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## PERFORMANCE ALTERATIONS OF MAN HAMMER THROWING BETWEEN 1980-2011

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**ABSTRACT.** This study is observing the changes in the performance of male hammer throwers from 1980 to 2011. In order to explore these alterations, the performance of certain throwers (placing 1st, 5th, and 10th) in the world ranking list and the average result of the top ten were analysed. The factors directly influencing changes in the performance of hammer throwers were also investigated. In the 1980s the increase in the performance of hammer throwers was followed by a sharp decline. This is true for the athletes occupying different positions in the world ranking list, and for the average of the top ten throwers as well. According to our investigations and observations, performances increased in the second half of the 1990s, and after the turn of the 20th. century, a newer, well-documented increase can be observed, although this does not reach the peak level of 1988. It is a pity that the trends show a slight decrease in the second half of the decade, dropping to the averages experienced at the beginning of the 1980s. Without going into an in-depth analysis of the technical innovations of the 1980s, some important things have to be emphasised (in case of right handed thrower): the effort to increase the radius of the hammer's trajectory with the „counterweight” technique; the proportion of the two-leg support in turn was increased, with the help of a delayed „lifting off” and the early planting of the right leg; the thrower does not aim to precede the movement of the hammer and does not move ahead of the hammer, as could be seen in previous techniques. Instead of, he drives the hammer with his whole body; the lifting work of the legs plays a determining role in the two-leg support phase during the acceleration of the hammer. We think, besides these technical innovations, another important factor related to improving results are conditioning abilities; the development of the maximum and speed strength to a very high level in harmony with technical elements.

**Key words:** hammer throw, changes in performance, technical innovations, conditioning abilities, world record

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## Introduction

The world record in male hammer throw (86.47m by J. Sedih in 1986) “survived” its 25<sup>th</sup> anniversary in August 2011, and this is the second-oldest world record in track and field apart from discus throw (that is still valid).

In modern track and field, the phenomenon of an intact record lasting for more than 25 years is rare indeed. It is an interesting coincidence that the hammer throw had already achieved the title of “longest world record” in the first part of the 20<sup>th</sup> century. In the years following the turn of the century, the world record of this dynamically developing event brought the sixty metres within reach (57.77m in 1913 by P. Ryan). But 25 years had to pass to improve upon this performance (59.00m in 1938 by E. Blask), and another fourteen years passed before the sixty metre mark was reached (60.34 in 1952 by Csermák J.). Therefore, it can be said that until the German Blask’s setting of the world record broke the first long period of stagnation, the improvement in results was very poor until the beginning of the 1950s.

The following 35-year long period, lasting until the end of the 1980s, is the one of a very fast and steep increase in performance. After the world record of Sedih, specialists were optimistic about opportunities for further favourable development in the second half of the 1980s, and they even found the limit of ninety metres to be surpassable (Bartonietz et al., 1988). Today it is known that this optimism was unfounded, and the expected development was replaced by a decline and a long stagnation period. Some specialists had already recognised this decline in the 1990s (Dickwach and Scheibe, 1993; Kovács, 1997), while others considered the stoppage temporary, and predicted outstanding development in the years following the millennium (Dick, 1997).

The concept of development replacing the temporary stagnation was only partly proven as a result of the Belorussian hammer throwers in the first years after the millennium that was followed by another decline. It seems certain that this ancient throwing event, showing a very special type of development in performance considering present conditions, has ended up in a permanent state of stagnation.

A longer stagnation period following an outstanding prominent performance increase generally raises questions as to the limits of human performance. Why can’t the world record be broken? Is it the efficiency limit of human performance? This is obviously not true, as several other world records – thought to be unsurpassable – have been broken and proved the term “unbreakable record” invalid. At the same time it can be also seen that each extreme performance improvement brings us nearer to the final utilisation of human performance capability, narrowing the possibility of further improvement in performance.

The answers for the following questions are raised in this paper:

- What was the 'secret' of the 1980s?
- What factors triggered the outstanding performance improvement?
- Is it only the world record that cannot be surpassed? Or will the averages stagnate or show some improvement?
- How can the stoppage in improved performance be explained?
- Can there be an improvement in the average performance expected in the second decade of the 21<sup>st</sup> century towards approaching the ninety-metre mark, as was expected in the 1980s?

These are questions of public interest, which accounts for this in-depth analysis of an outstanding period of hammer throwing and a presentation of the trends occurring in the changes in performance related to it in the first decade of the 21<sup>st</sup> century.

## **Material and Methods**

In order to answer the question suggested in the Introduction, data collection and analysis were conducted as follows:

- The hammer throw results of the examined period (1980-2011) were collected based on annual rankings. Data collection extended to the first through tenth (1-10) positions and to the results of athletes ranked in 1<sup>st</sup>, 5<sup>th</sup> and 10<sup>th</sup> places.
- The basic statistical characteristics (average, dispersion, average mistake, maximum and minimum values) of the obtained data were determined
- The average annual results of the top ten ranked athletes.
- The fluctuation in performance was graphically depicted to provide a better overview of the changes.
- The difference between the maximum and minimum and the average results were compared.
- The size and direction of the changes in performance were compared based on a standardised evaluation scale which was compiled with the help of the actual world ranking list of the all-time fifty best performances.
- The factors (changes in the rules, movement technique, training methods, competitions) directly influencing the changes were analysed on the basis of Hungarian and international literature.

## **Result**

The presentation and evaluation of changes in the performance of elite hammer throwers are fundamentally based on the average results of the top ten athletes according to annual world ranking lists. The annual changes in

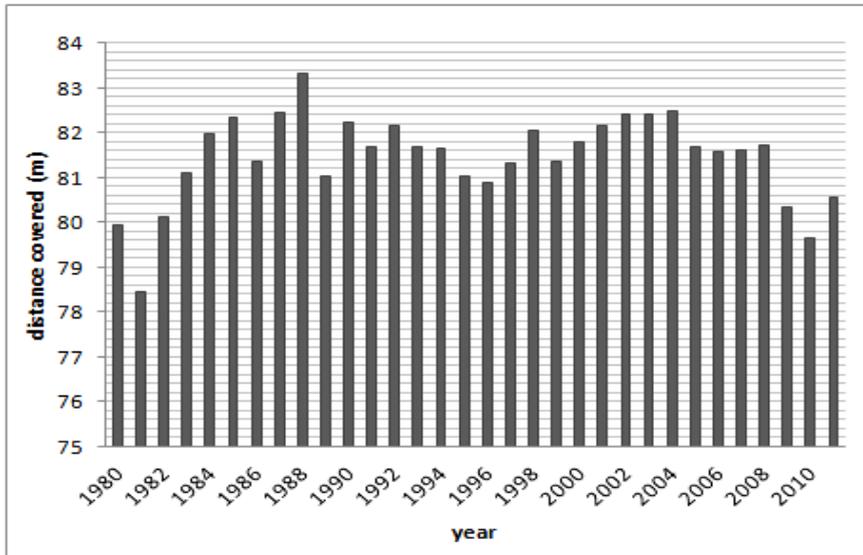
average performance are presented in the bar chart (Figure 1). Beside the graphical presentation, the examined basic statistical features are presented in tables (Table 1).

**Table 1.** Basic statistical values based on the performance of the top ten athletes on the annual world ranking list ( $\bar{x}$  = average,  $s$  = dispersion,  $s_{\bar{x}}$  = average fault)

<b>year</b>	<b>1980</b>	<b>1981</b>	<b>1982</b>	<b>1983</b>	<b>1984</b>	<b>1985</b>	<b>1986</b>	<b>1987</b>	<b>1988</b>	<b>1989</b>
$\bar{x}$	79,95	78,44	80,12	81,09	81,98	82,35	81,37	82,45	83,34	81,04
$s$	1,36	1,33	2,26	1,38	2,11	1,34	2,22	0,80	1,16	1,28
$s_{\bar{x}}$	0,43	0,42	0,72	0,44	0,67	0,42	0,70	0,25	0,37	0,41
<b>max.</b>	81,80	80,56	83,98	84,14	86,34	84,08	86,74	83,48	85,14	82,84
<b>min.</b>	77,96	76,84	77,92	80,00	80,50	80,20	80,68	80,74	81,88	79,38
<hr/>										
<b>year</b>	<b>1990</b>	<b>1991</b>	<b>1992</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>
$\bar{x}$	82,25	81,69	82,17	81,68	81,66	81,02	80,88	81,32	82,06	81,37
$s$	1,37	1,26	1,22	0,73	1,08	1,33	1,01	1,48	1,11	0,79
$s_{\bar{x}}$	0,45	0,40	0,39	0,23	0,34	0,42	0,32	0,47	0,35	0,25
<b>max.</b>	84,48	84,26	84,62	82,78	83,36	83,10	82,52	83,04	83,68	82,78
<b>min.</b>	80,90	80,56	80,46	80,80	80,22	79,66	79,52	79,14	80,88	80,51
<hr/>										
<b>year</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
$\bar{x}$	81,81	82,16	82,41	82,40	82,49	81,68	81,56	81,62	81,72	80,33
$s$	0,41	1,04	0,67	1,48	1,18	2,26	0,82	1,22	1,12	0,99
$s_{\bar{x}}$	0,13	0,33	0,21	0,47	0,37	0,72	0,26	0,39	0,35	0,31
<b>max.</b>	82,58	83,47	83,43	84,86	84,46	86,73	82,95	83,63	84,51	82,58
<b>min.</b>	81,36	80,88	81,59	80,89	80,90	80,00	80,54	80,00	80,45	79,48
<hr/>										
<b>year</b>	<b>2010</b>	<b>2011</b>								
$\bar{x}$	79,65	80,54								
$s$	0,81	0,88								
$s_{\bar{x}}$	0,26	0,28								
<b>max.</b>	80,99	81,89								
<b>min.</b>	78,73	79,04								

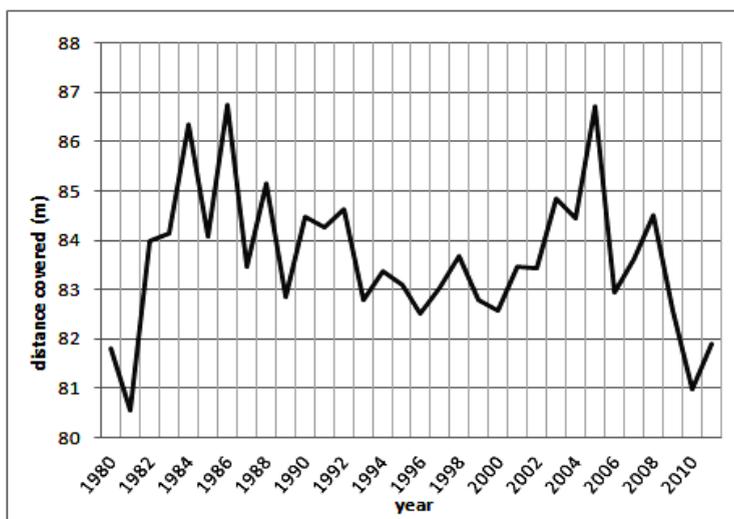
The results show that the average of the top ten athletes significantly improved until 1988, except for the years following the Olympic Games (1980  $\bar{x}$  =79.95m, 1988  $\bar{x}$  =83.34m). The very narrow range of elites analysed can

be considered as a very massive, homogeneous sample. The greatest dispersion hardly surpasses two metres ( $s=2.26\text{m}$  1982, 2005), and the smallest one does not even reach 0.5m ( $s=0.41$ ). After the 1988 peak, a fluctuation in the performances can be observed with a definite declining trend, the deepest point of which is year 1996 ( $\bar{x}=80.88\text{m}$ ) (Figure 1). After a period of improvement (the years preceding and following the millennium), the trend begins a descent, reaching its deepest point under 80m ( $\bar{x}=79.66\text{m}$ ) in 2010. A period worse than this one, could be observed 30 years ago (1981  $\bar{x}=78.44\text{m}$ ).



**Figure 1.** Average results of the top ten throwers on the world ranking list in hammer throw (1980-2011)

The annual changes in the performance of the first athletes in the ranking list show a very interesting picture (Figure 2). The outstanding level (over 84m) was already reached in 1983 by the first person on the list (Litvinov, 84.14m). This high level was always reached by the best athletes until the beginning of the 1990s, with the exception of two athletes. In two cases, results better than 86m (in 1984, 86.34m, and in 1986, 86.74m by Jurij Sedih) were necessary to be the best on the ranking list. Figure 2 well describes that a much poorer result was enough to be the best on the list between the beginning of the 1990s and 2003. An improvement could be observed from 2003 that reached its peak in 2005 (Tyihon reached 86.73m in that year), which was followed by another decline.

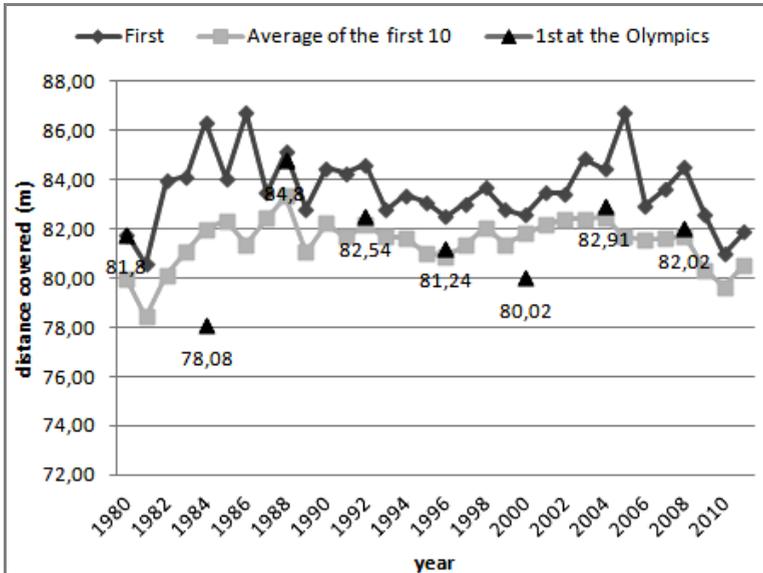


**Figure 2.** Results of the first athletes on the world ranking list (1980-2011)

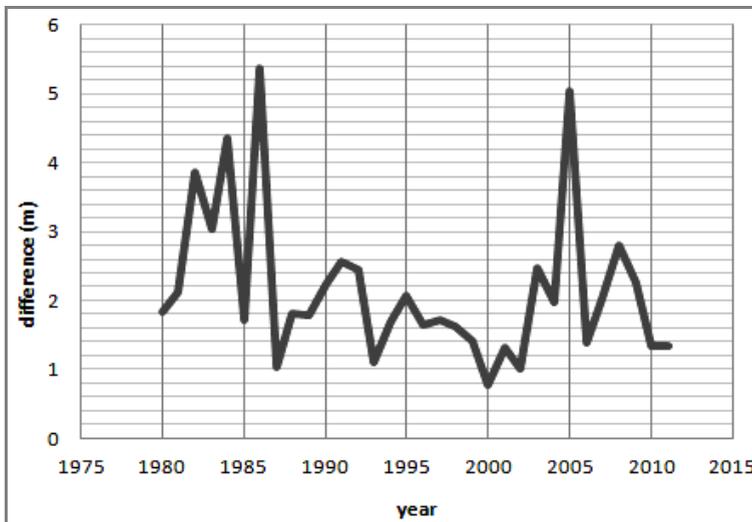
The differences between the first on the ranking list and the average performances might be interesting, in addition to their relation to the results necessary to win an Olympic medal (Figure 3). It shows that the curves of the graph get nearer to each other both in the decline and in stagnation periods. This means that the difference between the best on the ranking list and the average result is decreasing in this period (maximum distance 5.37 in 1986, minimum distance is 0.77 in 2000). A new greater increase in distance between the curves can be observed in 2005, which can be attributed to the extremely huge throw of Tyihon, approaching the world record by 1 cm (Figure 4). (Olympic Games were held during the examined period, so it is not irrelevant to study what the relation is between the winning results and the averages of that year.)

The differences between the first on the ranking list and the average performances might be interesting, in addition to their relation to the results necessary to win an Olympic medal (Figure 3). It shows that the curves of the graph get nearer to each other both in the decline and in stagnation periods. This means that the difference between the best on the ranking list and the average result is decreasing in this period (maximum distance 5.37 in 1986, minimum distance is 0.77 in 2000). A new greater increase in distance between the curves can be observed in 2005, which can be attributed to the extremely huge throw of Tyihon, approaching the world record by 1 cm (Figure 4). (Olympic Games were held during the examined period, so it is not irrelevant to study what the relation is between the winning results and the averages of that year.) Meanwhile, the results at the Olympic Games in the 1980s – except for the boycotted Olympic Games in 1984 – and the results of the winners coincided with those of the best on the top list, surpassing the average best ten throws. At the same time, the

winners' results approached the average of the top ten for the first time since 1992 (the difference was less than 0.5m) (Figure 4). There was only one exception: the winning throw at the 2000 Olympic Games, which, curiously enough, remained well below the average of the best ten throws.

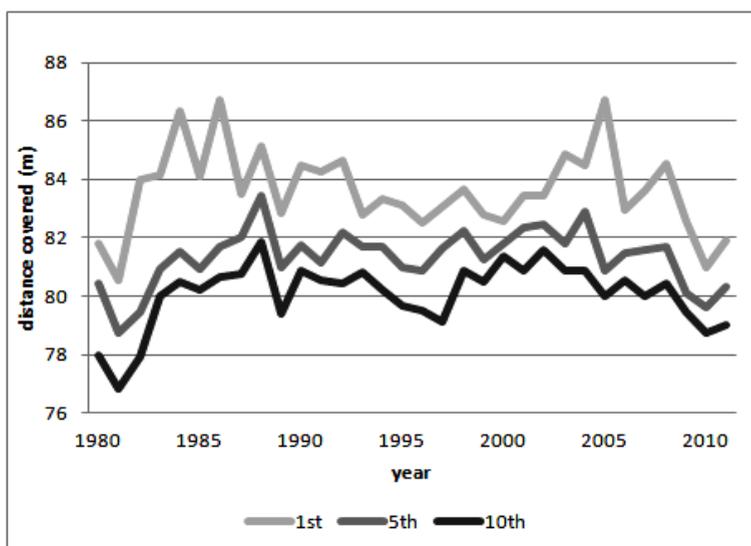


**Figure 3.** Performance of the first and of the top ten athletes on the ranking list (1980-2011)



**Figure 4.** Differences between the performance of the first and of the top ten athletes on the ranking list (1980-2011)

The annual changes of the best first-, fifth-, and tenth-ranked throws and the difference between them can be seen in Figure 5. Although the curves in this figure show great similarities as far as the path of the curves are concerned, the ones representing the 5<sup>th</sup> and 10<sup>th</sup> throws (since the beginning of the 1990s) get nearer to the curve of the best athlete on the ranking list. This hints as to the clustering of the performances, meaning that the results of the best and other top athletes became more similar, mainly as a result of the performances of the world ranking list leaders. This confirms the phenomenon presented in Figure 3.



**Figure 5.** Performance of the 1<sup>st</sup>, 5<sup>th</sup> and 10<sup>th</sup> athlete on the ranking list (1980-2011)

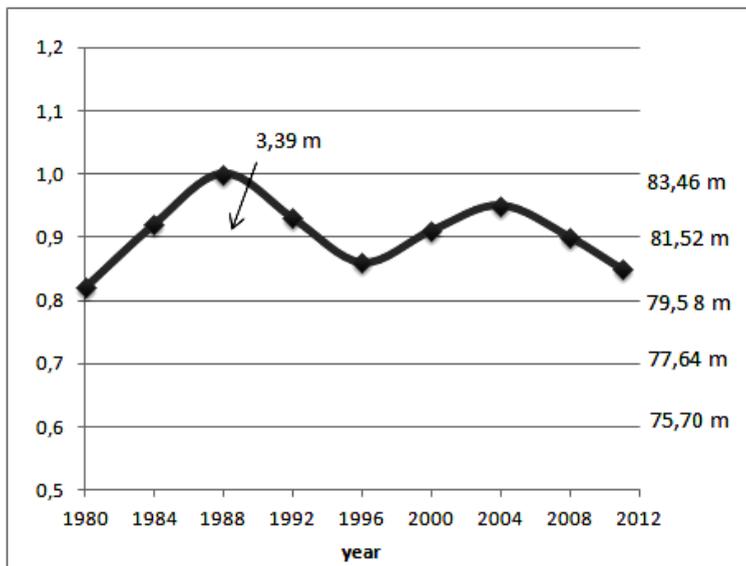
The changes in the size and direction of the hammer throws were also compared between the period 1980-2011 and the one preceding and partly overlapping it (1965-1991). In order to do this, the process of Dickwach and Scheibe based on standardized values were also applied. It means that the actual world ranking list of the fifty best all-time performances provides a good and reliable basis for determining the standardized values in hammer throw.

Standard values can be created if a determined (given) number of the all-time actual world ranking list performances (11=83.46m; 45=81.52m) are converted to the well-known 0-1 standard scale. The 1.0 value of the scale equals the performance of the eleventh-ranked result, while its 0.9 value equals the performance of the 45<sup>th</sup> place (ranked) result. Through this the other values of the 0-1 scale can be also determined, which are shown in Table 2.

**Table 2.** Standard values of hammer throwers based on the 1991 and 2011 all-time best world ranking lists

Standard value	1, 1	1, 0	0, 9	0, 8	0, 7	0, 6	0, 5
Performances (m) /2011/	85,40	83,46	81,52	79,58	77,64	75,70	73,76
Performances (m) /1991/	84,88	82,39	79,90	77,41	74,92	72,42	69,93

If the average top ten result in the first year of the examined period (1980  $\bar{x}$  =79,95m) and the performance of the year representing the maximum average result (1988  $\bar{x}$  =83,34m) are converted to the standardised value, then the difference between the two provides a comparable, standardised value of improvement. The value of the first year is 0.82, and that of the peak year is 1.0; thus, the rate of development from 1980 to 1988 is 0.18 in relation to the 2011 all-time world ranking list. The decline from the peak up to present day shows a similar order: 0.16. Thus, the male hammer throw in 2011 differs only slightly from the first year of the examined period as far as performances are concerned (Figure 6).



**Figure 6.** Standard values

## Discussion

The results support the unambiguous, dynamic improvement in hammer throw in the first quarter of the examined period, in the beginning of the 1980s. The development can be traced not only with regard to the world records and leaders of the ranking lists, but in the average of the top ten results of the annual lists as well.

Sedih's outstanding world record was followed two years later by the peak of the average of the ten best results (1988  $\bar{x}$  = 83,34m). This average has not yet been surpassed. That is why the analysers look at it as the reference value for measuring development. Dickwach and Scheibe related the size of the development between 1965 and 1991 to this value in such a way that the difference between the average value of the ten best results in 1965 ( $\bar{x}$  = 69.27m) and the average peak value of 1988 ( $\bar{x}$  = 83.34m) were converted to the standardised value scale, determined with the help of the actual (1991) all-time best ranking list. The received value (0.56) is very high. Only the development in the results in the pole vault can surpass it (0.62). It shows that the intensive improvement of the results in hammer throw started in the middle of the 1960s and continued for 23 years. Thus, only a small portion (eight years) of the examined period can be related to the period of intensive development. During this relatively short period, the average of the first year (1980  $\bar{x}$  = 79.95m) improved only by 3.39m up to the average of the peak year (1988  $\bar{x}$  = 83.34m), with a value of which give 0.18, it was transformed it into the standardised value. This value represents about one-third of the development in the total period (1965-1991). This result shows that the time span between 1980 and 1989 was a remarkable period of development in the hammer throw, but the intensive performance development started much earlier, in the middle of the 1960s, and remained on that level until the end of the 1980s without decreasing.

It is certain that a significant decline can be observed after 1988. This phenomenon can be observed not only in the hammer throw, but in all throwing events, with the exception of both men's and women's javelin throw.

There is no doubt that the Ben Johnson doping scandal also added to the stoppage in development, resulting in the introduction of much more serious doping control.

According to our investigations, performances increased in the second half of the 1990s, and after the turn of the century, a newer, well-documented increase can be observed, although this does not reach the peak level of 1988.

It is a pity that the trends show a slight decrease in the second half of the decade, dropping to the averages experienced at the beginning of the 1980s.

Regarding the improvement of the averages at the turn of the century, the appearance of throwers such as the Japanese Murofushi (84.86m in 2003), the Hungarian Annus (84.19m in 2003) and the Belarusian throwers Tyihon

and Gyevjatovszkij certainly played great roles. Knowing all that happened in Beijing, strong doubts have come to light among specialists (professionals) as far as the clearance of performances are concerned.

In the Introduction several questions were formulated. The main question concentrated on the factors resulting in changes in performance.

It could be seen that the increase in the performance at the beginning of the 1980s was the continuation of a dynamic development, which began in the 1960s. The determining factor of this very intense development of two decades was the foundation of the Soviet throwing school.

The school was the result of a long process. Its start can be connected to the first appearance of Soviet athletes at the Olympic Games (Helsinki 1952). The opportunity to appear at the Olympic Games urged the Soviet coaches and throwers to develop. Results came quickly: the Soviet throwers soon won silver (Krivonosov, 63.19m) and bronze (Samocetov 62.56m) medals at the next Olympic Games. Samocetov, based on his excellent practical experience developed the most important theoretical technical requirements as well. The technical requirements he described soon appeared in the movements of Klim and Bondarchuk, and then later in those of Sedih and Litvinov (with a little modification).

Perfecting movement techniques, the formation of techniques matching the laws of biomechanics, have always been important factors in improving track and field performances. It is worth looking at the fact that the breaking of Ryan's world record, which had lasted for 25 years, could be attributed to the new technical invention worked out by the German thrower Sepp Christmann: the rolling heel-sole pivot. A similar determining factor was (among others) the technical innovation, lasting even to today, of the aforementioned Soviet throwing school.

Without going into an in-depth analysis of the technical innovations of the 1980s, some important things have to be stressed:

- The effort to increase the path (trajectory) of the hammer with the 'counter-weight' technique.
- The proportion of the two-leg support in turn, with the help of a delayed 'lifting off' and the early placement of the right foot should be increased.
- The thrower does not aim to precede the movement of the hammer and does not move ahead of the hammer, as could be seen in previous techniques. Instead, they drive the hammer together with the ball with their whole body.
- The lifting work of the legs plays a determining role in the two-leg support phase during the acceleration of the hammer, thus minimising the speed resulting from the twisting of the hip and shoulder.

Besides these technical innovations, another important factor related to improving results are conditioning abilities; the development of the maximum and speed strength to a very high level in harmony with technical modalities. The previously presented technical innovations could not have been realised without the proper level of conditioning background.

The counter technique, the increase of the trajectory-radius of the hammer, the accelerating of the hammer in a longer way, and the lifting during pivoting all demand maximum speed strength in the lower limbs and the intense maximal strength of the whole body and collarbone muscles (Eckschmiedt, 1998).

The perfecting of the technique and the means and methods of specific strengthening should be harmonized. This harmony guarantees a unity of form and content of the movement, securing a stable performance increase (Bondarchuk, 1985). It is certain that this harmony was realized by the Soviet throwers of the 1980s.

Outlining the future trends in hammer throw results is a very difficult task.

A promising and confidence-inspiring fact is that a great percentage of the 50 all-time best hammer throwers ranking list (40% = 20 persons) consist of performances from the 21<sup>st</sup> century, and we can find relatively few athletes from the 1980s in this position (26 % = 13 persons).

At the same time, no one can expect the surpassing of the records (average of top ten throwers, world record, and Olympic record) of the 1980s in the future. It can probably be assumed that the stagnating period experienced in the first decade of the 21<sup>st</sup> century will continue. It is thought that the setting of a new world record will be a great day for hammer throw, which might be realised in the second decade of the 21<sup>st</sup> century.

## Conclusions

We analyzed the changes in the performance of male hammer throwers from 1980 to 2011. In order to explore these changes, the performance of certain throwers (placing 1st, 5th, and 10th) in the ranking list and the average result of the top ten were analysed. Based on the research, it can be stated that in the 1980s the increase in the performance of hammer throwers was followed by a sharp decline. A slight increase can be observed from the second half of the 1990s that turns into a measurable performance increase in the years after the millennium, although the height of the smoothed curve does not reach the average performance peak of 1988.

It is thought that the technical innovations of the Soviet throwing school – having an effect up until present day – had a determining role in the great performance development of the 1980s, and this level has yet to be reached again either on an individual or average result basis.

The changes in performance (decline, stagnation or slight increase) reflect the background events very well. It cannot be disputed that the doping scandal involving Ben Johnson in 1988 significantly contributed to the halting of and reduction in development, which finally resulted in the introduction of more serious doping control.

In the near future, no one can expect the surpassing of the records (average of top ten throwers, world record, and Olympic record) of the 1980s in the future. It can probably be assumed that the stagnating period experienced in the first decade of the 21<sup>st</sup> century will continue. It is thought that the setting of a new world record will be a great day for hammer throw, which might be realised in the second decade of the 21<sup>st</sup> century.

Suggestion how to improve the results in the future: we think, besides the technical innovations, another important factor related to improving results are conditioning abilities; the development of the maximum speed and power to a very high level in harmony with technical elements, using the modern audio techniques with analysed power control.

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## THE INFLUENCE OF HEMP OIL DIETARY SUPPLEMENTATION ON AEROBIC CAPACITY IN RATS TRAINED WITH PROGRESSIVE LOADING

**BULDUȘ CODRUȚA\*, TACHE SIMONA\*\*, MOLDOVAN REMUS\*\***

**ABSTRACT. Background.** Progressive loading is one of the basic principles of training, along with a proper nutrition. Hemp seed oil obtained by cold pressing is a source of polyunsaturated fatty acids omega 3 and omega 6 required for a balanced diet. **Aims.** The study investigated the effects of dietary supplementation with hemp seed oil on aerobic effort capacity in experimental conditions. **Methods.** The research was conducted in two groups (n = 10 animals / group) of male Wistar adult rats. Group I comprised rats trained to exercise with progressive loading, group II included rats trained with progressive loading and supplemented with hemp oil. In both groups aerobic exercise capacity was determined daily for 27 days using the swimming test. **Results.** Compared with control group (I) we found significant increases of the aerobic capacity in the group supplemented with oil (II) throughout the study. **Conclusions.** Our study shows a favorable effect of polyunsaturated fatty acids on aerobic capacity considering progressive loading.

**Key words:** rats, polyunsaturated fatty acids, aerobic capacity, progressive loading.

**REZUMAT. Influența acizilor grași polinesaturați asupra capacității aerebe de efort la șobolani antrenați la efort fizic cu încărcare progresivă. Premize.** Progresia încărcării este unul din principiile de bază ale antrenamentului alături de o nutriție corespunzătoare. Uleiul din semințe de cânepă obținut prin presare la rece constituie o sursă de acizi grași polinesaturați omega 3 și omega 6, necesari unei diete echilibrate. **Obiective.** S-a urmărit experimental efectul suplimentării cu ulei din semințe de cânepă, bogat în acizi grași polinesaturați, asupra capacității aerebe de efort la șobolani antrenați la efort cu încărcare progresivă. **Metode.** Cercetările s-au efectuat pe două loturi (n=10 animale/lot) de șobolani masculi, adulți, rasa Wistar. Lotul I a cuprins șobolani martori antrenați la efort cu intensitate progresivă, lotul II a cuprins șobolani antrenați la efort cu intensitate progresivă și suplimentați cu ulei de cânepă. La ambele loturi s-a determinat capacitatea aerobă de efort zilnic, pe baza probei de înot, timp de 27 de zile. **Rezultate.** Comparativ cu lotul martor (I),

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la lotul suplimentat cu ulei (II) se constată creșteri semnificative ale capacității aerobe de efort pe toată durata studiată. **Concluzii.** Studiul nostru demonstrează efectul favorabil al acizilor grași polinesaturați asupra capacității aerobe de efort în condițiile încărcării progresive.

