. The used method is a qualitative one – case study, "research method which takes as its subject a singular case or a few examples selected from a social entity" (Marshal & co., 2003, p. 601). The case study is a method proper for the complex analysis of a person or a group, as "pattern" of a phenomenon, of life experience with the characteristic features and emotions. Case studies show "how it would be" in a special situation, in order to capture reality and to describe thoroughly the participants – their experiences, thoughts and feelings in a certain situation" (Jones, Gratton, 2003, p.254).

For data collection, the interview was used, having as instrument a semi structured interview guide (where the discussion topics were established without imposing a certain approach order). A preliminary meeting was established with the subject in order to receive the participation agreement and to be presented with data referring to the research topic and purpose. Then, in mutual agreement, it was established the date, hour and place of the interview. The subject chosen for this study is an elite sportive, Olympic champion in 2012, who practices, as sport branch, target shooting. The interview was approached as a "life story" of the subject, recorded on electronic support and transcribed for analysis. The recorded data processing was made with the content analysis technique.

**Results and analyses**

The situation of athletes who have reached the end of their high performance career becomes analysis subject for researchers from many countries, starting off from "the reality many of the elite athletes must face is that they are little or insufficiently rewarded financially so they could live decently out of their sportive activity" (Stambulova, 2007 cited by Dawn, 2013, p.1). This situation emphasizes the necessity to pay more attention to the management of "dual career", to the period during which the sportive must successfully combine the academic career with the sportive one. Generally, athletes begin their sportive careers by experimenting several sports branches, first going through an "initiation" period, as Cote, Baker and Abernathy (2003) call it, period during which the participants are "willing to try various sports in order to realize which is fit for them, which they enjoy the most or if they have a certain talent. This period is named initiation or trial/sampling" (Keegan, Harwood, Spray, Lavallee, 2014, p.2).

For the subject of the present study, the first contact with target shooting "*was a child's play*" at the age of 13, following a selection at school where he "*was one of those who fired the rifle well and remained*, although, there were other attempts to practice other sports as well. Athletes can be motivated by extrinsic factors, such as rewards, acknowledgement" (Ryan&Deci, 2007 apud Pelletir, Rocchi, Vallerand, Deci, Ryan, 2013, p.1), and "*the first medals obtained in a national championship*" consolidate the idea of performance and activity continuation. The transition to another life stage also implies a change of environment which in "the domain of sports, from a young age, from junior to the adult phase, it can lead to additional stress in the case of athletes" (Petitapas & co., 1997, Engstrom, 2011 apud Ābeļkalns, Geske, 2013, p. 7). The responsibility in training, thoroughness, satisfaction to practice what they like, the recorded progress and results help the sportive not to feel the passing from one age category to another as if it were a situation which required accommodation to new situations – "*in my case, I had to compete in the juniors' category when I was very young, after that, I had to compete directly in the seniors' and I didn't feel it as passage*". The selection for

the national lot is perceived by the subject as acknowledgement of his work and added value in his development – "*the national lot meant very much and a different coach*".

"In sports, motivation has a crucial role, meaning that the sportive's success depends significantly on the performers' will to mentally focus, as well as on the physical effort targeted in excellence" (Moran, 2012, p.44). The seriousness of work, dedication, they make the effort become achievements, "*multiple national champion, then the first selection in the national lot which meant a competition in the Czech Republic, where the competition was in an age category bigger than mine, I won the competition and the national record; emotionally, for me it meant something extraordinary, it was a turning point when morally I became more self-confident*".

Even though "the external stimulants, such as money and status are connected to the athletes' performances" (Cresswell & Eklund, 2005, Pelletier, Fortier, Vallerand, & Brière, 2001 apud Keegan & co., 2014, p. 3), for the respondent there are more relevant the performance experiences in competitional context and to surpass his own limits.

The support of the sportive environment, of the coach is defining in a sportive's career, marking his personal development. The subject appreciates the coach's role as being "*crucial, without him, I wouldn't be at this level*"; he is the one who believes in him, valorizing his potential – "*the coach made me compete with the strong ones, he trusted me and it probably was some talent too*". The training programs which must be made by an elite sportive require a lot of time, intense physical effort – "*for me, performance training means all day long*", energy – "*target shooting consumes very much mental energy, it requires specific training*", high capacity of permanent concentration – "*I can train in various ways, I do not need a specific place*".

The demands imposed to high performance athletes are strict, rigorous so as they must be completely dedicated in order to achieve excellence in sports. This influences the sportive's life, his living style regarding the necessary time and responsibility to accomplish the role of being at the same time sportive, student, then spouse and parent. Under these circumstances, the support of the family is a significant one, "*major, it is impossible without the support of the family, you cannot succeed in anything, you cannot practice high performance sports*", although the sportive and educational components have priority in a sportive's life.

Generally, elite athletes are associated with obtaining substantial earnings, a high social status and a different life style. The interviewed sportive, being at a high performance level after years of hard work, is satisfied by the obtained financial benefits – "*the financial income from sports provides a decent living for me, I am pleased; generally, it is a good living from sports at this level*". High performance sport provides the placement in a budgetary institution with "taking out of activity" (he only takes part in the sportive activity), financial stimulants (allowance, prizes), the possibility to travel in the country and abroad, new social networks,

material benefits, a high social status, a specific life style. Thus, high performance sport becomes a way of living – "*this is what I live, sport, and when I say sport, I only say target shooting*".

The respondent's sportive career had continuity, without interruptions caused by accidents or other incidents. Although there were critical moments, "*failures, because, a good result obtained at a certain age, after a period, if you return or maintain yourself at the same level, is a failure*", periods in which "*it is very difficult to maintain yourself at a high performance level*", the sportive did not consider these as withdrawal reasons. Success and failure, reflected in the result of the action, are variables to which the sportive retrospects himself all along his high performance career, positively or negatively influencing the feeling of competence, confidence, efficiency, the perception regarding autonomy and social belonging (Nuț, 2009).

The high aspirations, blocked in surpassing his own limits, may constitute reasons to give up for a sportive – "*I had many moments when I wanted to give up, when nothing was right, I could not reach performance and you may think that it was not the case anymore, but I did not quit*". The critical moments from a sportive's life can be appreciated as turning points necessary for the human development, just as the predictable transitions, changes which mark a new way of living in the next development stage (Stambulova, 2011). The greatest achievement of a high performance sportive is to participate to the Olympic Games and obtaining a medal is a dream come true. "The performance objectives encourage athletes to focus on the relevant task information and on the controllable actions" (Moran, 2012, p.155). After years of sportive activity, with a sometimes exhausting training, with remarkable performances, being "*world champion and world vice champion, obtaining the bronze medal at the European championship, medals at world cups, national records*", his efforts were rewarded – "*the Olympic title came after 16 years of work*".

The emotional load with which he speaks about these events, tells us more than his words – "*it cannot be described what I felt there, on the podium*". The great performances do not just come with advantages, the responsibility keep a high level, the pressure from everybody around is not easy to take "*there is a certain pressure everybody because they all expect everything to be very well, although it is very hard, to always be the best*". "Many coaches and athletes think that concentration and the capacity to literally concentrate on the given task, while ignoring distractions, is an essential condition in order to successfully perform in sport" (Moran, 2012, p. 128). With rigorous, specific training, the sportive reaches a level where he succeeds in overcoming certain difficult moments, even if "*against your will, you become distracted, various problems occur which you have to solve and thus it is difficult to be mentally there all the time; if I do not feel very strongly this pressure, it does not mean that it is not there, I manage to protect myself from such situations*".

The social mobility (sportive environment), reflecting that the sportive is legitimated in several clubs, is influenced by extrinsic motivational factors which provide him with better living, training and social protection conditions – "*I started my initiation in Focsani, then I was at SC Dinamo Bucharest and at present, I am in Iasi with double legitimation; I left Focsani because I moved on to seniors and the other reason was getting a job*".

The concern for professional formation, in the case of our subject, occurred mostly from the wish to get over the critical moments in the high performance activity, the academic training supporting the sportive training – "*at a certain point I felt that I should have seen a psychologist and that was when I studied the psychology faculty; I felt that something was missing from performance and training, it was a part of the training which I could not cover*".

The graduated faculty provides him with the theoretical competences which help him make progress in his sportive activity, but he is aware that it will be very difficult to work in the domain after retiring from his sportive career, considering the long period of time which has passed since graduation and the inexistence of a training stage which should provide practical experience – "*I have no practice in the field, up to now I have not deepened my professional training because I haven't had time; sport requires a lot of time and one cannot do well both activities*". The orientation, the decision to continue the studies at higher level, was a personal one, the sportive only having the support of the family.

The sports club did not get involved as his sportive activity was not affected – "*the club did not get involved in my preoccupation, did not support me, ... I went to faculty in the private system because during the admission period I was in competitions ... I did not use the facilities referring to class attendance...I sat for most of my exams during the session of remained exams*". If at the beginning of the sportive career, school was the priority, the hierarchy changes once the great performances are obtained, high performance sport coming on first – "*in managing the sportive and educational activities, time was the only impediment ... you cannot undertake the same effort when your mind is at trainings, basically, you cannot make two activities at the same level, therefore school fell on the second place*". "Compared to traditional students, sportive students have to face additional challenges and energy consumption in accomplishing good academic and sportive performance" (Shuman, 2009; Gaston-Gayles, 2005; Gatmen, 2012 cited by Corrado & co., 2012, p.54)

The encouragement and support of elite athletes to continue their higher education as professional training is also reflected in the official statistics accomplished by the British Universities and Sports Colleges which show that "during the past 20 years, 60% of the teams in Great Britain have been "products" of the higher education system. During the Olympic Games in London – 2012, there was a series of sports which were very well represented by sportive students, such as pentathlon (100%), female polo (100%), canoeing (90%), grass hockey (87.5%), athletics (79.5%), swimming (54%)" (Dawn, 2013, p.4).

