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FACULTY OF PHYSICAL EDUCATION AND SPORTS

DOCTORAL SCHOOL OF PHYSICAL EDUCATION AND SPORTS

MOTOR AND HEALTH COMPONENTS OF PHYSICAL FITNESS AMONG STUDENTS IN MIDDLE SCHOOL

SUMMARY OF DOCTORAL THESIS

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Contents

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Introduction

According to Ioan Slavici (1848-1925) physical education represents „a guidance to take care of one's own health and proper development of their body". Throughout its development, physical education had glorious times and moments of decline. The words of Latin poet Juvenal from Satira X, 356 *Orandum est, ut sit mens sana in corpore sano* (You should pray for a healthy mind in a healthy body) underline the benefits which physical exercises have for the body as well as for the mind, resulting in a state of well-being.

According to World Health Organization (WHO) obesity is recognized as a major and independent risk factor. One out of three children in Europe is overweight or obese and in the last 30 years obesity has doubled among children (WHO, 2013b). Maintaining an optimal weight and body composition in school years should represent a national priority in Romania.

Regular practice of physical exercises and an optimal fitness level represent defense mechanisms against non-infectious diseases and they are indispensable factors for a good health. A low fitness level represents a high risk of developing diseases (cardiovascular diseases, type 2 diabetes or obesity) which occur as a result of physical inactivity.

According to studies, physical education class is the only subject in school which if practiced regularly, influences beneficially both physical competences as well as results obtained at other classes through cognitive development and attention. Simultaneously, physical education classes represent the first step for practicing physical activity throughout one's entire life and it is closely related to physical development, health and the development of the biometric potential of future generations. At the same time it is an essential factor in strengthening the body: water, air and the sunlight help make it stronger.

Today's adolescents, biopsychosocial beings in the making, part of generation Z (young people born between 1995-2009), register a phenomenon of physical development rate acceleration. After almost 30 years from the Revolution in 1989, in the circumstances of social, economic and political changes caused by the spreading of IT devices and changes in diet, students have changed their daily routine, and the number of overweight or obese students is increasing every year. This aspect has led to the installation of sedentarism among the population correlated with the massive decrease of physical activity.

The need for measuring and assessing has extended very much into physical education classes with the purpose to discover the essence of the problems of this social phenomenon. Currently, educational, political and economic systems of the modern world need data and information that would shed light on the state of health of school children.

Practicing physical exercises, starting from the primitive commune up to slavery, feudal system and post feudal system, had strict purposes like acquiring food or getting ready for battle. The first physical education classes from the 20th century had the goal to acquire motor performance and up until now there are many schools that use normative assessments. In the future, a change of the distribution of performances may lead to different interpretations. If the norms of the National School Assessment System in Physical Education and Sports are changed (increased or decreased), the individual performances do not change, but it results in a relative change of performance assessment. As a result of increasing the norms, the students with moderate or low performance levels may be discouraged even if they could excel in different kind of sports or have an optimal health related physical fitness level.

In the 2014-2015 school year the Physical Education and Sports Curriculum for middle school children contains: exercises for developing motor skill, technical and tactical procedures from different sports games, athletics and acrobatic elements from aerobic gymnastics. The grades are given exclusively based on muscle quality. We consider that due to some secular tendencies and difference in lifestyle, the current population of school children is changed while the minimum norms of the National School Assessment System stayed the same in the past almost 20 years.

This assessment tool operates based on the minimum norms equivalent to grade 5. The normative system ranks the students of a class exclusively based on some motor performance indicators showing a difference in value between the students as well as the achieved progress, recorded in their individual files. The main disadvantage of normative assessment resides in the relative position of the student within the class or the position of one individual compared to another. *The results refer rather to the current performance level and not to the level they should be at.* Another disadvantage of the normative assessment system is that it favors students with high level motor skills, while it leaves in disadvantage those with low level motor skills, as they have less chance to achieve the required performances. Many times normative assessments may be used in a subjective manner if we take in consideration the genetic inheritance and the growth and development rate which is different for each individual. This situation has created many cases of insufficiency and it has resulted in the issuance of medical exemptions for the physical education and sports classes.

In the science of physical education new physical condition assessment trends have emerged. Some test batteries measure fitness in relation with health (health-related fitness) as well as motor performance. Currently, FITNESSGRAM which appeared in the United States

of America in 1977, is used in all of its 50 states as well as in other 14 countries (Plowman & Meredith, 2013). It uses assessments based on criteria reference standards, called health standards. These standards correspond to a minimum motor performance needed to avoid certain health risks occurred due to physical inactivity.

The EUROFIT test battery appeared in Europe in 1988. EUROFIT was created for the unitary assessment of motor capacity level of the population from the countries of the European Community. Applying this test battery allows the comparative study of the biometric potential of subjects from different countries.

Starting from 1969, in Romania there have been numerous assessments regarding the biomotor potential of students, but all of them were made up of muscle quality measurements.

We wished to assess for the first time in Romania, the motor components and health components of physical fitness of middle school children followed by an experiment in order to optimize physical fitness of students in 6^{th} grade through a physical activity program organized in Oradea in the 2015-2016 school year.

The paper is structured in three sections and seven chapters preceded by the introduction, and it ends with a section dedicated to the conclusions and perspectives for continuing the research.

The first section is made up of four chapters containing concepts relating to the theoretical substantiation of the thesis.

The first chapter contains some definitions of motor skill along with its structural elements, then the difference between motor capacity and biometric potential is explained, followed by an enumeration and detailing of the contents of each physical fitness component (agility, balance, coordination, strength, reaction time, speed) and of health related fitness (aerobic capacity, muscle strength and endurance, flexibility and body composition).