**Cuvinte cheie:** șobolani, acizi grași polinesaturați, capacitate aerobă, încărcare progresivă.

## Background

Progress in sports performance, increased number of athletes capable of outstanding performance, motivation to practice sports, especially for performance and scientific training, methodical, systematic to optimize adaptation and optimum performance are based on a specific methodology.

Training is the most efficient way to achieve performance in sport. Principles to be followed are: active participation of athletes, specializing according to age, individualization of effort, planning by level of tolerance, individualized training according to age and gender, diversity training, progressive modeling of the athlete and progressive loading (Bompa 2002).

To improve performance, the training load should be increased gradually. Improvement of training requires time and adaptation of the body.

Principle of progressive loading is essential in the planning of training and considers the number of training sessions per week, number of hours per week, amount of technical required / free exercises or distance covered and number of intensive training sessions per week (Bompa 2002).

Four methods are used in practice for loading: standard loading (e.g. team sports); short-term overload (e.g. bodybuilding); loading in stages (e.g. wrestling, endurance sports); loading in plateau (e.g. for advanced athletes).

Among these methods, loading in stages is considered the most appropriate to the physiological and psychological requirements for planning.

Our previous experimental results (Bulduș et. al. 2012), regarding the increase of aerobic capacity by standard loading (10%, 15% and 20% of animal weight) and significant increase in aerobic capacity after supplementation with hemp oil and standard charge, led us to study the effect of progressive loading in three steps (10%, 15% and 20% of animal weight) on exercise capacity in animals supplemented with hemp oil.

## Aims

The study investigates the effect of dietary supplementation with PUFA on aerobic exercise capacity in rats trained with progressive loading.

## Materials and methods

The study is a prospective longitudinal study of experimental type, performed on animals.

The research was conducted at the Department of Physiology and Pharmacy "Iuliu Hațieganu", Cluj-Napoca, in the Laboratory of Experimental Physiology, on two groups (n = 10 animals / group) of adult male Wistar rats, with the average weight of 200 - 300 g.

PUFA supplementation was made by oropharyngeal gavage using hemp seed oil in amounts of 0.1 ml per rat, dose calculated in relation to oil ratio recommended to human daily intake. The hemp oil product used, called Canah Hemp Oil, is manufactured by SC Canah International LLC and has the following characteristics of 14 g per serving: energy value: 126 Kcal/14g and chemical composition: 1.4 g saturated AG, PUFA 12.5 g of which 1.7 g oleic acid, linoleic acid 7.7 g, acid gamma-linolenic acid a, 5 g,  $\alpha$  linoleic acid 2.5 g, 0.1 g stearidonic acid, vitamin E 1.35 mg (13.5% RDA).

### a) Groups

The two groups were as follows: group I was control group and comprised rats trained with progressive loading and no supplementation. Group II comprised rats trained with progressive loading and supplementation with hemp seed oil.

### b) Aerobic exercise capacity

Aerobic exercise capacity was determined by the swimming test in thermostatic water at 20-22 ° C, daily for 27 days. Indicator of aerobic capacity was the elapsed time in seconds since the introduction of animals into the pool until exhausted. The animals were trained daily for 27 days. The intensity of effort was modified by loading animals as follows: days1-7 of training without load then, the load was 10% during days 8-14, 15% during days 25-21 and 20% during days 21-27.

Moments chosen for analysis were day1 (T1), day 5 (T5), day 9 (T9), day 15 (T15), day 18 (T18), day 23 (T23), day 27 (T27).

c) Statistical calculations were performed with Microsoft Excel and SPSS 13.0 (demo versions). Statistical study was performed using Kolmogorov-Smirnov test, based on which, it was decided the application of t-test (Student), Friedman test or Mann-Whitney U test. The p value was pursued bilateral, with significance level alpha set at 0.05.

## Results

Comparative statistical analysis of aerobic capacity values in studied groups is presented in Tables 1-4.

**Table 1.** Statistical indicators of centrality, dispersion and location of swimming time (sec) at the moments analysed for the group I

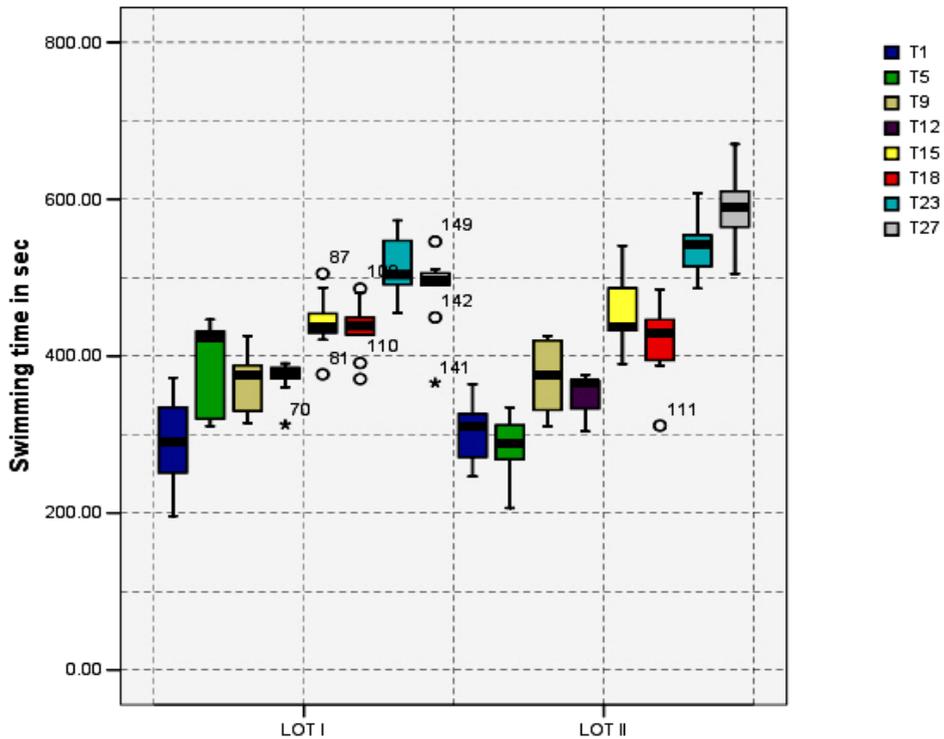
Moments	GROUP I					
	Mean	Standard Deviation	Confidence interval	Min	Max	Median
T1	295.2	57.2	254.28 ;336.12	196.2	372.6	290.1
T5	390.54	56.30	350.26;430.81	310.8	446.4	7423.9
T9	286.08	37.8	259.04;313.12	206.4	334.8	288.3
T12	353.94	26.14	335.24;372.64	304.2	376.2	366.3
T15	368.4	28.76	347.82;388.98	313.2	395.4	374.7
T18	420.3	47.55	386.28;454.32	311.4	485.4	429.9
T23	440.22	49.69	404.68;475.76	319.8	495	444.3
T27	406.92	0.70	377.04; 436.80	307.2	440.4	428.4

The study imposed the Friedman-test to group I to check for similarity between swimming time of rats in seconds according to the application of loads. The hypothesis of similarity of effects in the four samples was rejected, ( $\chi^2 = 170.83$ ,  $df = 19$ )  $p = 0.000$ .

**Table 2.** Statistical indicators of centrality, dispersion and location of swimming time (sec) at the moments analysed for the group II

Moments	GROUP II					
	Mean	Standard Deviation	Confidence interval	Min	Max	Median
T1	303.9	34.93	278.91 ;328.89	246.6	364.2	311.1
T5	363.72	35.60	338.26;389.18	315	426	375.3
T9	374.16	41.73	344.31;404.01	310.8	426	375.3
T12	457.32	44.88	425.21;489.43	390	540.6	437.1
T15	469.74	42.47	439.36;500.12	427.2	560.4	450
T18	544.08	39.68	515.69;572.47	486	607.2	542.7
T23	554.34	37.23	527.71;580.97	491.4	610.8	556.2
T27	610.38	37.71	583.40;637.36	547.2	686.4	612

The study imposed the Friedman-test to group II to check for similarity between swimming time of rats in seconds according to the application of loads. The hypothesis of similarity of effects in the four samples was rejected, ( $\chi^2 = 170.83$ ,  $df = 19$ )  $p = 0.000$ .

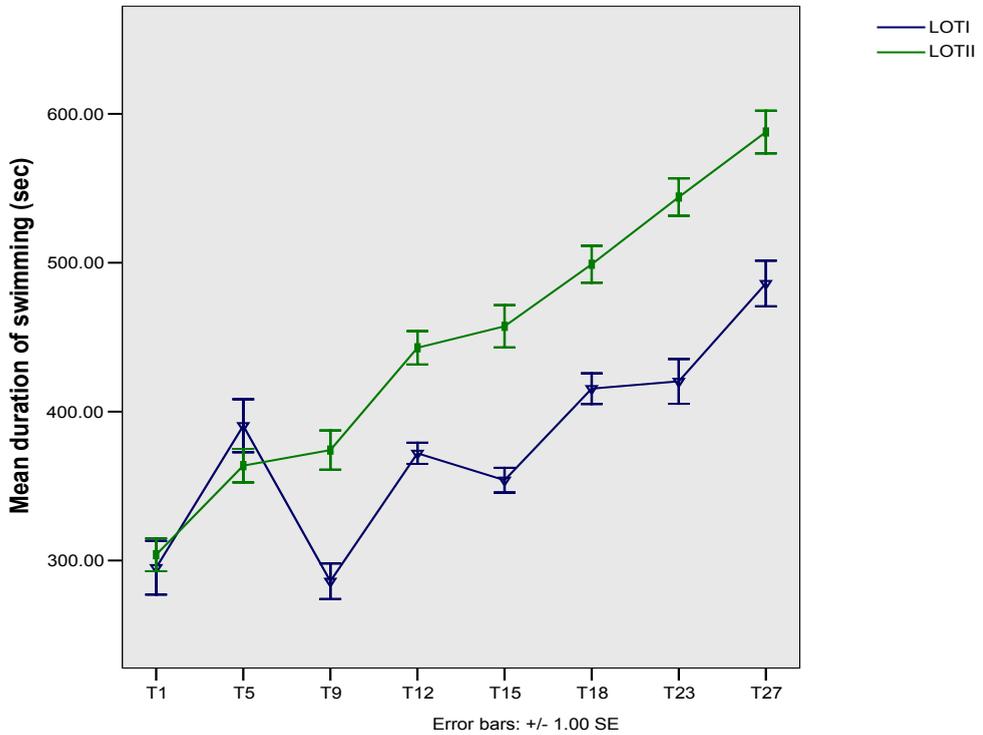


**Figure 1.** Comparison of swimming time between Lot I - Lot II

The results of the study, illustrated in Figure 2 show that:

1. Group I, subjected to exercise for 27 days with progressive loading of 10%, 15% and 20%, not supplemented with hemp seed oil has a significant decrease in exercise capacity on the day of 10% loading, 15% and 20%, followed by a mid-term growth.

2. Group II, subjected to exercise for 27 days with progressive loading of 10%, 15% and 20%, supplemented with hemp seed oil, on the day of loading by 10% and 15% shows reduced effort capacity compared to group I, followed by a mid-term growth. Loading with 20% did not cause a decrease in exercise capacity at the moment of time analysed.



**Figure 2.** The average swimming time expressed in sec

**Table 3.** Pearson correlation coefficients  $r$  of the workload and the percentage increase in swimming time measured at different times from baseline.

		<b>Correlations</b>							
		T1	T5	T9	T12	T15	T18	T23	T27
T1	r	1	0.815**	0.489*	0.463*	0.462*	0.429	0.468*	0.324
	p		<b>0.000</b>	<b>0.029</b>	<b>0.040</b>	<b>0.040</b>	<b>0.059</b>	<b>0.037</b>	<b>0.163</b>
T5	r		1	0.245	0.141	0.161	0.122	0.152	-0.038
	p			0.298	0.552	0.497	0.609	0.524	0.875
T9	r			1	0.926**	0.913**	0.81**	0.778**	0.83**
	p				0.000	0.000	0.000	0.000	0.000
T12	r				1	0.988**	0.924**	0.901**	0.913**
	p					0.000	0.000	0.000	0.000
T15	r					1	0.937**	0.909**	0.920**
	p						0.000	0.000	0.000

Correlations									
		T1	T5	T9	T12	T15	T18	T23	T27
T18	r						1	0.985**	0.944**
	p							0.000	0.000
T23	r							1	0.932**
	p								0.000
T27	r								1
	p								
**. Correlation is significant at the 0.01 level (2-tailed).									
*. Correlation is significant at the 0.05 level (2-tailed).									

Indices of correlation between swimming times at various times are shown in the table above. In the study conducted in this article the swimming times are strongly correlated between different moments studied which means that no other factor influences the swimming times.

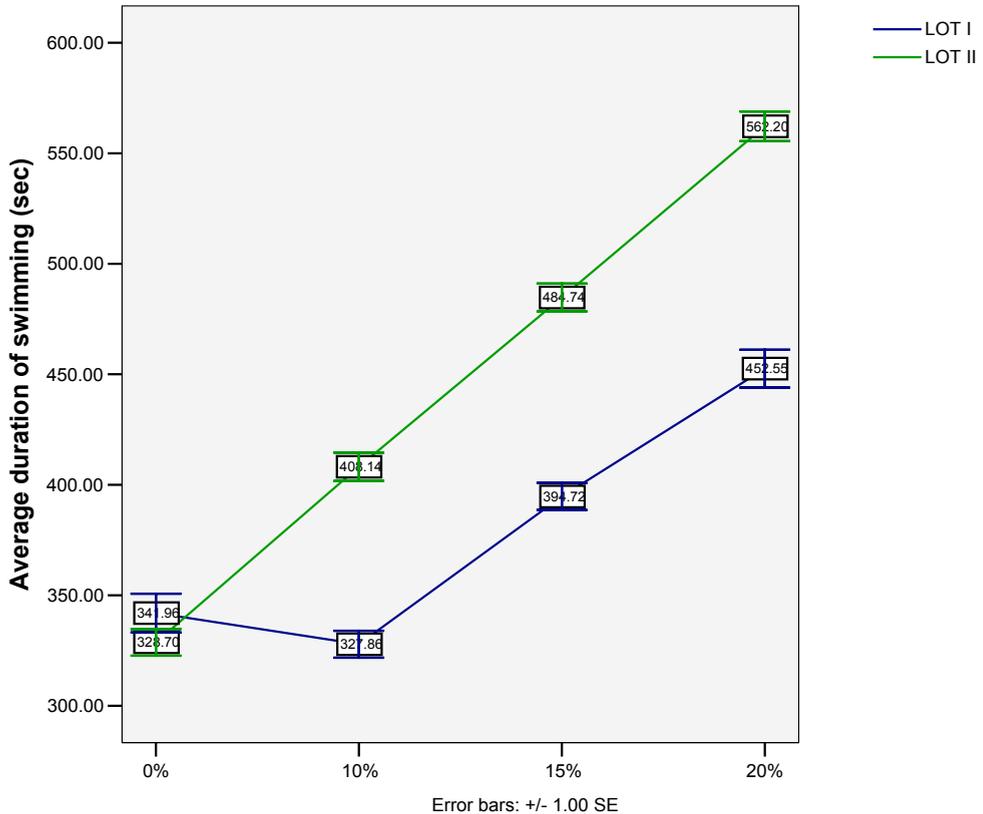
Comparison of average swimming times between group I and group II imposed Student's t-test and Mann-Whitney-test. The decision was taken based on Kolmogorov-Smirnov test.

The results obtained after applications of Student's t test are: at the moment T1, between group I and group II, there are statistically significant differences ( $p = 0.686$ ). At T8, between group I and group II, (10% load) there are no statistically significant differences, i.e. rats receiving oil have a higher resistance than those without administrative effort. At T18, between group I and group II with 15% load no statistically significant differences, i.e. rats receiving oil have a higher resistance than those without administrative effort.

**Table 4.** Comparing average duration of swimming between group I and group II

Moments	Group I		Group II		P
	Mean	Standard Deviation	Mean	Standard Deviation	
T1	295.2	57.2	303.9	34.93	0.686
T5	390.54	56.30	363.72	35.60	0.315
T9	286.08	37.80	374.16	41.73	<b>0.000</b>
T12	353.94	26.14	457.32	44.88	<b>0.000</b>
T15	368.4	28.76	469.74	42.47	0.000
T18	420.3	47.55	544.08	39.68	0.000
T23	440.22	49.69	554.34	37.23	0.000
T27	406.92	0.70	610.38	37.71	0.000

Results obtained from applying non-parametric test, Mann-Whitney show differences between the 2 groups from the time of trial T9 which coincides with the loading of 10% weight by the end of the study.



**Figure 3.** Average duration of swimming time expressed in seconds depending on load

## Discussion

Administration of hemp seed oil and concomitant exercise training for 27 days with 10% load, 15% and respectively 20% lead to increased exercise capacity. Compared with control (I), in the group supplemented with oil (II) we found significant increases in aerobic capacity throughout the study.

Hemp seed oil contains essential fatty acids linoleic (omega 6) and linolenic (omega 3) which are polyunsaturated fatty acids (PUFA). PUFA cannot be synthesized by the body but are found in most plants, vegetable and fish oils. The two classes of PUFA are widespread in nature: in the animal bodies

predominates class n = 6, instead n = 3 class of PUFA is found mainly in plants and in phospholipids of marine origin.

PUFA (linoleic, linolenic and arachidonic) fatty acids are essential or indispensable, that the body cannot synthesize them. They occur in normal metabolism in several ways: exist in the constitutional structure of lipids (lecithin, cephalin, sphingomyelin); reduce serum cholesterol by forming with it soluble and rapidly metabolized esters; involve in cell respiration, in redox reactions, because of the reactivity of ethylene groups; stimulate the activity of enzymes like cytochrome oxidase, succinate dehydrogenase; arachidonic acid is the precursor of prostaglandins, thromboxane and prostacyclin. The importance attributed to PUFA led them to be included on the list of vitamins (vitamin F).

According to Lieberman and Brüning (2005), the ratio of essential fatty acids omega 3/omega 6 is estimated at around 30/1. Usually the diet does not provide the necessary essential fatty acids at ratio of 2/1 or 1/1, which requires supplementation for prevention of chronic diseases: cardiovascular, diabetes, arthritis, cancer, allergies, skin diseases, immunological disorders, nerve disorders.

Although essential, fatty acids have no determined daily doses and symptoms of deficiency. Recommended daily dose by Lieberman and Brüning (2005) are 3 g of omega 3 and 0.24 g omega 6.

The presence of vitamin E in hemp seed oil is important for it has antioxidant capacity: it is the main non-enzymatic lipid-soluble antioxidant in cell membranes that: converts  $O_2^{\cdot-}$ ,  $OH^{\cdot}$  and lipoperoxide radicals in forms less reactive; interrupts lipid peroxidation, is a regenerator for vitamin C, reduces the synthesis of xanthine oxidase (generator of  $O_2^{\cdot-}$  radicals), is protective for Se and it is used as SeGSH-Px, is effective in stabilizing against PUFA autooxidation. Supplements of fatty acids include vitamin E to prevent their oxidation in the body.

Vitamin E is a universal stabilizer of cell membranes, which are subject to oxidative attack. It is located in the hydrophobic layer of membranes as a complex of phospholipids with PUFA (Tache 2001). Depending on the concentration and the environment, vitamin E can act as antioxidant or prooxidant (Tache 2006).

Our previous results in rats trained to effort with standard load (10%, 15% and 20% of animal weight) also show that hemp oil supplementation causes a significant increase of aerobic capacity. The increase of aerobic capacity for standard load is appreciably lower than for progressive loading.

The previous study was performed on six groups (n = 10 animals / group) of male Wistar adult rats, subjected to standard physical loading of 10%, 15% and 20%, to exhaustion, with oil supplementation or without, for 27 days. The moments analyzed were days 1, 9, 18 and 27. The maximum increase of aerobic capacity was in the group with 10% loading and oil supplementation

compared to groups with 15% and 20% with or without oil supplementation. In this study, progressive loading causes a large fluctuation in exercise capacity in group I which is not supplemented with hemp seed oil. In group II, which is supplemented with hemp seed oil, fluctuations of aerobic exercise capacity are reduced and at the load of 20% they disappear, only recording an increase in exercise capacity.

The favorable effect of oil supplementation may be due to: the presence of vitamin E in composition and antioxidant role of it; use of PUFA in the energy production; increased content of fatty acids omega-6 and the optimal ratio omega 6/omega 3 of 3/1 in the preparation used.

In literature we found few studies in the field. Similar results were obtained by Zhang G et.al.(2009).

Our results are in disagreement with data of other authors (Ayre, Huffman) who studied the effect of PUFA supplementation and compared omega 3 and omega 6. The negative effect was assigned only to omega 3 fatty acid.

## Conclusions

1. Training with progressive loading significantly increases aerobic.
2. Hemp oil supplementation and three-stage loading causes a significant increase in aerobic exercise capacity in 27 days compared to training without oil supplementation.
3. The increase of aerobic capacity after progressive loading up to 20% is significant at 27 days compared with the increase produced by training with linear load by 20% of weight.
4. Hemp oil supplementation and three-stage loading causes a significant increase in aerobic exercise capacity in 27 days compared to linear load by 20% of weight and oil supplementation.
5. PUFA supplements and training based on the load in steps help sustain endurance exercise.

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## EFFECTS OF WHOLE BODY VIBRATION TRAINING ON KNEE EXTENSOR STRENGTH IN RUGBY PLAYERS

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**ABSTRACT. Introduction:** Whole Body Vibration (WBV) might be considered an alternative to the traditional resistance training methods. The purpose of this study is to investigate the effects of long term WBV training on the maximum isometric knee extensor strength in rugby players. **Materials and methods:** Twenty volunteers participated in this study. They were recruited from the Romanian National Division rugby team Universitatea Cluj-Napoca. The participants were randomly divided into two groups: a Control group and a Vibration group. The subjects from the Vibration group were trained on the Fitvibe Excel Pro® vibration platform for three weeks (three times per week, 7 minutes per session). Mean torques were recorded over 5 s long time intervals of maximal isometric voluntary contractions of the knee extensor muscles at three different angles, for both legs, before and after WBV training, with the KIN-COM® isokinetic dynamometer. **Results:** Mean age of the subjects from the Control group was  $23.60 \pm 4.92$  years, mean height was  $183.70 \pm 1.75$  cm, and mean weight was  $96.90 \pm 4.82$  kg. Mean age of the subjects from the Vibration group was  $22.60 \pm 3.68$  years, mean height was  $182.30 \pm 2.17$  cm, and mean weight was  $99.00 \pm 4.72$  kg. No significant changes were found in isometric knee extensor strength between the Vibration and the Control group post-intervention. No significant changes were found between pre- and post-intervention torque values of the same group. **Conclusions:** Three weeks of vibration exposure might not be enough for chronic neural changes to occur in athletes. More research is needed on the potential effects of long term WBV exposure among highly trained athletes.

**Keywords:** vibration training, isometric torque, knee extensors, maximal voluntary contraction, rugby players.

**REZUMAT. Efecte ale antrenamentului obținut prin vibrarea întregului corp asupra forței mușchilor extensori ai genunchiului în cazul jucătorilor de rugby. Introducere:** Vibrarea întregului corp (WBV) ar putea fi considerată o alternativă la metodele tradiționale de antrenament cu greutăți. Scopul acestui studiu este acela de a investiga efectele antrenamentului WBV de lungă durată asupra forței izometrice maxime a extensorilor genunchiului în cazul jucătorilor

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de rugby. **Materiale și metode:** Douăzeci de voluntari au participat la studiu. Aceștia au fost recrutați dintre jucătorii echipei de rugby de nivelul Diviziei Naționale, Universitatea Cluj-Napoca. Subiecții au fost împărțiți, în mod aleator, în două grupe: o grupă de control și o grupă experimentală. Subiecții din grupa experimentală au fost supuși unui program de antrenament cu durata de trei săptămâni (de trei ori pe săptămână, câte 7 minute pe ședință) pe platforma de vibrații Fitvibe Excel Pro®. Înainte și după cele trei săptămâni de antrenament s-au înregistrat, cu ajutorul dinamometrului izokinetic KIN-COM®, valorile medii calculate pe un interval de timp de 5 s ale momentelor forțelor izometrice maxime generate de mușchii extensori ai genunchiului în contracție voluntară, în cazul ambelor membre inferioare, în trei unghiuri de flexie ale genunchiului. **Rezultate:** Media de vârstă a participanților din grupa de control a fost de  $23.60 \pm 4.92$  ani, înălțimea lor medie a fost de  $183.70 \pm 1.75$  cm și greutatea lor medie a fost de  $96.90 \pm 4.82$  kg. Media de vârstă a participanților din grupa experimentală a fost de  $22.60 \pm 3.68$  ani, înălțimea lor medie a fost de  $182.30 \pm 2.17$  cm și greutatea lor medie a fost de  $99.00 \pm 4.72$  kg. După trei săptămâni de antrenament cu vibrații, nu s-au înregistrat creșteri semnificative în forța izometrică a mușchilor extensori ai genunchiului în cazul subiecților din grupa experimentală comparativ cu cei din grupa de control. De asemenea, în cazul ambelor grupe, nu s-au observat modificări semnificative ale valorilor momentelor forței măsurate după perioada de antrenament comparativ cu momentul inițial. **Concluzii:** Trei săptămâni de antrenament cu vibrații nu par a fi suficiente pentru apariția modificărilor cronice la nivel neuronal în cazul sportivilor de performanță. În ceea ce privește potențialele efecte ale antrenamentului obținut prin vibrarea întregului corp în cazul sportivilor de performanță, este nevoie de studii noi pentru a putea trage o concluzie pertinentă.

**Cuvinte cheie:** antrenament cu vibrații, moment al forței izometrice, extensorii genunchiului, contracție voluntară maximă, jucători de rugby.

## Introduction

Whole body vibration (WBV) has been recently proved to have positive effects on leg muscle strength in adults with healed thermal burns (Ebid, Ahmed, Eid & Mohamed, 2012). WBV also reduces the Delayed-Onset Muscle Soreness (DOMS) symptoms when administered before eccentric exercise in healthy, untrained adults (Aminian-Far, Hadian, Olyaei, Talebian & Bakhtiary, 2011), and it increases, after acute exposure, the peak ground reaction force in sprint starts performed by collegiate athletes (Roberts, Hunter, Hopkins & Feland, 2009).

Long term studies on the effects of WBV on muscular performance range from 9 days (Cochrane, Legg & Hooker, 2004) to 8 months (Torvinen et al., 2003). The great majority of these studies have reported significant improvement

in muscle strength (Delecluse, Roelants & Verschueren, 2003; Roelants, Delecluse, Goris & Verschueren, 2004; Russo et al., 2003; Rønnestad, 2004; Salvarani et al., 2003; Torvinen et al., 2003; Verschueren et al., 2004; Fagnani, Giombini, Di Cesare, Pigozzi & Di Salvo, 2006; Rees, Murphy & Watsford, 2008; Trans et al., 2009; Tihanyi et al., 2010). Some studies found no improvement in muscle performance after long term exposure to WBV (Bautmans, Van Hees, Lemper & Mets, 2005; Cochrane, Legg & Hooker, 2004; Delecluse, Roelants, Diels, Koninckx & Verschueren, 2005; de Ruiter, van Raak, Schilperoort, Hollander & de Haan, 2003).

The studies who have investigated the effects of long term WBV exposure on the leg muscular performance of athletes report controversial results (Delecluse, Roelants, Diels, Koninckx & Verschueren, 2005; Fagnani, Giombini, Di Cesare, Pigozzi & Di Salvo, 2006; Mahieu et al., 2006; Annini et al., 2007). The present study is the first one to investigate, to the best of our knowledge, the effects of a 3-week WBV exposure on the maximum isometric knee extensor strength in male rugby players.

## **Materials and methods**

### ***Participants***

Twenty Romanian National Division male rugby players (18-36 years of age) participated in this study. They were recruited from the local rugby team "Universitatea" Cluj-Napoca (Romania). All known health risks associated with vibration training were explained to the participants and written informed consent was obtained from them. None of the subjects had any chronic diseases or contraindications with vibration exposure. All subjects participated at their usual training sessions with the rugby team throughout the entire duration of the study. None of the participants withdrew from the study (Câmpeanu, Deak, Chihai, Boros-Balint & Szabo, 2010).

### ***Procedures***

Two experimental groups were created as follows: 10 subjects were randomized to the whole body vibration group and the other 10 to the control group. The vibration protocol consisted of a 3-week whole body vibration training program (3 training sessions per week). The vibration platform used in this study was Fitvibe Excel Pro® (GymnaUniphy NV, Belgium), which generates vertical vibrations. The training protocol consisted of nine WBV training sessions. The duration of each training session was 7 minutes (rest included). All exercises were unloaded static standard leg exercises. The basic exercises were squats and lunges. For each training session, a different combination of exercises, vibration frequencies and amplitudes was performed. The frequencies used ranged from 20 to 60 Hz, and the amplitudes used were 2 mm (low amplitude - LA) and 4 mm (high amplitude - HA).

The maximal isometric knee extensor strength was evaluated with a KIN-COM® (Chattanooga Group Inc., USA) isokinetic dynamometer. Two sets of tests were performed. The first set of tests was done prior to subject's randomization and it consisted of three maximal 5s isometric contractions at three different knee flexion angles for each leg. Six mean isometric torque values were recorded for each subject. The angles considered for the tests were 0°, 20° and 40°, where 0° corresponds to the anatomical 90° knee flexion. The second set of tests was done at the end of the experimental intervention (Câmpeanu, Deak, Chihaia, Boroș-Balint & Szabo, 2010).

### Analyses

Means, standard deviations and standard errors were calculated for all measured parameters. In order to compare before and after training values of right and left leg isometric knee extensor strength, a statistical analysis with a paired Student's *t* test was performed. Correlation (*r*) between initial and final test values was also calculated. A  $P < 0.05$  was considered statistically significant. In order to compare vibration and control group mean values, the statistical analysis performed was the unpaired *t* test. A  $P < 0.05$  was considered statistically significant. All analyses were performed in SPSS, version 15.0 (SPSS Institute, Chicago, IL) (Câmpeanu, Deak, Chihaia, Boroș-Balint & Szabo, 2010).

### Results

Mean age of the subjects from the Control group was  $23.60 \pm 4.92$  years, mean height was  $183.70 \pm 1.75$  cm, and mean weight was  $96.90 \pm 4.82$  kg. Mean age of the subjects from the Vibration group was  $22.60 \pm 3.68$  years, mean height was  $182.30 \pm 2.17$  cm, and mean weight was  $99.00 \pm 4.72$  kg.

Table 1 and Table 2 present correlation and paired Student's *t* test values for the right leg and the left leg, respectively, of subjects from the Control group. Since a  $P < 0.05$  was considered statistically significant, the results of the paired Student's *t* test show no significant changes in the isometric knee extensor strength for either leg of subjects from the Control group. Overall, the correlation is also not significant.