## Conclusions

The analysis of the recorded results lead to the formation of certain relevant conclusions which emphasize the issue of dual career in high performance sports:

- The practicing of elite high performance sport requires a high consumption of time, energy, concentration, dedication, which is (sometimes) a barrier in the educational development and professional formation;
- The choice and concentration on the sportive activity to the detriment of academic preoccupations is supported by intrinsic and extrinsic motivations illustrated by the perspective of success in elite sport, by the recorded performances and the obtained benefits;
- The legislation referring to study facilities for elite sportive students does not provide a proper framework regarding class attendance and sitting for exams; the inexistence of study programs (particularized ones) correlated with the centralized and competitional training periods determine the orientation of athletes towards private institutions where they find more tolerance;
- The professional formation certified by obtaining a higher studies graduation diploma does not represent a guarantee of getting on the labour market in the studied domain, considering the long period of time between graduation and retirement from the sportive career, without the implication of athletes in the professional environment or professional practice;
- The sportive mobility is determined by (extrinsic) motivational factors which provide financial comfort, better living conditions and social protection;
- The hierarchy of life priorities is reconsidered proportionally with the recorded sportive performances and the benefits derived from this activity.

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# VARIATION OF UPPER BODY AND LOWER BODY FORCE IN CHILDREN WITH AND WITHOUT MENTAL DISABILITY

**BOGDAN CONSTANTIN UNGUREAN[1*], ADRIAN COJOCARIU[1], ALEXANDRU OPREAN[1]**

**ABSTRACT.** The aim of the current paper is to assess the motor quality of force, in children with and without mental disability, in order to identify its variations. Within the research, we started from the following hypothesis: mentally disabled children have reduced upper body and lower body force (as motor quality) compared to children without mental disability. The study included 35 female subjects aged between 14 and 17, with various degrees of mental disability. Measurement results show that for peak lower body force the best result was obtained by the group of children with mild mental disability. Consequently, force may not be influenced by the degree of mental disability, and this aspect should be studied in a future research.

***Keywords****: amplitude, force, disability, Down's Syndrome*

**REZUMAT**. ***Variaţia forţei la nivelul trenului superior şi a trenului inferior la copiii cu şi fără dizabilitate mentală.*** Prezenta lucrare are ca scop evaluarea calităţii motrice forţa, la copii cu şi fără dizabilitate mentală, în vederea identificării variaţiilor acesteia. În cadrul cercetării, am pornit de la următoarea ipoteză: copiii cu dizabilitate mentală au o calitatea motrica forţa pe trenul superior şi pe trenul inferior mai slab dezvoltată faţă de copiii fără dizabilitate mentală. Am inclus în cercetare 35 de subiecţi de sex feminin, cu vârste cuprinse între 14-17 ani, cu diferite grade de dizabilitate mentală. Rezultatele obţinute în cadrul măsurătorilor arată faptul că, pentru forţa maximă la trenul inferior cel mai bun rezultat a fost obţinut de grupa copiilor cu dizabilitate mentală uşoară. Ca urmare, există posibilitatea ca forţa, la această categorie de subiecţi să nu fie influenţat de gradul dizabilităţii mentale, aspect care ar trebui cercetat într-un studiu ulterior.

***Cuvinte-cheie****: amplitudine, forţă, dizabilitate, Sindrom Down.*

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## Introduction

The incredible possibilities of disabled people, as well as their permanent desire to better themselves, corroborated with the competition drive specific to humans, determined a reorientation of motor activities toward sports activities adapted to disabled persons (Năstase, 2003). In the scientific literature, there are specific terms for persons deviating from normality (as general signification), regarding the entire psychophysical development, because several physical, motor, sensory, or mental aspects are delayed. Hence, "normal" would mean properly adjusting to the environment and relating to the peer group and cultural environment; "abnormal" includes deviations from the standard, insufficiencies, development retardation, as well as physical, behavioural, sensory conditions, etc.(Pásztai, 2006).

## Hypothesis

Within the research, we started from the following hypothesis: mentally disabled children have reduced upper body and lower body force (as motor quality) compared to children without mental disability.

## Methods and materials

The study included 35 female subjects, aged between 15 and 17, with various degrees of mental disability (Table 1).

**Table 1.** Repartition of subjects per educational establishments

| *No.* | *Educational establishment* | *No. of subjects* | *Case observation* |
|---|---|---|---|
| 1. | "G. Ibrăileanu" High-school in Iaşi | 10 | Without disability |
| 2. | "Sf. Andrei" School in Gura Humorului | 10 | Mild mental disability |
| 3. | "Laurenţia Ulici" Foster Care Centre in Gura Humorului | 10 | Several mental disability |
| 4. | "Constantin Păunescu" School Iaşi " | 5 | Down's Syndrome |

The tests were applied in the kinesiotherapy practices of the "Sf. Andrei" School in Gura Humorului, of the "Laurenţia Ulici" Foster Care Centre in Gura Humorului, and of the "Constantin Păunescu" School Iaşi. We also used the gymnasium at the "G. Ibrăileanu" High-school in Iaşi. For measuring upper body and lower body force, we used two tests, as follows:

1. From plank position, we counted the number of push-ups executed in 30 seconds.

Force represents the property of the locomotor system of overcoming various external resistances or even the weight and inertia of body parts, by moving its segments following muscle contraction (caused by the activity of the nervous

system). This biological definition is completed by the mechanical–physical notion of force, which represents the value of the product between mass and acceleration (F = m X a) which in essence expresses the modification of the body's motion state and even previous form (Ifrim, 1986).

2. From sitting, we counted the squats executed for 30 seconds.

Concerning the morphophysiological substrate ensuring force, there are two main segments of the body, besides the activity of the other systems:

I. The nervous system;
II. The muscle system.

**I. The nervous system** acts through two main mechanisms:

**A.** Setting in motion as many motor units as possible

A motor unit is the formation comprised of the peripheral motor neuron and its dendrites and its prolongation, the axon, and corresponding neuromotor plaques, along with all muscle fibres that it innervates. It is known that, at rest, 2–5% of the units are in contraction; during minimal efforts, 10–30%; during intense efforts, 40–60%; during sports performance activity, 70–75%.

Setting in motion as many motor units as possible depends on the capacity of the motor neural cortex and of the pyramidal area of sending as many and as precise nervous impulses that determine the depolarization of motor units.

**B.** Unitary assembling of active motor units

Central nervous system (motor cortex) is the one that synchronizes the functionality of motor units because they initially act under various circumstances concerning their degree of contraction; subsequently, by increasing the nervous impulses to 45–50/sec., maximal contraction force is achieved (Ifrim M., 1986).

**II. The muscle system** is the second main element that conditions force.

It is known that force developed by a muscle is directly proportional with its physiological section. Hence, increasing the physiological section and muscle hypertrophy, respectively, is one of the ways of developing force (Ifrim M., 1986). We processed the statistical results using SPSS 13 for Windows.

## Findings and discussions

### *A. Results for peak upper body force*

As illustrated in Fig. 1, the mean values of the four groups range between 1.3 for the group of children with severe mental disability and 12.6 for the group of normal children.

After calculating the means for peak upper body force, statistically significant differences were found between the group of normal children and the group of children with severe mental disability and between the group of normal children

and the group of children with Down's Syndrome (9.4), for **p** ≤ 0,001. A significant difference was also highlighted between the group of normal children and the group of children with mild mental disability. The value of this difference is 6.5 repetitions and it is highly statistically significant (p < 0.02).

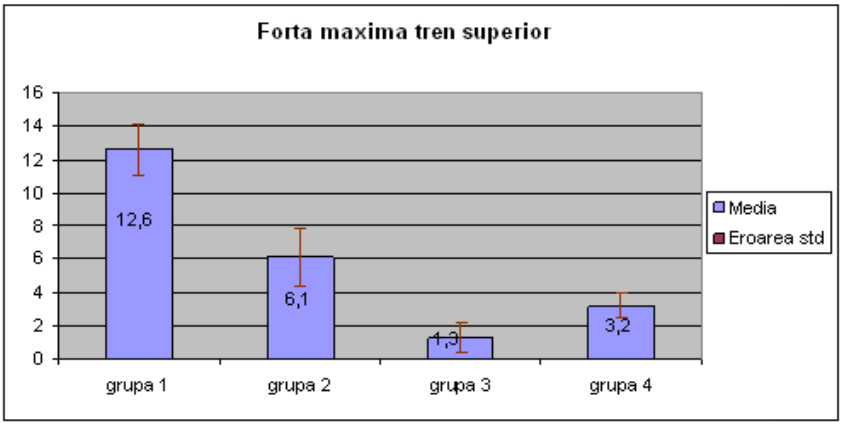


**Fig. 1.** Mean values and standard errors of the four groups for peak upper body force

After analyzing the variation coefficient – ranging between 39.45% and 214.68%, it can be stated that the four groups are heterogeneous. (Table 2).