Chapter 2 is dedicated to the characteristics specific to children in pubertal stage containing the general presentation of pubertal stage, reference points of growth and anatomo-physiological development, somatic development rate, development rate of the skeletal system and muscles, motor skill and the psychological characteristics specific to pubescents.

In **chapter 3** there is an incursion into specialty literature which studies physical education in school and physical activity of middle school children, presenting the physical education systems in Romania and Hungary.

In **chapter 4** the main tests and test batteries are introduced (FITNESSGRAM, EUROFIT, NETFIT) which are used within the physical education and sports classes, and also the measuring and assessing methods that are used in physical education classes in the USA and in Europe.

In **section II** we presented the pilot study regarding the examination of the instruments used in the research. We wanted to assure the conditions for performing accurate measurements with well-defined and unitary protocols, starting from the idea that the assessment tools and the measuring technique of all the health components are well known.

Section III includes two personal researches performed in order to assess the level of manifestation of motor components and health components in case of 10 – 15 year-old students from the Bihor – Hajdu-Bihar Euroregion.

Synthesis of Chapter 1. Concepts and Conceptual Delimitations of Motor Skill and Fitness

Movement and motor skill are two essential terms in the field of physical education. The concept of motor skill cannot be considered separately from the concept of movement, in the case of biological movement (Dragnea & Bota, 1999*)*. The word movement originates from the Latin word *movere* which means to come out of the state of immobility, a change of the position of the body in space, related to certain fixed reference points.

The elements of motor skill refer to the act, action and activity of moving. The motor act represents a reaction to a concrete situation. The simplest motor act is considered walking or running. According to Nicu (2002), the motor act is „a simple movement performed as an automatic or voluntary reflex in situations for which the intervention of the locomotor system is needed" (p. 24). In the paper entitled „The Encyclopedia of Physical Education and Sports in Romania" the motor action is defined as „a unitary structure of motor acts destined to solve certain concrete tasks of the motor action. It is performed according to the model developed in the motor areas of the cerebral cortex based on the analysis and synthesis of information received from the analyzers" (Nicu, 2002, p. 26). According to Dragnea & Bota (1999), motor activity represents „a set of motor actions performed systematically based on certain ideas, rules, organizational forms, resulting in the complex adaptation of the body, in the long term" (p. 35).

In the book entitled "The Theory and Methods of Physical Education and Sports" motor capacity is presented in two ways: a) in general: basic motor skills (speed, agility, strength

and endurance) and the basic and utilitarian-applicative acquired motor habits and abilities (walking, running, jumping, throwing-catching, transporting weights, scaling, crawling, climbing, etc.) b) specifically: as essential object of practicing physical exercises (Cârstea, 1993).

In the Anglo-Saxon literature, the equivalent term of motor capacity is *fitness* and the term of *physical fitness* refers to the basic physical condition.

The term fitness may be considered from two perspectives: as physical fitness and as health related fitness.

Fitness is considered „an activity aimed to increase the capacity of the individual to adapt to the requirements of life" (Epuran, 2011, p. 258). The same author describes the motor components of physical fitness: agility, balance, coordination strength, reaction time and speed.

Tudor & Gherghe (2011) considers that health related fitness is made up of the following components: cardiorespiratory endurance (cardiovascular fitness), muscles strength, mobility and body composition. Epuran (2005b) considers that health components of physical fitness refer to the aerobic capacity (aerobic fitness), muscle strength and endurance, flexibility, body composition (the percentage of adipose tissue) and nutrition.

Synthesis of Chapter 2. Characteristics Specific to Children in Pubertal Stage

Pubertal stage, also known as middle school age, comprises the ages from 10 – 12 years to 14 – 15 years, period in which numerous changes are taking place from somatic, functional and psychological point of view. We encounter the acceleration of body development and the first signs of sexual maturity appear.

Middle school students are going through a stage of great morphological and functional changes. This stage may be considered as being one of transiting from childhood to adolescence, preadolescence meaning an intense moment of physical growth.

The alternating growth rate, specific to each segment or organ, constantly results in changes of proportions between the different component parts of the body. The significant growth rates in cases of certain preadolescents are accompanied by tiredness, apathy, headaches, psychological instability, increased need for sleep, joint pain, clumsiness (Crețu, 2009).

In this stage the muscle system continues to develop and boys are preoccupied by muscle mass growth and they do exercises for strength in order to increase their muscle mass.

Despite this fact, the development of the muscle system remains a bit behind compared to the growth in height.

Performing movement is related to the position and movement of one's own body in space, which involves proprioceptive sensations. For a coordinated movement of high precision, more factors have to be analyzed: the position and movement of the body parts, the type of the passive movements, endurance and sense of balance.

Adolescence is regarded as a period for self discovery, a period in which the person gets to know best what they've become and what they could become. Curiosity regarding some classes in school and positive attitude are essential characteristics of this period.

The age range between 10 – 15 years is an optimal period for developing acquired motor skills specific to sports and for developing motor skill. The main goal of this period represents the diversity of technical and tactical procedures of sports games and initiation into practicing certain sports.

Szatmári (2009) considers that the best period for developing maximal static muscular strength is between the ages of 13 – 14 for girls and 7 – 16 for boys. The differences in strength between genders correspond precisely to the period when puberty starts.