**Table 1.** Correlation and paired Student's *t* test values for right leg (Control)

	<i>r</i>	<i>p</i>	<i>t</i>	<i>p</i>
Pre- and Post- values at 0°	0,664	0,036*	-1,073	0,311
Pre- and Post- values at 20°	0,782	0,007*	-2,151	0,060
Pre- and Post- values at 40°	0,596	0,069	-0,416	0,687

\*statistically significant ( $P < 0.05$ )

**Table 2.** Correlation and paired Student's *t* test values for left leg (Control)

	r	<i>p</i>	t	<i>p</i>
Pre- and Post- values at 0°	0,705	0,023*	0,550	0,595
Pre- and Post- values at 20°	0,397	0,256	-0,102	0,921
Pre- and Post- values at 40°	0,524	0,120	-0,716	0,492

\*statistically significant ( $P<0.05$ )

Table 3 and Table 4 present correlation and paired Student's *t* test values for the right leg and the left leg, respectively, of subjects from the Vibration group. Since a  $P<0.05$  was considered statistically significant, the results of the paired Student's *t* test show no significant changes in the isometric knee extensor strength for either leg of subjects from the Vibration group. The correlation is significant for both right and left leg values.

**Table 3.** Correlation and paired Student's *t* test values for right leg (Vibration)

	r	<i>p</i>	t	<i>p</i>
Pre- and Post- values at 0°	0,713	0,021*	2,630	1,123
Pre- and Post- values at 20°	0,715	0,020*	1,619	0,027*
Pre- and Post- values at 40°	0,690	0,027*	0,290	0,140

\*statistically significant ( $P<0.05$ )

**Table 4.** Correlation and paired Student's *t* test values for left leg (Vibration)

	r	<i>p</i>	t	<i>p</i>
Pre- and Post- values at 0°	0,869	0,001*	3,856	0,004*
Pre- and Post- values at 20°	0,806	0,005*	-0,539	0,603
Pre- and Post- values at 40°	0,876	0,001*	-1,295	0,228

\*statistically significant ( $P<0.05$ )

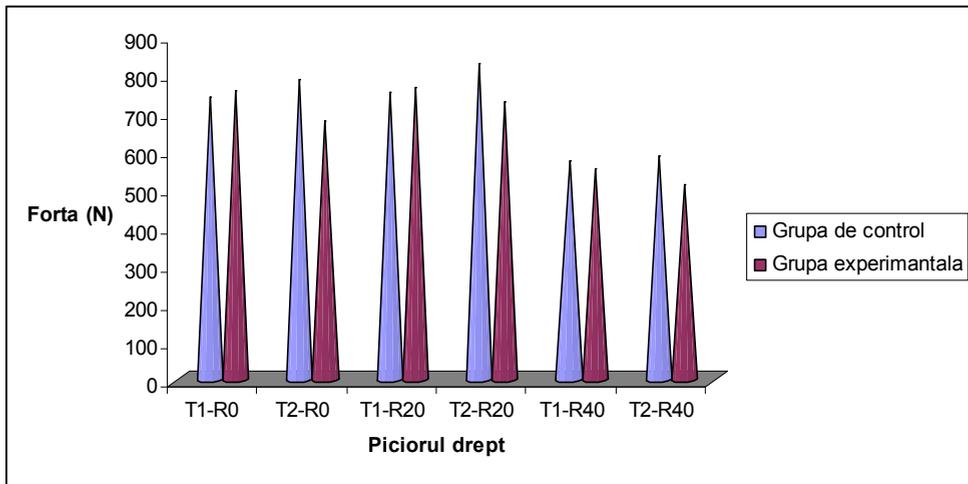
Table 5 presents the results of the unpaired *t* test for the mean values measured post-intervention for both legs. Since a  $P<0.05$  was considered statistically significant, the results of the unpaired *t* test show no significant changes in the isometric knee extensor strength between Vibration and Control group post-intervention.

**Table 5.** Unpaired *t* test values for Vibration and Control mean values (post-WBV)

	<i>t</i>	<i>p</i>
Post- values at 0° right leg	1,669	0,112
Post- values at 20° right leg	1,350	0,194
Post- values at 40° right leg	1,429	0,170
Post- values at 0° left leg	-0,037	0,971
Post- values at 20° left leg	0,070	0,945
Post- values at 40° left leg	1,149	0,265

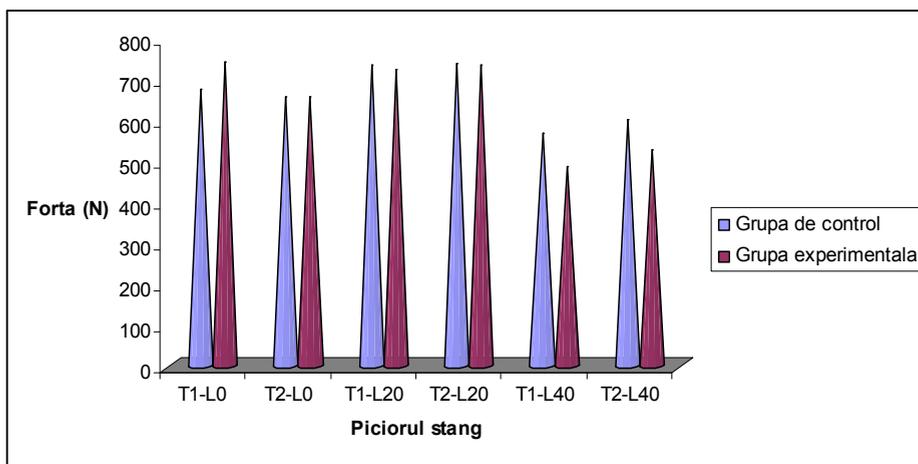
\* statistically significant ( $P < 0.05$ )

Figure 1 presents a comparison between pre- and post-intervention mean isometric force values for the right leg for both groups. T1-R0 represents the pre-intervention mean test values for both Vibration and Control groups at 0° test angle. T2-R0 represents the post-intervention mean test values for both Vibration and Control groups at 0° test angle. T1-R20 and T1-R40 have similar meanings with T1-R0 (only the test angles differ). T2-R20 and T2-R40 have similar meanings with T2-R0 (only the test angles differ). No significant differences can be seen between groups or between pre- (T1) and post-intervention (T2) values of the same group.



**Figure 1.** Comparison between initial and final test results for right leg for both groups

Figure 2 has the same meaning as Figure 1 except the fact that all values correspond to the left leg.



**Figure 2.** Comparison between initial and final test results for left leg for both groups

## Discussion

The hypothesis of this study was that 3 weeks of WBV training will increase isometric knee extensor strength in male rugby players. The results show no significant changes in isometric knee extensor strength post-vibration. No significant changes were also found in isometric knee extensor strength between the Vibration and the Control group post-intervention.

The subjects who have voluntarily participated in this study were all Romanian National Division level rugby players. Throughout the duration of the study, the team has played three important games in the Romanian National Rugby Division's play-off. The accumulated fatigue could have influenced the results.

To the best of our knowledge, no study has investigated so far the effects of long term WBV exposure on the isometric knee extensor strength in male rugby players. Thus, no comparison can be made with similar studies. Still, there are a few studies which had athletes as subjects and used WBV as a muscular performance enhancement method.

Delecluse, Roelants, Diels, Koninckx & Verschueren (2005) have investigated the effects of a 5-week training period with additional WBV on the leg muscular performance of 25 sprint trained athletes (18 males, aged 17-30 years). The results revealed no differences between the vibration group and the non-vibration group for isometric knee flexor strength, dynamic knee flexor strength, start time, horizontal start acceleration, counter movement vertical jump performance and 30 meter sprint performance (Delecluse, Roelants, Diels, Koninckx & Verschueren, 2005).

Another study, with young female athletes (ages 21–27 years) as participants, reported significant improvement of bilateral knee extensor strength ( $P<0.001$ ), counter-movement jump height ( $P<0.001$ ), and flexibility ( $P<0.001$ ), after 8 weeks of WBV training (Fagnani, Giombini, Di Cesare, Pigozzi & Di Salvo, 2006).

Mahieu et al. (2006) found significant increases in knee muscle strength and explosive strength in young competitive skiers (9-15 years) after a 6-week (3 times per week) WBV training program (Mahieu et al., 2006). WBV was found to be effective, after 8 weeks (3 times per week), in inducing improvements in the explosive strength of the knee extensor muscles of elite ballerinas (Annini et al., 2007).

In summary, there are no muscle performance enhancements in athletes after 3 or 5 weeks of WBV exposure. The beneficial effects might appear after 6 to 8 weeks of WBV exposure. Tihanyi et al. (2010) gave a possible explanation for this: “chronic vibration intervention of four weeks does not provide stimuli strong enough for chronic residual improvement in motor unit synchronization” (Tihanyi et al., 2010).

## Conclusions

This study investigated the effects of three weeks of WBV exposure on the isometric knee extensor strength in male rugby players. No significant changes were found in isometric knee extensor strength between the Vibration and the Control group post-intervention. A possible explanation could be the fact that three weeks of vibration exposure are not enough for chronic neural changes to occur.

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## THE EFFECTIVENESS OF TYPES OF SHOTS IN RELATION TO POSITION OF EXECUTION OF SHOTS IN WOMEN'S BASKETBALL

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**ABSTRACT.** The objective of this project is the recording and analysis of the types of shots that are realized in a number of Women's Basketball matches, as well as the recording and analysis of the effectiveness of the shots regarding their position of execution, so as to present a clear image of an amount of factors which are related to the shots and canvass whether these factors have a bearing on victory or defeat. For the realization of this objective, video analysis was done, in thirty four (n= 34) basketball matches of the First Women's League from 2005 to 2010. The program "Sportscout" was used for the analysis of the matches. The comparisons that were made concerned: a) the types of shots in relation to their effectiveness and b) the effectiveness of the types of shots made from within court in relation to their execution positions in both victory and defeat. The statistic process of the data includes the presentation of frequency at a double-entry table (Crosstabs command) and the application of the  $\chi^2$  (Chi-square) test. The results show that there are significant differences between winners and defeated in the types of shots and their effectiveness as well as in the execution positions of shots. More specifically, winners made shots from low post position more frequently and presented better rates, more free-throws, more successful lay-ups and less off-target two-point shots compared to the defeated. The kinds of shots performed from within court in total of offensive attempts were: jump shots at a percentage of 85.8%, lay-ups 13.4%, hook-shots 0.6% and follows 0.4%.

**Key words:** basketball, video analysis, effectiveness of kinds of shots, execution position

### Introduction

There are many studies which prove the special role that statistics play in the analysis or the prediction of performance in basketball games (Garcia, Parejo, De la Cruz, Domínguez, Saavedra, 2007; Sampaio & Janeira, 2003; Gómez,

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Lorenzo, Sampaio & Ibáñez, 2006). According to Ibáñez, Feu, García, Cañadas & Parejo, (2007), the attempt to accomplish optimum performance which guarantees victory has led to the analysis of statistics even of ongoing games. The recording of statistical data of games aims on one hand to integrated knowledge of our team or the opponent's potential and on the other hand to the knowledge of individual performance and potential of every player separately (Kioumourtoglou, Mavromatis & Bechrakis, 1988).

According to Hofler & Payne (1997), the shot is the most studied game action, since this action presents teams with the ability to be victorious and is directly associated with a team being successful. The shot is the most pleasing and valuable game action. The choice of an appropriate shot on the right moment is a rule of basketball coaching (Tsitskaris, and Chantziathanasiou, 1992; Zeravitca and Pavlovic, 1990). As far as Nelson (1989) is concerned, every team's goal should be the accomplishment of a "good shot". A good shot means that it was executed under the best possible conditions and by the most appropriate player for the occasion. In order to achieve high levels of success, we have to shift emphasis on four points: 1) make an effort for the ball to approach the basket before we take a shot from the perimeter, 2) we make our opponents commit offensive fouls, 3) while pursuing fouls near the basket, we direct our team toward the basket while creating ways in its direction and 4) the movement toward the basket creates opportunities for shots with high levels of success by passing the ball to a free co-player, as defensive actions turn into help during a lay-up effort by the opponent.

According to Ortega & Fernández, (2007) the introduction of the 6.25 line and the consequent ability of scoring three points caused the development of new strategies and tactics both in defense and offense. Statistical analyses of games show that victorious teams take less three-point shots in comparison to the defeated but are successful in more (Sampaio, Ibáñez & Feu, 2004). According to Dean (1997), winners had a percentage of success of 45.1% in 10-12 shots they attempted in every game, while the percentage of the defeated was 31-35% in 19-21 shots.

Statistics show that, without three-point shots, defensive/offensive systems have lower indexes per possession presenting the greatest difference in the simple zone defense (0,92 with three-point shot, 0,84 without three-point shot) (Mikes, 1988).

In average, a basketball team scores 15 to 20 points per game from the free-throw line. This number represents roughly 20-30% of the total points it scores (Ibáñez, et al. 2007; Kozar, Vaughn, Whitfield, Lord & Dye, B. 1994). After statistically analyzing 316 games of Division 1 of NCAA, Pim (1986) came to the conclusion that teams which made the most free-throw shots won 71.53% of the games. According to Kozar et al., (1994), in 490 games of Division 1 of NCAA,

the observation that was made was that in the last 5', approximately 35% of the points scored come from free-throw shots. In those games that the final score difference was less than 9 points, the free-throw shots made up 48% of the total points for the victorious team during the last five minutes of the game and 69% in the last minute.

According to Ibáñez, et al., (2007), the effectiveness of the shots depends on the area of the court that the shot is executed from and the distance in relation to the basket. According to Trupin και Couzens, (1989), one of the most indicative elements of basketball of percentages is the "effectiveness per area" factor, which can be defined as the ability to score from a specific area of the court.

The court according to Mikes, (1987) is divided in the following areas: lay-up, middle range, top of the key, left corner, left baseline, left wing, right corner, right baseline, right wing and back court. The most productive court position is Low Post. It holds a very low error percentage (8.2%), the highest scoring percentage (65.3%), the highest level of offensive rebounds (44.2%) and the highest level of earned fouls (15%). The next most productive positions are in the perimeter, with the right side being the most effective. The less productive area is the one within the racket, at an average distance from the basket (Middle Post), with an error percentage of 25.9% and a 33% of success. It must be noted that this area holds the second highest percentage of earned fouls (11.9%) (Mikes, 1987).

A detailed recording of the technical and tactical aspects of teams and the analysis of their effect on the outcome of a game compose the characteristics and tendencies of the way teams play and their common elements define the game style (Tsamourtzis, Salonikidis, Siskos & Athanailidis 2003). Bibliography mainly refers to men's teams. The objective of this project was recording and analysis of a number of Women's Basketball games, the kinds of shots realized as well as their effectiveness and execution positions, so as to provide coaches with a clearer image of the shots that lead either to victory or defeat.

## **Methodology**

**Sample:** The sample consists of thirty-four (n=34) Basketball games of the First Women's League of the Greek Championship from 2005 to 2010. The recording of the games was done through video.

**Measurement instruments:** The instrument used for the realization of the project was the program "Sportscout" which evaluates action and movement, based on digital video and computer through which Definition, Encoding and Analysis of the parameters was done (Tsimpiris, Tsamourtzis, Sfingos, Zaggelidis G., Zaggelidis S., 2006).

**Procedure:** Video analysis was done for the realization of the objective of this project. The comparisons made were among winners and defeated; moreover, the frequency with which the following parameters turned up was studied: a) the types of shots (free-throw shot, jump shot, lay-up shot, hook shot, and follow shot) in relation to their effectiveness (successful and missed free-throw shots, successful and missed two-point or three-point shots) and b) the effectiveness (successful and missed two-point or three-point shots) of types of shots from within the court (free-throw shot, jump shot, lay-up shot, hook shot and follow shot) in relation to their execution positions (low post, middle post, high post, forward left, forward right and guard) both in victory and defeat.

***Semantic definition of parameters:***

- Free- throw shot: It is an unguarded shoot taken from the free-throw line (or foul line) by a player whose opponent committed a foul. The player is at a motionless posture and the shot is taken without any pressure from the opponents.
- Jump shot: It is a shot taken while jumping, usually straight up.
- Lay-up shot: It is a shot taken near the basket after driving to it from a distance (Tsitskaris and Chantziathanasiou, 1992).
- Hook shot: It is a shot in which the player, turned perpendicular to the basket, takes it with one arm.
- Follow shot: It is the shot made after the ball bounces on the basket hoop and the player is off the ground.
- Low Post (LP): It is the area of the limiting 3 second space at a 0-3 meters distance from the end line.
- Middle Post (MP): It is the area of the limiting 3 second space at a 3-5 meters distance from the end line.
- High Post (HP): It is the area of the free-throw line (or foul line).
- Forward Left (FL): It is the area confined by the left line of the limiting 3 second space, the extension of the free- throw line, the left sideline and the end line.
- Forward Right (FR): It is the area confined by the right line of the limiting 3 second space, the extension of the free- throw line, the right sideline and the end line.
- Guard (G): It is the area above the High Post position and the extension of the free- throw line.

**Data analysis:** The statistic package SPSS, the command Crosstabs and the  $\chi^2$  (Chi-square) test were used for the statistical analysis of the data.

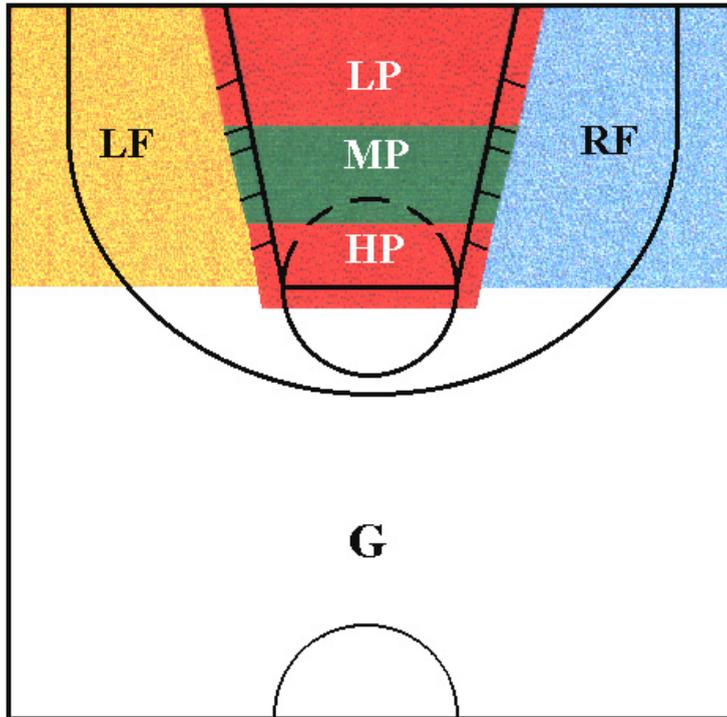


Figure 1. Execution positions of shots from within court.

## Results

Table 1. Types of shots and their effectiveness in victory and defeat

percentage %	1+		1-		2+		2-		3+		3-		Distribution of types of shots	
	Win	Def	Win	Def	Win	Def	Win	Def	Win	Def	Win	Def	Win	Def
Free-throw shot	73.6*	64.1*	26.4	35.9									29.9*	27.6*
Jump shot					37.7*	30.1*	42.6	47.9	6.6	7.1	13.1	14.9	60.1	62.5
Lay-up shot					57.2*	45.3*	42.8	54.7					9.1	9.5
Hook shot					38.5	44.4	61.5	55.6					0.5	0.4
Follow shot					72.7	100	27.3	0					0.4*	0*
Effectiveness distribution	21.7*	17.3*	7.8	9.7	29.2*	24.7*	26.5	34.8	4	4.4	7.8	9.1	100*	100*

\*  $p < .05$  Win=Winners Def=Defeated 1+ =Successful free-throw shot, 1- =Missed free-throw shot, 2+ =Successful two-point shot, 2- =Missed two-point shot, 3+ =Successful three-point shot, 3- =Missed three-point shot

In total of offensive attempts, the shot percentages are: free-throw shots 28.3%, two-point shots 59% and three-point shots 12.7%. The percentages of the types of shots from within court (sum of successful and missed two-point and three-point shots) in total of offensive attempts are: Jump shots 85,8%, lay-up shots 13.2%, hook shots 0.6%, follow shots 0.4%. We can conclude from Table 1 that winners take more shots from within the court compared to the defeated, presenting a big statistical difference [ $\chi^2=7.89 > 3.84, p>.05$ ].

Winners take more free-throw shots [ $\chi^2=9.41>3.84, p<.05$ ] whereas in two-point shots [ $\chi^2=3.68<3.84, p<.05$ ] and three-point shots there is no significant difference [ $\chi^2=0.64<3.84, p>.05$ ]. Winners take successful free-throw shots at a percentage of 73.6% compared to the percentage of the defeated which is 64.1%, two-point shots 47.7% as opposed to 41.7% and three-point shots 33.8% as opposed to 32.5%.

By checking the significance, we came to the conclusion that there is an important statistical difference between winners and defeated in successful free-throw shots [ $\chi^2=21.60>3.84, p<.05$ ] and successful two-point shots [ $\chi^2=20.24>3.84, p<.05$ ] but no such difference exists in successful three-point shots [ $\chi^2=0.01<3.84, p<.05$ ], in missed free-throw shots [ $\chi^2=2.08<3.84, p<.05$ ], in missed two point shots [ $\chi^2=2.57<3.84, p<.05$ ] and missed three point shots [ $\chi^2=0.60<3.84, p<.05$ ]. The shots presenting a higher rate of success are the follow shots (72.2%), immediately followed by lay-up shots (57.2%). Winners realize more successful two-point jump shots [ $\chi^2=15.48>3.84, p<.05$ ], and make more successful lay-ups [ $\chi^2=3.87>3.84, p<.05$ ]. Both winners and defeated present a similar number of missed two-point jump shots [ $\chi^2=1.63<3.84, p<.05$ ] and unsuccessful lay-ups [ $\chi^2=2.39<3.84, p<.05$ ].

**Table 2.** The effectiveness of types of shots taken from within the court in relation to their execution positions in victory and defeat

Percentage %		LP		MP		HP		FL		FR		G		Distribution of types of shots	
		Win	Def	Win	Def	Win	Def	Win	Def	Win	Def	Win	Def	Win	Def
2+	Jump shot	48,2	53,5	10,1	9,1	10,8	10,1	15,8*	12,7*	11,8	13,1	3,3*	1,5*	79,7*	80,2*
	Lay-up shot	92,1	96,4	6,4	2,7				0,9					18,5*	18,8*
	Hook shot	60	100	40	0									0,7	0,7
	Follow shot	100	100	0	0									1,1	0,3
	Distribution of shot position 2+	57*	62*	9,6*	7,8*	8,6	8,2	12,7*	10,3*	9,5	10,5	2,6*	1,2*	100*	100*

Percentage %		LP		MP		HP		FL		FR		G		Distribution of types of shots	
		Win	Def	Win	Def	Win	Def	Win	Def	Win	Def	Win	Def	Win	Def
2-	Jump shot	35,5	29,7	14,7	15,9	11,9	13	19,4	18,4	13,5*	18,4*	4,9	4,6	85,6	84,6
	Lay-up shot	86,9	76,2	13,1*	22,1*						1,6			13	14,8
	Hook shot	75	60	25	40									1	0,6
	Follow shot	100	0	0	0									0,4	0
	Distribution of shot position 2-	42,9	36,8	14,6	16,9	10,2	11	16,6	15,6	11,5*	15,8*	4,2	3,9	100	100
3+	Jump shot							24,5	25,7	29,4	22,9	46,1	51,4	100	100
	Distribution of shot position 3+							24,5	25,7	29,4	22,9	46,1	51,4	100	100
3-	Jump shot							26,2	27,3	23,8	24,1	50	48,6	100	100
	Distribution of shot position 3-							26,2	27,3	23,8	24,1	50	48,6	100	100
Distribution from within the court		41,5*	38,6*	10	10,6	7,9	8	16,5	15,9	13,1	15,5	11	11,4	100	100

\*  $p < .05$  Win=Winners Def=Defeated LP = Low post, MP = Middle post, HP = High post, FL = Forward left, FR = Forward right, G = Guard 2+ = Successful two-point shot, 2- = Missed two-point shot, 3+ = Successful three-point shot, 3- = Missed three-point shot

We can conclude from Table 2 that the shots from within the court are executed from various positions and present significant differences in execution frequencies. The majority of shots is taken from the Low Post position (38.6-41.5 %) leaving behind the Forward Left position which follows it with a percentage of 15.9-16.5 % [ $\chi^2=360.52 > 3.84, p<.05$ ]. Moreover, Forward Left position hosts more shots in comparison to Forward Right position which presents a subsequent percentage of 13.1-15.5 % [ $\chi^2=4.52 > 3.84, p<.05$ ]. At Low Post position, winners take more shots than the defeated [ $\chi^2=5.30 > 3.84, p<.05$ ] while at the remaining positions both winners and defeated shoot with similar frequency: middle post [ $\chi^2=0.02 < 3.84, p<.05$ ], high post [ $\chi^2=0.05 < 3.84, p<.05$ ], forward-left [ $\chi^2=1.08 < 3.84, p<.05$ ], forward-right [ $\chi^2=1.89 < 3.84, p<.05$ ] and guard [ $\chi^2=0.01 < 3.84, p<.05$ ].

Teams shoot more frequently from the Forward Left position than from the corresponding Forward Right one with a statistically significant difference in favor of the winners [ $\chi^2=7.36 > 3.84, p<.05$ ], and with no such statistical difference for the defeated [ $\chi^2=0.08 < 3.84, p<.05$ ].

At Low Post position, winners not only take more shots but also present higher percentages in comparison to the defeated (56.8% as opposed to 54.6%) [ $\chi^2=5.14 > 3.84$ ,  $p < .05$ ]. At Middle Post position, percentages drop (39.3% as opposed to 24.7%) [ $\chi^2=5.72 > 3.84$ ,  $p < .05$ ] whereas at High Post position the percentage is 45.5 % as opposed to 34.5 % [ $\chi^2=2.55 < 3.84$ ,  $p < .05$ ]. At the remaining positions, the percentages of winners for the two-point shots are: Forward Left position 43%, Forward Right position 45% and Guard position 38.5%. For the defeated, the corresponding percentages are 32.1 %, 32.2 % and 18 %. Apart from the higher rates of successful shots of winners in two-point shots at the abovementioned positions, they appear to shot many more successful two-point shots from Forward Left position [ $\chi^2=7.80 > 3.84$ ,  $p < .05$ ] and Guard position [ $\chi^2=6.25 > 3.84$ ,  $p < .05$ ] but not from the Forward Right position [ $\chi^2=0.74 < 3.84$ ,  $p < .05$ ].

As far as the two-point shots are concerned, the Jump shot is taken from all execution positions. It has already been noted that there is a big statistical difference between winners and defeated in successful two-point Jump shots which are taken from Forward Left and Guard positions in addition to missed two-point Jump shots which are taken from Forward Right position [ $\chi^2=7.74 > 3.84$ ,  $p < .05$ ] which is where the defeated shoot more from. However, there is no difference between winners and defeated in successful two-point shots from all other execution positions such as Low Post [ $\chi^2=2.52 < 3.84$ ,  $p < .05$ ], Middle Post [ $\chi^2=3.11 < 3.84$ ,  $p < .05$ ], High Post and Forward Right as we have already mentioned above about the last two positions.

As far as lay-ups are concerned, they are taken from Low Post and Middle Post Positions. It seems that both winners and defeated take a similar number of shots in all categories except for the missed lay-ups from Middle Post position [ $\chi^2=4.9 > 3.84$ ,  $p < .05$ ] from where the defeated take more shots than the winners: a) successful lay-up shots: from Low Post position [ $\chi^2=2.05 < 3.84$ ,  $p < .05$ ]; from Middle Post position [ $\chi^2=3 < 3.84$ ,  $p < .05$ ] winners take more shots than the defeated and b) missed lay-up shots: from Low Post position [ $\chi^2=0.27 < 3.84$ ,  $p < .05$ ] the defeated take more shots than winners.

Hook and follow shots are also executed from Low Post and Middle Post Positions. There is no significant statistical difference between winners and defeated in these cases and their number is too small to draw any safe conclusions.

As far as three-point shots are concerned, from the Guard position winners shoot almost a double amount (48.7%) in relation to the other two positions: Forward Left 25.65% [ $\chi^2=21.68 > 3.84$ ,  $p < .05$ ], Forward Right 25,65 % [ $\chi^2=21.68 > 3.84$ ,  $p < .05$ ]. In a similar manner, the percentages for the defeated are: Guard position 49.5%, Forward Left 26.8% [ $\chi^2=21.75 > 3.84$ ,  $p < .05$ ], Forward Right 23,7 % [ $\chi^2=29.31 > 3.84$ ,  $p < .05$ ]. Success percentages for winners are: Guard position 31.8%, Forward Left 32% and Forward-Right 38.5%. For the defeated, the corresponding percentages are 34%, 31.4% and 31.6%. Both winners and

defeated take a similar number of successful and missed three-point Jump shots from all positions: Forward Left [ $\chi^2=1.08 < 3.84$ ,  $p<.05$ ], Forward Right [ $\chi^2=1.89 < 3.84$ ,  $p<.05$ ] και Guard [ $\chi^2=0.01 < 3.84$ ,  $p<.05$ ].

## Discussion and conclusions

Scoring is the aim of every offensive attempt and it constitutes one of the most important actions of basketball of percentages. In this project we recorded and analyzed the shots and their effectiveness, their execution positions and the types of shots taken in a number of basketball games so as to give coaches a clear image of the kind of game-play that leads to either victory or defeat.

In this project we found that in the total of offensive attempts, the percentages of shots taken are for free-throw shots 28.3%, two-point shots 59% and three-point shots 12.7%. The corresponding percentages in men's basketball are for free-throw shots 31%, two-point shots 48% and three-point shoots 21% (Tsamourtzis et al., 2003). It seems that free-throw shots present a similar percentage in both men's and women's games. In contrast, female teams take more two-point than three-point shots.

Winners took more free-throw shots with a success rate of 73.6% as opposed to 64.1% of the defeated. For male teams, the corresponding percentages range from 70 to 76% for winners compared to 67 to 69% for the defeated (Howard, 1993 and Schuetzle, 1988). According to Sampaio & Janeira, 2003; Gómez, et al. 2006, free-throw shots and successful two-point shots constitute the determining parameters which bring victory to the team both for male and female teams. As Smith & Spear (1981) mention, the best offensive line is the one that manages to win fouls in every attack. Most teams hold an average of above one point every time they shot free throws. In no other occasion is more than one point accomplished per possession of the ball. According to Pim, (1986), the teams which took the most free-throw shots won 71.53% of all games.

In the present project, it has been observed that the number of shots from within the court (sum of successful and missed two and three-point shots) presented no significant difference between winners and defeated. Likewise, for male teams, Tsamourtzis, Salonikidis, Taxildaris, Mawromatis (2002) agree that the number of offensive attempts a team realizes does not coincide with the game outcome. At the same time, the success percentage of the team fully coincides with the outcome of the game. The results of this project agree with all the above, as a great difference was observed between winners and defeated concerning successful two-point shots (49.7% as opposed to 41.7%), the higher percentage belonging to winners, of course.

Both winners and losers took three-point shots at a percentage of 33.8% and 32.5 respectively without significant statistical difference. Ortega, Cárdenas, Sainz de Baranda & Palao, (2006); Sampaio et al. (2004); Schunk (1994),

in their study of the relevancy of victory to three-point shots, mention that victorious teams took less three-point shots, with a success rate of 40.3% in comparison to the defeated who took more three-point shots with a success rate of 30.9%. The results of the present project are not in agreement with the above mentioned because it is apparent that in women's team both winners and defeated take the same number of three-point shots with a similar percentage of approximately 33%.

By studying the types of shots, it appears that, during games, women's teams use mainly jump shots (85.8%) and lay-ups (13.2%) while hook shots (0.6%) and follows (0.4%) are barely used. For men's teams, the percentages differ in every category. More specifically, the percentages are: jump shots (72%), lay-ups (16%), hook shots (6%), follows (2 %) and dunks (4%) (Tsamourtzis et al., 2003). According to Gómez et al., 2007; Sampaio et al., 2004, these results are mainly associated with anthropometric characteristics and variations in technical elements or tactics.