**Table 2.** Characteristics of peak upper body force in children with and without mental disability

| Group | N | M | M% | Std. E. | V. C.% | t | p |
|---|---|---|---|---|---|---|---|
| Group 1 | 10 | 12.6 | 100% | 1.571 | 39.45 | 2.782 | 0.012 |
| Group 2 | 10 | 6.1 | 48.41% | 1.728 | 89.61 | | |
| Group 1 | 10 | 12.6 | 100% | 1.571 | 39.45 | 6.268 | p<0.001 |
| Group 3 | 10 | 1.3 | 10.31% | 0.882 | 214.68 | | |
| Group 1 | 10 | 12.6 | 100% | 1.571 | 39.45 | 5.417 | p<0.001 |
| Group 4 | 5 | 3.2 | 25.39% | 0.734 | 51.35 | | |
| Group 2 | 10 | 6.1 | 48.41%^ | 1.728 | 89.61 | 2.473 | 0.027 |
| Group 3 | 10 | 1.3 | 10.31% | 0.882 | 214.68 | | |
| Group 2 | 10 | 6.1 | 48.41% | 1.728 | 89.61 | 1.544 | 0.149 |
| Group 4 | 5 | 3.2 | 25.39% | 0.734 | 51.35 | | |
| Group 3 | 10 | 1.3 | 10.31% | 0.882 | 214.68 | 1.391 | 0.123 |
| Group 4 | 5 | 3.2 | 25.39% | 0.734 | 51.35 | | |

The dispersion values for the entire series vary between a minimum of 0 repetitions for the group of children with mild mental disability and the group of children with severe mental disability, and a maximum of 19 repetitions, recorded for the group of normal children (according to Table 3).

**Table 3.** Central and dispersion values of peak upper body force for the four groups

| Peak u.b. force | *gr.1* | *gr.2* | *gr.3.* | *gr.4* |
|---|---|---|---|---|
| ***Minimum*** | 6 | 0 | 0 | 1 |
| ***Maximum*** | 19 | 14 | 9 | 5 |
| ***Median*** | 11 | 6 | 0 | 4 |
| ***Module*** | 10 | 0 | 0 | 4 |
| ***Mean*** | 12.6 | 6.1 | 1.3 | 3.2 |
| ***Amplitude*** | 13 | 14 | 9 | 4 |

The highest amplitude (14 repetitions) is recorded in the group of children with mild mental disability (according to Fig. 2).

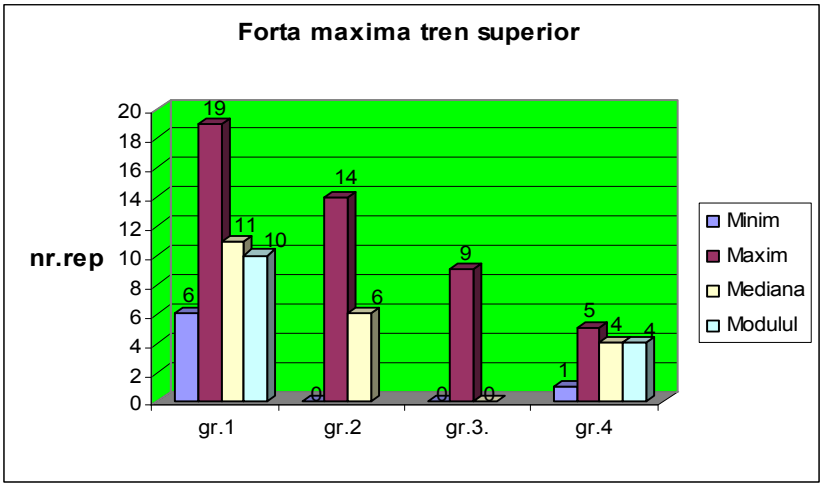


**Fig 2.** Minimum, maximum, median, and module values in the four groups for peak upper body force

### *B. Data on peak lower body force*

As shown in Fig. 3, the values of lower body force are very close for the group of normal children (18.18 repetitions) and for the group of children with mild mental disability (18.5%). The difference is in favour of the group of

children with mild mental disability, that is 0.32, and it is not statistically significant. The greatest difference is recorded between the group of children with mild mental disability and the group of children with severe mental disability.

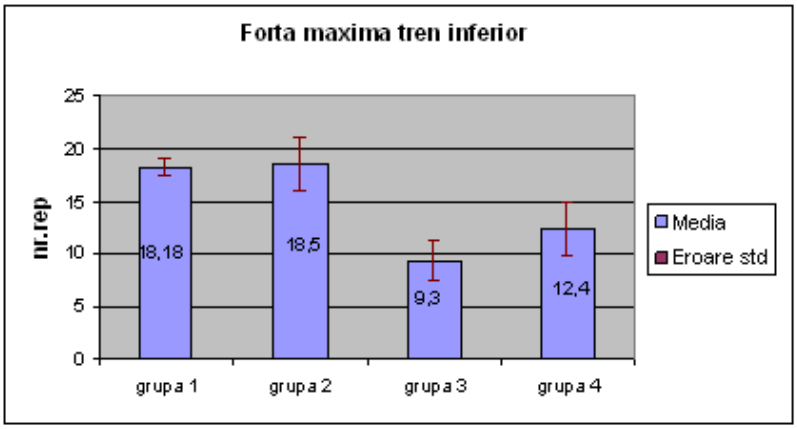


**Fig. 3.** Mean values and standard errors of the four groups for peak lower body force

It has the value of 9.2 repetitions and it is statistically significant, for $\mathbf{p} \leq 0.01$. Another highly statistically significant difference was found between the group of normal children and the group of children with severe mental disability – 8.88 repetitions – for $\mathbf{p} \leq 0.001$ (according to Table 4).

**Table 4.** Characteristics of peak lower body force in children with and without mental disability

| Group | N | M | M% | Std. E. | V. C.% | t | p |
|---|---|---|---|---|---|---|---|
| Group 1 | 10 | 18.8 | 100% | 0.879 | 14.79 | 0.111 | 0.913 |
| Group 2 | 10 | 18.5 | 98.40% | 2.552 | 43.64 | | |
| Group 1 | 10 | 18.8 | 100% | 0.879 | 14.79 | 4.554 | 0.001 |
| Group 3 | 10 | 9.3 | 49.46% | 1.891 | 64.33 | | |
| Group 1 | 10 | 18.8 | 100% | 0.879 | 14.79 | 2.413 | 0.06 |
| Group 4 | 5 | 12.4 | 65.95% | 2.502 | 45.12 | | |
| Group 2 | 10 | 18.5 | 98.40% | 2.552 | 43.64 | 2.895 | 0.01 |
| Group 3 | 10 | 9.3 | 49.46% | 1.891 | 64.33 | | |
| Group 2 | 10 | 18.5 | 98.40% | 2.552 | 43.64 | 1.505 | 0.156 |
| Group 4 | 5 | 12.4 | 65.95% | 2.502 | 45.12 | | |
| Group 3 | 10 | 9.03 | 49.46% | 1.891 | 64.33 | 0.965 | 0.352 |
| Group 4 | 5 | 12.4 | 65.95% | 2.502 | 45.12 | | |

The only homogenous group is the group of normal children, with VC = 14.79%. The other groups are heterogeneous; the value of the variation coefficient ranges between 43.64% and 64.33%.

For the entire series, dispersion varies between a minimum of zero, recorded for the group of children with mild mental disability (this group also records the maximum value of 28 repetitions, according to Table 5). As illustrated in Fig. 4, the highest amplitude was also scored by the group of children with mild mental disability.

**Table 5.** Central and dispersion values of peak lower body force for the four groups

| F.max inf | *gr.1* | *gr.2* | *gr.3.* | *gr.4* |
|---|---|---|---|---|
| ***Minim*** | 14 | 0 | 2 | 5 |
| ***Maxim*** | 24 | 28 | 18 | 18 |
| ***Mediana*** | 18.5 | 21 | 11.5 | 15 |
| ***Modulul*** | 18 | 21 | 12 | * |
| ***Media*** | 18.8 | 18.5 | 9.3 | 12.4 |
| ***Amplitudinea*** | 10 | 28 | 16 | 13 |

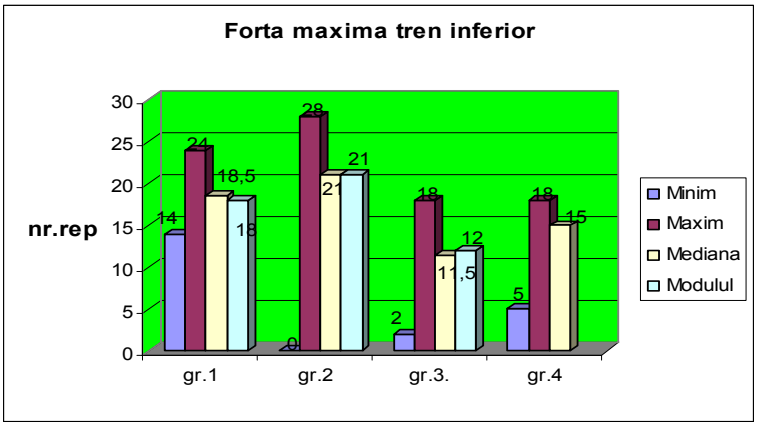


**Fig. 4.** Minimum, maximum, median, and module values in the four groups for peak lower body force

## Conclusions

Consequently, force may not be influenced by the degree of mental disability, and this aspect should be studied in a future research.