Badiu, Gheorghiu, Ene, Onet & Robu (2001) propose that "in the first grades of middle school, agility (ambidexterity, precision in throwing) and speed should be developed primarily, especially of reaction time, execution time and acceleration speed" (p. 90). These two skills represent great growth potential in pubertal stage.

Performing great efforts without multiple repetitions may lead to exhaustion and negative effects. According to Szatmári (2009) the VO_{2max} differences between genders is due to the difference in physical activity, and Grosser, Brüggemann & Zintl (1986) appreciates that the biggest difference occurs during pubertal stage.

Synthesis of Chapter 3. Physical Education in School and Physical Activity of Middle School Students

According to studies, sedentary lifestyle may lead to the development of certain health problems. Regular physical activity develops and maintains bone and muscle health, reduces the risk of obesity, chronic diseases, depression and anxiety, and results in a state of well-being. In order to maintain and improve cardiovascular fitness, to increase muscle fitness and maintain bone fitness, WHO recommends physical activity to be mostly moderate and intense (Lukács & Hanțiu, 2016b).

Epidemiologic studies have shown that persons with high level of physical fitness have 50% less chances of to be exposed to non-infectious diseases compared to those with a low level of physical fitness (Myers and Others, 2004). Adolescents with low physical fitness present a high risk of developing cardiovascular diseases, type 2 diabetes (Moreira and Others, 2011) and abdominal adiposity (Ortega, Ruiz, Castillo & Sjöström, 2008). Physical exercises improve self-esteem, cognitive functions and health by reducing anxiety, depression and negative emotional states (Callaghan, 2004).

WHO coordinates a strategy to develop physical activity in Europe for the period of 2016-2025 through which it recommends different exercises for kindergarten and schools. WHO recommends that the optimal number of physical education and sports classes (PES) to be present equally in all member states of the European Union, in accordance with the existing scientific bases. The lessons have to contain a variety of motor activities and abilities, team games, competitions, all for the purpose of improving the *state of health* of the children (WHO, 2015).

Physical education represents an essential link of general education, as it is a motor activity with a predominantly shaping characteristic. The physical education class is the basic form of practicing physical exercises and its main goals are developing acquired motor skills and motor skill, obtaining a harmonious physical development, emphasizing the development of personality through volitive, emotional, moral and esthetic sphere.

The education reform that took place in Romania after the Revolution from ’89 meant the modernization of the physical education system. Today’s school physical education is part of the subsystem of physical education of the young generation which comprises subjects from pre-school, school and university.

In the 2014-2015 school year the physical education class is included in all educational cycles and in accordance with the finality of education, the curricular area of Physical Education and Sports, along with six other curricular areas, are part of the national curriculum of Romania. Staring from 2017, the new name of the curricular area is *Physical Education, Sports and Health*.

The daily physical education class in Hungary for the students in the 5^{th} – 8^{th} grades may have the following contents:

a) front and formation exercises, exercises for harmonious physical development and motor capacity, consolidation of coordination through games / contests, concepts for preventing and correcting inadequate attitude, developing the state of health, developing personality and motor skills.

b) swimming;

c) sports games (basketball, volleyball, handball, football);

d) athletics (running, jumping, throwing);

e) gymnastics (acrobatic gymnastics and jumps) + rhythmic gymnastics (girls) + aerobic gymnastics (girls + boys);

f) at least four alternative open air sports games in accordance with the season (taking in consideration the financial situation and the qualification of the teaching staff): scaling, archery, horse riding, karate, Nordic walking, fencing, dance, ice skating and roller skating, table tennis, etc.;

g) self-defense.

In the 2015-2016 school year, out of the total of 28 UE member states, Hungary occupied 1st place and Romania the 21st place regarding the number of physical education and health classes. The physical education and health classes mean "sports, physical activity to improve health by traditional games, gymnastics, swimming, athletics, dance or other activities which develop physical and social competences (abilities, sense of coordination, psychomotor development, cooperation) and an active and healthy lifestyle" (CCE, 2016, p. 8).

Synthesis of Chapter 4. Measuring and Assessing in Physical Education in Schools

The measuring tool in physical education class becomes more and more necessary and it represents the act by which both quantitative (in case of tests involving running, jumping or throwing) and qualitative (in case of floor exercises in acrobatic gymnastics) information is gathered. Regardless of the gathered information, measuring has to follow the principle of objectivity and accuracy. This means using a test or a trial.

Assessment in physical education in school represents a complex process, an act of great importance, having a role in conducting the instructive-educative process and it measures whether the students have reached the educational targets proposed by the teacher of the class.

Measuring physical fitness has always been a research subject for many specialists. Globally, the number of test batteries is high. According to Marcu & Pețan (2005), these tests help to get to know better the motor potentials of the students and give the possibility to compare their individual results. The assessment system of physical education offers

information about the efficiency of the methodology, contents and means used to achieve the proposed targets (Hoştiuc, 2003).

The FITNESSGRAM concept was born in 1977 when Charles L. Sterling, the sports manager of Richardson School from Texas, noticed an increased interest towards the physical condition assessment files displayed by the institution as well as by the parents. In 1981, Dr. Sterling became the employee of Cooper Research Institute from Dallas. One of the institute's high speed computers had the possibility to record the motor results of the students. This program was named FITNESSGRAM, after „telegram", „telegraph" in Romanian, in order to underline the importance of transmitting a message / information to the children and their parents.

In 2013 the assessment standards were perfected and the terminology was modified. The following action zones (AZ) appear: Healthy Fitness Zone (HFZ), Needs Improvement (NI) zone and Needs Improvement Health Risk (NIHR) zone. The goal of each student was to be within the HFZ. The results that were within this zone (HFZ) were considered to be accessible and sanogenetic factors. The results of the assessment regarding health related fitness (HRF) offer an overview of the level of physical condition as well as of the state of health.