In the present project, the shots that show the highest rate of success are follow shots (72.2%), followed by lay-ups (57.2%). Winners take more successful two-point shots and realize more successful lay-ups. Both winners and defeated take a similar number of missed two-point jump shots and missed lay-ups.

By analyzing frequency of shot occurrence in relation to execution positions, we found that the largest number was taken from Low Post position, followed by Forward Left and Forward Right. From Low Post position, winners took more shots with higher rates of than the defeated (56.8% and 54.6% respectively). For men's teams the percentages are higher and reach 65% for winners compared to 56.5% for the defeated (Mikes, 1987; Tsamourtzis et al., 2003). According to the majority of studies, the effort to find ourselves under the basket and shoot from an ideal position is the optimum concept as far as the game of basketball is concerned (Ibáñez et al., 2007; Nelson, 1989; Trupin και Couzens 1989; Zeravitsa και Pavlovits, 1990).

An aspect that we should focus on is the ability to score from Middle Post position. We have found in this project that it is the area that shows the lowest rates of effectiveness as far as the execution of shots is concerned, presenting a success rate of 39.3% for winners and a 24.7% for the defeated. According to Mikes, (1987), Middle Post position functions as a passage so as to attack towards the basket in addition to this area having the second highest rate of earned fouls ( 11.9%). At High Post position the success rate is 45.5% and 34.5% respectively. The higher success rate of High Post position compared to Middle Post position can be attributed to less pressing defense without simultaneous significant distancing from the basket (Tsamourtzis et al., 2003).

As far peripheral scoring positions are concerned, it appears that Forward Left position presents higher mobility as teams take a bigger number of shots from the corresponding Forward Right position with a significant statistical difference in favor of winners. Success rates for winners in two-point shots seem

to be almost equally divided into Forward Left position 43% and Forward Right position 45%, whereas at Guard position, they drop to 38.5%. The corresponding percentages for the defeated are 32.1%, 32.2% and 18% respectively. Finally, it appears that winners take significantly more successful shots from Forward Left and Guard position.

From Guard position, double the number of three-point shots is executed (48.7% for winners and 49.5% for the defeated) in comparison to Forward Left position (25.65% for winners and 26.8% for the defeated) and Forward Right position (25.65% for winners and 23.7% for the defeated). The results coincide with male teams' percentages (Tsamourtzis et al., 2003).

As far as two-point shots are concerned, jump shots are taken from all execution positions. There is a significant statistical difference between winners and defeated in successful two-point jump shots from Forward Left and Guard position; the defeated take more missed two-point jump shots from Forward Right position. In contrast, there is no difference between winners and defeated in successful two-point jump shots taken from all the rest execution positions. As far as Lay-ups are concerned, they are taken from Low Post and Middle Post position. It appears that both winners and defeated take a similar number of shots of all types, except from missed lay-ups from Middle Post position, from where the defeated take more shots than winners. Hook shots and follow shots are also taken from Low Post and Middle Post positions. There is no significant statistical difference between winners and defeated in these cases and the number of shots is very small for one to draw any safe conclusions.

The conclusions drawn from this project provide information about the types of shots made in Women's Basketball Games, their effectiveness and their execution positions and their relevance to victory or defeat. To be more specific, the conclusions drawn from this project are the following: winners take more shots from Low Post position presenting higher success rates, more free-throw shots, more successful lay-ups and two-point shots than the defeated and a similar number of three-point shots with a success rate of 33%. The types of shots from within the court in total of offensive attempts consisted of jump shots (85.8%), lay-ups (13.2%), hook shots (0.6%) and follow shots (0.4%).

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## THE INFLUENCE OF MAXIMAL AEROBIC EFFORT OVER THE CONTACT AND BODY CONTROL

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**ABSTRACT.** *Background.* Your body constantly adapts to the stresses under which you place it. Exercise is one such stress. Over time, your body will physiologically adapt to aerobic training. Researchers measured changes before and after training in many physiological factors, including changes in different muscle fibers types. They discovered major changes in the strength and power of both slow twitch and fast twitch oxidative muscle fibers as a result of the training. Since adaptations only occur in muscle fibers that are active during exercise this study supports the findings of Dudley, showing that both slow and fast twitch fibers are active during easy to moderate intensity run training. *Aims.* We have set a few simple aims for this study: (a) to unveil the road towards further research in the physiological adaptation of the organism to different kinds of efforts; (b) to identify a clear effect of maximal aerobic effort. *Methods.* We used the Cooper aerobic test and the MGM-15 Jump Carpet for every stage of our study. *Results.* The data we gathered had a span between 5.7 and 8.95 for the initial test and between 7.99 and 8.07 for the final test. The results for the Cooper test were 3000m for one subject, 2800m for other two subjects and 2600m for the last one, all this corresponding to grades ranging from Good to Very Good. *Conclusions.* Considering the fact that all the subject registered a Good or above grade at the aerobic test strengthens the fact that the influence of the aerobic effort on the muscle and movement control is dependent on the level of effort deployed and also by the training level of the subjects, due to the fact that none of them had any special and individual training before the study.

**Key words:** aerobic effort, muscle, control, sport, measurement, training.

**REZUMAT. Influența efortului aerobic maximal asupra controlului contactului și al structurii corporale.** *Premize.* Corpul uman se adaptează mereu la stres. Exercițiul fizic este o formă de stres. Cu timpul, corpul se va adapta fiziologic la antrenamentele aerobice. Cercetătorii au măsurat înainte și după un antrenament modificările unor factori fiziologici. Ținând cont că adaptările apar în fibrele musculare active în timpul exercițiului, acest studiu este în conformitate cu descoperirile lui Dudley, care arată că toate tipurile de fibre musculare sunt active în timpul antrenamentelor de intensitate ușoară și moderată. *Obiective.*

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Am stabilit câteva obiective simple: (a) să deschidem drumul către studii aprofundate ale adaptărilor fiziologice la efort (b) să identificăm un efect clar al efortului aerob maximal. *Metode.* În cadrul cercetării au fost folosite: Testul Cooper și Covorul de sărituri MGM-15. *Rezultate.* Datele adunate au fost cuprinse între 5.7 și 8.95 pentru testul inițial și între 7.99 și 8.07 pentru testul final. Rezultatele pentru testul Cooper au fost: un subiect de 3000m, 2800m pentru alți doi subiecți și 2600m pentru ultimul, toate acestea corespunzând cu calificativele de Bine și Foarte bine pentru testul Cooper. *Concluzii.* Considerând faptul că toți subiecții au obținut calificative de Bine și Foarte Bine la testul aerob, se întărește ideea că influența efortului aerob asupra mușchilor și a controlului mișcării este dependentă de nivelul de pregătire al subiecților și de nivelul de efort depus, deoarece nici unul dintre subiecți nu a avut o pregătire specifică.

**Cuvinte cheie:** efort aerob, mușchi, control, sport, măsurare, antrenament.

## Background

Your body constantly adapts to the stresses under which you place it. Exercise is one such stress. Over time, your body will physiologically adapt to aerobic training. These physiological adaptations will decrease muscle soreness and make your heart more efficient so you can exercise more easily and at a higher intensity than when you first start a workout routine. More importantly, your overall health will improve.

### *Oxygen Transport*

When you exercise, your muscles require more oxygen in relation to the intensity of the exercise. Oxygen delivery depends on your heart efficiently pumping blood to the muscles. With aerobic training your heart, because it is a muscle, increases in size. Consequently, more blood enters the heart, resulting in more blood pumped out to your body with each beat. This increase in blood flow leads to an increase in oxygen to the working muscles. An increase in oxygen transport to the working muscles enables your muscles to exercise longer before fatiguing.

### *Heart Rate*

With aerobic training, your resting heart rate will decrease. Average heart rate is between 60 and 80 beats per minute. If your heart rate is 80 beats per minute, after 10 weeks of endurance training, this can be lowered to 70 beats per minute, or one beat per minute each week of training. A trained heart is a more efficient heart. Furthermore, your exercising heart rate also will decrease, enabling you to exercise longer or at a higher intensity.

### ***Blood Volume***

Blood volume increases with aerobic training via increased plasma volume. Immediately after a workout, you have higher levels of protein in your blood plasma. With repeated exercise, your body synthesizes new proteins. The increased protein attracts more fluid, thereby augmenting your plasma volume. Additionally, exercise causes your kidneys to retain more water and sodium, which also increases plasma volume. When the ratio of your plasma to your cells is increased, your blood is thinner. According to Harvard Medical School, thinner blood flows easily through your veins and arteries and is less likely to form blood clots compared with more viscous blood.

### ***Muscle Fiber Type***

Your muscles can be comprised of Type I or Type II fibers. Type I fibers are suitable for endurance exercise because they do not contract as quickly, but they also do not fatigue as quickly. By contrast, Type II fibers are suitable for sprinting exercise because they contract rapidly, but also fatigue rapidly. With aerobic training, Type I muscle fibers increase in size. This means your muscle fibers are able to contract for a longer period of time.

A study was conducted on muscle adaptations from marathon training in novice runners.(2) The training program these novice runners followed was a 4 days-per-week, 18 week program of running at an intensity of 60%-75% heart rate reserve (an easy to moderate training intensity). Researchers measured changes before and after training in many physiological factors, including changes in different muscle fibers types. They discovered major changes in the strength and power of both slow twitch and fast twitch oxidative muscle fibers as a result of the training. Since adaptations only occur in muscle fibers that are active during exercise this study confirms the findings of Dudley, showing that both slow and fast twitch fibers are active during easy to moderate intensity run training.

Aerobic adaptations occur in both slow twitch and fast twitch oxidative fibers at intensities up to 116%  $VO_{2peak}$ , with maximum adaptations occurring around 94%  $VO_{2peak}$ . Adaptations in fast twitch glycolytic fibers begin to occur at around 73%  $VO_{2peak}$ . Slow twitch and fast twitch oxidative fibers are active and adapt during both easy and fast paced training. Fast twitch glycolytic fibers begin adapting at about 73%  $VO_{2peak}$ . Slow twitch fibers adapt to training up to an intensity level of 116%  $VO_{2peak}$ , with peak adaptations occurring around 94%  $VO_{2peak}$ . Slow twitch fibers adapt during both easy and fast paced training. Maximum aerobic adaptation in slow twitch fibers occurred at around 93%  $VO_{2peak}$ .

## **Hypothesis**

Identifying the effects of maximal aerobic effort over body movements.

## **Methods and materials**

### ***Subjects***

The participants in this study were adult college students(N=4) with no special training for any sport in particular.

### ***Methods and the Steps of the Research***

We used the MGM-15 Jumping Carpet for the initial and final test. The test consists of 15 jumps on both legs that must not be bent during the execution. The software from the MGM-15 Jumping Carpet laid out, among others, one measurement for each subject named "Coeficient de variabilitate structurală" (Structural variability coefficient).

C.V.S (Structural variability coefficient) – it refers to the ability to control the contact to the ground during the successive jumps. The average value for the jumps on both legs is between 3 and 3.5. Higher values mean that the subject can't anticipate or can't be ready fast enough for the contact with: a ball, an object or and adversary. Besides these, high-end values for a subject mean that he or she doesn't know her body structure and that he or she doesn't know how to prepare for a contact.

The first part of our study was to do an initial test with the MGM-15 Jump Carpet. This will be the initial data before the actual experiment.

The practical part of our study was consisted of applying the Cooper test to our subjects.

The Cooper test is a test of physical fitness. Kenneth H. Cooper designed it in 1968 for US military use. In the original form, the point of the test is to run as far as possible within 12 minutes. The test is meant to measure the condition of the person taking it and therefore it is supposed to be run at a steady pace instead of sprints and fast running. The outcome is based on the distance the test person ran, their age and their sex.

The last part of our research was to redo the initial test on the MGM-15 Jumping Carpet and compare the results, thus identifying if the Cooper Test influenced the C.V.S.

## **Results**

The data we gathered had a span between 5.7 and 8.95 for the initial test and between 7.99 and 8.07 for the final test. The results for the Cooper test were 3000m for one subject, 2800m for other two subjects and 2600m for the last one, all this corresponding to grades ranging from Good to Very Good.

**Table No. 1** – The CVS values before and after Cooper Test

Name	Initial Test	Final Test
P.T.	6.48	8.07
P.M	5.7	8.03
P.S.	8.53	8.07
T.E.	8.95	7.99
Optimal Value	3 - 3.5	

**Table No. 2** – The Cooper Test comparison values

Age	Very Good	Good	Average	Bad	Very Bad
20-29	2800+m	2400-2800m	2200-2399	1600-2199	1600- m

**Table No. 3** – The Cooper results from our test

Name	P.T.	P.M	P.S.	T.E.
Cooper Results	2800	2800	3000	2600

### Discussion of the results

The first thing that needs to be pointed out is that even though the study had only 4 subjects the results look promising. The fact that the value of CVS (Structural variability coefficient) became stable at around the value 8 for all the subjects after the Cooper Test opens a door towards future studies. Regardless of the initial values, the CVS lowered or increased itself after the Cooper Test. Considering the fact that all the subject registered a Good or above grade at the aerobic test strengthens the fact that the influence of the aerobic effort on the muscle and movement control is dependent on the level of effort deployed and also by the training level of the subjects, due to the fact that none of them had any special and individual training before the study. Even though the initial values were way above the optimal value for the measured coefficient, the fact that the final test values became so close to each other, points out the fact that a larger test must be done to have a better statistical overview.

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## POWER OUTPUT TEST WITH THE MGM-15 JUMP CARPET

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**ABSTRACT.** *Background.* The aim of this article was to test if the MGM-15 Jump Carpet can be used as a reliable method of recording the real level of power output generated by athletes. A good support for our study was the Bahamonde and Johnson study that aimed at identifying a reliable power measurement. *Methods.* We used the MGM-15 Jump Carpet for any of the tests we undertook on this study. *Results.* The value span for the performance athletes group was between 1.77 and 5.4 while for the other group the span was between 2.33 and 4.42. Considering these data, the average values for the first group were 3.37 – 3.54 (for the 2 measurements) and for the second one were 3.45 – 3.54 (for the same 2 measurements). *Conclusions.* We can say that the MGM-15 Jump Carpet is a good support for power increase training for any of the top teams that compete in the National Championship. This is a great way of helping the work of the staff from any team simply by offering a non-subjective way of determining the effectiveness of a training program.

**Key words:** handball, muscle, power, sport, measurement, training.

**REZUMAT. Testarea puterii dezvoltate cu ajutorul Covorului de sărituri MGM-15** *Premize.* Scopul acestui articol este acela de a testa Covorul de sărituri MGM-15 dacă poate fi folosit ca un instrument fiabil pentru a înregistra nivelul real al puterii dezvoltate de sportivi. Un suport excelent a fost studiul lui Bahamonde și Johnson care s-a concentrat pe identificarea unei metode de măsurare obiectivă a puterii. *Metode.* Am folosit covorul de sărituri MGM-15 pentru toate testele aplicate în timpul studiului. *Rezultate.* Valoarea înregistrată pentru grupul de sportivi de performanță a fost între 1.77 și 5.4, în timp ce pentru celălalt grup a fost între 2.33 și 4.42. Având în vedere aceste date, valorile medii pentru primul grup au fost 3.37 și 3.54 (pentru cele 2 măsurători), iar pentru celălalt grup au fost 3.45 și 3.54 (pentru aceleași măsurători). *Concluzii.* Putem spune că Covorul de Sărituri MGM-15 este un bun ajutor pentru sistematizarea antrenamentelor pentru creșterea de putere dezvoltată pentru oricare dintre echipele de top care concurează în Campionatul Național. Aceasta este o modalitate foarte bună de a ajuta activitatea personalului oferind un mod obiectiv de a stabili eficiența unui program de instruire.

**Cuvinte cheie:** handbal, mușchi, putere, sport, măsurare, antrenament.

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## Background

The power developed by the muscles is different from the traction force of the muscle contraction. Power measures the muscle labor in a given period of time. The power is dependent not only to the force of contraction of the muscle, but also to the length and the number of contractions in a minute. In general, muscle power is measured in kg-m/min (Kilogram-force meter/minute). Thus, a muscle that can lift a weight of 1 kg at a height of 1 m in one minute or can move sideways against a resistant object of 1 kg in a minute, has a power of 1 kg-m/min. The maximum power that can be produced by all muscles of a trained athlete, with all the muscles working together, has the following values:

- For the first 8-10 sec., Maximum power is 7000 kg-m/min;
- For the first minute, maximum power is 4000 kg-m/min;
- For the first 30 minutes, maximum power is kg-m/min 1700;

The motivation for this article was to test if the MGM-15 Jump Carpet can be used as a reliable method of recording the real level of power output generated by athletes. A good support for our study was the Bahamonde and Johnson study that aimed at identifying a reliable power measurement. The following ideas are an extract from that article.

The vertical jump test is one of the most popular ways to assess power output. But an accurate determination of power output requires force platforms and/or high-speed film analysis. Most high schools and colleges do not have such sophisticated pieces of equipment. One of the most popular power prediction equations used with the vertical jump is the Lewis formula (11):

$$P = (\sqrt{4.9}) * BM * (\sqrt{hj})$$

where BM is the body mass in kg and hj is the vertical jump height in meters. The Lewis formula was developed to obtain a true measure of power output, where body weight and jump speed were taken into consideration. It is relatively simple to administer and requires little equipment. However, Harman et al. (10) discovered that the Lewis formula has several flaws: (a) it does not use standard units of power; (b) it does not take gravity into consideration; and (c) it does not state whether it measures peak or average power. Harman et al. found that the Lewis formula only predicts the average power of a jumper as he or she falls back to the ground. Harman et al. (10) and Garhammer (8) have stated that the Lewis formula is inaccurate. Harman et al. (10) developed prediction equations for peak and average power but performed two separate jump tests, one on a force platform and the other off the force platform. Also,

Harman et al. (9, 10) used very few subjects to develop the equations. Garhammer (7) modified the Lewis formula for each gender but did not state the accuracy of their method and only tested 13 subjects. There has not been a simple formula developed using the results from a countermovement jump and reach test from a force platform. Also, though there are gender differences in power output, gender has never been used as a variable to predict power (12,15).

There were significant differences ( $p < 0.05$ ) for both peak and average mechanical power, respectively,  $5,782 \pm 1,123$  and  $3,037 \pm 638$ . This is the actual data that we need to compare our results with.

## **Hypothesis**

Identifying a reliable method of measuring the power output of top performance athlete.

## **Methods and materials**

### ***Subjects***

The participants in this study were adult college students or graduates (N=23), aged from 22 to 33 years that were split into 2 groups: the non-professional students (that aren't enlisted in a high performance team) and the members of the handball team enlisted in the National Championship.

### ***Methods and the Steps of the Research***

We used the MGM-15 Jumping Carpet for test. The test consists of 15 jumps on both legs that must not be bent during the execution. The software from the MGM-15 Jumping Carpet laid out, among others, one measurement for each subject named "Puterea unitară medie"(Average Unit of Power).

P.U.(Average Unit of Power) – it is measured during the jumps on both legs and offers data regarding: (a) the level of conditional training in sport performance; (b) information regarding the relation between force and speed.

### ***Procedure***

Our test was split into 2 smaller parts.

First part was consisted of 2 consecutive measurements of the power generated during the MGM-15 Jumping Carpet test. At this stage we measured the normal students from our Faculty with no special training.

The second part was the same as the first but we measured the athletes from a professional handball team that is enlisted in the National Championship.

## Results

After all the tests were completed the data was introduced into tables and the average values of the data were calculated. The tables below contain the initial letters of the subject's names and the recorded values of the power output as given out by the MGM-15 Jump Carpet software.

**Tabel. No.1** – The power of the top performance athletes

Name	1st Record	2nd Record
B.M.	3.2	2.89
F.L.	3.85	3.87
G.A.	1.77	2.68
I.A.	4.18	4.16
L.R.	1.96	1.82
L.P.	3.79	3.28
M.A.	3.08	3.16
M. B.	2.19	3.3
S.T.	4.32	4.26
S. R.	2.11	2.77
T. E.	4.69	4.85
V.V.	5.34	5.4
Average	3.37	3.54

**Tabel No.2** – The power of the students from our faculty

Name	1st Record	2nd Record
P.M	3.9	3.67
P.A.	3.46	4.1
P.C.	3.56	3.37
P.A.	4.05	3.77
P.M.	4.3	3.85
P.T.	2.39	2.27
P.V.	2.77	2.41
P.B.	3.74	4.2
P.A.	3.5	3.58
R.T.	4.42	4.37
V.A.	2.88	2.33
Average	3.54	3.45

**Tabel No.3** – The comparison of the values

Recordings	Performance Athletes		Non-Performance Students		The control value	
	Peak	Average	Peak	Average	Peak	Average
1st Record	5.34	3.37	4.42	3.54	5,782 ± 1,123	3,037 ± 638
2nd Record	5.4	3.54	4.37	3.45	5,782 ± 1,123	3,037 ± 638

### Discussion of the results

The first thing that needs to be pointed out is that the value span for the performance athletes group was between 1.77 and 5.4 while for the other group the span was between 2.33 and 4.42. Considering these data, the average values for the first group were 3.37 – 3.54 (for the 2 measurements) and for the second one were 3.45 – 3.54 (for the same 2 measurements).

If we compare our results with the data from the Bahamonde and Johnson study we can see that our numbers are well in the limit that the comparison study offered us. This is the main proof that the test we did is a reliable and secure way of measuring the power output of any athlete. Furthermore, the fact that the measurements of the non performance students were in the same limit emphasizes the consistence that the test has.

All this considered, we can finally say that the MGM-15 Jump Carpet is a good support for power increase training for any of the top teams that compete in the National Championship. This is a great way of helping the work of the staff from any team simply by offering a non-subjective way of determining the effectiveness of a training program.

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## **STUDY ON THE CORRELATION OF SYSTEMATIC PRACTICING OF PHYSICAL EXERCISES, PARTICIPATIVE MOTIVATION AND HEALTHY LIFESTYLE**

**IONESCU CECILIA LILIANA\***

**ABSTRACT.** In the current context of a rapidly transforming society in which the stress and the intellectual strain are ubiquitous in daily life, the constant practice of physical exercises represents an important factor in general health strengthening, in providing a comfort and a mental balance so necessary and useful for healthy living. Although physical education and sports (hereby the acronym PE) is a practical field mainly, it can be approached from the perspective of creation of positive attitudes towards exercising, towards promotion and development of values through direct participation in the activities specific to the above mentioned field. To this effect we conducted a research that did not focus strictly on the motor dimension of the physical activities practitioner; this research represented the doctorate thesis of the undersigned, out of which I would like to introduce a cutting of the research undertaken, namely a study on the correlation of the systematic practicing of PE, the participative motivation and the healthy lifestyle. Health is essential to normal growth, harmonious development and creation of a balance between physiological, physical and mental functions. Thus the utility of the constant practicing of PE is justified, raising the biological potential, the work capacity of the body, the improvement of nervous system functions and preventing illness due to strain. Of course, we must consider that maintaining health can be achieved by the higher adaptability of the organism to various conditions, by stimulating young people's interest in independent and continuous practice of PE or of a sports branch that incorporates socio-moral values.

**Key words:** systematic practicing of physical exercises, motivation and healthy lifestyle

**Rezumat. Studiu privind corelația dintre practicarea sistematică a exercițiilor fizice, motivația participativă și stilul de viață sănătos.** În contextul actual, cel al unei societăți aflată în continuă transformare, în care stresul și suprasolicitarea intelectuală sunt omniprezente în viața de zi cu zi, practicarea constantă a exercițiilor fizice reprezintă un factor important în întărirea stării generale de sănătate, în asigurarea unui confort și a unui echilibru psihic atât de necesare și utile unei vieți sănătoase. Deși educația fizică și sportivă e un domeniu eminent practic, ea poate fi abordată și din perspectiva formării de atitudini pozitive pentru mișcare, pentru promovare și dezvoltare de valori prin participarea directă la activități specifice domeniului mai sus enunțat. În această idee am realizat o cercetare științifică, care

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nu s-a concentrat strict asupra dimensiunii motrice a practicantului de activități fizice și care s-a constituit în teza de doctorat a subsemnatei, din care doresc să prezint un decupaj al cercetării întreprinse, și anume un studiu privind corelația dintre practicarea sistematică ale exercițiilor fizice, motivația participativă și stilul de viață sănătos. Sănătatea este indispensabilă creșterii normale, dezvoltării armonioase și creării unui echilibru între funcțiile organice, fizice și psihice. De aceea se justifică utilitatea practicării constante a exercițiilor fizice, pentru ridicarea potențialului biologic, a capacității de muncă a organismului, pentru perfecționarea funcțiilor sistemului nervos, pentru prevenirea îmbolnăvirilor ca urmare a suprasolicităților. Desigur, trebuie să ținem cont că menținerea stării de sănătate se poate realiza pe fondul creșterii capacității de adaptare a organismului la condiții variate, a stimulării interesului tinerilor pentru practicarea independentă și continuă exercițiilor fizice sau a unei ramuri sportive, care încorporează și valori socio-morale.

**Cuvinte cheie:** practicarea sistematică a exercițiilor fizice, motivația și stilul de viață sănătos

To investigate our topic, we used two sampled populations represented by 219 students and 80 teachers of physical education from five non-specialized institutions of higher education. The hypothesis that we formulated states the following matters: *if, during the formal activity of Physical Education and Sport we shall practice systematically physical exercises in a modern, active way, under optimal conditions of organization and in an optimal learning environment - facilities, equipment, logistics, including an offer of positive values (climate, team work, etc), then the motivation of the participation will increase, the lifestyles and the relationship will improve and will become obvious in students' daily behavior.*

In our opinion, the systematic practicing of physical exercises during the formal activities of PE can determine the students to target an active and constant participation in PE activities in their leisure time and to accommodate themselves to a systematic practice independently.

The objective that we proposed for this variable was to stimulate students' interest in independent and/or collective practicing of PE or team games. The indicators on which we focused were identified with the frequency of participation in PE classes and the degree of satisfaction regarding the conditions of organization and practicing of PE classes. The research method that we used was the questionnaire of opinions addressed to students, respectively item 1 and point f of item 5, and item 2 from the questionnaire of opinions addressed to teaching staff.

The item 1 addressed to students included the following question: *Indicate how often you perform a PE activity. Tick your answer. We created a scale from 5 to 1 and we established the response variants accordingly. Depending on the frequency recorded for each interval, we wrote down the rank corresponding to each interval. The data collected and centralized for this item in students' questionnaire are listed in Table 1.*

**Table 1.** Frequency of students' responses regarding PE specific activities

<i>Scale</i>	<i>Variants of response</i>	<i>Frequencies</i>		<i>RANK</i>
		<b>Number</b>	<b>Percent</b>	
5	At least 30 minutes daily	48	22%	<b>III</b>
4	3 times a week	75	34 %	<b>I</b>
3	2 times a week	59	27%	<b>III</b>
2	In PE classes only	28	13%	<b>IV</b>
1	Very rarely, not at all	9	4%	<b>V</b>
<b>TOTAL</b>		<b>219</b>	<b>100%</b>	

The data recorded in this table reveal the nature of students' interest in PE activities practicing. Thus, from the variants of responses that we advanced to the students and depending on the number of answers assigned to them, we compiled a ranking, in which ranks from I to V were allocated. The highest frequency, with 75 options, rank I respectively, was recorded for the form "at least 3 times a week". For the variant "2 times a week", which represents the average interval, in our opinion, the frequency was 59 responses, taking the rank II, while the variant "at least 30 minutes daily", which was considered the maximum interval, was chosen by 48 respondents, the rank III respectively. Looking at the lower levels, we notice the rather small frequency for practicing PE "in PE classes only" which belongs to a number of 28 respondents; only a number of 9 students out of the total number of 219 participate in PE activities "very rarely, not at all".

While investigating the variable defined by the systematical practicing of physical exercises, we were interested in students' opinions on the facilities where they carry out the PE formal activities. With that end in view we analyzed point **f** of item 5, which refers to the material basis necessary for a good development of PE activities that we shall highlight while reviewing the following variable that refers to motivation.

Teachers expressed their opinions regarding the frequency of students' participation in PE classes by answering the following item: I.2. *To what extent are you satisfied with the participation of your students in your classes of PE?* Their responses on this topic were specified in table 2.

The data that we recorded in Table 2 indicate a good participation of students in PE classes, by expressing the satisfaction of teaching staff about it. One can observe that out of the total number of 80 teachers, 16 are satisfied "to a very large extent", and 50 "to a great extent" with the frequency of students' participation in the formal activities of PE. If we make an analysis of teachers' responses by ranks, we notice rank I for the response "to a great extent", rank II

for “to a very large extent” and rank III for “equally”. The frequency of teachers’ answers on the 2<sup>nd</sup> level of the scale, “to a small extent”, is 4 responses, 5% respectively, while for the 1<sup>st</sup> level, “to a very small extent”, the frequency is 0.

**Table 2.** Participation of students in classes of PE according to teachers’ opinion

Scale	Possible responses	Frequency	Percent	Rank
5	To a very large extent	16	20%	<b>II</b>
4	To a great extent	50	63%	<b>I</b>
3	Equally	10	12%	<b>III</b>
2	To a small extent	4	5%	<b>IV</b>
1	To a very small extent	0	0%	<b>V</b>
TOTAL		80	100%	

From the data presented so far, we can advance the idea that the developed PE formal activities stimulated students’ interest in EXF practicing, fact confirmed by their attendance to PE classes and by important preoccupations for an independent participation in various forms of PE activities.

Motivation is a “fundamental concept in psychology and, generally, in the sciences about man, expressing the fact that the human behavior is always based on an assembly of motives – needs, trends, affects, interests, intentions, ideals–supporting the achievement of certain actions, facts, attitudes” (apud. Wikipedia, accessed on 10.12.2010). In our research, we were interested in the participative motivation, which is crucial for a good participation of the students in PE activities. The list of the motivational factors that generate a good participation in this type of activities is rather generous, represented by the following indicators: self-assertion, achievement, need of movement, attractive activities of PE etc. The creation of motives depends on the modality in which the needs and feelings of everyone must be expressed and the mode of action of the social or pedagogical external factors. The importance of this variable led us to decide to include it in our research.

The goal that we set was to determine the increase of students’ motivational spectrum related to PE; the indicator used to quantify this variable was the identification of the motivational factors spectrum that determines the participation in PE activities. As research method we have used the questionnaires of opinions addressed to both students and teaching staff.

In the questionnaire of opinions, students answered item I.5, while the teachers answered the item I.8. The sampled populations had to assess, from a list of 12 motivational factors, those that they consider primordial for a good participation in activities of PE. We also mention that we calculated the coefficients of correlation of items I.5 and I.8, as we wanted to know the intensity of the links between students and teachers regarding the listed values.