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# THE NUTRITIONAL STATUS OF A CATEGORY I JUNIOR HANDBALL TEAM IN TRAINING

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**ABSTRACT**. *Introduction.* Youth is the optimal period for healthy physical exercise, as well as performance sports. One achieves harmonious physical and mental development through these means. Nevertheless, the conditions of modern life, with its numerous temptations and food industry novelties, as well as the change in traditional eating frequency and habits are responsible for nutritional deficiencies or excess of potentially anti-nutritional substances. Since the speciality literature on this topic has only been studied to a small extent, we have considered evaluating the nutritional status of professional athletes. *Objectives.* The main objective of this research has been to investigate the nutritional status and its consequences, in the case of professional handball players (junior I team – males). *Methods.* While investigating the nutritional status, we have used standard protocol, involving several components: eating intervals (generating data that pertain to food behaviour and preferences), analysis of food intake (this uses data provided by the food inquiry and the structure of the food rations), anthropometry and biochemical analyses. *Results.* Based on anthropometrical measurements, we have found that the lot is homogenous, with excess adipose tissue comparable to the upper limit of normality. Within the handball team, following detailed research, we have discovered that there are eight harmoniously developed players, and seven disharmonious ones, a diagnostic set by using BMI, excess adipose tissue and active muscle mass. With regard to biochemical analyses, the lot is considered to be within normal parameters, given the tests performed. *Conclusions*. Within the handball team, eight players are harmoniously developed, while seven are disharmonious. The average value of biochemical parameters is normal. The average value of the total caloric intake of handball players during training period is 4330.14 ± 340.69 kcal/day. The synthesis of the food rations structure of the handball team is: protein participation 13.46%, fat 34.30% and carbohydrates 52.24%. Fats of vegetable origin account for 50.11%, while animal ones stand at 49.89, i.e. below recommended levels.

***Keywords:*** *sports diet, professional sports, sports nutrition, food regime, dietetics, handball*

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**REZUMAT.** ***Evaluarea stării de nutriție la lotul de handbal categoria juniori I în perioada de antrenament.*** *Introducere.* Tinerețea este perioada optimă pentru mișcare fizică sănătoasă, chiar sport de performanţă. Este o modalitate prin care se obține o dezvoltare armonioasă, fizică și psihică. Dar condițiile vieții moderne, cu multiplele ei tentații și noutăți comerciale alimentare, precum și modificarea frecvenței și obiceiurilor alimentare tradiționale sunt responsabile de carențe nutriționale sau exces de substanţe cu potențial antinutritiv. Pentru că în literatura de specialitate a fost lacunar studiată, ne-am gândit să evaluăm starea de nutriție a sportivilor de performanță. *Obiective.* Scopul principal al acestei cercetări, a fost de a se investiga starea de nutriție și consecințele ei pentru sportivii care practică handbal de performanţă (categoria junior I masculin) *Metode.* În investigarea stării de nutriție s-a utilizat un protocol standard, care presupune mai multe componente: interviul nutrițional (aduce informații referitoare la comportamentul alimentar, preferințele alimentare), analiza aportului alimentar (utilizează datele oferite de ancheta alimentară și structura rației alimentare), antropometria și analize biochimice. *Rezultate.* Pe baza măsurătorilor antropometrice s-a constatat faptul ca avem un lot omogen, cu țesut adipos excedentar față de limita superioară a normalului. În cadrul lotului de handbal, după cercetări amănunțite s-a descoperit că există 8 sportivi dezvoltați armonic, iar 7 dizarmonic, diagnostic stabilit prin utilizarea IMC, surplus de țesut adipos și masă musculară activă. Referitor la analizele biochimice putem spune că avem un lot care se află între parametrii normali după testările efectuate. *Concluzii.* În cadrul lotului de handbal 8 sportivi sunt dezvoltați armonic, iar 7 disarmonic. Valoarea medie parametrilor biochimici este normală. Valoarea medie a aportului caloric total al handbaliștilor din perioada de antrenament este de 4330,14 ± 340,69 kcal/zi. Sinteza structurii rației alimentare a lotului de handbal din perioada de antrenament este: participare proteică 13,46%, lipidică 34,30% și glucidică 52,24%. Lipidele de origine vegetale reprezintă 50,11%, iar cele de origine animală 49,89% fiind sub recomandări.

***Cuvinte-cheie:*** *diete sportive, sporturi profesioniste, nutriție sportivă, regim alimentar, dietă, handbal.*

## Introduction

Experts' recommendations pertaining to nutritional intake provide standards for energy and nutritional consumption of various categories of people. Nutritional recommendations are chiefly aimed at ensuring nutritional needs, as well as protein, vitamin and mineral intake, thus setting general principles for energy intake, without appropriately covering the 'moderation area' and protecting the population from excess of fat, sugar, salt and other food components which are believed to be connected to cardiovascular disease (Simu, Roman, Szilagy, 2000).

Healthy eating principles may be encountered in nutritional recommendations for professional athletes. However, in their case there are specific caloric and nutritional adaptations that are needed, depending on several criteria germane to the type of

sport, age, stage, duration and type of physical effort. The diet of athletes must meet the following conditions: to cover the energy consumed by basic metabolism, the additional energy needs of growth and everyday life, the energy required by training and competitions, as well as that prompted by effort recovery processes, and unforeseen energy expenditure (special conditions, based on environment, illness or stress), while also protecting athletes from potentially avoidable illnesses (Zamora, Crăciun, 1999).

With regard to the necessary nutritional intake for supporting oneself, it is preferred to opt for a formula that takes into account the quantity and quality of the effort spent during training (duration, intensity and complexity), presumptive energy consumption (evaluated as kcal/hour of effort), added to the previously mentioned activities. It is apparent that all decisions leading to nutritional recommendations should take into consideration weather conditions (temperature, humidity, wind and altitude). Another way of calculating the necessary nutritional intake, starting from theoretical data, refers to 60-70 kcal/kg of body mass, depending on sport, sex, physical effort, duration and environmental factors (Dragan, 1989).

## Objectives (operational hypothesis)

Starting from the major impact of eating on the development, health and performance of athletes, chiefly at this delicate age, we have aimed to investigate their nutritional status in the pre-competition preparatory stage (training), as well as to potentially correlate our results with the anthropometric indicators of their physical development and biochemical confirmations of their state of health. We have carried out a transversal descriptive study.

## Material and method

We have included in our study a number 15 junior athletes (aged 16-18), who practice professional handball. Their sporting effort is divided into training stages, competition and training camp, albeit this study solely focuses on the training stage.

The data gathered have been processed using the MS EXCEL application. The calculation formulas have been generated by the same program.

In order to analyse the nutritional value and understand the structure of the food rations, we have used a relevant computer application.

## Results

**Table 1.** Anthropometric measurements. Statistical indicators

| Indicator | Age | Height (cm) | Weight (kg) | B.M.I. | Body surface area ($m^2$) |
|---|---|---|---|---|---|
| Average value | 16.92 | 179.75 | 73.45 | 23.82 | 1.97 |
| Standard deviation | 0.93 | 5.37 | 9.63 | 3.73 | 0.12 |
| "P" value | 5.50 | 2.98 | 13.11 | 15.66 | 5.85 |

**Table 2.** Statistical indicators (continues)

| Indicator | Torso (cm) | Abdominal perimeter | Length of lower limbs (cm) | Biacromial width (cm) | Bitrochanteric width (cm) | Arm span (cm) |
|---|---|---|---|---|---|---|
| Average value | 93.56 | 81.07 | 89.63 | 41.67 | 31.87 | 185.20 |
| Standard deviation | 2.79 | 7.78 | 6.83 | 1.63 | 1.68 | 5.36 |
| "P" value | 2.98 | 9.59 | 7.62 | 3.92 | 5.29 | 2.89 |

**Tabel 3.** Adiposity measurement. Statistical indicators

| Indicator | Triceps (cm) | Scapula (cm) | Flank (cm) | Abdomen (cm) | Thighs (cm) | Fat tissue % |
|---|---|---|---|---|---|---|
| Arithmetic mean | 9.53 | 9.73 | 10.67 | 15.33 | 14.33 | 16.41 |
| Standard deviation | 4.00 | 4.03 | 6.21 | 8.48 | 7.08 | 4.07 |
| Coefficient of variation % | 41.93 | 41.36 | 58.19 | 55.32 | 49.38 | 24.83 |

In the case of the players in the handball team, excess adipose tissue amounts to 16. 41%, compared to the normal upper limit of 13%.

**Table 4.** Integrated physical development

| No. | Status | Excess adipose tissue (kg) | Active mass | Harmonious/ Disharmonious |
|---|---|---|---|---|
| 1 | normal weight | 4 | g | H |
| 2 | underweight | normal | minus 6 kg | D |
| 3 | overweight | 20 | vg | D |
| 4 | normal weight | 14 | minus 4 kg | D |
| 5 | normal weight | normal | vg | H |
| 6 | normal weight | 5 | vg | H |
| 7 | normal weight | 8 | minus 9 kg | D |
| 8 | normal weight | normal | vg | H |
| 9 | underweight | 5,5 | minus 14 kg | D |
| 10 | underweight | 9 | minus 15 kg | D |
| 11 | underweight | normal | minus 8 kg | H |
| 12 | normal weight | normal | vg | H |
| 13 | normal weight | normal | vg | H |
| 14 | normal weight | 14 | minus 10 kg | D |
| 15 | normal weight | normal | g | H |

In the handball team, eight players are harmoniously developed, and seven are disharmoniously developed, a diagnostic established using BMI, excess adipose tissue and active muscle mass.