FITNESSGRAM has four health components: aerobic exercise capacity, body composition, muscle strength / endurance and flexibility. In 2013 FITNESSGRAM / ACTIVITYGRAM was an educational assessment and recording software used in schools all over the world by thousands of teachers and millions of young people in order to help the teachers to monitor information regarding the physical condition level and state of health as well as the details related to the students' physical activity. Thus, it was possible to draw up personalized physical condition assessment files, the data contained by these being accessible to the students, their parents as well as the school principals.

The EUROFIT test, established in 1987 by the Council of Europe through the Sport Development Committee, was created with the purpose of a unitary assessment of the students' physical condition. Using this test battery allows the comparative study of physical fitness of subjects from European countries. Developing EUROFIT test battery was possible after a preliminary study that lasted three years and involved 50.000 students from 15 countries.

EUROFIT test battery is made up of ten motor tests, three somatic indicators (height, weight and body fat from 4 skinfolds) as well as two pieces of identifying information. The 10 EUROFIT motor tests were the followings: sit-and-reach, Flamingo balance test, bent arm

hang, standing broad jump, sit-ups, handgrip test, plate tapping, 10 x 5 meter shuttle run, endurance shuttle run and bicycle ergometer test.

In 2013 Cooper Institute signed a partnership agreement with the School Sport Federation of Hungary regarding the introduction of a national test for the assessment of the students' fitness level. The NETFIT test battery (*Nemzeti Egységes Tanulói Fittségi Teszt = National Unitary Test for Students' Fitness Assessment*) was created based on the model of FITNESSGRAM and it was introduced following a preliminary representative study.

For the interpretation of the results, NETFIT uses a criteria based reference standard called health standard, by age and gender, establishing the subject's level in relation to certain targets. This health standard corresponds to a minimal motor performance necessary to avoid certain health risks that appear as a result of physical inactivity (cardiovascular disease, type 2 diabetes, sedentary lifestyle, etc.). The values of health standard do not refer to the level required in competitive sports but to an optimal level needed for a healthy lifestyle.

Aerobic fitness, skeletal muscle fitness and flexibility were measured by 7 motor tests: endurance shuttle run, rhythmic sit-ups, trunk extension test, rhythmic push-ups, handgrip test, standing broad jump and flexibility test.

In order to analyze the BMI values, the AT percentage and the results of the endurance shuttle run test in relation to age and gender, the authors propose the subjects to be grouped up in action zones (AZ) delimited by using three color codes: HFZ – green, NI – yellow, NIHR – red (high risk of diseases).

The researches performed in Romania regarding the biomotor potential of students, used different tests to determine the anthropometric and motor indicators (speed, agility, endurance, strength).

The study of the biomotor potential of students in Romania was performed using measurements elaborated by teachers and it covered the following periods: A) 1969-1972 (pre-school children, students in 1^{st} – 12^{th} grades, 82941 students); B) 1981-1984 (1^{st} – 12^{th} grades, 81282 students); C) 1989-1994 (pre-school children, students in 1^{st} – 12^{th} grades, over 25900 students); D) 2011-2012 (1^{st}, 5^{th}, 9^{th}, 12^{th} grades 146770 students), and the penultimate biomotor assessment of school children, called „The Biomotor Program" N: 8212/12.02.2014 (1^{st} – 12^{th} grades), was concluded between the Ministry of National Education and the National Institute of Research for Sports.

Synthesis of Chapter 5. Measuring the Motor and Health Components of Physical Fitness and Physical Activity Level

The NETFIT test battery has never been used in Romania. In order to get to know it, I attended a professional training course between September the 12th, 2014 – September the 20th, 2014 called *„Physical Education in Schools as Health Improvement: Renewed Methodology and Unitary Fitness Assessment (NETFIT) in Practice* (N.281/8 from 22.09.2014) (*„Iskolai testnevelés az egészségfejlesztésben: módszertani megújulás és egységes fizikai fittségmérés (NETFIT) a gyakorlatban*), annex 5, a module made up of 30 hours (theoretical and practical) organized in Debrecen, Hungary.

The purpose of the pilot study was to identify the difficulties and errors that may exist in measuring motor components and health components of students in middles school from the Bihor – Hajdú-Bihar Euroregion, using two test batteries (EUROFIT & NETFIT). We are referring to inaccuracies of the measuring instruments as well as to certain errors occurred while performing the measurements. At the same time, we wanted to test whether the Physical Activity Level Assessment Questionnaire (PAQ-C) was translated in a way that it would be understood by children.

In order to prepare a research involving a larger sample group, the pilot study wishes to test the feasibility of the project proposed, through analyzing the viability of the equipment and of the materials used in the assessment of motor and health components of physical fitness and in the assessment of the physical activity level. We will also examine the method used to analyze the data.

Students from two schools from Oradea have been invited to attend this research. The pilot study was performed on a group of 20 children from 5th grade, aged 10-11. We wanted to choose a homogenous group of students. 10 students (5 girls and 5 boys) were from "Szent László" Roman Catholic Theological High School (LTSZL) and 10 students (5 girls and 5 boys) from the "Iosif Vulcan" National College (CNIV) from Oradea. The consent of the participating children and their parents / legal guardians has been obtained.

The pilot study took place in November of the 2014-2015 school year. The measurements were performed in the gym rooms of "Szent László" Roman Catholic Theological High School (LTSZL) and of "Iosif Vulcan" National College (CNIV) from Oradea. The measurements and the filling of the questionnaires required a total number of 8 meetings in these schools.