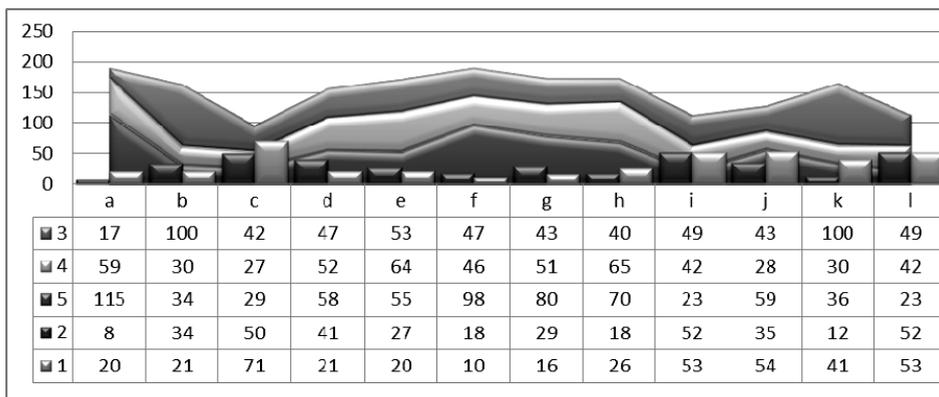
Students answered the following item: *the extent to which the factors mentioned below determine you to participate systematically to activities of PE.*

From the data recorded in students' answers, on the scale maximal interval we noticed that the students had indicated the following reasons that determined them to participate in formal activities of PE "need to move" with 115 options, "proper equipment of PE facilities" with 98 and, good for us, "the habit of practicing PE activities" with 80 options. The lowest frequencies were recorded for "mandatory participation" with 23 options, fact revealing that most students do not take part in PE classes because this subject is compulsory, but for the reasons mentioned above. The "wish of self-improvement" was also indicated with 23 frequencies. 46% of the respondents opted for the two high intervals 4 and 5 of the offered scale, while 24% opted for the average interval.

According to the ranks obtained, the following motivational factors mentioned by students ranged on levels 4 and 5: "need to move" takes rank I, "proper equipment of PE facilities" takes rank II, "attractive EFS activities" - rank III, "habit to practice PE activities"- ranks IV and V were assigned to "habit of practicing the activities of EFS" and "the active emotional awareness" respectively. Corresponding to lower intervals, rank I was indicated for "identification with the chosen /preferred model", "mandatory participation" rank II and "grade" rank III.

We can state that students' participation in PE formal program is not due to the statute of mandatory subject of PE or to obtaining a credit or a grade, but for reasons such as: need to move, attractiveness of the activities carried out, need to affiliate to a group, satisfaction given by living the present experiences, etc.

The figure below shows the graphic distribution of students' responses, recorded for defining the motivational factors decisive for the participation in PE characteristic activities.



**Figure 1.** Students' opinions on the motivational factors decisive for participation in PE activities

Chart 1 show that six of the motivational factors that we presented reach a maximum of the options expressed on interval 5. On interval 4 we find a motivational factor represented by the “active emotional awareness” that reaches the peak of options, and on level 3 of the scale are placed 2 factors, “relaxation, remove of stress” and “need for success” with 100 nominations each. The “identification with the chosen model” has the highest frequency of the options for the two lower intervals 2 and 1.

In order to get an image as clear as possible on this variable, we wanted to learn the opinion of PE teachers regarding the reasons that lead students to attend the classes of PE. Thus, they answered the item 8 of the opinions questionnaire: *“to what extent do you consider that the factors mentioned below determine the students to participate in PE activities entered into the official curriculum”*.

Teachers’ points of view on the reasons that determine students’ participation in formal nature activities specific to PE were the following ones: on the superior interval 5, we find out that the higher frequency of respondents’ answers regarding motivational factors is for “the need to move” with 50 options, followed by “active emotional awareness” with 42 options, “need to compete with others” with a total of 40. The “habit of practicing PE activities” has 31 adhesions and the “grade/credit” gathered 30 votes from the total of 311 votes expressed on this interval.

It is worth highlighting the fact that teachers assessed five of the motivational factors introduced starting from interval 3, as they consider them very important for students’ participation in PE formal activities. We also noticed that the frequencies obtained by their summation on the high intervals determine the following ranking of the motivational factors, in teachers’ opinion: rank I for “credit”, rank II for “active emotional awareness”, rank III for “need to move” and rank IV for the “need to compete with others”.

In conformity with the analyses performed, we can affirm that we determined which are the main motivational factors that a student’s leads to have a satisfactory participation in PE activities; thus the spectrum of their motivations for PE is revealed.

Lifestyle combines all activities that make up the life of a person, a group, a community, how they organize their life to meet certain necessities and material and spiritual needs. Lifestyle includes the scheduling of the action directions selected by a person, comprising a series of beliefs, values, representations about world and life. According to these ones, each of us behave and act to complete successfully or not our approaches. It is considered that, related to lifestyle, the decisions making and the actions carrying out are achieved under life conditions that affect or do not affect our health.

The objective that we wanted to accomplish, according to this variable, was to influence/generate the dominance of students’ and teaching staff’s interests and expectations for the creation and manifestation of a healthy lifestyle, in private and professional context.

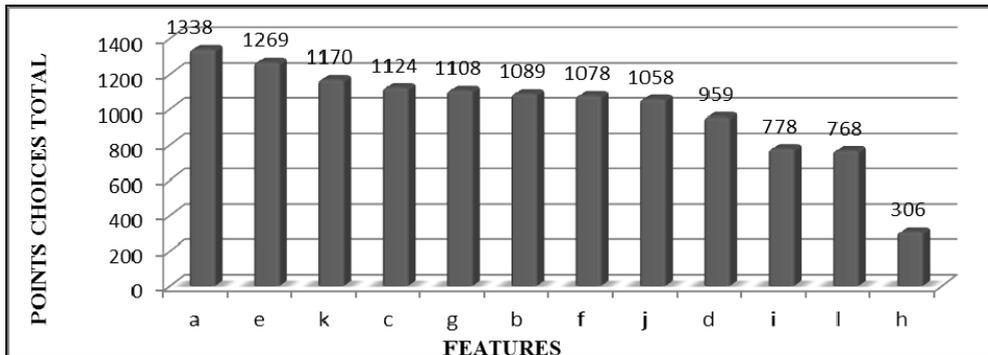
The indicator was represented by the establishment of the identity of the characteristics of healthy lifestyle consistency and relevance. To investigate this variable we used item 6 of the questionnaire addressed to students and item 9 for teachers from the opinions questionnaire. The requirement of item 6 was the following one: *“on a scale from 10 (very important for me) to 1 (not important for me) please mark the place occupied by each of the following characteristics that you consider important for a healthy lifestyle of children and young people (students)”*.

From a list of 12 elements put in a random order, the students assigned points from 10 to 1 to each feature, in order of their importance. After we had determined the total of points choices by the sum of the products for each feature separately, we set them in a table, in descending order, according to their ranks. On this occasion, we admit that we did not succeed to fully grasp the assembly of features/components that sketch/define the healthy lifestyle, because this one is a much larger concept as meaning and, therefore, much more comprehensive compared to the components.

We determined, following up the opinions expressed by the 219 students, the top ten features of a healthy lifestyle. We remark with satisfaction the presence of the feature defined by “meeting the need to move” on the first position, rank II was assigned to “maintaining a balance of health dimensions (emotional, intellectual, social, physical, spiritual)” while the “formation of the habit to practice physical exercises in leisure time” takes rank III. We point out that among the top ten components that define the healthy lifestyle can be found characteristics related to health condition, to PE practicing, to keeping a balance of the emotional, intellectual, physical, spiritual and social dimensions. The elements that remained outside the frame represented by lifestyle were the ones that aimed at the knowledge of human body and the theoretical concepts of physical effort hygiene and physiology.

We are pleased with the table made by respondents regarding our variable and we also found out that the students admitted that PE specific activities’ practicing represents an essential feature for the creation of a healthy lifestyle. We expect that this recognition is materialized in students’ daily life by a constant participation in activities involving physical dimension. Also, the concern for preserving optimal health, along with the other elements mentioned above, give students the confidence that they can express themselves multilaterally in the actions they undertake. We believe that we could not catch all the features of lifestyle, but we hope that those on which we focused cover to a great extent the elements defining this concept that was identified and accepted by the investigated students.

The graph in figure 2 shows a real image of the main components regarding lifestyle, according to students’ opinion.



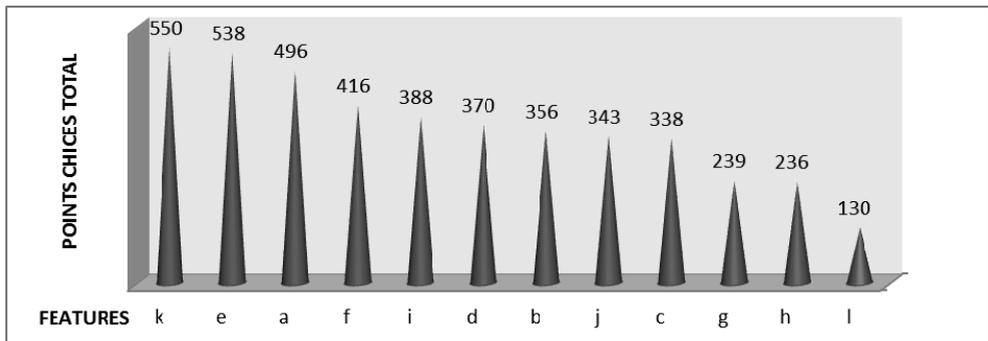
**Figure 2.** Ranking of healthy lifestyle features - students' opinion

We made this graph based on the ranks assigned to the features that define the healthy lifestyle according to students' opinion. Figure 6 shows us that the difference of the values obtained for the first 9 features of our list is relatively small, fewer than 100 points, with values rather close together. What we want to emphasize by this finding? The components shown for a healthy living are, in conformity with students' opinion, very important and it was difficult to make their dissociation, fact proved by the relatively close values obtained for the first nine features. Related to the structural table formed by these 11 constituents, only one feature was marginalized, namely the "knowledge of human body" that was nominated by 48 of the students, totaling 306 points. Regarding the tenth item of the ranking, according to students, the difference was extremely small between "creation and development of the interest in the issues of integral (total) health" and the "acquisition of basic theoretical knowledge in the field of physical effort physiology and hygiene".

Following up the analysis performed as soon as the students had expressed their opinions on determining the features of lifestyle, we are satisfied that the respondents admitted and nominated the components of our variable. In the same time, we are pleased that there was not any non-response from students' part in the investigation of lifestyle.

We wanted to know teachers' opinion on the same topic. Thus, they responded to item 9 of the questionnaire that had the following statement: *"set in order the first ten objective features on a progressive scale from 10 (very important, very much) to 1 (not important, very little) - the place taken by the following features that you consider important for the formation of a healthy lifestyle of the students"*. Our interest focused on the first ten components for our variable and also to see which one of the elements raised for discussion remained outside the ten ones. As a first remark after seeing the results, we point out that we identified the following similarities in the opinions expressed by

students and teachers: the top three items in the rankings made after accounting the points through the sum of the products of the two population samples are occupied by the same features, with the only difference of their position. Thus, the “formation of the habit to practice physical exercises in leisure time” has rank I for the teachers, while it takes rank III in the case of the students. For “preserving a balance of health dimensions (emotional, intellectual, social, physical, spiritual)” both students and teachers assigned rank II. In the case of “meeting the need of movement” teachers gave rank III and students rank I. There is one more feature, “health periodical checkup” for which the same rank was assigned by teachers and students too, rank VIII respectively. Among the listed features that were not assimilated by students and teaching staff too in lifestyle table are included the “knowledge of human body” and “acquisition of basic theoretical knowledge in the field of physical effort physiology and hygiene”. In conclusion, we noticed the presence of the same constitutive elements in the two populations sampled, students and teachers respectively, which show a similarity of the opinions expressed by the groups surveyed. We shall introduce below the graphical distribution of the features that define lifestyle; afterwards we set in order these features, depending on the determined ranks, following up the calculation of the total points by the sum of the product (fig.3).



**Figure 3.** Teachers' opinions on features of healthy lifestyle

From this graphical representation of teachers' options expression, set in descending order, it can be observed that there are the same small differences between the points obtained for each feature separately. One can also notice that the last item is somewhat marginalized because of the number of points accumulated, related to the other features. Finally, we noticed the preference for the same features evaluated by the two sampled populations that make up the healthy lifestyle; there are only differences of opinions regarding the assignment of the ranks, here and there.

**Statistic data.** In table 8 are recorded the values of the statistic indicators values represented by the indicators of central tendency - arithmetic mean, median, module, indicator of data scattering- standard deviation and the asymmetry and Kurtosis indicators as well.

**Table 8.** Statistic indicators for items 1, 5 and 6 for students, 2 and 8 for teachers respectively

Indicators Items	Arithmetical mean $\bar{X}$	Median Me	Module Mo	Standard deviation S	Skewness indicator	Kurtosis indicator
Students I1	3.57	4	4	1.091	-.450	-.474
I5	3.28	3	5	1.385	.269	-1.137
I6	5.50	6	1	2.885	-.002	-1.233
Teachers I2	3.98	4	4	.729	-.767	1.123
I8	3.56	4	5	1.399	-.575	-.785

The arithmetical mean for items 1, 5 and 6 in the questionnaire addressed to students and for items 2, 8 and 10 in teachers' questionnaire has values exceeding value 3, fact that indicates that most of respondents' choices were placed on the median interval up to the higher intervals, namely 3, 4 and 5 respectively. The value 4 of the median for items 1, 2 and 8 shows that the half of responses is reached at level 4, ranging between intervals 4 and 5 while value 3 of the median for item 5 indicates the location of 50% of students' options on the average interval 3, between intervals 3 and 5.

The modal value equal to 4 shows that this is the value taken with the greatest frequency and is placed between intervals 3 and 5. The arithmetical mean of the items in the table is smaller than the median and indicates a moderately slanting distribution and negatively ended towards smaller values, while the positive value of the asymmetry indicator for item 5 shows a moderate positive asymmetry (the longer tail of the distribution towards large values). The positive value of Kurtosis indicator for item 2 proves a high distribution of data, pointing the intensity of the concentration of teachers' opinions frequencies around the average, in terms of their degree of satisfaction related to students' participation in PE classes.

**Interpretations and comments concerning the systematic practicing of physical exercises, participative motivation and healthy lifestyle.** After the completion of the review carried out by investigating the topics defined above, we can advance the following conclusions:

(1) Referring to the problem of systematic practicing of physical exercises, we remind the indicators that we set corresponding to this analysis: frequency of students' attendance in PE classes and degree of satisfaction on the conditions of PE facilities organization. We have found out that students participate quite actively in PE activities, the percentage of those who refuse to practice activities specific to PE is pretty small, only 4%, respectively 9 students out of a total of 219 respondents. There is also a high degree of satisfaction regarding the equipment of the material resources existing in the spaces where they develop the activities specific to PE field. Therefore, out of the 219 students, a number of 144, 68% respectively, assessed this determinant factor for their participation in PE activities as belonging to the maximum interval of the scale.

(2) The indicator that we used to measure the participative motivation was the identification of the spectrum of the motivational factors that determine the participation in activities specific to PE. As a preliminary conclusion, drawn following up the review of the tables and graphs created for students and teachers, it may be noted that students' participation in the program of PE specific formal activities is not due to the binding character of PE discipline, but to some reasons, such as the need to move, the attractiveness of PE activities carried out, the need to join the group, the satisfaction given by living the present experiences, etc. We established and identified the table of the motivational factors decisive for the formal practicing of PE activities.

(3) The features of lifestyle were investigated by means of the questionnaire addressed to students and teachers as well. The indicator was to establish the identity of these features, their coherence and relevance. Healthy lifestyle components were very important, according to students' views, and we noticed that it was difficult to make a ranking of these components, fact proved by the relatively close values obtained for the top ten features.

We express our gratitude that we were able to also identify similarities of views between the two samples as for certain features of lifestyle that we have outlined above.

At the end of our comments on the issues represented by the variables described we were able to say that the hypothesis defined by the following statement: "if in the course of the formal activities of physical education and sport we practice systematically physical exercises in a modern, active manner, under optimal organization conditions and in the best environment for learning - facilities, equipment, logistics, including an offer of positive values (climate, teamwork etc), then the motivation of participation will increase, the life and relationship styles will improve and will become obvious in students' daily behavior" was confirmed.

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## EFFECTS OF 12 WEEKS INTERVENTION PROGRAM ON OLD WOMEN' PHYSICAL AND MOTIVATIONAL STATUS

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**ABSTRACT.** Due to the increasing proportion of elderly in society, it seems important to find means and methods to successfully improve their quality of life. The purpose of this study was to measure a 12-week yoga program on elderly fitness level (Fullerton test), quality of life (WHOOLD QOL) and attitude toward aging (WHO AAQ). In one of Budapest's senior houses there were 32 elderly who were considered fit enough to meet the expectations of such a program. The program for the research group (n=16) was involved 3 yoga sessions a week and the control group (n=16) was not involved in any kind of intervention. According to paired t-tests, the 12-week program did not cause meaningful differences in most of the anthropometric indicators, the Fullerton fitness test's and the quality of life categories. However, in the attitude towards aging test, there were 8 items showing significant differences between pre- and posttest. As an effect of the 3 sessions-per-week yoga training, the participants remained not only physically fit, but also their motivational level stagnated, moreover it gradually increased. Probably, a longer program might be more beneficial as measured by these test.

**Keywords:** elderly, yoga program, quality of life measures

### Background

The ratio of young adults and the elderly within the population is ever changing: the less children being born and the growing number of elderly people shifts the age composition, which prognosticates severe societal and economic crisis. It can be attributed to the problem that Hungary's most populous area, Budapest's aging index is less favorably taking shape compared to the national average (KSH, 2011).

In certain countries, especially in Hungary, males die significantly earlier than what would be expected based on the economic development of the country (Kopp M. & Skrabszki Á., 2009). Life expectancy is significantly affected by

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lifestyle, since the most frequent causes of death can be deprived from the improper lifestyle illnesses. These are stress, malnutrition, sedentary lifestyle and maladaptive coping strategies for stress. The study also showed that in the legatee risk factors, smoking and particularly the lack of physical activity significantly forecasted early mortality in the course of both men and women.

However, we know that aging is a physiological process. Older people are as part of the society as the middle-aged, the young and children. But while the latter ones have future and round of duties, the elderly chiefly have their past (Semsei I., 2010). Due to the previously mentioned, in today's society only negative stereotypes are related to becoming elderly. In order to improve this tendency, the creation of specific action plans would be sorely needed to make a positive change in the quality of life of the ever thriving elderly age group.

The aging process is characterized by the impairment of the functional capacity of the organs. However, the homeostasis could be sustainable until the end of life, since the great number of chronic illnesses is not an obligate attendant of aging. The elderly are not a homogenous group; therefore there are huge differences in the individuals' quality of life, physical and mental conditions. The elderly become ill not because they are aged, but because pathological processes occur in the organism (Iván L., 2002). After all, if we think of the elderly, the thought associated to them gather around the illnesses only.

A significant segment of the Hungarian population does not consider physical activities desirable free time activity. Unfortunately neither do the middle-aged and the young, but significantly nor do the elderly. Among the over 60 year-olds only 7% reported doing sports on a weekly basis, whereas 91% never has done any sports, including 87% of women and 97% of men. The typical physical activity of the elderly age group is physiotherapy (29%), and physical activity usually means gymnastics at home respectively (42%) (Neulinger Á, 2008).

In general the real obstacle of the more active lifestyle of the elderly is their health condition; due to this it is really essential to induct exercise programs into their everyday life taking their state and skills into far-reaching consideration. The method that could be effective shall be chosen circumspectly and by evaluating the individual sanitary and physical conditions. The health promoting and preventing effects of regular physical activity can not only be discovered among the young and the middle-aged, but also among the elderly (Sidó Z., 2005; Jákó P., 2008).

One of the most considerable novelties related to the topic is the medical Nobel laureate Elisabeth Blackburn. She and her colleagues scored full marks for examining the effects on life-span of telomerase enzyme. One of the branches of the research is joined to the renowned cardiologist professor Dean Ornish, who justified that as an effect of a complex and intense change of

lifestyle – low-fat nutrition, daily yoga, meditation and breathing exercises for stress treatment, and supporting group participation - could increase the telomerase activity by 30% within three months, consequently increasing the sanitary conditions of the participants (Falus et al, 2010).

Louisiana State University examined the effect of various movement forms through 9 months on people with diabetes. 73 of the 262 participants did muscle development, another 72 did aerobic training, 76 of the participants took part in a combined program and 42 as a control group did not perform any sport activities. According to the results the hemoglobin Alc. level decreased by 0.16% in the first, by 0.24% in the second respectively by 0.34% in the third group compared to the control group. In addition, in all three groups the waist circumference was also reduced, since they needed less medicine and their well-being also improved (Sigal R. J & Kenny G. P., 2010).

In 2002, at the World Sport Medicine Congress held in Budapest, took the floor the one Steven N. Blair, who later, in 2009 published in British Journal of Sports Medicine. In his overall article a number of research results demonstrated the sanitary effects of regular exercise on most common chronic diseases such as cardio-vascular problems, diabetes, cancer and other diseases that progress with aging. He also pointed out that physical inactivity is the largest public health problem of the 21. century.

The cognitive functions in old age can also be developed. Eisler (2002) showed that the earlier they begin to lead an active lifestyle, the more preferably they would reduce the risk of dementia in old age. In another study involving 9344 women also showed these results. We may regard to it as a warning, since the inactive lifestyle even among the young became a general phenomenon, which lays the foundations for the latter decay of physical and mental conditions (Barnes M., Lui, D. E. & Yaffe K, 2010)

The results of Visser's (2004) seven years long study involving 3075 participants showed that mobility and body composition changed favorably among those who had walked at least 1.5-2 hours per week. The author also drew attention to the importance of prevention and passing the information. It is however stated that it is never too late to start a more active lifestyle, which -in not every case- may not be a subject to any sports club.

It was examined in a study, that effect of physical activity of the elderly, with special attention drawn to the metabolism of the cardiac muscle (Soto P. E. & Herrero P., 2008). The study was conducted on elderly people between the ages 60-75 over an 11 month period, which consisted of 3-5 sessions per week. The subjects trained on 65%, later 75% of their performance. As an action of the program, the metabolism of the cardiac muscle improved significantly, this may decrease the risks of ischemic heart diseases and stroke.

## **Material and Methods**

We developed our research program based on the presented professional literature in which we examined fitness indicators, nutritional status, quality of life and attitude toward aging during the 12 week yoga program. We hypothesized that the observed factors within the yoga group will change favorably compared to the results of the control group.

### ***Sample sampling***

The examination takes place in Budapest XI. district Újbuda Municipality Senior House. The participants, who's mentally, physically and sanitary conditions were good enough to be involved in this study, were selected by the nursing staff. After presenting the program 21 women signed up for it. Later on four of them did not find themselves fit enough to keep on the 12 weeks of continuous physical activity. The causes of the rejection were severe heart disease, dermatological disease and previously done surgery. Another person had an accident after the second week, so due to treatment in hospital she had to quit the program. So finally the group had 16 participants. There a lot of residents in the institution who struggle with severe illnesses, so the control group was randomly selected from the members of the senior club.

Composition of the groups has evolved as follows:

- Active group (A): three times a week, one hour yoga sessions for 12 weeks (N=16, M=80,68 years)
- Control group (C): did not participate in any physical activities, and did not change their lifestyle in the course of the 12 weeks. (N=16, M=79,93)

### ***Methods***

At the start of the program we used open questionnaire to record the participants' socio-demographic data, and also measured their anthropometric characteristics such as: body weight (BW) body height (BH). Based on these two latter we were able to calculate body mass index (BMI). Before and after the intervention program physical fitness, quality of life and attitudes toward aging were measured. To examine the change in physical condition of the participants, the validated Fullerton Functional Fitness Test (FFFT) was used, measuring the necessary motions in daily life of the seniors (Rikli R. E. & Jones C. J., 2002). Since most of the yoga group was in bad condition, I decided to eliminate the 6 minutes' walk during the measurement, due to that some participants could only stand up and walk with aid and many complained of dizziness (Table 1.)

**Table 1.** Items of the Fullerton Functional Fitness Test

<b>Item</b>	<b>Aim</b>	<b>Method</b>
30-Second Chair Stand	To assess lower body strength	Stand up and sit down from a chair for 30 minutes (pc.)
Arm Curl	To assess upper body strength	Curl and elongate of the arm with 2 kg dumbbell in the hand for 30 minutes (pc.)
Back Stretch	To assess upper body (shoulder) flexibility	Measure the distance between big toe and tip of middle digits (+, - cm)
Sit and Reach Test	To assess lower body/hamstring flexibility	Measure the distance between middle digits (+, - cm).
8'Up and Go	To assess physical mobility, involves power, speed, agility, and dynamic balance	Set the time through stand up from a chair, come round a buoy and sit down (s)

We surveyed quality of life with the WHOQOL-OLD questionnaire, made by WHO and validated in Hungarian by Tróznai and Kullmann (2007). Additionally we surveyed the attitude toward aging with the similarly validated AAQ (Attitude to Aging Questionnaire). The WHOQOL-OLD questionnaire contains 24 questions and six main topics. Each topic includes 4-4 questions about the individual's sensory abilities, autonomy, past, present and future plans of activities, their participation in community, death and dying issues, participant's adjudication of intimacy. The evaluation is performed with the help of the Likert scale. To process data with descriptive statistical analysis, multi-sample and paired t-tests, we used SPSS.17 for Windows.

### ***Exercise program***

During the 12 weeks of intervention program the participants attended three Etká Yoga sessions per week. The method that we today know as Etká Power Yoga, was evolved during long years by the nowadays also excellently healthy lady, Etká Benke Kártyikné from Szeged (Kártyikné B. E., 2005). In virtue of the experiences she had while she observed the movements of the vertebrates and the babies, she created a health preserving and developing method, that is based on preserving, developing and restoring our congenital, ancient motor skills. Principles are: natural posture, natural breathing and natural movements. The Etká Yoga is nothing but the collective training of body and mind, understanding the natural processes of life, and increasing the sense of the body and vitality. The exercises work on improving blood circulation, progressing the blood supply of the muscles and the heart, thus rendering the operation of all our organs.

## Results

In the course of the pre- and post measurements we did not find any significant difference in the anthropometric indicators – body weight, body height and BMI. However we only found significant differences in the starting status of body height. Apparently the participants in group A are shorter despite there is no variance in age between the groups (Table 2). In the results of the Paired Samples T-Test among the motor skill test, the strength of the lower extremities was considerable: active group:  $M=5,38\pm 4,113$ , control group:  $M=9,06\pm 3,974$ . The analyzed results of the questionnaire are shown in table 3 and 4.

**Table 2.** Results of Paired samples T-test on body composition

Measurement	Mean± Standard Deviation (M±SD)	
	Active	Control
Body hiBBH1	158,38±6,52*	162,81±4,549*
BW1	65,38±8,563	68,19±7,842
BMI1	26,108±3,611	25,8413±3,204

\* shows significant differences

The results of the pre- and post measurements were compared with paired t-test. Out of the examined five elements of the FFFT, it was only the dynamic balance that did not show significant variance between the two groups (Graph 1.). In the course of Group A, we found that the muscle strength increased while the flexibility shows decline.

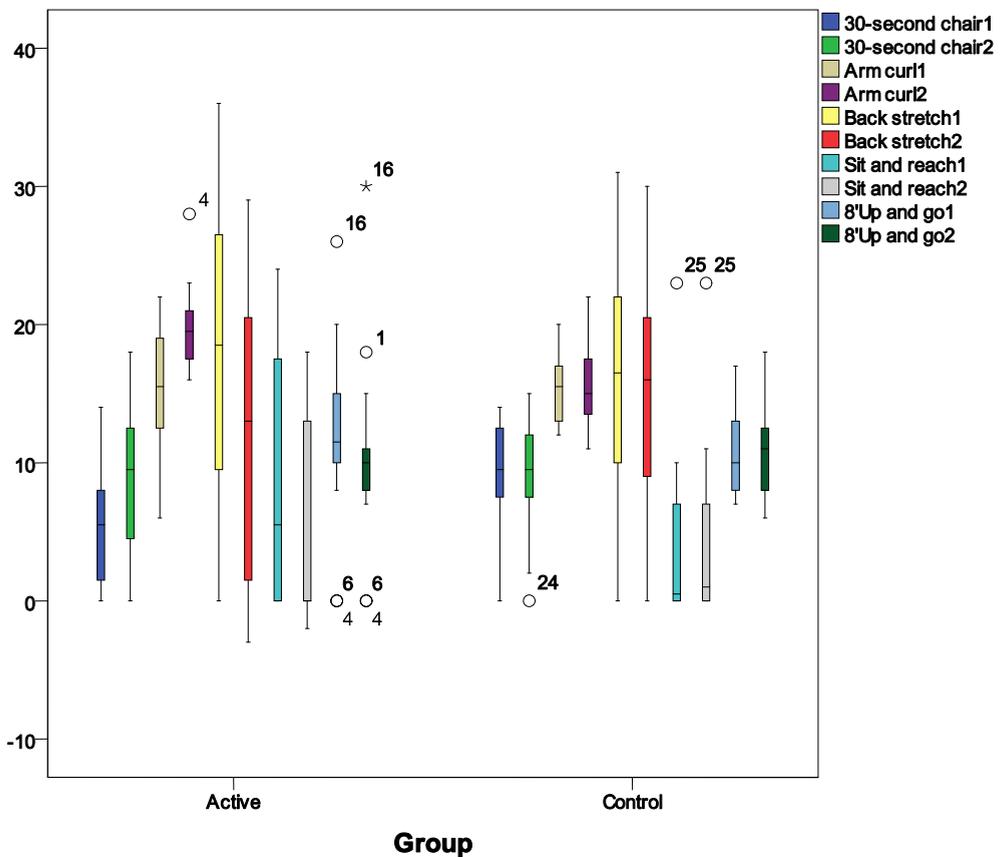
Taking the WHOQOL-OLD test into account only the plans of the past, present and future showed significant differences (Table 3.). Interestingly the active group decreased, and the control group increased the score.

**Table 3.** Results of the WHOQOL-OLD questionnaire

WHOQOL-OLD	Measurement	Mean±Standard deviation (M±SD)			
	Group	Active		Control	
	Measurement date	1.	2.	1.	2.
Kérdés:					
F25	Perception	2,55±,526	2,52±,423	2,38±,204	2,39±,288
F26	Autonomy	3,34±,811	3,19±,348	3,52±,716	3,69±,704
F27	Activities of past, present and future	3,36±,584*	3,31±,487*	3,91±,554*	4,03±,591*

WHOQOL-OLD	Measurement Group	Mean±Standard deviation (M±SD)			
		Active		Control	
	Measurement date	1.	2.	1.	2.
F28	Sociability	2,59±,856	2,48±,788	2,08±,898	2,05±,797
F29	Death dying	3,11±,695	3,16±,569	3,44±,710	3,66±,688
F30	Intimacy	2,70±,927	2,64±,841	2,53±,806	2,56±,878

\* shows significant differences



**Graph 1.** Significant differences of FFT test with Paired Samples T-test

In the course of the AAQ questionnaire, we found 8 important questions in the point of the two trials and the groups (Table 4.).