**Table 5.** Laboratory analyses. Statistical indicators

| Indicator | Glycaemia (mg/dL) | Cholesterol (mg/dL) | Creatinine (mg/dL) | Serum iron (µg/dL) | TG (mg/dL) | Hb mg/Dl | VSH (mm/hour) |
|---|---|---|---|---|---|---|---|
| Arithmetic mean | 89.19 | 146.13 | 1.05 | 89.21 | 79.53 | 14.94 | 5.47 |
| Standard deviation | 7.87 | 25.22 | 0.23 | 16.50 | 32.82 | 0.56 | 4.98 |
| Coefficient of variation % | 8.82 | 17.26 | 21.44 | 18.50 | 41.26 | 3.76 | 91.17 |

**Table 6.** Statistical indicators (continues)

| Indicator | Nitrogen (mg/dL) | Calcium (mg/dL) | Magnesium (mg/dL) | Tgo (UI/ litre) | Tgp (UI/ litre) | L (x10³ elements/ µL) | HT (%) | TR (x10³ elements/ µL) |
|---|---|---|---|---|---|---|---|---|
| Arithmetic mean | 27.27 | 8.23 | 1.93 | 22.53 | 20.00 | 6.81 | 44.96 | 254.13 |
| Standard deviation | 7.31 | 2.93 | 0.59 | 6.62 | 6.90 | 1.11 | 2.32 | 73.50 |
| Coefficient of variation % | 26.82 | 35.58 | 30.70 | 29.38 | 34.49 | 16.30 | 5.16 | 28.92 |

The average value of biochemical parameters is normal.

The total average caloric intake of handball players during training period is 4330.14 ± 340.69 kcal/day. The spread of consumption is fairly uniform, with one athlete reaching the intake recommended by some authors. (Fig. 1)

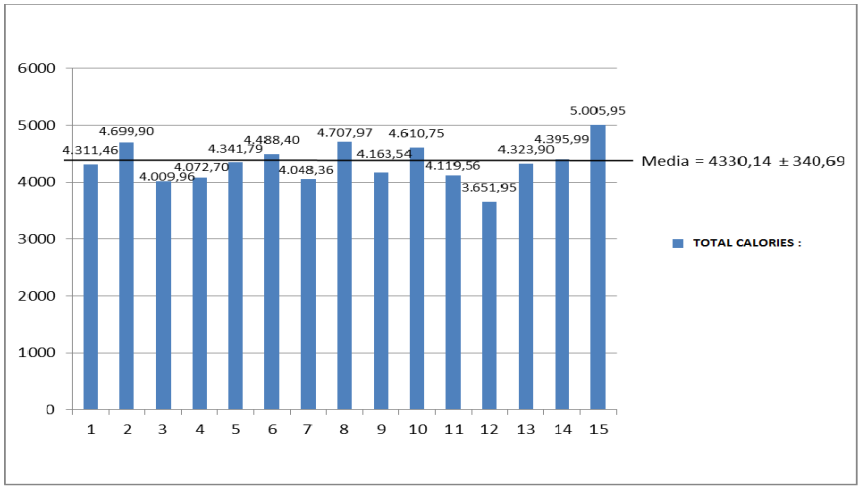


**Fig. 1.** Total average caloric intake of handball players. (training period)

The synthesis of the structure of the handball team's food rations during training period is: proteins 13,46%, fats 34,30% and carbohydrates 52,24%. (Fig. 2)

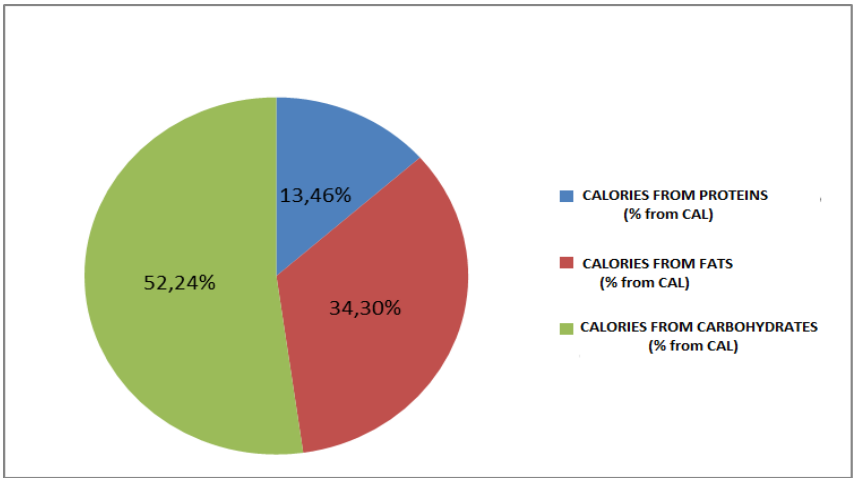


**Fig. 2.** Structure of the team's rations, as microelements, in percentages.

Fats of vegetable origin account for 50.11% (greatly exceeding recommended levels), while those of animal origin stand at 49.89%, i.e. below recommended levels. (Fig. 3)

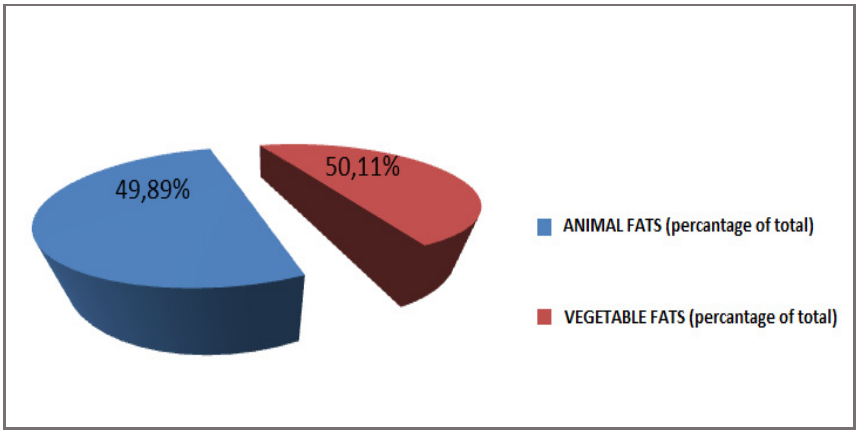


**Fig. 3.** Fat type share in food rations during training period

The (average) ratio of proteins of animal origin in the daily diet is 69,71% (above recommended levels), while vegetable ones account for 30,29%. (Fig. 4)

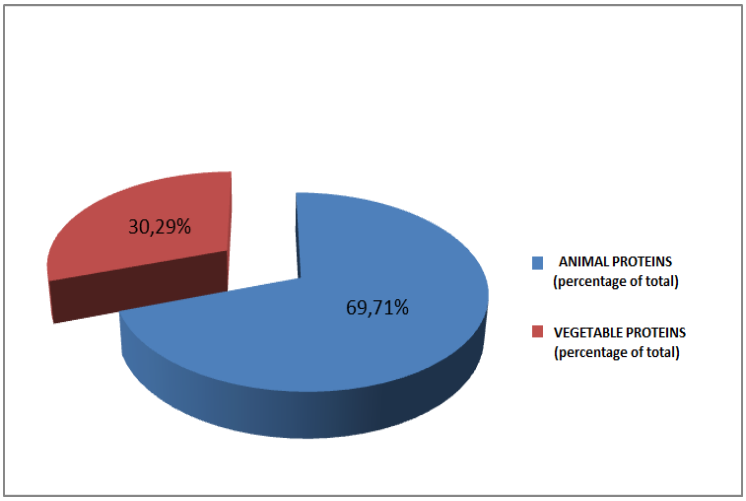


**Fig. 4.** Intake of proteins of animal and vegetable origin (%).

**Table 7.** Consumption of minerals in members of the handball team.

| No. | Calcium (mg) | Magnesium (mg) | Iron (mg) | Potassium (mg) | Sodium (mg) | Phosphorus (mg) |
|---|---|---|---|---|---|---|
| 1 | 1224.4 | 479.6 | 34.1 | 4543.8 | 15764 | 2230.6 |
| 2 | 1301.6 | 577.4 | 28.3 | 6007.8 | 1735.7 | 2092.7 |
| 3 | 1261 | 664.3 | 24.1 | 6131.6 | 1518.9 | 2325.2 |
| 4 | 1344 | 430.5 | 23.8 | 5649.5 | 1659.4 | 2208.4 |
| 5 | 1187.2 | 465.6 | 19.6 | 5641.6 | 1433.5 | 1807.4 |
| 6 | 829 | 396.3 | 18.7 | 4097.1 | 1696.2 | 1642.9 |
| 7 | 1114.8 | 615.6 | 30.4 | 5275.2 | 1460.6 | 2511.3 |
| 8 | 974.2 | 482.9 | 241 | 5095 | 1503.5 | 2300.9 |
| 9 | 1213.7 | 431.6 | 21.5 | 4760.3 | 1794 | 2203.9 |
| 10 | 1166.2 | 503.9 | 19.2 | 4727.7 | 1848.2 | 2124.3 |
| 11 | 1226.5 | 438.3 | 21.6 | 4608.3 | 1491 | 2110.4 |
| 12 | 1235.2 | 325.3 | 22.1 | 4832.9 | 1465.1 | 2001.4 |
| 13 | 1152.3 | 563.4 | 24.3 | 5173.3 | 1553.3 | 2235.9 |
| 14 | 982.5 | 423.8 | 24.8 | 5495.3 | 1325.8 | 2520.5 |
| 15 | 872.1 | 563.2 | 23.5 | 5559.2 | 1256.2 | 2158.3 |
| MEAN | 924.8 | 529.8 | 24.8 | 5576.2 | 1320.8 | 2195.9 |
| SD | 204.23129 | 81.819789 | 4.3779989 | 680.86942 | 194.46148 | 288.66619 |