Based on the Shapiro-Wilk test we calculated the normality of the distribution of variables. In case the p value was lower than 0.05 we used the Mann Whitney-U nonparametric test. In case of a normal distribution of the scores, we calculated based on the independent sample t test, for each class, whether the average values of the measurements were significantly different from each other.

The number of overweight and obese children from CNIV (3 cases) is 10% higher than the number of same kind of children from LTSZL (2 cases). 70% of children from CNIV and 80% of the students from LTSZL had normal weight for their age.

Out of the total number of children, 5% were overweight and 20% were obese, resulting that 25% had weight surplus.

Out of the total sample group, 70% of the students from LTSZL and 70% of the students from CNIV had an AT percentage within normal limits (including the ones under normal limits (UNL)).

Out of the total number of subjects from CNIV, 20% of the girls and 10% of the boys had one % of AT over the normal limit. At LTSZL, 10% of the girls and 20% of the boys had excess adipose tissue (EAT).

Al questionnaires were distributed at the beginning of the physical education classes on November the 17th, 2014. The data obtained through the means of the questionnaires, show that, out of the total of 20 students that participated to the study, the results of 20 subjects have to be included into the study, which corresponds to 100% of the sample group. All students were medically fit during the week in question.

While filling the questionnaires, certain difficulties occurred related to the understanding the questions. Regarding the first item, there were questions related to certain sports with which the students were not very familiar, like soccer or football, but there were subjects who marked multiple answers, this happening with other items as well. The subjects who made mistakes while filling the questionnaires, received new ones or they finished the initial ones according to the indications they received.

Some subjects pointed out that the circles for the answers were too close to each other making it hard to read the results. For this reason, the questionnaire was re-edited with bigger characters and enough space between the lines.

According to the registered data, we establish that the average value of physical activity (FA) for girls from LTSZL is 3.60 points, and for girls from CNIV is 3.53 points. In case of boys, this value was 3.48 in LTSZL, respectively 3.74 in CNIV.

Synthesis of Chapter 6. Study I. Comparative Study Regarding the Motor and Health Components of Physical Fitness of Middle School Students from the Bihor – Hajdú-Bihar Euroregion

In the science of physical education new physical condition assessment trends have emerged. After FITNESSGRAM appeared in 1977 in the U.S.A., at the request of the EC in 1988, the EUROFIT test battery was proposed. EUROFIT was created with the purpose of unitary assessment of motor capacity level of the population of the European Community. Applying this test battery allows the comparative study of the biomotor potential of subjects from different countries. Certain test batteries that appeared within the last years have a double role: assessing HRF (*health-related fitness*) or the exclusive measuring of motor performance (*performance-related fitness).*

In our country, between 1969-2017, there have been numerous longitudinal researches of biomotor potential of pre-university students, but all of them were made up of measurements of muscle quality!

In 2001 the Ministry of National Education of Hungary implemented the HUNGAROFIT test battery, and starting from the 2014-2015 school year, following a protocol signed between Cooper Institute from the U.S.A. and the School Sport Federation of Hungary, the NETFIT test battery was implemented in all pre-university schools.

We wished to assess the motor potential from two perspectives: a) of the level of physical condition of the subjects using two similar test batteries: EUROFIT+NETFIT; b) of the level of the health component of physical fitness determined using the NETFIT test battery;

According to the specialists' opinion, the level of motor qualities has direct implications on health. Even if there are intense concerns in this regard, in Romania there have been no researches performed which would specify the health zones depending on the manifestation level of physical fitness.

This study wished to determine the levels of motor and health components of middle school students from the Bihor-Hajdú – Bihar Euroregion, using two test batteries, and comparing the obtained data among themselves as well as with the results of other similar researches, as well as to establish certain structures of means to make up a physical activity program organized with the experimental groups. Based on the resulted information, we can obtain a strong control in the experiment that will follow.

In this study we started with the following assumptions:

- according to the secular tendency regarding obesity, the weight values of children of the current generation exceed the ones of children of the previous generation, and the number of overweight and obese children is higher;
- the percentage of overweight and obesity is higher in the urban area (UA);
- students with the percentage of AT within normal limits obtain better results at motor tests than those with EAT;
- there is a direct relation between the biomotor and somatic potential level of students in 5^{th} – 8^{th} grades and the number of physical education classes from the common curricular classes;
- the number of children with values within the health zone is lower in case of students in 8^{th} grade in Bihor County (BH CO);
- the physical activity level of students from the urban area is lower than the one of children from the rural area (RA).

The selected sample group is made up of students from the urban and rural areas, from 5^{th}, 6^{th}, 7^{th}, 8^{th} grades, from 15 schools (9 from Bihor County (BH CO) and 6 from Hajdú-Bihar County (HB CO)), from 50 classes from the Bihor – Hajdú-Bihar Euroregion. The total number of the participants was 934 students (BH CO: 474; HB CO: 460), out of which 472 were girls and 462 boys, 525 from the UA and 409 from the RA, aged between 10-15 (table no. 15). In the 2014-2015 school year, all of them were in middle school.

The transverse study took place between February – May of the 2014 -2015 school year.