**Table 4.** Results of the AAQ: means significant differences on 1 st measurements

AAQ	Measurement	Mean±Standard deviation (M±SD)			
	Group	Active		Control	
	Measurement date	1.	2.	1.	2.
A7.	Old age is a time of loneliness	2,81±1,167	2,69±,873	2,69±1,014	2,44±,964
A10.	Old age depressing time of life	3,06±,998	3,06±,854	2,44±1,031	2,38±1,088
A14.	More difficult to talk about feelings	2,5±1,095	2,94±,929	1,88±,719	1,87±,619
A17.	Old age mainly as a time of loss	2,69±1,19*	3,19±1,167*	2,13±,806*	2,25±,577*
A21.	Loss physical independence as I get older	3,44±,629	3,38±,5	2,56±,727	2,44±,629
A24.	More difficult to make new friends	2,69±1,19*	3,19±,981*	2,5±,816*	2,5±,816*
A32.	Don't feel involved in society	2,69±1,25*	3,13±1,025*	1,69±,602*	1,94±,68*
A34.	I feel excluded because of my age	2,5±1,033	2,69±,873	1,5±,516	1,38±,5
A12.	Important to take exercise at any age	4,31±,602*	4,88±,342*	3,5±,816*	3,5±,816*
A13.	Whisdom comes with age	2,63±,957	2,5±,632	3±,73	3,13±,719
A16.	I do not feel old	2,44±,964	2,06±,998	3±1,155	3±1,155
A19.	My identity is not defined by my age	2,44±1,031	2,75±,447	2,69±,704	2,75±,577
A20.	More energy than I expected for my age	2,44±1,01*	2,94±1,181*	2,38±,885*	2,5±,816*
A22.	Physical health problems don't hold me back	2,5±1,211	2,44±,964	2,75±,577	2,75±,577
A36.	Health is better than expected for my age	2,25±1,125	2,5±,894	2,81±,544	2,69±,602
A37.	Keep myself fit and active by exercising	2,63±1,31*	3,69±1,138*	2,5±,816*	2,56±,727*
A2.	Better able to coping life	2,75±,931	2,94±,68	2,63±,5	2,69±,479
A4.	Privilege to grow old	3,13±1,258	2,88±1,31	2,31±,873	2,44±,727
A8.	Whisdom comes with age	3,56±,727*	3,94±,574*	3,50±,516*	3,81±,834*
A9.	Pleasant things as I growing older	2,44±,814	2,69±1,078	3,13±,806	3,13±,806
A15.	More accepting of myself	2,31±1,078	2,63±,885	2,31±,793	2,31±,602
A25.	Pass on benefits of experience	3,38±1,08*	3,81±,834*	4,06±,68*	3,38±,683*
A30.	Belive my life has made a difference	3,25±1,183	3,63±,885	3,38±,5	3,19±,403
A33.	Want to give a good sample	3,56±,892	3,94±,574	4,44±,512	4,44±,512

\* shows significant differences on 2. measurements Paired Samples T-test

## Conclusion

As an effect of the 3 sessions-per-week training the participants remained not only physically fit, but also their motivational level stagnated, moreover it gradually increased.

In Hungary there are few data of professional literature in the terms of senior's exercise intervention programs. 27 senior women ( $M=79,46\pm 7,80$  years) took part in the study of Barthalos et al (2008) in an 15-week exercise program and 10 out of the 27 participants attended a presentation about lifestyle. In the anthropometric measurements neither did they found significant differences in BMI. Motor skills did however improve, so did the strength of the lower extremity, the strength of the upper arm, the endurance and the dynamic balance.

A national, cross-sectional study compared the anthropometric data and the fitness indicators of residents of senior homes and of those pensioners who attended senior clubs (Kopkáné et al, 2011). In this study difference was shown in body height and the strength of the lower extremities in favor of the senior clubbers.

We can also report that during the pre-measurement the results of quality of life and attitudes toward aging are equal to the non-representative, study of Tróznai and Kullmann (2007), that was executed on a larger sample 333 participants.

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## THE INFLUENCE OF COGNITIVE CONTROL OVER BASKETBALL REPETITION SPEED

PĂTRAȘCU ADRIAN\*

**ABSTRACT.** *Background.* Cognitive control processes include a broad class of mental operations including goal or context representation and maintenance, and strategic processes such as attention allocation and stimulus-response mapping. Cognitive control is associated with a wide range of processes and is not restricted to a particular cognitive domain. *Aims.* The aims for this research are the following: 1. Applying the MGM-15 Jumping Carpet test at the beginning and at the end of the research, 2. Apply a practical basketball passing speed test under different conditions; *Methods.* The methods used: 1. the MGM-15 Jumping Carpet Test(Hardware and Software), 2.Basketball passing test under different conditions. *Results.* The results span at the initial test between the values of 0.13 and 0.3 for the Repetition Speed Coefficient. For the final test the values for the same coefficient span between 0.23 and 0.4. *Conclusions.* The data collected suggests that the cognitive control over motoric actions is relatively weak and undeveloped at this age; due to the fact that the more the environment changed the further the values for the speed tests went.

**Key words:** basketball, physical education, sport, psychology, cognitive control

**Rezumat. Influența controlului cognitiv asupra vitezei de repetiție din baschet.** *Premize.* Procesele controlului cognitiv includ o amplă clasă de operații mentale care includ reprezentanța și menținerea obiectivelor și a contextului. Totodată controlul cognitiv include și procesele strategice precum alocarea atenției și formarea hărții stimul-răspuns. Controlul cognitiv este asociat cu o largă paletă de procese care nu este restrânsă la un domeniu cognitiv particular. *Obiective.* Obiectivele acestui studiu au fost: 1. Folosirea covorului de sărituri MGM-15 pentru testarea inițială și finală, 2. Aplicarea unui test practic de pasare în viteză cu tehnica din baschet în diferite condiții. *Metode.* Metodele folosite: 1. Testul Covorului de Sărituri MGM-15(Hardware și Software), 2. Testarea vitezei de repetiție a paselor în diferite condiții, *Rezultate.* Rezultatele pentru testul inițial sunt cuprinse între valorile de 0.13 și 0.3 pentru Viteza de Repetiție. Pentru testul final valorile pentru același coeficient au fost cuprinse între 0.23 și 0.4. *Concluzii.* Datele culese sugerează că, de fapt, controlul cognitiv asupra acțiunilor motrice este relativ slab și nedezvoltat la vârste fragede, deoarece, cu cât mediul se schimba mai mult, cu atât valorile pentru testul de pasare în viteză scădeau mai mult.

**Cuvinte cheie:** baschet, educație fizică, sport, psihologie, control cognitiv

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## Background

"Cognitive control" is a construct from contemporary cognitive neuroscience that refers to processes that allow information processing and behavior to vary adaptively from moment to moment depending on current goals, rather than remaining rigid and inflexible. Cognitive control processes include a broad class of mental operations including goal or context representation and maintenance, and strategic processes such as attention allocation and stimulus-response mapping. Cognitive control is associated with a wide range of processes and is not restricted to a particular cognitive domain. For example, the presence of impairments in cognitive control functions may be associated with specific deficits in attention, memory, language comprehension and emotional processing. Given its pervasive influence, impaired cognitive control could account for many of the widespread impairments exhibited by people with schizophrenia and other neurodevelopmental disorders. (Carter & Cho 2004)

It is the set of brain processes necessary for goal-directed thought and action. Remembering a phone number before dialing requires cognitive control. Also, anything outside routine requires cognitive control (because it's novel and/or conflicting with what you normally do). This includes, among other things, voluntarily shifting attention and making decisions. (Cole & Schneider 2007)

A mountain of evidence is accumulating that a common set of brain regions are involved in cognitive control. We looked for these regions specifically, and verified that they were active during our experiment. The brain regions are spread across the cortex, from the front to the back to either side. However, it's not the whole brain: there are distinct parts that are involved in cognitive control and not other behavioral demands. We defined the cognitive control network as the parts of the brain active during a line search task. This task involves remembering a target line orientation, attending to each probe line orientation, and making a decision about whether each probe is what is being looked for. We then looked at spontaneous neural activity during rest periods to measure how the network's regions are connected. (Cole & Schneider 2007)

Cognitive controls are defined by Klein et. al. (1959) as ego structures or stable organizational dispositions that regulate thought processes. In psychoanalytic terminology, they are characterized as secondary thought processes that produce consistency in a person's perceptual, memory and thinking activities. Cognitive controls are assumed to be relatively "conflict-free" mechanisms and are thought to reflect an individual's customary modes of facing reality.

A cognitive control is thought to unfold in a behavioral sequence that is integrated by an intention or aim, e.g., to judge size in an experiment. Cognitive controls are considered to be the organizing principles that guide the interplay of perceptual, memory and motoric processes and the determiners of cognitive responses. A given cognitive control is thought to operate within a limited

range of situations that pose similar adaptive requirements. Thus the ability to generalize behaviors particular to a given control are dependent upon the requirements of a given situation. Klein et al.(1959) assume that there are a finite number of cognitive controls and that they are idiosyncratically organized within each individual. It is assumed that cognitive controls interact, serving alternately as an intermediary, catalyst or initiator of behavioral tendencies.

## **Hypothesis**

Identifying the effects of cognitive control over the repetition speed.

## **Methods and materials**

### ***Subjects***

The subjects of this study were 21 girls between the ages of 10 and 11 years old.

### ***Methods and the Steps of the Research***

We used the MGM-15 Jumping Carpet for the initial and final test. The test consists of 15 jumps on both legs that must not be bent during the execution. The software from the MGM-15 Jumping Carpet laid out, among others, one measurement for each subject named "Viteza de Repetiție"(Repetition Speed).

Repetition Speed – it refers to the average value of the time spent on the ground and it offers data regarding the relation between force and speed. The quality and level of the speed for each subject is directly correlated to the value of the coefficient registered:

- high speed values between 0.16-0.165 s;
- average-normal speed values between 0.17-0.18 s;
- very poor speed values over 0.200 s.

For the intermediary test we used a simple passing exercise for the subjects. This test was implemented after the first initial test four times in a row, before the final test, at a 2 days interval. The tests took place in the following environments:

- inside the sports hall
- inside but with little light
- outside during windy weather and on grass
- outside during sunny weather and on concrete.

This practical test consisted of counting the number of fast paced passes the subjects did in 30 seconds time. The technique was the normal two-handed chest-to-chest passes, but completed as fast as possible.

The last part of our research was to redo the initial test on the MGM-15 Jumping Carpet and compare the results, thus identifying if the changes of the environment where the passing is done influence the cognitive control over the repetition speed.

## Results

The procentual values of the gathered data were arranged in tables.

**Table No. 1** – The initial test (in seconds)

Name	C.V.E.(B)
A. A.	0.24
B.A.	0.21
Ci.I.	0.22
Cr.A.	0.21
Cr.C.	0.25
Fa.M.	0.16
Fe.A.	0.25
Fe.M.	0.23
Fo.D.	0.18
I.P.	0.23
L.M.	0.25
Mol.A.	0.23
Mor.O.	0.19
M.-C. M.	0.13
Mu.I.	0.2
Mu.R.	0.18
P.I.M.	0.26
Se.T.	0.22
St.P.	0.19
Su.K.	0.24
Sz.-I. C.	0.3

**Table No. 2** – The final test values

Name	C.V.E.(B)
A. A.	0.4
B.A.	0.32
Ci.I.	0.31
Cr.A.	0.29
Cr.C.	0.35
Fa.M.	0.26
Fe.A.	0.35
Fe.M.	0.33
Fo.D.	0.28
I.P.	0.33
L.M.	0.35
Mol.A.	0.33
Mor.O.	0.29
M.-C. M.	0.23
Mu.I.	0.32
Mu.R.	0.28
P.I.M.	0.36
Se.T.	0.32
St.P.	0.29
Su.K.	0.34
Sz.-I. C.	0.4

**Table No. 3 – The speed passing test values**

Name	Passing tests between initial and final tests			
	1st Test	2nd Test	3rd Test	4th Test
A. A.	15	14	10	10
B.A.	18	19	13	10
Ci.I.	17	16	11	11
Cr.A.	13	15	9	5
Cr.C.	13	16	10	8
Fa.M.	10	13	11	8
Fe.A.	14	12	9	7
Fe.M.	18	15	12	9
Fo.D.	8	11	8	5
I.P.	16	12	10	9
L.M.	12	11	11	11
Mol.A.	11	11	11	11
Mor.O.	17	16	12	9
M.-C. M.	18	18	14	10
Mu.I.	14	14	13	7
Mu.R.	18	18	16	10
P.I.M.	17	15	13	9
Se.T.	19	18	17	12
St.P.	16	16	16	9
Su.K.	12	13	14	9
Sz.-I. C.	18	17	16	10

### Discussion of the results

The first thing that needs to be pointed out is that the value span for the first test was between 0.13 and 0.3 seconds while for the final test the span was between 0.23 and 0.4. The data for the intermediary tests raised a question: Why did the number of passes drop so much during the study? As I tried to answer this question I asked their coach to tell me more about their training stage. The information I received was sadly more of a bad news: during the same period I was undergoing my research the subjects started their annual strength increase training. I couldn't control the course of their training so I didn't know that they were in a period that decreases the speed in general. Even so, the data collected suggests that the cognitive control over motoric actions is relatively weak and undeveloped at this age; due to the fact that the more the environment changed the further the values for the speed tests went.

Even though this research didn't come out with any concrete data to show the importance of environment changes in improving the cognitive control over repetition speed, it opens the way to a further and much deeper research into the wonderful domain of human mind and its effect over the abilities of the human body.

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## PHYSICAL ACTIVITY AND MOVEMENT: A CRISIS PREGNANCY

FRANCESCO PERROTTA\* & ANGELO PANNELLI\*

**ABSTRACT.** We live in a box from morning to night, at home, school, car, office. The "syndrome confined space", the physical and psychological suffering that comes from living in closed spaces can cause problems getting smaller physically and mentally. The drastic reduction in physical movement exacerbates the damage caused by environmental constraints. To find balance is essential to find time and space motion. They are well-known fact that the benefits they bring the conduct regular physical activity. The movement does not just "calorie", simplistically as you think, but more substantial advantages: not everyone knows that among its many benefits, sports and do more exercise to help women get pregnant. Women who want to become pregnant are more likely to succeed if they engaged in moderate physical activity, with the exception of overweight and obese. A support is a survey of Boston University, published in "Fertility and Sterility", where we examined the effects of exercise on fertility, according to Lauren Wise, epidemiologist and study author, in turn, varies according to the list body mass.

**Keyword:** Physical activity and movement, calorie consumption, pregnancy, fertility

### Introduction

We live in a box from morning to night, at home, school, car, office. The "syndrome confined space", the physical and psychological suffering that comes from living in closed spaces can cause problems getting smaller physically and mentally. The drastic reduction in physical movement exacerbates the damage caused by environmental constraints. To find balance is essential to find time and space motion. They are well-known fact that the benefits they bring the conduct regular physical activity. The movement does not just "calorie", simplistically as you think, but more substantial advantages: not everyone knows that among its many benefits, sports and do more exercise to help women get pregnant. Women who want to become pregnant are more likely to succeed if they engaged in moderate physical activity, with the exception of overweight and obese. A support is a survey of Boston University, published in

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"Fertility and Sterility", where we examined the effects of exercise on fertility, according to Lauren Wise, epidemiologist and study author, in turn, varies according to the list body mass. The positive effects on reproductive, therefore, would be present only on the basis of a given body mass index, apparently, this exercise "save-fertility" is not applicable to women who are overweight and obese and very thin ones. Nonetheless, moderate exercise, always part of the guidelines of a health in good condition and prevention of many diseases, may represent an important weapon in promoting conception.

## **Methods**

This study 'the first to show the effect of exercise on fertility: Lauren Wise has followed more than 3,500 women aged between 18 and 40 years who have tried to become pregnant during a year. The participants had reported being in a stable relationship and not receive fertility treatment. The researchers found that moderate exercise such as walking, cycling or gardening, and 'associated with greater and faster ability to get pregnant: Women who had spent more than five hours per week doing physical exercise moderate had found 18 per cent more likely to get pregnant. There is therefore a possible link between physical activity and pregnancy, probably due to the fact that the sport keeps the body alive and elastic, including internal organs and thus makes it easier and faster conception during intercourse.

## **Results**

The research also found that for women who are obese or overweight, there was no relationship between exercise, ease and speed at conception and that for those very thin, regular moderate physical activity reduced the time to get pregnant. According to the researchers, therefore, the study data allow to recommend moderate exercise for women who have decided to have a baby. Physical activity can improve autonomic rhythms of sleep and appetite, already important in everyday life and even more when you are "pregnant". Allows, in fact, - "Download" the accumulation of tension and aggression that might otherwise have strong effects and emotional balance, going to raise the general irritability, and the delicate rhythms of sleep. - Regulate the so-called hypothalamic set point, i.e. the center that controls and regulates the balance between signals of appetite and satiety.

Moreover, the physical movement improves peripheral insulin consumption: the muscles are in fact rich in receptors for this important hormone, which regulates the recruitment and use of sugars also helping to improve the activity of the ovary, reducing the tendency of micropolycystic.

But physical activity also has advantages for the mind: the physical movement increases the production of endorphins, our internal analgesics, which we also call "molecule of joy" and the increase of these substances improves mood, reduces the sense of fatigue (physical and emotional), increases the sense of well being, the perception of the vital energy and, in general, the gaze with which we watch our lives. Even in case of depression, for the same antidepressant drug therapy, it was found that the physical movement accelerates the speed with which the depression is exceeded, by stabilizing the well and allowing reducing the dosage of medication while maintaining the improved mood found. When and how to make the move? There is a definite rule, the ideal is to do so in harmony with their biorhythms: good in the morning, but towards the afternoon / evening.

What you should do is a snack of fruit and carbohydrates two hours before, instead of avoiding physical activity after meals, and / or when the outside temperature is high (for example, never during the heat of summer). And it is well to remember that menstruation is not a contraindication to exercise, in fact, regular physical activity also helps reduce the intensity of dysmenorrhea.

Once you reach the goal and into the role of "mothers" of course we must not abandon the exercise, we can and must continue to get moving but paying some attention.

## **Conclusions**

What then is the best exercise to practice when you are pregnant? It is very suitable for swimming all his life, until (almost) time: it has an action of muscle and mental relaxation, does not load the muscles of the spine, tones the muscles, makes the most of all psychophysical benefits listed above. Not least, helps to optimize the right weight gain (in whole 9-12 kilos at the most) and to maintain a smooth shape of the body. Indicate also the daily walks at a brisk pace, lasting about an hour, with comfortable shoes. In the first few months, well cross-country skiing, for its completeness and harmony. It is always advisable to perform stretching, gymnastics on the floor, yoga and all that helps to harmonize body and soul with sweetness, through a conscious use of breath and relaxed. Forbidden, however, is the underwater activity due to changes in partial pressure of oxygen and nitrogen in the blood, as well as for changes in the distribution of body fluids which might facilitate also a detachment of the placenta. Also, be considered unsuitable as horseback riding, tennis, squash, downhill skiing, snowboarding, paragliding, but also the steps and aerobics at a dizzying pace. Finally, you should avoid all sports that involve hopping, jumping and quick changes of direction, because the ligamentous laxity and the slowing of reflexes can facilitate accidents and falls hazardous for mother and child.

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## MOTOR LEARNING IN ANIMALS SUBMITTED TO CHRONIC INTERMITTENT ANAKINETIC STRESS

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**ABSTRACT.** Motor learning is defined as the acquisition and retention of new motor skill. *Aims.* To study the influence of interval training (anakinetic stress through immobilization and physical exercise) on the motor learning capacity of rats. *Material and methods.* The study was made on 3 groups of male Wistar rats (n = 10 animals/group): Group I – controls – sedentary animals; Group II – exercise trained for 42 days; Group III – training for 21 days, preceded by alternating stress for 21 days (immobilization for 3 hours/day and physical exercise). Spatial learning capacity was evaluated using the Morris water maze. The time moments included in the study were  $T_0$ ,  $T_{21}$ ,  $T_{42}$ . *Results.* Training for 21 days preceded by combined alternating stress through immobilization and exercise for 21 days (group III) has an unfavorable influence on the motor learning capacity at  $T_{21}$ , with a significant increase in the latency time for learning and the control time, followed by decreases at  $T_{42}$ , compared to initial values at  $T_0$ . The number of rounds and diagonal distances increases in the learning period at  $T_{21}$  and then decreases significantly at  $T_{42}$ , compared to initial values. There are no significant changes in the total time spent in quadrant D. *Conclusions.* Daily training contributes to the increase in the motor learning capacity. Interval training has an unfavorable influence on the motor learning capacity. Intermittent stress, through immobilization alternating with physical exercise, can be considered as an experimental model for interval training in sport.

**Keywords:** training, anakinetic stress, motor learning, Morris water maze, rats.

**Rezumat. Învățarea motorie la animale supuse stresului anakinetic cronic intermitent.** Învățarea motorie este definită ca și achiziția și reținerea de noi deprinderi motorii. *Obiective.* S-a urmărit experimental influența antrenamentului pe intervale (stres anakinetic prin imobilizare și efort fizic) asupra capacității de învățare motorie la șobolani. *Material și metode.* Studiul a fost efectuat pe 3 loturi de șobolani masculi rasa Wistar (n = 10 animale/lot): Lot I – martor – sedentari; Lot II – antrenat la efort fizic 42 zile; Lot III – antrenament 21 zile, precedat de stres alternant 21 zile (imobilizare 3 ore/zi și efort fizic). Capacitatea de învățare spațială s-a evaluat cu ajutorul labirintului cu apă Morris. Momentele

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luate în studiu au fost  $T_0$ ,  $T_{21}$ ,  $T_{42}$ . *Rezultate.* Antrenamentul susținut timp de 21 zile, precedat de un stres alternat combinat din imobilizare și efort timp de 21 zile (lotul III) influențează nefavorabil capacitatea de învățare motorie în momentul  $T_{21}$ , cu creșteri semnificative ale timpului de latență pentru învățare și a celui de control, urmate de scăderi în momentul  $T_{42}$ , față de valorile din momentul inițial  $T_0$ . Numărul de ture și de diagonale crește în perioada de învățare în momentul  $T_{21}$  și apoi scade semnificativ în momentul  $T_{42}$ , față de valorile inițiale. Timpul total petrecut în cadranul D nu prezintă modificări semnificative. *Concluzii.* Antrenamentul zilnic contribuie la creșterea capacității de învățare motorie. Antrenamentul pe intervale are influență defavorabilă asupra capacității de învățare motorie. Stresul intermitent, prin imobilizare alternând cu efort fizic, poate fi considerat ca un model experimental pentru antrenamentul pe intervale în sport.

**Cuvinte cheie:** antrenament, stres anakinetic, învățare motorie, labirint Morris, șobolani.

## Introduction

Motor learning is defined as the acquisition and retention of new motor skills (Foss and Keteyian 1998). The structures specialized in motor learning are found in the neocortex – the premotor area and the additional motor area; the basal ganglia and the thalamus; the cerebellum (Foss and Keteyian 1998, Weineck 1995).

Motor learning involves several important processes:

- a. the reception and selection of information, the central nervous control of the afferent pathways, the capacity of treating information;
- b. the storage of sensory and sensory-motor information in the memory (Weineck 1995).

Motor learning involves 3 phases: the global coordination phase, the elaborate phase, of fine coordination, the automatism phase (Weineck 1995, Derevenco 1998, Tache și Staicu 2010).

## Aims

To study the influence of interval training preceded by anakinetic stress through immobilization and physical exercise on the motor learning capacity of rats.

## Material and methods

The researches were performed in the Experimental Research Laboratory of the Department of Physiology, “Iuliu Hațieganu” UMPH, Cluj-Napoca.

**a. Groups:** the study was made on 3 groups of male Wistar rats, between 200-250 g body weight, 16 weeks age (n = 10 animals/group)

- Group I – controls – sedentary animals
- Group II – exercise trained for 42 days
- Group III – training for 21 days, preceded by alternating stress for 21 days (immobilization for 3 hours/day and physical exercise)

**b. Experimental methods**

*Anakinetic stress* was induced by the immobilization of rats for 3 hours/day.

*Aerobic exercise capacity* was determined by the treadmill running test; the duration of the test (seconds) was timed from the starting of the treadmill to the exhaustion of the rats.

*Spatial learning capacity* was evaluated using the Morris water maze (1).

The time moments included in the study were:  $T_0$  – before the first day of exercise;  $T_{21}$  – after 21 days;  $T_{42}$  – after 42 days.

The learning indicators were:

- the latency time for learning and control in seconds
- the number of complete rounds
- the number of diagonal distances

**c. Statistical calculation** was performed using the SPSS 13.0, Statistica 8.0 and Microsoft EXCEL programs.

## Results

**a. Comparative statistical analysis for groups II and III**

The mean latency time in the learning and control period was compared between groups II and III at time moments  $T_0$ ,  $T_{21}$  and  $T_{42}$  (Table 1).

At  $T_0$  the mean latency time in the learning and control period was not significantly different between the groups. At  $T_{21}$ ,  $T_{42}$  the mean latency time in the learning period in group III was significantly higher than the mean latency time in the learning period in group II. At time  $T_{42}$  the mean latency time in the control period in group III was significantly higher than the mean latency time in the control period in group II (Table 1).

The number of complete rounds in the learning and control period was compared between groups II and III at time moments  $T_0$ ,  $T_{21}$  and  $T_{42}$  (Table 2).

At  $T_0$  the number of complete rounds in the learning and control period was not significantly different between the groups. At  $T_{21}$  the number of complete rounds in the learning and control period in group III was significantly lower

than the number of complete rounds in the learning and control period in group II. At  $T_{42}$  the number of complete rounds in the learning period in group III was significantly higher than the number of complete rounds in the learning period in group II (Table 2).

**Table 1.** Comparison of the mean latency time in the learning and control period between groups II and III at time moments  $T_0$ ,  $T_{21}$  and  $T_{42}$

Mean latency time	Moment	Group II		Group III		p
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation	
Learning	$T_0$	49.13	9.22	55.05	16.57	0.34
	$T_{21}$	44.47	6.81	72.33	18.47	<b>0.0003</b>
	$T_{42}$	36.32	8.12	67.19	5.98	<b>&lt;0.0001</b>
Control	$T_0$	17.60	9.90	21.10	7.77	0.60
	$T_{21}$	20.00	8.07	25.30	5.42	0.16
	$T_{42}$	11.30	4.72	16.90	3.90	<b>0.01</b>

**Table 2.** Comparison of the number of complete rounds in the learning and control period between groups II and III at time moments  $T_0$ ,  $T_{21}$  and  $T_{42}$

Number of complete rounds	Moment	Group II		Group III		p
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation	
Learning	$T_0$	0.98	0.23	1.02	0.22	0.68
	$T_{21}$	1.53	0.29	1.30	0.13	<b>0.03</b>
	$T_{42}$	0.53	0.18	0.90	0.36	<b>0.01</b>
Control	$T_0$	1.40	1.07	1.20	0.42	0.59
	$T_{21}$	2.10	1.20	1.10	0.57	<b>0.03</b>
	$T_{42}$	1.00	1.05	1.00	0.67	1.00

The number of diagonal distances in the learning and control period was compared between groups II and III at times  $T_0$ ,  $T_{21}$  and  $T_{42}$  (Table 3).

At  $T_0$  the number of diagonal distances in the learning period in group III was significantly higher than the number of diagonal distances in the learning period in group II. At  $T_0$  the number of diagonal distances in the control period was not significantly different between the groups. At  $T_{21}$  the number of diagonal distances in the learning and control period in group III was significantly lower than the number of diagonal distances in the learning period in group II. At  $T_{42}$  the number of diagonal distances in the learning and control period was not significantly different between the groups (Table 3).

**Table 3.** Comparison of the number of diagonal distances in the learning and control period between groups II and III at time moments T<sub>0</sub>, T<sub>21</sub> and T<sub>42</sub>

Number of diagonal distances	Moment	Group II		Group III		p
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation	
Learning	T <sub>0</sub>	0.90	0.24	1.32	0.28	<b>0.002</b>
	T <sub>21</sub>	1.84	0.23	1.63	0.22	<b>0.04</b>
	T <sub>42</sub>	0.79	0.26	0.73	0.23	0.55
Control	T <sub>0</sub>	1.40	0.97	1.70	0.95	0.49
	T <sub>21</sub>	2.10	0.99	1.30	0.48	<b>0.03</b>
	T <sub>42</sub>	1.50	0.97	1.50	0.71	1.00

The total time spent in quadrant D in the control period was compared between groups II and III at time moments T<sub>0</sub>, T<sub>21</sub> and T<sub>42</sub> (Table 4).

At T<sub>0</sub>, T<sub>21</sub> and T<sub>42</sub> the total time spent in quadrant D during the control period in group III was significantly longer than the total time spend in quadrant D during the control period in group II (Table 4).

**Table 4.** Comparison of the total time spent in quadrant D in the control period between groups II and III at time moments T<sub>0</sub>, T<sub>21</sub> and T<sub>42</sub>

Time	Moment	Group II		Group III		p
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation	
Total time	T <sub>0</sub>	11.60	6.80	25.50	8.21	<b>0.0001</b>
	T <sub>21</sub>	10.30	2.83	25.30	6.04	<b>&lt;0.0001</b>
	T <sub>42</sub>	8.60	1.78	25.00	8.76	<b>&lt;0.0001</b>

The mean latency time in the learning and control period was compared between time moments T<sub>1</sub>, T<sub>21</sub> and T<sub>42</sub> in groups II and III (Table 5). At T<sub>42</sub> the mean latency time in the learning and control period was significantly shorter compared to the other time moments in group II. At T<sub>0</sub> the mean latency time in the learning period was significantly shorter compared to the other time moments in group III. At T<sub>42</sub> the mean latency time in the control period was significantly shorter compared to time T<sub>21</sub> in group III (Table 5).

The number of complete rounds in the learning and the control period was compared between time moments T<sub>1</sub>, T<sub>21</sub> and T<sub>42</sub> in groups II and III (Table 6). At T<sub>21</sub> the number of complete rounds in the learning period was significantly higher compared to the other time moments in groups II and III. At T<sub>0</sub> the number of complete rounds in the learning period was significantly higher compared to T<sub>42</sub> in group II. At T<sub>42</sub> the number of complete rounds in the control period was significantly lower compared to T<sub>21</sub> in group III (Table 6).

**Table 5.** Comparison of the mean latency time in the learning and control period between time moments  $T_0$ ,  $T_{21}$  and  $T_{42}$  in groups II - III

Test	Group	Mean latency time	Arithmetic mean of the difference	Standard deviation of the difference	Standard error of the difference	95% confidence interval of the mean of the differences		p
Learning	Group II	$T_0-T_{21}$	4.67	13.16	4.16	-4.75	14.08	0.29
		$T_0-T_{42}$	12.82	13.76	4.35	2.97	22.66	<b>0.02</b>
		$T_{21}-T_{42}$	8.15	4.25	1.34	5.11	11.19	<b>0.0002</b>
	Group III	$T_0-T_{21}$	-17.28	20.70	6.55	-32.08	-2.47	<b>0.03</b>
		$T_0-T_{42}$	-12.14	13.05	4.13	-21.48	-2.81	<b>0.02</b>
		$T_{21}-T_{42}$	5.13	17.48	5.53	-7.37	17.64	0.38
Control	Group II	$T_0-T_{21}$	-2.40	6.54	2.07	-7.08	2.28	0.28
		$T_0-T_{42}$	6.30	8.54	2.70	0.19	12.41	<b>0.04</b>
		$T_{21}-T_{42}$	8.70	7.07	2.24	3.64	13.76	<b>0.004</b>
	Group III	$T_0-T_{21}$	-4.20	8.77	2.77	-10.47	2.07	0.16
		$T_0-T_{42}$	4.20	7.47	2.36	-1.14	9.54	0.11
		$T_{21}-T_{42}$	8.40	8.14	2.57	2.58	14.22	<b>0.01</b>

**Table 6.** Comparison of the number of complete rounds in the learning and control period between time moments  $T_0$ ,  $T_{21}$  and  $T_{42}$  in groups II - III

Test	Group	Number of complete rounds	Arithmetic mean of the difference	Standard deviation of the difference	Standard error of the difference	95% confidence interval of the mean of the differences		p
Learning	Group II	$T_0-T_{21}$	-0.56	0.46	0.15	-0.89	-0.23	<b>0.004</b>
		$T_0-T_{42}$	0.44	0.30	0.09	0.23	0.66	<b>0.001</b>
		$T_{21}-T_{42}$	1.00	0.30	0.10	0.78	1.22	<b>&lt;0.0001</b>
	Group III	$T_0-T_{21}$	-0.28	0.14	0.05	-0.39	-0.18	<b>0.0001</b>
		$T_0-T_{42}$	0.12	0.28	0.09	-0.08	0.32	0.22
		$T_{21}-T_{42}$	0.40	0.28	0.09	0.20	0.60	<b>0.001</b>
Control	Group II	$T_0-T_{21}$	-0.70	1.16	0.37	-1.53	0.13	0.09
		$T_0-T_{42}$	0.40	0.84	0.27	-0.20	1.00	0.17
		$T_{21}-T_{42}$	1.10	0.88	0.28	0.47	1.73	<b>0.003</b>
	Group III	$T_0-T_{21}$	0.10	0.57	0.18	-0.31	0.51	0.59
		$T_0-T_{42}$	0.20	0.42	0.13	-0.10	0.50	0.17
		$T_{21}-T_{42}$	0.10	0.74	0.23	-0.43	0.63	0.68

The number of diagonal distances in the learning and control period was compared between time moments  $T_1$ ,  $T_{21}$  and  $T_{42}$  in groups II and III (Table 7). At  $T_{21}$  the number of diagonal distances in the learning period was significantly

higher compared to the other time moments in groups II and III. At  $T_0$  the number of diagonal distances in the learning period was significantly higher compared to  $T_{42}$  in group III. At  $T_{21}$  the number of diagonal distances in the control period was significantly higher compared to the other time moments in group II (Table 7).