**Table 8.** Consumption of vitamins in junior handball players.

| Name | Vit. A (UI) | Carotene (microg) | Vit. B1 (microg) | Vit. B2 (microg) | Vit. B6 (mg) | Vit. C (mg) | Vit. D (UI) |
|---|---|---|---|---|---|---|---|
| 1 | 1802.5 | 2805 | 2849.5 | 1912.9 | 4.4 | 74.5 | 124.8 |
| 2 | 11142.6 | 5787.8 | 2406.7 | 3738.3 | 4.4 | 211.2 | 190.6 |
| 3 | 2076.3 | 9137.8 | 3105.6 | 2580 | 4.8 | 175 | 139.6 |
| 4 | 2108.6 | 2512 | 2106.1 | 1910 | 3.3 | 173 | 166.9 |
| 5 | 1724.3 | 4131.2 | 1809.5 | 2353.5 | 5.9 | 231.3 | 144.8 |
| 6 | 1284.3 | 6439.5 | 1776 | 1675.4 | 3.5 | 125.6 | 154.7 |
| 7 | 14563.8 | 7436.6 | 3050.1 | 4263.5 | 4.9 | 190 | 136.7 |
| 8 | 25313 | 5411.1 | 2600.5 | 2272 | 4.5 | 236.9 | 221.3 |
| 9 | 1997.1 | 3176.9 | 2490.8 | 2619.3 | 4.1 | 73.8 | 146.4 |
| 10 | 1995.5 | 3425.3 | 2062.1 | 2188 | 4.3 | 109.5 | 153.7 |
| 11 | 2594.1 | 4293.1 | 1811.5 | 2145.4 | 4.3 | 154.6 | 127.4 |
| 12 | 2465.3 | 4324.6 | 2651.3 | 2176.9 | 4.8 | 145.3 | 103.2 |
| 13 | 1985.2 | 3245.1 | 2789.2 | 3287.2 | 3.5 | 165.3 | 145.3 |
| 14 | 2109.5 | 5456.8 | 2698.5 | 2489.3 | 3.9 | 187.3 | 198.8 |
| 15 | 1890.4 | 3547.6 | 5498.1 | 1983.3 | 4.2 | 198.2 | 120.1 |
| MEAN | 2215 | 4737 | 3075.2 | 2512 | 5.2 | 102.9 | 122.8 |
| SD | 1536.9 | 1890.2 | 2680.1 | 2175.9 | 5 | 119.8 | 147.8 |

## Discussion

The training period may be regarded as a maintenance and/or support period. At its turn, it is of two types: one that aims to increase energy reserves and another seeking the growth of muscle mass. The rations meant for the increase in the body's energy reserves encompass the growth of muscle and hepatic glycogen reserves. This is particularly useful to athletes practising high-endurance activities. In the week prior to competing, on days 7, 6, 5 and 4 before the contest, high intensity and volume training is to be pursued.

During this interval, the intake of carbohydrates decreases to 45%-50%, leading to a shortage of carbohydrates inside the body. On days 3, 2 and 1, trainings are to have a high intensity, but a low volume. This is the stage marked by "oversaturation with carbohydrates", with the latter accounting for ~70% of the rations. Muscle and hepatic glycogen increases 2,3-2,6 times/100g of active tissue, compared to initial values.

The increased protein intake (high-protein diet) is justified when growing muscle mass and strength. It is useful in strength sports. Proteins are supplemented, reaching a level of 4 g/kg of body mass/day, or up to 18-20% of the total number of calories/day, preferably through food, albeit there are authors who consider that one

can administer protein concentrates with added minerals and vitamins. Diets during competitions are not an exceptional source of energy for the body; their role is chiefly psychological. They have to be pleasant in terms of aspect and taste, prevent unwanted hunger and leave the stomach within two and a half – three hours of consumption.

The post-effort recovery rations have several distinctive characteristics: they have to be hypocaloric, hyperhydric, hyperglucidic, rich in alkaline radicals (to fight the acidosis triggered by effort) and rich in minerals and vitamins (to compensate for losses and the consumption prompted by effort). The intake of liquids should take into account the high loss occurring during training or competitions, and the fact that liquids (water) are needed for metabolic processes and the composition of skeletal muscles. Each litre of water lost through perspiration dissipates 600 kcal of warmth. Athletes may lose over 1,5 litres of water for every hour of endurance workout. Optimal hydration is done before, during and after exercising. Depending on the time of workout, the following are recommended: plain cold water (apart from workouts), sweetened beverages (during workouts) and sodium-rich beverages (during long-lasting workouts).

Talent is the most important trait of a professional athlete, but there are also other notable factors, including efficient and constant preparation through training, a series of psychological and cognitive features, resistance to injury and adequate nutritional support (Damian. 2006; Talbott, 2003; Muraru, 2005). Professional sports are becoming ever more competitive and athletes aiming for lasting top-level performance need to explore every possibility to reach and maintain this privileged position.

Nutrition is an area that can undoubtedly make a difference – the food the athlete chooses may contribute to failure or success (Damian, 2006). Nevertheless, just as a well-suited diet cannot make a champion out of an athlete that lacks the talent and/or motivation for winning, so too must we be aware that inadequate diets can prevent a talented athlete from reaching the top.

Our results draw attention to the fact that, probably without admitting it, the athletes from handball team consume dietary supplements, since the average values obtained for all three stages, in the case of both minerals and vitamins, are above those currently recommended. No shortage of microelements is detected, which is highly improbable in uncontrolled diets of professional athletes, which engender significant dietary imbalances, with respect to calories and macronutrients.

## Conclusions

1. Within the handball team, 8 players are harmoniously developed, while 7 are disharmonious.
2. The average value of biochemical parameters is normal.
3. The average value of the handball players' total caloric intake during training period is 4330.14 ± 340.69 kcal/day. (fig.1)

4. The synthesis of the handball team's food rations during training period is: proteins 13,46%, fats 34,30% and carbohydrates 52,24%. (fig.2)

5. Vegetable fats account for 50,11% (greatly exceeding recommended values), while animal ones stand at 49,89%, below recommended values. (fig. 3)

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# ANALYSIS OF SPEED RUNNING AND INDEX OF POLES USED BY FINALISTS OF POLE VAULT JUMPING IN 2014 NATIONAL CHAMPIONSHIP FINAL

**CRISTIAN GRAUR[1*], BARNA SZABÓ-CSIFÓ[1]**

**ABSTRACT.** Pole vault jumping is one of the most complex athletic events. The level of each athlete on physical qualities are considered a condition sine qua non in achieving high-level results in pole vaulting. Determinate the specific speed parameters on the last part of the approach and grip characteristics of hardness and height used by the finalists in 2014 Senior National Championship. The speed parameters on last part of the approach were measured with Microgate Time Racer2, a device consisting of three pairs of placed photocells. Features of the poles used by the first three finishers in the National Championship Final were monitored during the competition. The first three finalists in 2014 Seniors National Championship Final, obtained specific speed parameters with values between 7.9 m/s and 8.8 m/s on the last 5 m of approach right before the take of phases and detachment. From the point of view of the used poles, they used poles with stiffness index, values between 75 kg and 82 kg. Grip heights were 4.50 m and 4.64 m. All these parameters led to crossing height between 4.85 m and 5.11 m by the first three finishers in the monitored contest. A higher value of speed parameters, hardness -elasticity and the grip of used pole have as repercussions the achievement of good results in the pole vaulting event.

***Keywords****: pole vaulting, speed running, Microgate*

**REZUMAT.** ***Analiza vitezei pe elan şi a caracteristicilor prăjinilor folosite de finaliştii probei de săritura cu prăjina la finala campionatului naţional 2014.*** Proba de săritură cu prăjina este una dintre cele mai complexe probe atletice. Nivelul fiecărui atlet privind calităţile fizice reprezintă o condiţie absolut necesară în vederea atingerii unor rezultate cât mai bune în probă. Parametrii de viteză pe ultima parte a elanului au fost determinaţi cu ajutorul dispozitivului Microgate Time Racer 2, Caracteristicile prăjinilor folosite de primii trei clasaţi în finala Campionatului Naţional au fost monitorizate în timpul desfăşurării concursului. Primii trei clasaţi în Finala Campionatului Naţional de seniori ediţia 2014 au obţinut parametrii de viteză specifică cu valori cuprinse între 7,9 m/s şi 8,8 m/s pe ultimii 5 m de alergare pe elan, chiar înaintea fazei de prezentare şi desprindere. Din punct de vedere al caracteristicilor prăjinilor folosite, aceştia au folosit prăjini cu indice de duritate cu valori între 75 kg şi 82 kg. Înălţimea prizelor a fost de 4,50 m şi 4,64 m. Toţi aceşti parametrii

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au dus la trecerea peste înălțimi între 4,85 m și 5,11 m de către primii 3 clasați în concursul monitorizat. O valoare cât mai mare a parametrilor de viteză, duritate-elasticitate și priză a prăjinii folosite au repercusiuni în obținerea de rezultate bune la proba de săritură cu prăjina.

***Cuvinte-cheie:*** *săritura cu prăjina, viteză pe elan, Microgate*

## Introduction

Pole vault jumping is considered the most technical athletic track. The index with the greatest influence in determining the final performance it is held by the speed. When we talk about speed motor skills in pole vault jumping, we firstly refer to motion speed especially on the last part of approach (Schulek, 2002). Specific speed of pole vault jumping is the speed obtained by the athlete on the last 10 m of running before batting phase and detachment (Xuezhen Liu, Tiemin Zhou, 2008).

The highest level of this specific speed will ultimately lead to the ability to use high grids and poles with a high index of hardness and flexibility, the final result being to obtain the best results in the track. (Falk Schade, Juha Isolehto, Paavo Komi, 2005) Thus, the specific speed in pole vault jumping represents a limiting factor and favourable in the performance (Adamczewski, Horst/Kruber, Dieter, 1993.