Regarding the anthropometric measurements, when determining the percentage of AT and BMI we can draw the following conclusions:

In both counties, the average values of height were higher in case of students from the UA, except for boys in 5^{th} grade in BH CO. From comparing the average values registered in case of subjects from the two counties, it results that the difference is significant in case of height (girls – 12 years, 13 years, 14 years; boys – 13 years, 14 years), of weight (girls – 13 years, 14 years) and insignificant in case of height (girls – 11 years; boys – 11 years, 12 years), weight (girls – 11 years, 12 years; boys – 11 years, 12 years, 13 years, 14 years).

Regarding BMI, in BH CO we encounter an excess of 27% (overweight (OW)=15%, obesity (OBS)=12%), (boys=32%, girls=22.48%) and in HB CO an excess of 28% (OW=16%, OBS=12%), (boys=27.12%, girls=28.13%).

Based on the data obtained after calculating the BMI and comparing it with the previous studies, we found that the hypothesis was accepted: the weight values of the subjects

included in this study, exceed the values of those of previous generations, and the number of overweight and obese children is higher. At the same time, there is a direct relation between the somatic potential level of students in 8th grade and the number of physical education and sports classes (PES) from the common curriculum classes. The different number of physical education classes in the two counties of the students in 8th grade (BH CO=1 class/week; HB CO=3 classes/week), may be the cause of the significant difference encountered in the BMI of boys. From comparing the average BMI values registered in case of subjects from the two counties, it results a that there is a significant difference in case of girls in 7th grade and boys in 8th grade, and insignificant in case of girls in 5th, 6th and 8th grade, as well as in case of boys in 5th, 6th and 7th grade.

The hypothesis according to which the rate of overweight and obesity is higher in the UA, was accepted for the subjects from BH CO, but rejected for those from HB CO. According to BMI values, in BH CO the rate of overweight and obesity was 30% in the UA and 24% in the RA, and in HB CO this difference was only 1% (UA=27%, RA=28%).

In BH CO, 32.57% of the students from the UA and 24.41% from the RA, and in HB CO, 26.17% of the students from the UA and 31.63% from the RA exceeded normal values of the AT percentage. Out of the total number of 80 obese students from BH CO, the number of those who live in the UA is more than double (N=55) of the number of those from the RA. In Oradea we found a percentage of 11.49% of children with excess adipose tissue and 21.08% obese!

Regarding BMI and the percentage of AT, depending on the AZ, we found that the percentage of AT in case of subjects with values within the HFZ is lower for students in 8th grade from BH CO (the hypothesis is accepted).We also found that in BH CO weight excess is 19% in 7th grade and 26% in 8th grade, but in case of subjects in 5th grade to 7th grade there is a higher number of children with values within the HFZ (66.93% 72.99% 78.18%) while this number is lower in 8th grade (75%). On the other hand, in HB CO we notice in the HFZ close average values for 5th – 7th grade and higher ones in 8th grade : 5th grade (67.48%), 6th grade (69.85%), 7th grade (68.38%), 8th grade (79.76%).

Regarding the calculation of the AT percentage, we notice that in HB CO the percentage of students within the HFZ in 5th grade is 65.85% and in 8th grade is 76.19%, while in case of the subjects from BH CO this percentage is lower (5th grade (65.35%), 6th grade (67.88%), 7th grade (70.91%), 8th grade (64%).

Regarding the motor tests we can conclude the followings:

Students with their AT percentage within normal limits obtained better results than those with an excess of AT in case of seven (girls), respectively eight (boys) EUROFIT motor tests. The hypothesis is accepted. Only in case of the handgrip test the subjects with an excess of AT had better results.

From comparing the average values registered in case of girls from BH CO and HB CO, it results that the difference is significant for the sit-ups (ST), rhythmic sit-ups (RST), sit-and-reach (SAR), flexibility (FLT), handgrip test (HT), endurance shuttle run (ESR), trunk extension test (TE), bent arm hang (BAH), shuttle run (SR) tests, and insignificant for the standing broad jump (SBJ), rhythmic push-ups (RPU), Flamingo balance test (FB) and the plate tapping (AP) tests. In case of boys the differences are significant in case of ST, RST, SAR, FLT, HT, ESR, TE, RPU, FB tests, and insignificant in case of SBJ, BAH, SR and PT tests.

Regarding the AZ we found that the subjects fell within the HFZ as it follows:
at the SBJ test 73.1% out of the total number (TT) of students (74% BH CO & 72.2% HB CO); at the ESR test 64.8% out of the total number (TT) of students (71.3% BH CO & 58% HB CO); at the HT test 87.4% out of the TT of students (84.8% BH CO & 90% HB CO); at the RST test 86.8% out of the TT of students (90.9% BH CO & 82.6% HB CO); at the TE test 57.1% out of the TT of students (65.2% BH CO & 48.7% HB CO); at the RPU test 62.3% out of the TT of students (57.2% BH CO & 67.6% HB CO); at the FLT test 36.4% out of the TT of students (11.4%! BH CO & 62.2% HB CO).

Comparing the motor tests results obtained by the students in 7^{th} grade from BH CO (having two PES classes / week) with the results of students in 8^{th} grade (having one PES classes/ week), we can say that the percentage of 8^{th} graders who fall within the HFZ is lower in case of six out of a total of seven motor tests : RST (from 88.89% to 77.38%), SBJ (from 82.90% to 73.81%), HT (from 98.29% to 91.66%), TE (from 71.79% to 59.52%), ESR (from 63.25% to 60.71%) and RPU (from 69.23% to 66.67%). Thus, we can say that there is a direct relation between the biomotor potential level of students in 5^{th} – 8^{th} grade and the number of PES classes within the common classes.