**Table 7.** Comparison of the number of diagonal distances in the learning and the control period between time moments  $T_0$ ,  $T_{21}$  and  $T_{42}$  in groups II - III

Test	Group	Number of diagonal distances	Arithmetic mean of the difference	Standard deviation of the difference	Standard error of the difference	95% confidence interval of the mean of the differences		p
Learning	Group II	$T_0$ - $T_{21}$	-0.94	0.29	0.09	-1.15	-0.74	<b>&lt;0.0001</b>
		$T_0$ - $T_{42}$	0.11	0.34	0.11	-0.14	0.35	0.34
		$T_{21}$ - $T_{42}$	1.05	0.16	0.05	0.93	1.17	<b>&lt;0.0001</b>
	Group III	$T_0$ - $T_{21}$	-0.31	0.40	0.13	-0.59	-0.02	<b>0.04</b>
		$T_0$ - $T_{42}$	0.59	0.44	0.14	0.28	0.91	<b>0.002</b>
		$T_{21}$ - $T_{42}$	0.90	0.34	0.11	0.66	1.14	<b>&lt;0.0001</b>
Control	Group II	$T_0$ - $T_{21}$	-0.70	0.67	0.21	-1.18	-0.22	<b>0.01</b>
		$T_0$ - $T_{42}$	-0.10	0.88	0.28	-0.73	0.53	0.73
		$T_{21}$ - $T_{42}$	0.60	0.52	0.16	0.23	0.97	<b>0.005</b>
	Group III	$T_0$ - $T_{21}$	0.40	0.84	0.27	-0.20	1.00	0.17
		$T_0$ - $T_{42}$	0.20	1.03	0.33	-0.54	0.94	0.56
		$T_{21}$ - $T_{42}$	-0.20	0.79	0.25	-0.76	0.36	0.44

The total time spent in quadrant D in the control period was compared between time moments  $T_1$ ,  $T_{21}$  and  $T_{42}$  in groups II and III (Table 8). At  $T_{21}$  the total time spent in quadrant D in the control period was significantly longer compared to  $T_{42}$  in group III (Table 8).

**Table 8.** Comparison of the total time spent in quadrant D in the control period between time moments  $T_0$ ,  $T_{21}$  and  $T_{42}$  in groups II - III

Group	Total time spent in quadrant D	Arithmetic mean of the difference	Standard deviation of the difference	Standard error of the difference	95% confidence interval of the mean of the differences		p
Group II	$T_0$ - $T_{21}$	1.30	4.69	1.48	-2.06	4.66	0.40
	$T_0$ - $T_{42}$	3.00	6.15	1.94	-1.40	7.40	0.16

Group	Total time spent in quadrant D	Arithmetic mean of the difference	Standard deviation of the difference	Standard error of the difference	95% confidence interval of the mean of the differences		p
	T <sub>21</sub> -T <sub>42</sub>	1.70	2.11	0.67	0.19	3.21	<b>0.03</b>
Group III	T <sub>0</sub> -T <sub>21</sub>	0.20	6.89	2.18	-4.73	5.13	0.93
	T <sub>0</sub> -T <sub>42</sub>	0.50	11.95	3.78	-8.05	9.05	0.90
	T <sub>21</sub> -T <sub>42</sub>	0.30	9.14	2.89	-6.24	6.84	0.92

**b. Comparative statistical analysis for groups I and II**

The latency time in the control period was compared between groups I and II at time moments T<sub>0</sub> and T<sub>21</sub> (Table 9).

At T<sub>0</sub> and T<sub>21</sub> the latency time in the control period was not significantly different between the groups (Table 9).

**Table 9.** Comparison of the latency time in the control period between groups I and II at time moments T<sub>0</sub> and T<sub>21</sub>

Mean latency time	Moment	Group I		Group II		p
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation	
Control	T <sub>0</sub>	18.30	5.91	17.60	9.90	0.98
	T <sub>21</sub>	18.50	4.86	20.00	8.07	0.86

The total time spent in quadrant D in the control period was compared between groups I and II at time moments T<sub>0</sub> and T<sub>21</sub> (Table 10).

At T<sub>0</sub> and T<sub>21</sub> the total time spent in quadrant D in the control period was not significantly different between the groups (Table 10).

**Table 10.** Comparison of the total time spent in quadrant D in the control period between groups I and II at time moments T<sub>0</sub> and T<sub>21</sub>

Time	Moment	Group I		Group II		p
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation	
Total time	T <sub>0</sub>	12.00	2.16	11.60	6.80	0.99
	T <sub>21</sub>	13.30	2.50	10.30	2.83	0.25

**c. Comparative statistical analysis for groups I and III**

The latency time in the control period was compared between groups I and III at time moments T<sub>0</sub> and T<sub>21</sub> (Table 11).

At T<sub>0</sub> and T<sub>21</sub> the latency time in the control period was not significantly different between the groups (Table 11).

**Table 11.** Comparison of the latency time in the control period between groups I and III at time moments  $T_0$  and  $T_{21}$

Mean latency time	Moment	Group I		Group III		p
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation	
Control	$T_0$	18.30	5.91	21.10	7.77	0.72
	$T_{21}$	18.50	4.86	25.30	5.42	0.06

The total time spent in quadrant D in the control period was compared between groups I and III at time moments  $T_0$  and  $T_{21}$  (Table 12).

At  $T_0$  and  $T_{21}$  the total time spent in quadrant D in the control period was significantly longer in group III compared to group I (Table 12).

**Table 12.** Comparison of the total time spent in quadrant D in the control period between groups I and III at time moments  $T_0$  and  $T_{21}$

Time	Moment	Group I		Group III		p
		Arithmetic mean	Standard deviation	Arithmetic mean	Standard deviation	
Total time	$T_0$	12.00	2.16	25.50	8.21	<b>0.0001</b>
	$T_{21}$	13.30	2.50	25.30	6.04	<b>&lt;0.0001</b>

The latency time in the control period was compared between time moments  $T_1$  and  $T_{21}$  in group I (Table 13). At  $T_0$  and  $T_{21}$  the latency time in the control period was not significantly different in group I (Table 13).

**Table 13.** Comparison of the mean latency time in the control period at time moments  $T_0$  and  $T_{21}$  in group I

Control	Mean latency time	Arithmetic mean of the difference	Standard deviation of the difference	Standard error of the difference	95% confidence interval of the mean of the differences		p
Group I	$T_0$ - $T_{21}$	-0.20	4.42	1.40	-3.6	2.96	0.89

The total time spent in quadrant D in the control period was compared between time moments  $T_1$  and  $T_{21}$  in group I (Table 14). At  $T_0$  and  $T_{21}$  the latency time in the control period was not significantly different in group I (Table 14).

**Table 14.** Comparison of the mean total time spent in quadrant D in the control period between time moments  $T_0$  and  $T_{21}$  in group I

Control	Mean latency time	Arithmetic mean of the difference	Standard deviation of the difference	Standard error of the difference	95% confidence interval of the mean of the differences		p
Group I	$T_0-T_{21}$	-1.30	2.63	0.83	-3.18	0.58	0.15

## Discussion

Training for 42 days (group II) causes an improvement in the motor learning capacity, with a decrease in the latency time for learning and in the control time of learning at time moments  $T_{21}$  and  $T_{42}$ , compared to the initial moment  $T_0$ . The number of rounds and diagonal distances increases in the learning period at  $T_{21}$  and decreases significantly at  $T_{42}$ , compared to initial values  $T_0$ . The total time spent in quadrant D decreases significantly from  $T_{21}$  to  $T_{42}$ , compared to  $T_0$ .

Training for 21 days preceded by combined alternating stress through immobilization and exercise for 21 days (group III) has an unfavorable influence on the motor learning capacity at  $T_{21}$ , with a significant increase in the latency time for learning and the control time, followed by decreases at  $T_{42}$ , compared to initial values at  $T_0$ . The number of rounds and diagonal distances increases in the learning period at  $T_{21}$  and then decreases significantly at  $T_{42}$ , compared to initial values. There are no significant changes in the total time spent in quadrant D.

Compared to sedentary animals (group I), the exercise trained group (group II) and the exercise trained group previously submitted to alternating stress (group III) have no significant changes in the control time at  $T_0$  and  $T_{21}$ . The time spent in quadrant D significantly increases for group III at  $T_0$  and  $T_{21}$ .

Our results show a reduction in the latency time, favored by training and its prolongation, and disfavored by alternating intermittent anakinetic stress associated with physical hyperkinetic stress. The decrease in the total time spent in quadrant D does not indicate the appearance of fatigue in the trained group; the number of rounds and diagonal distances swum within quadrant D shows changes in the same direction as the time spent in the quadrant.

The combined alternating stress used by us can be considered an experimental method for interval training: pre-established exercise and rest for athletes. In our model, exercise alternates with complete rest periods, through the immobilization of the animals. The main effects of interval training, which was widely used in Europe in the '60s and in North America in the '80-90s, are

the training of aerobic endurance, through the restoration of muscle phosphagen, the covering of the O<sub>2</sub> debt, the restoration of muscle glycogen, the removal of lactic acid from muscles and blood, the diminution of muscle fatigue (Tache and Staicu 2010).

Interval training for 21 days (T<sub>0</sub>-T<sub>21</sub>) in group III determines an increase in the latency time for learning and the control latency time, with a decrease in the number of rounds and diagonal distances compared to classical training (group II), with an increase in the time spent in quadrant D compared to the control group.

### Conclusions

1. Daily training contributes to the increase in the motor learning capacity.
2. Interval training has an unfavorable influence on the motor learning capacity
3. Intermittent stress, through immobilization alternating with physical exercise, can be considered as an experimental model for interval training in sport.

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## THE MOBING IN THE NEW SOCIAL AND PROFESSIONAL CONTEXT. NOTIONS AND CHARACTERISTICS

PRODEA COSMIN\* & STANCIU LUCIA ANA-MARIA\*\*

**ABSTRACT.** Today, we are increasingly facing the phenomenon called mobbing. A phenomenon which was first observed in animals, the mobbing has also occurred in social groups, within the professional framework. This phenomenon refers to the emotional abuse at the work place. Researchers in the field have reached the conclusion that mobbing is present within organizations having a weak management system, a bad organization and a bad organizational system. The persons dealing with these abuses are generally creative, intelligent and integral individuals. The mobbing is manifested in four phases: the first one can be encountered in any organization - conflicts, struggle for power, or divergences of opinion. The unsolved component of conflicts turns into mobbing. The second phase leads to the breaking of the victim's mental balance, stress symptoms appear, confidence and self esteem drop. In the third phase, the targeted individuals are defenseless, the organization management fails to intervene in the solving of the dispute, due to the victim's preconception of guilt. In some organizations, this can even lead to a legal case. In the fourth phase, stigmatization occurs, social isolation and the victim's status of inferiority. In other states, there are especially assigned laws, against the mobbing phenomenon. Even though this behavior is visibly present, in Romania, there is no law against the individual practicing this behavior or supporting the person targeted by it. From a legal point of view, in Romania, the mobbing or psychological harassment are not punishable, only the sexual harassment is. The Directives of the European Union related to this matter are rather vague, and the dispositions are mostly targeting discrimination issues, such as: disability, sexual, religious or racial discrimination etc.

**Keywords:** mobbing, behavior, work place, communication, sports.

**REZUMAT. Mobbing-ul în noul context socio-profesional. Noțiuni și caracteristici.** În zilele noastre, tot mai des ne confruntăm cu un fenomen numit mobbing. Apărut prima dată la animale, acesta își face apariția și în grupurile sociale din cadrul profesional. Acest fenomen se referă la abuzul emoțional de la locul de muncă. Cercetătorii din domeniu au ajuns la concluzia că acest fenomen este prezent în organizațiile cu un management slab, cu o organizație proastă și cu un sistem organizatoric prost. Persoanele care suferă aceste abuzuri

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sunt în general persoane creative, inteligente și integre. Mobbing-ul se manifestă în patru faze: prima fază este întâlnită în orice organizație - conflicte, lupta pentru putere, sau divergențe de opinie. Partea nerezolvată a conflictelor se transformă în mobbing. A doua fază duce la ruperea echilibrului psihic al victimei, apar simptome de stres, scade încrederea și stima de sine. A treia fază, persoanele în cauză sunt lipsite de apărare, conducerea organizației nu intervine în rezolvarea conflictului, datorită unei preconcepții de vinovăție a victimei. În cadrul unor organizații se ajunge chiar la caz juridic. A patra fază, apare stigmatizarea, izolarea socială și punerea în inferioritate a victimei. În alte state există legi alocate expres împotriva fenomenului mobbing. Chiar dacă adoptarea acestui comportament își face simțită prezența, în România nu există o lege care să intervină împotriva celui care îl adoptă sau să intervină pentru cel care este supus acestui comportament. Din punct de vedere juridic, în România mobbingul sau hărțuirea psihologică nu sunt pedepsite, doar hărțuirea sexuală. Directivele Uniunii Europene sunt destul de vagi în legătură cu acest subiect iar dispozițiile lor se referă în mare parte la la probleme discriminatorii cum ar fi : handicap, discriminarea dintre sexe, religie, rasă, etc.

**Cuvinte cheie:** mobbing, comportament, loc de muncă, comunicare, sport.

This behavior was first studied within the animal behavioral studies, especially ornithology, where it refers to anti-predator behavior, by harassing those representing a threat.

The mobbing is an obvious behavior form, which birds use to protect themselves against predators. When a predator is *discovered*, they start sending an alarm signal, by flying towards the predator, harassing and distracting it. Even physical contact occurs sometimes. The mobbing begins with one or two birds, but can attract a large number, frequently from different species. For instance, several alarm signals, departing from the same tree, are usually a good sign, signaling a cat or an owl in shelter. The mobbing behavior was observed within a large variety of species, but is especially developed among the seagulls and is most frequently encountered among crows. Besides the fact that the birds fly towards the predator and harass it, by sending alarm signals, some birds, such as seagulls, add other, less common, methods, such as defecation and vomiting towards the predator, with a particular precision ..." (RSPB - Royal Society for protection of Birds website).

The mobbing behavior is an anti-predator behavior which appears when a species of individuals crowds the predator by cooperation, attack and harass it, usually for the purpose of protecting their breed. A simple definition of the mobbing is: a gathering of individuals around a predator. It is mostly encountered in various animal species. The behavior has undergone several

adaptations in some breeds, such as camouflage or hiding. Some animal species use alarm signals for calling individuals nearby, in order to cooperate during the attack.

In the 1960s, the Australian Kondrat Lorenz (Das sogenannte Böse, 1963, Methuen Publishing edition, Austria) has used the word mobbing, in English, to describe the behavior animals use to chase away a stranger in their vicinity. A number of weak individuals, such as geese, gather and adopt an attack behavior, which manages to scare even a fox.

The study of this phenomenon was initiated by the Swedish researcher born in Germany Heinz Leymann (The mobbing encyclopedia, Bullying; Whistleblowing, 1996). He has borrowed the notion from the animal behavior field, perfectly describing how a group can attack an individual, establishing the attack on the negative communication adopted by the group. On a human level, Leymann adopts the mobbing term for describing psychologically aggressive actions, denigration, psychological harassment, mocking at the work place, professional disparage. The researcher proposes two meanings for this notion: the attenuated one, where mobbing appears as a persecution phenomenon, and the radical one, where we can speak about psychical terror at the work place.

He also builds a scheme of the psychical terror at the work place. The mobbing can be identified according to this scheme:

- **first phase** can be encountered in any organization - conflicts, struggle for power, or divergences of opinion. The unsolved component of conflicts turns into mobbing.

- **second phase** leads to the breaking of the victim's mental balance, stress symptoms appear, confidence and self esteem drop.

- **third phase**, the targeted individuals are defenseless, the organization management fails to intervene in the solving of the dispute, due to the victim's preconception of guilt. In some organizations, this can even lead to a legal case.

- **fourth phase**, stigmatization occurs, social isolation and the victim's status of inferiority.

The definition of mobbing at the work place:

In the book *Mobbing, the emotional abuse at the American work place*, the authors claim that this behavior is encountered within workplaces with a weakly organized production or weak management, and the victims are usually individuals that have already proven intelligence, competence, integrity, creativity, dedication and success.

"The psychological terror", the mobbing, in everyday life at the work place, involves hostile and less ethical communication, systematically directed towards an individual that is in a defenseless situation. These actions occur frequently (statistic definition: at least once every week) and during a long period of time (statistic definition: for a period of at least 6 months). The mobbing

describes negative communication actions against a person. Along with its repercussions, it represents a challenge for organizations, administrations and enterprises. Due to the high frequency and long duration of the hostile behavior, this abuse has considerable mental and social effects.

The definition is not so much based on the activities themselves, but on the psychical problem they cause. The origin of this psychological situation at the work place is encountered in medical stress research: the research tries to prove that, where there is a stress factor at the work place, affecting the individual, which can even lead to illness.

The definition excludes temporary conflicts and dwells upon the psychological and social situations causing psychiatric problems. In other words, the difference between "conflict" and "mobbing", does not refer to what or how it is done, but to the frequency and duration of the event. It is mainly a research based on somatic or mental stress: how intense does the mobbing have to be in order to have psychosomatic results or mental problems? The research was especially oriented towards the psychical and mental stress. In his research, Leymann (The mobbing encyclopedia, Bullying; Whistleblowing, 1996), focused on the psychological, psychosomatic or mental results, of various natures, that the mobbing behavior can cause at the work place. The scientific definition of the term, although it refers to the social interaction through which an individual, sometimes more, is attacked by another or several individuals, almost every day, for several months, leaving that person(s) in a helpless, defenseless, position, with a high risk of complete elimination.

This phenomenon is not very familiar in Romania. Specialists translate it through the "psychological harassment at the work place" concept. People within an organization establish various types of interpersonal relationships, which are necessary for their activity. These relationships can also be cordial ones, of cooperation, based on support and respect, but it can't always be perfect, so, sometimes, tension loaded situations occur, leading to conflicts. If the said conflict is not settled, it can lead to insults, verbal aggressions or even physical ones. These conflicts cause severe dysfunctions on a personal and organizational level, affecting the productivity of the entire organization. This aspect has drawn attention, several specialists beginning to study this issue, even setting out a subdomain of psychology, called organizational psychopathology, which describes and explains the causes determining these conflicts, their evolution, and of course, offers solutions and advice for avoiding them or for settling them, if they already exist. The mobbing is included in the psychopathology branch. In his paper called *Mobbing*, Leymann claims that it represents „a communication situation threatening to cause severe physical and psychical damages to the individual. It includes hostile activities, verbal aggression, abuse, despising of the person and his/her work, which, in time, cause serious

effects on the psychic of the abused person, affecting his/her efficiency in on a social and professional level. The mobbing is built from hostile actions which, taken separately, can seem meaningless, but, through constant repetition, have dangerous effects” (Leymann, 1990). There are also authors calling this phenomenon „bullying” (Adams, 1992 - Bullying At Work - Book by Andrea Adams & Neil Crawford).

Leymann’s classifications – during the study conducted by Leymann, he has discovered, in the course of 300 interviews, 45 cases of behaviors (actions) performed by the aggressors, and has divided them into 5 categories:

1. Actions with the purpose of limiting targeted person’s freedom of speech – more exactly, he/she, is not allowed to speak, being constantly interrupted by colleagues, sometimes even offended or criticized, is not allowed to express a point of view.

2. Actions targeting the victim’s isolation: he/she is ignored, no attention is given to him/her, nobody speaks to him/her, his/her physical presence is ignored.

3. Actions for denigrating the victim in front of the coworkers: the victim is gossiped by work colleagues, different rumors are spread, he/she is ridiculed, maybe even considered to be mentally ill, jokes are made related to him/her, his/her personal sector, he/she is sexually harassed.

4. Actions for the victim’s professional disparage: no tasks are assigned to him/her, or the assigned tasks are too hard or too easy, humiliation tasks are imposed.

5. Actions targeting the deterioration of the victim’s health: threatening with physical violence, assigning of hazardous or harmful tasks for the victim, physical aggression, sexual aggression of the victim.

According to Heinz Leymann, the mobbing has two manifestation forms: the attenuated one, as a persecution phenomenon, and the radical one, referring to psychological terror at the work place.

Based on the theories issued by specialists in the field, a few basic ideas can be drawn, for socially “correct” and “incorrect” behavior types. In the next table, a „healthy” behavior in a conflict situation is compared to an adequate behavior for conflict situations, which characterizes the occupation of the work force in harassment situations. According to Leymann, (The mobbing encyclopedia, Bullying; Whistleblowing, 1996):

**Table no 1.** Leymann classification about “correct” and “incorrect” behavior types.

<b>Healthy - conflicts</b>	<b>Work place - Harassment</b>
Roles and responsibilities are clear	Roles are ambiguous
Cooperation relationships	Behavior of non-cooperation/boycotting
Common goals	Lack of foreseeing
„Clear sky” type relationships	Ambiguous relationships

<b>Healthy - conflicts</b>	<b>Work place - Harassment</b>
Sound company	Corporate defects
Occasional frictions and confrontations	Non-ethical acts
Open and honest strategies	Suspicious, debatable strategies
Opening for conflict and dialog	Conflict denial behavior
Direct contact	Lateral, in contact, with apologies

According to Leymann, the impact on health and life quality is considerable. The mobbing can cause various behavior disorders and also affects the health. In the table below, several symptoms are listed:

**Table no. 2.** Leymann – the impact on health and life quality

<b>Psychopathology</b>	<b>Psychosomatic</b>	<b>Behavioral</b>
Events, stress	Blood pressure	Aggressive reactions
Apathy	Asthma	Eating disorders
Reaction avoidance	Cardiac arrhythmia	Increasing of alcohol consumption
Focusing issues	Coronary cardiac diseases	Increasing of smoking
Depressions	Dermatitis	Sexual dysfunction
Excitability	Hair loss	Social isolation
Uncertainty	Headaches	
Insomnia	Muscular pain	
Obsessions	Lack of balance	
Irritability	Migraines	
Lack of initiatives	Stomach pain	
Melancholy	Ulcer	
Available modifications	Tachycardia	
Recurring nightmares		

(Source: Occupational health protection)

Mobbing related legal regulations in the European area...

The most severe behavior included by the mobbing term is the aggressive one. The more it is associated with several behaviors listed above, the more severe it is. This phenomenon occurs gradually, starting with less aggressive and less serious actions, until it becomes a persistent and aware action.

Several statistics have revealed the fact that the mobbing impacts more than 12 million employees every year, in the European Union.

On a global level, The Campaign against Workplace Bullying offers a gender distribution:

- approximately **45 % of the men** and **55% of the women** are affected by this phenomenon;
- **76%** of the men are harassed by men, **3%**, by women and **21%** by both genders;
- **40%** of women are harassed by women, **30%** by men and **30%** by both genders.

Sweden was the first EU member state which has inserted this concept into the legislation, through the 1993 Decree on the abuse at the workplace. Although no concrete remedies were implemented for persons affected by this, the concept is recognized and mobbing related debates are encouraged.

Unlike France where, in 1960, legal courts have admitted this issue, namely the psychological harassment, but it was included in the legislation long after. The first conflict of this kind was observed in 1960, but only in 2002, this law was inserted into the Work Code and the Penal Code. The French Work Code also states the required evidence, for both parties, in order to commence a trial in this matter. The employee has to bring evidence, proof and elements supporting his/her statement, and the defendant has to objectively prove that the attitude claimed by the plaintiff does not represent a case of mobbing. The French Work Code sanctions this by a one year imprisonment and a pecuniary fine.

The Community legislation, art. 31 of the Chapter on the fundamental rights of the European Union, is written against psychological harassment, where „every employee has the right to work conditions respecting his/her health, safety and dignity”. There are two more Directives in the European Union:

- 2000/43/EC on the implementing of the people’s equality of chances, regardless of their ethnic or racial origins
- 2000/70/EC, establishing the guidelines on treatment equality, in employment and profession.

According to the provisions of Directive 200/78/EC, the EU member states, according to their national legal regulations, shall take the necessary measures in order to promote dialogue between social partners, including the monitoring of the existing practices at the workplace, collective agreements, conduit codes, studies or experience exchange regarding the practices to be applied.

In conclusion, each member state applies different and upon its own will sanctions regarding this matter, according to the social realities that the specific state confronts.

## **How do we protect ourselves against these attacks?**

Several institutions have proposed various options for the avoidance of mobbing. Most of them are procedures attempting to control internal communication and the employees' behavior towards one another. A monitoring of employees and occupational environment is attempted, along with the performance of direct investigations and professional rehabilitation. Some enterprises even adopt management training, for monitoring the causes of the conflict and for preventing the occurrence of mobbing. Another method is the reconciliation of parties, through a specialist, a third person acting as a mediator.

The Romanian Constitution states that „No person shall be subjected to torture nor any type of inhumane or degrading punishment or treatment” and that „any person can refer to justice for defending their rights, freedom and legitimate interest”. The constitutional provisions regarding the rights and freedom of citizens shall be interpreted and applied according to the Universal Declaration of Human Rights.

In Romania, three articles were published on this subject, where the moral harassment manifestations and the applicable reactions to these cases are presented.

## **Manifestations of the mobbing phenomenon in sports**

The sports psychologist, Marius Crăciun, considers the mobbing as being the exertion of psychical stress on someone, at the place of activity, in our case, sports clubs. Some examples of actions typical for the mobbing phenomenon are: attacks to a person's dignity through physical and verbal violence, insults or, being frequently spread regarding the targeted person, untrue information, for the purpose of isolating and tormenting the said person. An "advanced" form of this behavior is the bullying. Bullying refers to an aggressive behavior, manifested through the use of force upon others, mostly when there is a „power gap” between the two parties. This behavior includes physical aggression, besides from the verbal one. It is an emotional, verbal and physical abuse.

Going back to the mobbing behavior, it can exist in an attenuated form, thus preventing many people from observing the situation. In order to observe a behavior, the perception/interpreting is essential. The observation involves participation, but a balance must exist. The criteria used for noticing a behavior are: concrete (descriptive), referring to the form (localization in space, topography, intrinsic properties of the body, up to the most analytical level), effects (moves, alters, loses information, it is a more general level) or theoretical (interpretive), where various theories or postulates apply in order to interpret directly visible clues.

The cause classification refers to the same labeling of behaviors with the same cause. In this case, this classification can be used to identify and measure the competition behavior. A variety of conflicts can occur because of this competitive instinct and desire to stand out, especially in the case of team sports. It has to be noted when a certain behavior commences and ends. The recording of behavior is performed upon a quality and narrative description and the recording of time related behavior aspects: sequentiality, duration, lurking of the behavior (the period between the beginning of the observation or the stimulus and the commencement of the behavior), and the interval (refers to the period between the end of a behavior and the beginning of another). The behavior intensity is recorded through a scale. Also, the variability, frequency of the behavior, case specificity and complexity of the recording system have to be observed.

Mobbing is also present in the case of sports players. For instance, in a basketball team, during practices or games, the targeted person does not receive passes during the game, is not included in the greeting, at the beginning and end of the game, is offended and gossiped about by the other players. At practices, during the warm-up, they group 2 or more, to pass among themselves. The person left behind and not included in any group can question this matter. The examples are frequent and highly visible. He/she can be excluded outside the field, in the locker room, tables gathering the team's players etc. Unfortunately, all teams have divergences, arguments, but not all cases lead to mobbing. This does not mean that there are no players horrified of participating to practices. This phenomenon does not necessarily have to be present among the players, but can exist between one or several players and the team coach. There are players that have given up sports, because of these strives, taken to the extreme, or because of the emotional abuse.

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## LIFESTYLE. ANOTHER WAY OF LIFE

PRODEA COSMIN\*, STANCIU LUCIA ANA-MARIA\*\* &  
CHIOREAN IULIA ROXANA\*\*\*

**ABSTRACT.** Words borrowed from other nations are more and more frequent in Romanian speaking. One of these words is the *Lifestyle* field. This term, which is also the subject of this article, refers to the lifestyle reflecting the attitude and values of a person or group. We can include here 3 major categories: alimentation/nutrition, sports and fashion. This article will dwell upon one of these categories, namely that of nutrition. The central theme of the article is the human body, more accurately, its representation, through an adequate nutrition, as healthy as possible. The human nutrition is a fundamental pole in our existence. The mental balance and not only, is based on the food we consume every day. A healthy life means, first of all, a healthy nutrition. It is very important what we eat, how and, most of all, how much. This is why we have to have a feeding behavior which is adequate for our organism, and as healthy as possible for our body. Nutrition is in fact the act of “insuring food for the body”, with the nutritional matter it needs. The nutrition of our ancestors is still an example that the Romanian people follow. Also, the Greek and Egyptian people have a tradition related to the way of eating. We can find many of their practices in the modern cuisine. At the same time, nutrition is not only the way of eating, but also the psychological and medical effects it may have. An inappropriate nutrition can lead to severe health disorders. Because individuals are not well enough informed about the adequate way of eating, awareness campaigns are the most recommended in these situations.

**Keywords:** nutrition, body, lifestyle, dimensions, awareness.

**REZUMAT. Lifestyle. Un alt mod de viață.** Cuvintele împrumutate de la alte nații sunt tot mai des prezente în vorbirea limbii române. Un astfel de cuvânt este domeniul Lifestyle. Acest termen, care este și tema articolului, se referă la stilul de viață care reflectă atitudinea și valorile unei persoane sau a unui grup. Putem încadra aici 3 mari categorii: nutriție/alimentație, sport și modă. În acest articol vom prezenta una dintre aceste categorii, și anume cea a alimentației. Tema centrală a articolului este corpul, mai exact reprezentarea corpului printr-o

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alimentație corespunzătoare, cât mai sănătoasă. Alimentația omului reprezintă un stâlp fundamental în existența noastră. Echilibrul psihic și nu numai, se bazează pe hrana pe care o consumăm noi zi de zi. O viață sănătoasă înseamnă în primul rând o alimentație sănătoasă. Este foarte important ce mâncăm, cum și mai ales cât mâncăm. De aceea trebuie să avem un comportament alimentar adecvat organismului nostru și cât mai sănătos pentru corp. Alimentație înseamnă de fapt „asigurarea corpului cu hrană”, cu materiile nutritive de care acesta are nevoie. Alimentația strămoșilor noștri este un exemplu care încă este urmat de poporul român. De asemenea poporul grec și cel egiptean au o tradiție referitoare la modul de alimentație. Multe dintre practicile lor le regăsim și astăzi în bucătăria modernă. În același timp, alimentație nu înseamnă doar modul de hrănire ci și efectele psiho-medicale care le poate avea. O alimentație necorespunzătoare poate produce grave tulburări de sănătate. Datorită faptului că indivizii nu sunt informați suficient despre modul adecvat de hrănire, campaniile de informare sunt cele mai recomandate în aceste situații.