Monitoring the specific speed indexes on the last part of approach in the finalists of pole vault jumping, seniors category, gives us a true picture of the parameters obtained by the most representative athletes of this track, on the national level, in terms of synergy between specific speed, characteristics of used pole and the result directly in the track (Zagorac N., Retelj E., & Katic R., 2008).

## Material and methods

In order to determine the specific speed of pole vault jumping it was measured the speed on the last 10 m of momentum with Microgate Time Racer 2 device.

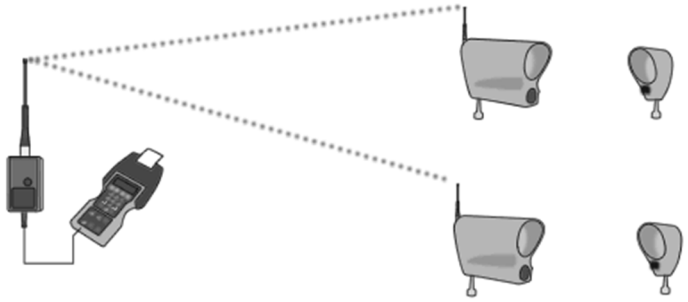

**Figure 1.** Microgate Racetimer 2 Device
(http://www.microgate.it/Timing/Products/Kit-Racetime2-Light-Radio/Description)

This device was used with three pairs of photocells placed on the last 10 m approach run as follows.


**Figure 2.** Microgate system in use at the National Championships

Vt - is the value of the overall speed meaning the monitored speed in the approach run range from last 10 m to 0 m.

V1 - is the speed value in the approach run range from last 10 m to the point of beginning of the last 5 m.

V2 - is the value of the approach speed on the last 5 m of running.

V1-V2 - is the difference of speed parameters value between V1 and V2 and indicates the acceleration or deceleration on last part of the momentum of each competitor individually.

Result – is the result obtained by contestants during the competition where the approach speed was monitored.

The values of speed parameters were calculated in m/s, monitored distance (m) being divided to the obtained time.

### The research protocol

The research was conducted in conditions of competition even during the final National Championship of seniors in pole vault jumping. Monitoring the characteristics of hardness and length of used poles was visually performed and were taken into account

only the characteristics of the pole used to carry out the most valuable jump in terms of the result obtained in the track. Data on the specific speed were recorded during most valuable jumps in the competition.

### Time and place of research

The research was conducted in March 8th, 2014 in the Indoor Athletics Hall "Lia Manoliu" during carrying out the pole vault jumping in senior-boys category of Romanian National Championships.

### Subjects and plots

Data monitored over specific speed features

**Table 1.** Obtained results and place by the monitored subjects

| Name | Date of birth | Obtained results | Obtained place |
|---|---|---|---|
| D.R. | 28-Oct-93 | 5,15 m | place I |
| P. B. | 3-Oct-85 | 4.85 m | place II |
| S.V. | 18-May-94 | 4,80 m | place III |

### Applied tests

We measured the velocity of the top athletes on the last 10 m of the approach, using the Microgate system. In addition, we made the difference of the velocity on 0 to 5, from 5 to 10m and the main velocity on 0 – 10 m.

### Results

**Table 2**. Specific speed parameters obtained by the monitored subjects

| Athlete | Obtained place | Speed vt 10- 0 m | Speed v1 10- 5 m | Speed v2 5- 0 m | Difference v1 – v2 | Result |
|---|---|---|---|---|---|---|
| D. R. | I | 8,13 m/s | 7,69 m/s | 8,80 m/s | 1,11 m/s | 5,15 m |
| P.B. | II | 7,57 m/s | 7,14 m/s | 8,06 m/s | 0,92 m/s | 4,85 m |
| S.V. | III | 7,14 m/s | 7,35 m/s | 7,90 m/s | 0,55 m/s | 4,80 m |

**Table 3.** Characteristics of poles used by the monitored subjects

| Name | Obtained place | kg | Index of pole hardness (kg) | Index of pole length (m) | Result (m) | Index of specific speed (kg) |
|---|---|---|---|---|---|---|
| D.R. | I | 70 | 82 | 4,65 | 5,15 | 12 |
| P.B. | II | 70 | 80 | 4,60 | 4,85 | 10 |
| S.V. | III | 71 | 80 | 4,60 | 4,80 | 9 |

## Discussions

In terms of speed parameters specific to the athlete ranked first place, he reaches a speed on the last 5 m of the approach run of 8.80 m/s while the nearest competitor ranked second place reaches a specific speed index of 8.06 m/s and the competitor ranked third place fails to pass the threshold of 8 m/s and he gets a specific speed of 7.90 m/s. As it can be seen from the monitored data, the competitor who obtains the best result in the competition and the national champion in pole vault jumping, senior category in 2014, also obtains the highest value of specific speed parameters.

The same situation is also found when analyse the characteristics of the poles used by the three monitored subjects from the viewpoint of grip height and hardness index of the pole in relation to the own weight. The competitor ranked first place uses a pole with a hardness index of 82 kg compared to own weight of 70 kg and a grip of 4.65 m. The index of specific strength is of 12 kg. Index of specific strength on the other two athletes is 10 kg, respectively 9 kg.

## Conclusions

From the results acquired following to the monitoring of the three subjects who obtained the most valuable results in the athletics championship final of pole vault jumping we could conclude that the subject D.R. ranked first place and who achieved a result of 5.15 m has the best indexes of specific speed and specific strength indexes of in the perspective of pole hardness used in relation to his own weight. The competitor ranked second place has the values of these monitored indexes lower than the competitor ranked first place.

The competitor ranked third place obtained the worst results in terms of both specific speed and in terms of specific strength index, all these with direct influence on the final outcome in the track. In order to obtain some better results in the track each of the three monitored competitors should on the one hand to improve the motion speed, particularly the speed on the last part of the approach run, this bringing, on one hand the possibility of using some poles with a greater hardness index and on the other hand, the use of higher grips with positive consequences on the final pole vault jumping test.

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# SPORTS NUTRITION PRINCIPLES IN TRAINING STAGES

**ANIELA BRÎNDUŞA RUSU[1*], MARIUS ADRIAN RUSU[2], OANA ORBAN[1], MIHAI ORBAN[1]**

**ABSTRACT.** In maintaining good health and sports performance, nutrition plays an important role. Rational diet allows optimal development of athletes, helping them to achieve desired performance. Such a diet should be set according to metabolic processes in various sports branches and is determined by the particularities of substance exchange and the intensity of physical effort. Athletes' diets must be sufficient, in terms of quality and quantity, and compensate for energy and plastic loss of the body. They must provide an intake of calories that will cover the energy consumed by daily sporting activities, both in training and in competitions. A series of recommendations are meant to assist performance athletes with regard to their everyday diet, intake of liquids, and correct distribution and configuration of meals, depending on training or competition. To support performance sport and guide athletes towards a healthy lifestyle, to achieve exceptional results, a series of general valid directions are proposed for a balanced in the life of a performer.

***Keywords****: sports performance, nutrition, health, exercise*

**REZUMAT.** ***Principiile nutriției sportive în etapele de antrenament.*** În menţinerea sănătăţii şi a performanţei sportive, nutriția are un rol foarte important. Alimentația rațională permite dezvoltarea optimă a sportivilor, ajutându-i în obținerea performantelor dorite. Aceasta trebuie să fie stabilită în funcție de procesele metabolice în diferitele ramuri sportive și este determinată de particularitățile schimbului de substanțe și intensitatea efortului fizic. Alimentația sportivilor trebuie să fie calitativă și suficient cantitativă, pentru a putea să compenseze pierderile energetice și plastice ale organismului. Nutriția sportivilor trebuie să le furnizeze un aport de calorii în măsură să acopere consumul energetic legat de activitatea sportivă zilnică, atât la antrenament cât și în competiții. Pentru a veni în ajutorul sportivilor de performantă se vor întâlni o serie de recomandări privind compoziția dietei zilnice, consumului de lichide, repartizarea corectă și alcătuirea meselor în funcție de antrenament sau competiție. În scopul de a sprijini sportul de performanţă şi a orienta sportivii către un stil de viată sănătos, pentru obținerea unor rezultate deosebite, sunt propuse o serie de direcții orientative cu caracter general valabil pentru o alimentație echilibrată în viaţa unui performer.

***Cuvinte-cheie****: sport, performanţă, alimentație, sănătate, exercițiu fizic*

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## Introduction

The principles of eating healthily are also found in the nutritional recommendations issued for performance athletes. In their case, it is necessary to resort to specific caloric and nutritional adaptations, depending on several criteria which refer to the type of sport practised, age, stage, duration and manner of conducting physical effort. Athletes' diets should meet the following conditions (Zamora & Crăciun, 1999), thus covering:

- Energy consumption of basal metabolism
- Additional energy need due to everyday life
- The energy need imposed by consumption during training and competitions, as well as the one stemming from the recovery processes after effort
- Unforeseen energy consumption (special conditions related to environment, disease, stress)
- The protection of athletes from potentially avoidable illness

The nutritional intake in athletes ' diets differs depending on:

- Training
- Competition
- Recovery

With regard to the nutritional need for conservation, one opts for the formula which takes into account the quantity and quality of the effort spent during practice (length, intensity, complexity), the presumptive energy consumption (evaluated as kcal/hour of effort), along with the other aforementioned activities. It is obvious that all decisions regarding nutritional recommendations must take into consideration environmental conditions (temperature, humidity, wind, altitude). Another way of calculating nutritional need, starting from theoretical data, accounts for about 60-70 kcal/kg of body mass, depending on sport, gender, physical effort, duration and environmental factors (Drăgan, 1989).