Regarding the level of physical activity we can conclude the followings:

In HB CO the students in 5^{th} – 7^{th} grade (having five PES classes / week) and the students in 8^{th} grade (having three PES classes / week) had a physical activity (FA) level (3.01) very close to the values of students in BH CO in 5^{th} – 7^{th} grade (having two PES classes / week), and those in 8^{th} grade (having one PES classes/ week) (3.02), resulting a

difference of only 0.01 points. Although the number of PES classes is higher in Hungary, according to the questionnaire, the students from BH CO had a more active participation to them: BH CO (4.38), HB CO (4.18). The FA level during the spare time of the students has close values (2.73 in BH CO and 2.86 in HB CO).

The analysis of the FA level of students depending on their residential area (urban / rural), showed us the followings: the FA level in case of subjects living in UA (2.89) in BH CO is lower than in case of those living in the RA (3.14), as a result the hypothesis being accepted, but the FA level from the UA (3.08) in HB CO is higher than of those living in the RA (2.92), the hypothesis in this case being rejected.

Although the efforts to promote FA and improve health were intensified both by the EC and the public authorities, the level of physical inactivity in Romania continues to remain elevated. We consider that schools have to offer material basis, qualified personnel, attractive activities and an optimal number of classes for practicing FA.

Synthesis of Chapter 7. The Effects of an Additional Physical Activity Program on Motor and Health Components of Students in 6th Grade

According to Study I, there is a direct relation between the level of somatic and motor characteristic of students and the number of PES classes of the common curriculum classes. The students that participated to four or five PES classes per week have higher motor component average values or the number of those who fall within the HFZ is higher compared to students who had one or two PES classes per week. Considering that the number of physical education classes in a week is higher in schools from Hungary than in those from Romania, taking into account the conclusions of the ascertaining study, we wished to analyze what consequences would have the introduction of an additional program of physical activities for students in 6^{th} grade.

The goal of the experimental research is to improve motor and health components of students in 6^{th} grade, using exercises and games with elements from handball, basketball, rugby-tag and badminton. Our study wishes to determine the somatic and motor responses to additional physical activity in case of students in 6^{th} grade achieved by introducing two additional sports sessions per week for 7 months.

This study is based the following hypotheses:

- Increasing the number of hours of physical activity for students in 6th grade through the means of a program which uses exercises within certain additional sports sessions, increases the values of motor and health components of physical fitness;

- The additional physical activity program will increase the number of students that fall within the HFZ;

- Increasing weekly physical activity reduces the percentage of adipose tissue of students in 6th grade;

The sample group is made up of 55 students out of which 36 are girls and 19 are boys. The subjects of the two experimental groups were students in 6th grade from the "Szent László" Roman Catholic Theological High School from Oradea. In the 6th A class there were enrolled 18 children out of which 5 were boys and 13 were girls. In the 6th B class there were enrolled 17 children out of which 8 were girls and 9 were boys. The subjects of the control group were students in 6th B class of "Iosif Vulcan" National College from Oradea with having 20 children (15 girls and 5 boys). The subjects of the three groups were in the proportion of 65.45% girls and 34.55% boys, with ages between 12-13 years.

In order to test the normal distribution of the data we used the Shapiro-Wilk test.

For comparing the average values we used the paired sample t-test or the Wilcoxon signed-rank test. The differences between the average values were tested with the independent sample t-test or with the Mann Whitney-U nonparametric test. We calculated the Pearson correlation coefficient (r), the effect size (Cohen's d) with a confidence interval of 95%.

This study was made up of the following steps:

- formulating the research hypotheses;
- the scientific substantiation of the contents of the additional sports sessions;
- elaborating the work plan;
- selecting the specific methods and means for the research;
- selecting the sample group (control group / two experimental groups) and the place where the research would take place;
- planning the activities depending on the schedule of the respective class;
- recording the results obtained at the pretest and posttest;
- the statistical analysis of the obtained results;
- drawing up conclusions based on the results;
- make use of the results in conferences / seminars / round tables.

In the first phase (Octomber 5^{th} – 9^{th}, 2015) the initial and ascertaining measurements took place regarding the motor and health components of physical fitness with the consent of the schools and parents or legal guardians of the children.

In the second phase, the students were divided into groups.

In the third phase between October 2015 – May 2016, the experiment itself took place on a sample group of 55 students.

The additional sports sessions were programmed to take place twice a week for each class according to the following schedule: Monday at 13^{00} 6^{th} A class; Monday at 14^{00} 6^{th} B; Wednesday at 13^{00} 6^{th} B; Friday at 13^{00} 6^{th} A.

At the beginning of the experiment all students submitted medical certificates. The children consented to attend the experiment out of their free will. Over the experiment, the amount of work was developed for both experimental groups according to our own plans, the work-flow chart being the following one:

Experimental Group A (EXGA)	Pretest	Additional Program	Posttest
Experimental Group B (EXGB)	Pretest	Additional Program	Posttest
Control Group (CTRG)	Pretest	Without Additional Program	Posttest

The final testing was performed between May the 23^{rd} – 27^{th}, 2016, the monitored indicators being measured again for the purpose of their post-experimental comparison.

The activities of the experiment were performed by the experimental groups during two additional sports sessions per week with duration of 60 minutes each.

The contents of the two additional sports sessions organized for the experimental group A included specific exercises, dynamic games and bilateral games from two acknowledged sports games (handball and basketball), and the contents of the sessions held with the experimental group B had elements from other two sports games (rugby-tag and badminton).