**Cuvinte cheie:** alimentație, corpul, lifestyle, dimensiuni, informare.

The central theme of the project is the body, more accurately, its representation through an adequate nutrition, as healthy as possible.

The Romanian dictionary defines the body as “the totality of the organs of a living being; considering the organism as an anatomic and functional whole; corpus.” (<http://dexonline.ro/definitie/CORP>). The key concept of this theme is the term “*Lifestyle*”. *Lifestyle*... a word borrowed from English that we hear more and more frequently. This word refers to the attitude and values of a person or a group. (<http://lifestyle.dictionarweb.com/am.php?action=searchWord&word=lifestyle>) Other sources define this term as the totality of pleasures or non-pleasures of a particular market segment, especially those referring to products and services that people buy or consume. The Romanian dictionary defines lifestyle as “the way in which an individual lives his/her life, according to his/her interests, attitudes and opinions.” (<http://www.dex.ro/index.php?a=term&d=Dictionar+de+termeni+internazionali&t=LIFESTYLE>).

The term “lifestyle” is a general one, which includes: nutrition, sports, pleasure activities, clothing style etc.

We have listed a few branches of this term, namely nutrition, sports, pleasure activities, clothing style. Of course, there are many more examples, besides from the aforementioned ones. The human nutrition is a fundamental pole in our existence. The mental balance and not only, is based on the food we consume every day. A healthy life means, first of all, a healthy nutrition. It is very important what we eat, how and, most of all, how much. This is why we have to have a feeding behavior which is adequate for our organism, and as healthy as possible for our body. Nutrition is in fact the act of “insuring food for the body”, with the nutritional matter it needs.

The Romanian dictionary defines sports as “methodical practice of physical exercises, performed for strengthening the body and for educating the will, courage and initiative” (<http://dexonline.ro/definitie/sport>). The practice of physical exercises is an important factor in our everyday life.

Clothing style. We can debate many subjects related to this ancillary dimension. It has become a “must have” for almost every individual. There are numerous blogs discussing this subject, targeting both men and women. Not to talk about fashion magazines, classes for dressing, consultants etc. this field has become highly important. Almost anyone mentioning lifestyle also mentions this clothing section. It is a constantly changing field, this is why it is constantly followed and considered interesting. These are the most familiar dimensions of lifestyle.

Among these listed dimensions, we have chosen to dwell upon that of nutrition. We consider it to be a sector as interesting as clothing style, and also a sector which is full of information. Unlike the clothing style, this subject is vital, and the more we know, the more we can improve our lifestyle. We will find out how our ancestors ate, what is the ideal of body aesthetics and what do psychologists and doctors think of how we should feed ourselves. All these information are meant to enrich our knowledge in this area and give us an image as complex as possible regarding nutrition.

As a highly complex and important field, it has been researched and studied by specialists. For instance, Gheorghe Mencinicopschi has published the book called “And what do we get to eat?” where he refers to the highly industrialized, half-finished, 21<sup>st</sup> century food, establishing the boundary between sensorial and nutritional. Unlike Mencinicopshi, Floarea Damaschin proposes “333 pieces of advice for nutrition and healthy foods”, a publication where she proposes several nutrition lifestyles, as healthy as possible. There are many issued publications in this field, written after a thorough research of the subject, most of them developed by specialists in the field.

Another highly interesting book is that of David le Breton, “The anthropology of the body”. The author considers that “To live is to constantly reduce the world, to the body, through the symbolism it proposes. The human existence is bodily.” (David, Le Breton, 2002) The author’ vision is very interesting, and also the way in which he speaks of corporality, considering the body to be “the individual’s sign, it’s element of distinction, differentiation ...” (David, Le Breton, 2002) In the author’s view, the body is most important for medicine and mass-media. Medicine offers progressively the possibility for the man to separate genetics from will. We can be more vigorous, more intelligent, live longer, thanks to the generous pharmaceutical palette. Nutrition or gymnastics are included in this context.

Besides from campaigns, there are numerous blogs on the Internet approaching lifestyle or just nutrition. For instance, the sports nutritionist Șerban Damian has performed several researches regarding our nutrition, posting on his blog various useful and interesting information (<http://nutritionist.info.ro/>). He has proposed the *Paleo* diet, where he details the feeding pattern of the population, in the Paleolithic Era. Besides from his researches regarding our ancestor's way of eating, he also speaks about sports and about all the ways in which we can live a life as healthy as possible.

These are only a few examples of researches, publications and approaches of the theme. Of course, there were published materials about nutrition and psychology, for instance, the book written by psychologist Crăciun Marius, "The psychology of education", where we can find an entire chapter dedicated to this subject, namely nutrition and its effect on the human psychic. The Romanian dictionary defines the dimension as "size, measure, proportion." (<http://dexonline.ro/definitie/dimensiune>) Next, we will debate the cultural, social, medical and psychological dimension of the chosen theme, namely the body and nutrition.

**1. The cultural dimension:** A very interesting theme to approach is the way in which our ancestors ate. A short history is always welcome. Of course, there are many populations with an impressive tradition in nutrition, this is why we will only choose a few, namely the Greek, Roman and Egyptian.

***The Egyptian people*** – The foods and beverages in the Ancient Egypt were easy to prepare, because the valley of the Nile held rich crops for the entire country. The basic Egyptian food was bread, and their beverage was beer, made of barley. In order to cook bread, women put wheat into the flour, which was then kneaded by the men, in order to be properly milled. Into the dough, they added sesame seeds, honey, fruit, butter and condiments, which gave the bread's flavor. The Egyptians preferred vegetables with a strong taste, garlic and onions, because they are considered excellent for the health (these were consumed at every meal). Many of the foods (vegetables and fruit) were consumed raw, because of the lack of fuel, and meat was consumed once every month. The sacred animals, the cow and the ram, were not slaughtered. The Egyptians would eat frequently, in moderate quantities.

***The Greek people*** – Today, there are several publications which have brought fame to the Greek cuisine, among which: "The fish" by Dorion, "The art of the chef" by Chrysippe de Tayne and "Cakes" by Mendes. In the time of Pericles and Alexander of Macedon, the Greek cuisin stood out through art, at a high level. Athens becomes famous for the abundance of feasts and the so-called Agape (unlike Sparta, which was famous for its military-like soup, very

difficult to eat). The wealthy Greeks would stock from all the corners of the Mediterranean Sea, with poultry, fish, domestic animals, oysters, vegetables, fruit (almonds, dates, quinces, figs). The Greek people would consume a lot of very salty, smoked fish and sardines. As main ingredients, they used, barley flour, honey, milk, oil, rabbit and small poultry, served with Greek salad.

***The Roman people*** – After the conquest of Greece, the Roman people becomes more refined, in what the gastronomy is concerned. A sauce called *garum* or *liquamen* (meaning juice or sauce, in Latin) was used as a main condiment. The *garum* was also known in the Ancient Greece since the Etruscan period and was prepared out of soaked fish. As a feeding practice, they were very much like us, besides the fact that they would frequently skip breakfast, which is a rather unhealthy custom. Lunch had a Mediterranean specific, with various salads, walnuts and olives, hazelnuts, seeds, meat and whole bread. The dinner was the main meal, where they would consume lots of rather unhealthy fats, sweets and spices. There were no eating utensils, since the foods were proportioned into small pieces. The wine never missed from a meal and warm water, honey or spices were added in it. Beer was not consumed.

The menu was divided according to social class. Initially, the Romans preferred the vegetables and cheeses, rather than meat, but very spicy. Along with the expansion of the Empire, meat becomes irreplaceable, and the nutrition caused diseases become more frequent. At every feast, the Romans had a very interesting practice. After a rich meal, they had a feather, which they used to tickle their throats, induce vomiting, and then resumed their feast. It was an embarrassment not to taste all the foods. There were especially created places, small rooms, for this practice.

***Modern cuisine*** – We do not eat that different from our ancestors, but it would be recommended to only take the good parts of their diets and avoid excess fats, which can lead to severe health disorders. The product abundance today also has a negative consequence, feeding excesses are just one of the dangers threatening our health, if we are not careful how and, most of all, what we eat. As we can see, the Egyptian diet is the healthiest and is also recommended today, as it contains plenty of vegetables, fruit, frequent and not very heavy meals.

The sports nutritionist Șerban Damian has performed several researches regarding the way in which people ate in the Paleolithic period. It seems that, at the time, people ate healthier than we do now. In a way, this is normal, considering the fact that they only had 100% natural food, without pollution and chemical additions, and that the food was not processed (sometimes not even thermally). But, with all this healthy food, their life average was up to 30-40 years, but they died healthy, and not because of diabetes, cardiovascular diseases, obesity or cancer. They were generally killed by animals, cold weather, infections and parasitizes.

**2. Social dimension:** along with the emphasis on bodily beauty, this dimension gains more and more importance. People become more and more concerned about their looks and the way other people see them. At the same time, health becomes a priority, meaning that a healthy nutrition does not only serve the aesthetic purpose, but also a healthy body.

David le Breton, the author of the publication called "The anthropology of the body", considers that there is more and more emphasis on the body, which becomes in itself an object of aesthetics, medicine and nutrition. "Living means to continuously reduce the world to the body, through the symbolism it proposes. The human existence is bodily". (David Le Breton, 2002) "the modern body closes the subject in itself, separating it from the community of all there is". (David Le Breton, 2002) The same author dwells upon the perspective of others, the way in which you are seen by others. The image that they individually create about the body "is shaped according to its advance in life, which spares it from a brutal appreciation of oldness". (David Le Breton, 2002) The path of the lack of self confidence can lead to the perception of an ugly body, and a beautiful, sculptural body leads to confidence.

But what is the opinion of a sociologist? – Medical sociology is an ancillary branch of sociology. "The emerging of medical sociology is based both on the multi-dimensionality of the „health“ phenomenon and sociology's ambition to grow, according to the statements of its founders, a science of human „wellbeing“ and „freedom“." (<http://www.scribd.com/doc/31431578/SOCIOLOGIE-MEDICALA>)

Nutrition and body care diseases: the illness represents a modification of the body's functioning normality. Nutrition diseases appear in the Western society along with the globalization of the food production industry, which has been constantly growing during the past 30 years. A large mass of individuals follow a diet or a weight loss diet. This does not necessarily mean the loss of extra weight, but the fact that we need to create a personalized diet for our own body, a nutritional lifestyle. Many young women suffer from anorexia and other eating disorders. They are caused by women's emancipation and by the fact that women start gaining a more and more important role within society, they are appreciated both for their accomplishments and for the way they look. The feeling of being ashamed by one's own body generates eating disorders. The woman feels insecure, unconfident, imperfect, and her fears regarding the others focus on their opinion regarding their own body. These statements are not only valid for women, but also for men. As they become more and more assertive and gain a higher position within society, their interest regarding their appearance also increases, and they become interested of how they are perceived by people around them.

The ideal of the body aesthetics is a subjective one, there is no concrete standard for it. We all imagine a well shaped body (neither thin, nor fat), with well worked muscles, but not excessively and an average height. To this so-called skeleton, each person can add or remove weight. Each person has her/his own ideal of beauty, but a body that is neither too thin, nor too fat, neither too tall, nor too short etc., can satisfy anyone's desires, representing the foundation for ulterior additions.

Sociology considers that social factors influence the individual's perception over his/her own body, and that the environment plays an important role in our development and evolution or involution. The target of sociologists in this field is to gain knowledge of the society, the medical field, "specifically reflecting individual behavior and the behavior of social groups. By studying the relationship between health, illness and society, medical society attempts to reveal this particular place of the social life." (<http://www.scribd.com/doc/31431578/SOCIOLOGIE-MEDICALA>)

How do the others see you? – More and more persons ask themselves this question, generally those unconfident with their physical appearance. Unfortunately, appearance has become an acceptance criterion for some individuals, this is why overweight people are sometimes even excluded from certain groups of individuals. The same thing applies for underweight people. I have often heard the expression: "oh my God, you look so..." (applicable for both obese and very thin persons), or discriminations such as "I am not dating a certain person, because he/she is fat and ruins my image". Unfortunately, there are many similar examples.

We consider that the beauty of the body is positively advantaging and that it is highly important for self-esteem and success in the social and professional life.

**3. Psychical and medical dimension:** An adequate nutrition also means a healthy psychic. An unbalanced nutrition caused by vitiated feeding patterns can compromise health and lead it to extreme conditions, meaning death (there were cases of death caused by an extremely restrictive diet, for the purpose of weight loss). Unfortunately, the adoption of very strict diets is nothing out of the ordinary, both in the case of sports practitioners (for instance, gymnasts) and that of more or less sedentary people. This behavior affects the individual both physically and mentally and become dangerous when the individuals assimilate these patterns which they can no longer abandon, even if they want to. There are numerous eating disorders, distinct, according to their severity. Severe eating disorders have to comply with several criteria, only applicable for a small percent of the population. There are also individuals which do not have the symptoms of an eating disorder. In the middle, there are those that

show a few characteristics of these disorders, but not enough to be diagnosed with certainty. Some studies reveal that more than 60% of the population shows unbalanced eating behaviors. At the same time, most studies are focused on women, because they show a higher risk for developing these disorders. Some men also suffer from these conditions, but for them, the most frequent case is that in which they fail to keep their weight constant and have permanent weight fluctuations.

***The diagnosis of eating disorders:*** As we have stated previously, bulimia has very old roots and was a practice of the Roman people. Nervous bulimia “is characterized by an excessive alimentation cycle, followed by the elimination of the foods, through vomiting”. (Crăciun, Marius, 2008) This disorder is caused by a feeling of guilt, felt by the individual that has just fed himself/herself.

Nervous anorexia is characterized through the “refusal to maintain a normal minimal body weight, according to the age and height, an excessive fear of gaining weight and a distorted perception on the body shape and size.” (Crăciun, Marius, 2008) There are two types of anorexia one consisting in the constant practice of excessive physical exercise, and the other, in maintaining the weight under average, through an excessive feeding and afterwards vomiting.

Other eating disorders are not only determined by the presence of some of the characteristics above, and not all of them. These are called “non-specific”. The following are classified under eating disorders without clinical diagnose: excessive feeding and female triad (unbalanced nutrition, amenorrhea and osteoporosis). Eating disorders are determined by biological and genetic factors (pituitary gland, thyroid gland), psychological factors (personality characteristics – perfectionism), environment related factors (mass-media, family, friends).

The author David le Breton considers that the body image is the representation that the subject creates regarding his/her body, the way in which he/she perceives it, more or less aware, within a social and cultural context, particularized through social experience. Gisela Pankov states that there are 4 ways which structure the implementing of the body image: *the shape*, the feeling of unity between the different body parts, which form a whole, and *the knowledge*, by the subject, regarding the idea that the society projects regarding the invisible consistency of the body, *the content*, the image of the body as a familiar and coherent universe, and *the value*, interiorizing the social judgments over the physical attributes characterizing him/her (beautiful, ugly, fat, thin...); these four components are linked to a social, cultural, personal and relationship related context, without which there would be no body image, nor subject identity.

Each individual has to adapt his/her nutrition style according to the individual necessities. This means leading a lifestyle diet molded according to calories consumption, metabolism, preferences etc. this diet should be assigned after a complete set of analyses. For instance, an active person, who exercises 3, 4 times a week, needs a diet rich in proteins and vitamins. If he/she is prone to gain weight due to the consumption of human proteins, these can be replaced by vegetal proteins. Also, a meal schedule has to be complied with. The diet has to be chosen according to many analyses and factors (available time, daily exercise, blood cholesterol, metabolism etc.) A nutritionist can best recommend what and how that person should feed himself/herself. It is important to highlight that a diet is not a weight loss schedule, but a lifestyle. A weight loss schedule can last for days or weeks, but a diet should last throughout the entire lifetime.

Diet has to represent a lifestyle! Choose a healthy lifestyle!

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## RELATIONSHIP BETWEEN SOCIO-ECONOMIC CHARACTERISTICS AND MOTOR TESTS OF CHILDREN

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**ABSTRACT.** During this study physical development and motor performance of children and the relationship of the above-mentioned results with some sociological factors was evaluated. The research was carried out in Hungary, in Keszthely, a town located in the northwest part of Europe's biggest lake, Lake Balaton, in 2009. The sample of the research extended to 7-11 year-old students (N=389): 188 boys and 210 girls. The results show that the place of residence (inner city, suburb or community) and the living conditions (family house with garden, terrace house or multi-storey) do not have an effect on which level of P.E. lessons or trainings children participate in, what sport they choose or what their level of school achievement is. Family size and the number of brothers and sisters (although the correlation coefficients are significant in many cases), show only a loose correlation with P.E. lessons, the chosen sport, or school achievement. The level of P.E. lessons, going to trainings, or the chosen sport also correlate less with the qualifications of the parents. But at the same time, the average (intermediate), positive ( $r= 0.39; 0.41$ ) correlations refer to the fact that the qualification of both the mother and the father has an effect on the school achievement of the child.

**Key words:** sport and learning achievement, family, living and education conditions

### Introduction

The research involved the body parameters, motor tests and socio-economic relations of young primary school pupils. It is known that in addition to genetic factors, the role of environment is of decisive importance in the development of the child. Family conditions play a great role in ensuring the harmonious development of the child. Of course the educational and pedagogical role of school is also very important at this age.

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The sociological model of human development was outlined by *Bronfenbrenner (1979)*, in which four levels were separated. The first level is the growth, development and health of the child. The second is the immediate family conditions, while the third comprises the macro environment of the residence. The fourth contains the economic conditions and institutions of society, e.g., the expansion of education (among others, the environs of kindergartens and schools) or the facilities of body culture and conditions of doing sport, etc.

It was *Schmith (1983)* who drew attention to the importance of environmental factors; mainly to the social condition of the family and its micro environment. Based on his observation carried out in kindergartens, the size of the playground has an effect on the number and type of motor activities. Children ran less, but climbed more and made use of the slide when they had a smaller territory (*cit. Renson et al 1983*).

*Stachowka (1964)* studied the state of health, physical development and family conditions of more than 1,000 children. Those in lower primary school grades living in better conditions significantly surpassed their classmates who were living in worse conditions, both in physical development and in state of health.

*Ponthieux and Barker (1965)*, in their researches, found that children from worse social conditions performed better in 50 and 600 yard running and in throwing a small ball than those living in better conditions.

*Eggert and Shuck (1975)* cite the results of *Kephart*, who found significant differences in balance, strength, speed strength and skillfulness and visual motor ability for groups formed according to the social status of the fathers.

*Renson et al (1979)* analyzed their material on the basis of seven factors formulated with regard to social status, in which they examined 21,000 Belgian children from a somatic and motor ability point of view. Their conclusions were that the socio-professional status of the father was a decisive factor from a physical fitness standpoint, and that this factor correlated with the qualification levels of the parents. Urbanization is also a differentiating factor. The effects of family size and birth order manifested themselves in the level of somatic development.

*Parizková (1981)* carried out research with kindergarten children. She reported no significant differences in the motor features between the groups based on the socio-economic (income per person) status of families. On the other hand, a significant difference was found between those living in the capital or in the countryside. Children from the countryside proved to be better in running and throwing, while those living in the capital performed better in the standing broad jump and in coordination tests.

*Renson et al (1983)* analyzed the data of children in rural, half-rural and urban groups in his 'Leuven development studies'. His final conclusion was that speed strength and the hand moving speed show a positive correlation

with the level of urbanization, while the step-test (with which the state of the circulatory system was examined) shows a negative correlation.

As far as the Hungarian special literature is concerned, a study by *Csillag (1984)*, based on 15 motor tests and carried out among students of a regional centre and its surroundings, found that the performance of urban children are better. A greater difference was observed between the two groups in the case of the girls.

*Ákoshegyiné (1986)* studied motor characteristics and the socio-economic status of younger primary school children in towns. She stated that the area (square meter) per person in a flat is an important factor in early motor development. Better motor performances were observed with those children who had sisters or brothers, and with those who were born as a second child. A correlation was also found between the qualification of the parents and the motor development of the children.

*Barabás and Fábrián (1988)* examined the motor performance of 6-18 year-old children and youths in five different settlement levels: the capital, city, town, small town and scattered settlement. It was stated that essential differences were found in the motor performances between these groups. The performance of those living in cities was better as far as the mean values are concerned. Muscle strength of the boys (in the shoulder girdle and arm), and the strength (in the shoulder girdle) and speed of the girls proved to be a differentiating factor.

*Mészáros (2011)* compared the physical development and motor performance of three groups of 7-11 year-old boys (a normal group, a group attending specialized P.E. classes, and a socially-supported group). It was found that regarding body height the way in which the children were grouped had no effect on the speed of development in each of the sample groups, but the socially-supported children were significantly shorter in each observation period. Pupils listed in the normal group were the heaviest. In the 30m dash and in the broad jump test, the performance of children attending specialized P.E. classes were the best, while there was no significant difference between the normal and socially-supported groups. But in the Cooper-test the children attending specialized P.E. classes were not better than their classmates either.

The following can be summarized from the literary data:

1. Level of motor characteristics and motor development are influenced by the conditions of the environment.
2. These motor skills manifest themselves through better environment or more favorable education. Inorganic conditions, mainly the effects of the natural environment, should not be neglected either.

3. Those who used a complex approach in their research pointed out the fact that the environmental factors do not have individual effects, but rather a cumulative one.
4. The environmental conditions are uniform and not one-way. For example, certain elements of the environment have different effects on coordination than on conditional abilities.

### Aim of the study

Based on the previous conditions, the study was aimed at obtaining new data and viewpoints regarding the physical development and motor performance of the 7-11 year old age groups in Hungary. At the same time, the relationship of the above-mentioned two factors and the important sociological ones were also compared.

### Methodology

#### Site and sample (Site of examination and sphere of participants)

The research was carried out in Hungary, in Keszthely, a town located in the northwest part of Europe's biggest lake, Lake Balaton, in 2009. The sample of the research extended to 7-11 year-old students (N=389): 188 boys and 210 girls. The data of these children (age and gender) are summarized in *Table 1*.

**Table 1.** Age and gender of tested children

Age	Boys		Girls		Total No of elements
	No of elements	Average	No of elements	Average	
7	31	7.12	39	6.92	70
8	45	7.94	39	7.98	84
9	43	8.96	42	8.99	85
10	34	9.97	53	9.99	87
11	35	11.07	37	10.94	72
Total	188	-	210	-	398

### Applied methods

From among the anthropometric data, body height, body mass, shoulder-width, circumference of the forearm and the hand, and two skinfolds (triceps and biceps) were measured. In addition, the decimal age, morphological age, the BMI and the plastic index were also measured. The motor tests were comprised

of a 20m dash, standing broad jump, six minutes of continuous running, throws with a stuffed ball and obstacle race tests.

To determine fine coordination, hand-synchronization was also used (Bakonyi, 1981). Data were collected regarding family size, the child's birth order, the qualifications of the parents, residence, type of flat, quantitative and qualitative indices of teaching P.E. to children, participation in sport and school achievement with the help of questionnaires.

The non-numerical data were coded in order to evaluate relationships between physical development, motor performance and social conditions with correlation calculations.

### ***List of the different data:***

- Qualifications of parents: 1: primary school; 2: skilled worker; 3: secondary school; 4: college; 5: university
- Type of settlement: 1: community; 2: suburb; 3: (inner) city
- Housing estate: 1: yes (lives there); 2: no
- Ranking of flat type: 1: with garden; 2: terraced house; 3: multi-storey house
- P.E. specialization: 1: yes; 2: no
- Training: 1: yes (attends); 2: no
- Sports: 1: track and field; 2: cycling; 3: combat sports/martial arts; 4: sport games; 5: gymnastics-dance; 6: triathlon; 7: swimming; 8: other (not listed)

## **Results and discussion**

*Table 2* shows the correlations of the examined socio-economic indices with P.E. lessons and school achievement.

**Table 2.** Relations between the emphasized sociological indices (Pearson correlation,  $r$ , boys and girls together,  $n=396$ )

Name	Family size	No. of sisters and brothers	Qualifications of father	Qualifications of mother	Residence	Flat type
Advanced level P.E. lesson	n.s.	n.s.	-0.11	-0.06	n.s.	n.s.
Training	0.09	0.09	-0.27	-0.21	n.s.	n.s.
Regularity of training	0.05	0.05	-0.06	-0.15	n.s.	n.s.
Sport	-0.10	-0.10	0.15	0.04	n.s.	n.s.
School achievement	-0.11	-0.11	0.41	0.39	n.s.	n.s.

The results in Table 3 show that the place of residence (inner city, suburb or community) and the living conditions (family house with garden, terrace house or multi-storey) do not have an effect on which level of P.E. lessons or trainings children participate in, what sport they choose or what their level of school achievement is. Family size and the number of brothers and sisters (although the correlation coefficients are significant in many cases), show only a loose correlation with P.E. lessons, the chosen sport, or school achievement. The level of P.E. lessons, going to trainings, or the chosen sport also correlate less with the qualifications of the parents. But at the same time, the average (intermediate), positive ( $r= 0.39$ ;  $0.41$ ) correlations refer to the fact that the qualification of both the mother and the father has an effect on the school achievement of the child. It means generally that the higher the level of qualifications the parents possess, the better the school achievement of the children. These results are similar to the data obtained by Ákoshegyiné (1986), who also recognized the effect of parents' qualifications. The obtained data in this paper are also supported by Quell and Sattel (1976), who showed the effects of the parents' qualifications.

The correlations between P.E. lessons, school achievement and some motor performances are summarized in *Table 3* (for girls) and *Table 4* (for boys).

**Table 3.** Correlation between motor performance and socio-economic features  
(Pearson correlation,  $r$ , girls,  $N=204$ )

Name	Advanced level P.E.	Training	Regularity of training	Sport	School achievement
20m dash	0.22	0.21	-0.28	0.12	-0.28
Standing broad jump	-0.40	-0.20	0.31	n.s.	0.20
Throw with a stuffed ball	n.s.	-0.20	0.26	n.s.	0.15
Six minutes of continuous running	-0.41	-0.35	0.39	-0.21	0.21
Obstacle race test	0.16	0.24	n.s.	n.s.	-0.24
Match test???	n.s.	n.s.	n.s.	n.s.	n.s.

**Table 4.** Correlation between motor performance and socio-economic features  
(Pearson correlation,  $r$ , boys,  $N=192$ )

Name	P.E.	Training	Regularity of training	Sport	School achievement
20m dash	0.22	n.s.	n.s.	0.21	-0.16
Standing broad jump	-0.42	-0.12	n.s.	-0.24	0.14
Throw with a stuffed ball	-0.19	n.s.	0.26	-0.26	n.s.
Six minutes of continuous running	-0.39	-0.17	n.s.	-0.14	0.19
Obstacle race	0.21	0.11	n.s.	0.21	n.s.
Match test	0.16	n.s.	n.s.	n.s.	n.s.

Data in Table 3 and 4 shows that several of these correlations are not significant, and those significant correlations are generally loose. For the 20m dash, there is a loose, positive correlation in both groups with the level of P.E. lessons (advanced or ordinary level), the chosen sport, and for girls, with training.

Relationships between standing broad jump, throws with stuffed-balls, and continuous running with the level of P.E. lessons, and the positive correlations with going to training regularly and with school achievement, hint to the fact that those boys and girls who attended the advanced-level P.E. lessons or train regularly are better students, and generally have better results in motor performance than the others. The obstacle race test showed a loose, positive correlation with the P.E. lessons, and it was supported by the result, shown in school achievement. So it means that they have better results in the 20m dash, standing broad jump, and throw with a stuffed ball, continuous running and in the obstacle race tests as well.

All these draw the attention to the fact that participating in advanced-level P.E. lessons or regularly going to training are already very important at this age. The relatively loose correlation with school achievement shows that good learning and doing sports reinforce each other; that is to say, those who do sports are generally better (or at least not worse) in learning.

The correlation of sports (motor) performance with the level of physical development can be found in *Table 5* and 6.

**Table 5.** Relation between sports performance and level of development  
(Pearson correlation, r, girls, N=204)

Name	20m dash	Standing broad jump	Throw with a stuffed ball	Continuous running	Obstacle race	Match test
Decimal age	-0.63	0.39	0.78	0.15	-0.66	-0.53
Morphological age	-0.23	n.s.	0.36	-0.18	-0.24	-0.34
Body height	-0.53	0.21	0.78	0.15	-0.51	-0.36
Body weight	-0.26	n.s.	0.63	n.s.	-0.27	-0.25
BMI	n.s.	-0.12	0.33	-0.13	n.s.	n.s.
Plastic index	n.s.	-0.20	n.s.	-0.15	n.s.	n.s.
Triceps	n.s.	-0.19	0.20	-0.22	n.s.	-0.18
Biceps	n.s.	0.23	0.16	-0.13	0.15	n.s.
Body height at birth	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Body weight at birth	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

The data show that *no correlation could be shown between the height and weight at birth with sport performance*. No significant correlation coefficient was found in any cases with the girls and only on one occasion with the boys.

*A closer correlation between sport performance and decimal age, as rather than morphological age, was generally observed. While the previous values hint to a medium-level or closer relation, in the latter case it describes a looser correlation with the girls.*

**Table 6.** Relation between sports performance and level of development (Pearson correlation,  $r$ , boys,  $N=192$ )

Name	20m dash	Standing broad jump	Throw with a stuffed ball	Continuous running	Obstacle race	Match test
Decimal age	-0.70	0.45	0.77	0.28	-0.64	-0.22
Morphological age	-0.54	0.29	0.76	n.s.	-0.51	-0.14
Body height	-0.59	0.38	0.76	0.18	-0.51	-0.21
Body weight	-0.23	n.s.	0.57	n.s.	-0.23	n.s.
BMI	n.s.	-0.17	0.27	-0.21	n.s.	n.s.
Plastic index	-0.13	n.s.	0.22	-0.13	-0.21	n.s.
Triceps	n.s.	n.s.	0.34	-0.18	n.s.	n.s.
Biceps	n.s.	n.s.	0.32	-0.15	n.s.	n.s.
Body height at birth	-0.39	n.s.	n.s.	n.s.	n.s.	n.s.
Body weight at birth	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

*Body height*, both with girls and boys, showed a strong correlation with stuffed ball throwing. It has a closer correlation with the 20m dash and with the result of the obstacle race test than with the standing broad jump, continuous running and the hand synchronization test. The correlation of *body mass* with stuffed ball throws was stronger than the other tests in both groups.

In several cases the relationship of the *BMI*, *the plastic index* and *the biceps-triceps skinfold measures* with sport performance is not significant, or in most cases it shows a loose, negligible correlation.

## Conclusion

It should be stressed that the examination sample is about a typical town and its environment in Hungary, the sociological status of which is greatly influenced by the fact that it acts as a holiday resort, as it is located near Lake Balaton.

- The results of this survey suggest that the size of the family and the living conditions have less influence as to which level of P.E. lessons the children attend and what sports they choose and how often they do them. It is supposed that the facilities of the school also have an influence on them.

- At the same time it seems that the qualifications of the parents have an effect on the type of activities the children take part in and their school achievement.
- The outcome of the research hinted that the sport performance of those taking part in advanced-level P.E. lessons or at trainings is generally better than that of the other children.
- It also seems to be proven that those children who learn better have better results in sports as well.
- Furthermore, it could be stated that the decimal age generally shows a stronger correlation to sports performance than the morphological age.

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