When establishing the necessary number of calories, one has to consider basal metabolism, the specific dynamic action of food, the energy necessary for thermoregulation, energy loss resulting from food preparation, and most of all, energy metabolism upon effort (Drăgan, 1989/ 2002; Avramescu, 2010).

The latter represents the energy spent during physical activity and is, first and foremost, the result of the amount and nature of muscle activity. An increase in effort metabolism depends on the intensity of physical effort, the level of training and the conditions provided by the environment. The metabolism of physical effort is defined by specific changes depending on the nature of the effort spent in various sports branches, along with intensity, duration and weather conditions. Sport effort firstly refers to muscle activity, which is why muscle metabolism needs to be adapted to the actual needs of the body (Rusu, 2011).

The speciality literature informs us as to the energy spent in various types of sport effort. Thus, in a 100-metre run, one estimates a caloric consumption of 35 kcal; for 400 m ~ 100 kcal; for 800 m ~ 130 kcal; for 1500 m ~ 170 kcal; for 3000 m ~ 230 kcal; for 5000 m ~ 450 kcal; for 10,000 m ~ 750 kcal; for a 5 km march ~ 250 kcal; for a marathon ~ 2,500 kcal; for speed skating 500 m ~ 45 kcal; for rowing ~ 10 kcal/min; for football ~ 1,500 kcal/match; for basketball ~ 900 kcal/match; for volleyball ~ 10 kcal/min match; for wrestling ~ 8,5-9,5 kcal; for a boxing match (3x3 minutes) ~ 200 kcal. The Ministry of Health has set several norms regarding caloric intake, depending on the nature and intensity of professional effort, as follows: for light physical activities 75-100 kcal/hour; for medium physical activities ~ 100-300 kcal/hour (Drăgan, 1994/2002).

**The structure of diets for performance athletes**

The correct diet of athletes must respect an optimal ratio between proteins, carbohydrates and fats, specific to each sport, depending on the nature of the effort spent (Drăgan, 2002; Antonio,2001; Stout,2001). In general, this ratio should be 55-60% carbohydrates, 25-28% fats and 14-18% proteins. For athletes engaging in intense physical activities, it is necessary to have an intake of proteins amounting to 1,5-1,8 g/kg body mass/24 hours, which can increase, in the case of sports branches where force is predominant and considerable development of muscle mass is required (weightlifting, wrestling) to 2,3-2,5 g/kg body mass/24 hours.

The above-mentioned recommendations lie at the basis of the research conducted by specialists, who recommend extra carbohydrates prior to and during effort, to gain better endurance, while after effort this is advisable to replenish glycogen levels (Spagnoli, 2004). Other sources reveal that the protein intake should be of 12-25%/24 hours (Zamora & Crăciun, 1999). From the total proteins ingested, 60% should be of animal origin and 40% of plant origin. In athletes, protein needs are greater that in untrained adults and depend on the nature and intensity of the effort spent, as well as the preparation time and weather conditions in which the physical activity is conducted (Phillips & Van Loon, 2011). For an athlete weighing an average of 70 kg, the approximate amount of proteins is 160-180 g/day. The following is recommended for athletes who train on a daily basis:

- Proteins with high biological value
- To consume an appropriate amount of proteins, albeit not an excessive one
- To avoid protein sources that are rich in saturated fatty acids: red meat, minced meat, sausages.

In the period of intensive training and after, it is recommended to use a complex mix of amino acids: glycine, arginine, glutamine, serine, taurine, methionine and cysteine, and essential amino acids with ramified chains: valine, leucine and isoleucine. These

are very important for stimulating muscle recovery after intensive effort and for reducing post-effort fatigue (Potgieter, 2013).

An athlete's need for fats depends on age, profession and sports branch practised. An intake of 1,5 g/kg body mass/24 hours is recommended, while for athletes conducting activities in a low-temperature environment, the need for fats is greater: 2-2,3 g/kg body mass/24 hours. Fats must account for 25-30% of the total calories in performance athletes' daily food supply and should be divided qualitatively as follows: 70% of animal origin and 30% of plant origin (Debuigne, 1989). The tendency to remove fats from diets is unjustified and even harmful to performance. This potential diet profile is marked by the difficulty to increase the intake of proteins and carbohydrates during intense training, which could provide sufficient energy so as to maintain an optimal weight and muscle mass. A hypolipidemic diet may cause a relative state of malnutrition due to the absence of essential fatty acids (linoleic acid), as well as of liposoluble vitamins (Kreider & Wilborn,et. 2010).

Carbohydrates should account for at least 55% of the daily energy intake. A significant increase is recommended, up to 70% of the total number of calories, due to the need to promote, facilitate and ensure the glycogen supply. In short-term effort, with maximum intensity (sprint, throw, weightlifting), it is not necessary to have an additional dose of carbohydrates, either before, or during the competition, given that such efforts rely on the energy released by ATP and phosphocreatine, without the participation of carbohydrates. In efforts lasting between 10 seconds and 30 minutes, the higher the intensity, the greater the consumption of carbohydrates per time unit. For example: anaerobic efforts lasting between 10 and 60 seconds: 200-400-metre races, mixed efforts of great intensity lasting between 1 and 3 minutes: 400 or 1500-metre races, some stages of various matches, almost entirely anaerobic efforts, of average intensity and lasting 3-30 minutes: some trials in athletics, swimming, rowing, cycling, skiing, skating.

The consumption of glycogen reaches 150-200 g, far less than the one stored within the body (500 g). Hence, there is no need for a glycogen supplement prior to the competition, but one must make sure that the amount of glycogen stored in the muscles and liver is increased through specialised training, as well as an optimal diet. In the case of efforts lasting more than 30 minutes and of low intensity (marathon, skiing, cycling, football, volleyball, lawn tennis), there is a need for a larger amount of energy, which cannot be provided by the glycogen available inside the body. In such efforts, the intake of carbohydrates is quite useful and has important effects in achieving performance (Simu, Roman & Szilagy, 2000).

Vitamins and minerals are the first options of energotropic medication, for well-grounded reasons. Being first on the list of recovery substances (trophotropic). The explanation regarding their presence in this category of pharmaceuticals is that, on the one hand, they are consumed excessively due to physical effort, depleting

their supply, and on the other hand, they are eliminated through excessive sweating, also as a consequence of physical effort (Drăgan, 1989; Ionescu & Anton, 2004).

Vitamins are essential substances for the body and their presence relies almost entirely on exogenous sources (Powers&Nelson, 2011). Vitamin $B_1$ is necessary in the amount of 0,5-0,7 mg per 1000 kcal, vitamin $B_2$ 0,6-0,8 mg/1000kcal, vitamin $B_6$ 1 mg/1000kcal, and vitamin $B_{12}$ of 50γ. In athletes wishing to increase their muscle mass, 150-200γ are recommended per day, along with a rich protein diet. The daily intake of vitamin C is 20-25 mg/1000kcal. During physical activity, the need for vitamin C increases to 150-200 mg/day, while during competitions, it does so to 300-400 mg/day. The vitamin D intake is 400 UI (1.5 mg).

In athletes, the need for vitamin E is 50-70 mg/day, which during training increases to 90-120 mg/day, and during competitions up to 150-200 mg/day. The daily need for minerals, overall, in mg, for every 1000 kcal, is: iron 5 mg, calcium 300 mg, magnesium 200 mg, phosphorus 500 mg, sodium 1500mg and potassium 1000mg (Zamora & Crăciun, 1999; Facts About Dietary Supplements, 2001).

## Specific aspects of diets in various effort periods

### Training diet

There are two maintenance diets: one which aims to increase energy supplies and another whose purpose is muscle mass growth. The diet for increasing the body's energy supplies relies on an increase in muscle and hepatic glycogen reserves. It is useful to athletes practising endurance effort. The following process occurs: during the week prior to competing, on days 7, 6, 5, 4 before the trial, high-intensity and long-lasting training is pursued. In this period, the intake of carbohydrates is decreased to 45-50% (carbohydrate depletion).

On days 3, 2, 1, trainings shall have a high intensity, but a medium duration. The intake of carbohydrates shall increase to 70% (carbohydrate oversaturation). Muscle and hepatic glycogen levels increase, for 100 g of active tissue, 2,3-2,6 times compared to initial values. The protein intake is aimed at increasing muscle mass and strength. It is boosted to 4g/kg body mass per day. (Zamora & Crăciun, 1999; Damian, 2011; Muraru, 2004 )

### Competition diet

This does not constitute a source of energy for the body. It mostly plays a psychological role. It is expected to be pleasant, in terms of aspect and taste, avoid hunger sensation and leave the stomach in 2 and a half - 3 hours (Zamora & Crăciun, 1999; Damian, 2011; Muraru, 2004).

### Post-effort recovery diet

It must be: hypocaloric, hyperhydric, hyperglucidic, rich in alkaline radicals (to counteract the effort-induced acidosis) and rich in minerals and vitamins (to compensate for effort-induced losses and excessive consumption) (Drăgan, 1989, 2002; Avramescu, 2010).

### Conclusions

Sports performance is the result of a few combined factors, such as genetic potential, training, sleep, high-performance equipment, emotional involvement and, most importantly, nutrition. An athlete's diet greatly influences their performance. It is recommended that an athlete, given the possibilities, should consider the fact that their diet plays a major role in their life as a performer and it must be customized depending on the stages of preparation and the type of effort.

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