The activities were embedded into their school schedule so that they would not disturb their normal afternoon activities. Simultaneously, both experimental groups attended two physical education classes per week. We wished for the conditions be controlled as well as much as possible, thus, the selected control group had a similar material basis: gym room, open-air sports field, materials and equipment. For this purpose, the control group was working based on similar plans and performed its activities according to the curriculum valid at that time. The students in the control group had to attend only the two physical education classes per week without attending additional sports sessions. At the same time, we wished to isolate as many independent variables as possible, so that the only variable to have an effect

would be the intervention program. We have to mention that during the experiment no students from the sample group practiced regularly any sports.

The organization, warm-up and the exercises / dynamic games took up approximately 50% of the session, and the rest of it consisted of bilateral games specific to the above mentioned sports.

The additional sports sessions had the following structure:

1. Warm-up (12-15 minutes)
2. Fundamental part (45-50 minutes)
3. Closing part (3-5 minutes)

The research performed on a sample group of 55 subjects, students in 6^{th} grade from two schools in Oradea, allows us to formulate the following conclusions:

a) Additional number of hours of physical activity in case of students in 6^{th} grade, by organizing activities in schools in the form of additional sports sessions using dynamic exercises and games with technical elements from handball, basketball, rugby-tag and badminton, result in an increased level of motor and health components of physical fitness, thus the hypothesis is accepted.

b) Based on the paired sample t-test applied in case of EXGA, the average values of the initial testing (IT) and final testing (FT), at 9 out of the total of 13 motor tests (FB, PT, SBJ, HT, ST, RST, SR, ESR and RPU) showed a significant difference ($p < 0.05$), a high correlation of the average values ($r = 0.76$), effect size ($d = 0.97$). In case of EXGB, the average values of the IT and FT, in case of 10 out of the total of 13 motor tests (PT, SBJ, HT, RST, SR, SAR, FLT, ESR, RPU, BAH) had a significant difference ($p < 0.05$), a high correlation of the average values ($r = 0.83$) and effect size ($d = 1.23$).

c) Due to the weekly additional physical activity the percentage of adipose tissue decreased in case of students in 6^{th} grade. EXGA showed a 6% increase of the number of children with normal weight and a 5% decrease of the number of overweight and obese children, the weight excess decreasing from 22% to 17%. The increase of average BMI values and AT percentage in case of students from the control group (CTRG) compared to EXGA was more pronounced (BMI + 0.99, % AT + 1.23). In case of EXGB we encounter a decrease of the number of obese children by 6%, and the increase of the average BMI value and of the AT percentage in case of the students from the CTRG compared to EXGB, was more pronounced: (BMI + 0.28, % AT + 0.22). The hypothesis was accepted.

d) The additional hours of physical activity in case of EXGA resulted in the increase of the number of students that fall within the healthy fitness zone. Practicing the well-known sports games within the additional sports sessions contributed to the improvement of health components of physical fitness; at 5 motor tests the number of those who fell within the HFZ at the FT has increased (ESR –by one student, TE –by three students, RPU –by five students, HT –by one student, SBJ –by three student), at one test it decreased (FLT –by two students), and at one test it didn't change at all (RST) compared to the initial testing. In case of EXGB practicing the alternative sports games within the additional sports sessions improved the health components of physical fitness in case of 6 motor tests, the number of those that fell within the HFZ at the FT has increased (ESR – by one student, TE – by three student, RPU – by three student, HT – by three student, SBJ – by one student, FLT – by one student) compared to the IT. The hypothesis was accepted.

Physical fitness of the students from the EXGA improved at the FT, confirming the efficiency of the operating systems specific to basketball and handball practiced within the additional sports sessions depending on age, compared to the CTRG who exercised these two sports games only during the physical education classes, with a differences of the average values better compared to those of the CTRG in case of the following tests: PT (-0.08 s), SBJ (+5.93 cm), HT (+1.25 kg), ST (+3 nor (no. of repetitions)), RST (+5.22 nor), BAH (+0.45 s), SR (-0.24 s), SAR (+1.69 cm), ESR (+2.02 nosh (no. of shuttles)), TE (+0.13 cm) and RPU (+5.3 nor).

Physical fitness of the students from the EXGB improved at the FT, confirming the efficiency of the operating systems specific to badminton and rugby-tag practiced within the additional sports sessions depending on age, compared to the CTRG who didn't attend these additional sports sessions, with a differences of the average values better than those of the CTRG in case of the following tests: FB (-1.16 nof (no. of falls)), PT (-0.22 s), SBJ (+5.57 cm), HT (+2.13 kg), ST (+0.74 nor), RST (+5.83 nor), SR (-0.65 s), SAR (+4.3 cm), FLT (+4.4 cm) ESR (+3.65 nosh), TE (+0.18 cm) and RPU (+4.52 nor).

The students' level of involvement regarding the research was superior in both experimental groups, despite this fact, the students from EXGB showed a more pronounced motor state.

Badminton is becoming more popular among school children in Romania and we consider that the project called *Shuttle Time – Badminton in Schools*, started in 2012, has an essential role in implementing this game in schools, which contributes to the increase of motor and somatic indicators of the participants.

Starting with the 2009-2010 school year, rugby-tag is part of the physical education curriculum, and the number of those who practice it increases every year. We consider that practicing this game develops volitional and affective characteristics, and for those who want it, it could be the first step towards competitive sports.

The results of this experiment may motivate teachers of this field to use these two alternative sports games for physical education and sports classes held in schools, which may contribute to the development of skeletal muscle fitness and of cardiovascular fitness.

Limits of the Research

The research we conducted has the following limits:

Although the foreign specialty literature afferent to this topic was abundant in bibliographic titles, we didn't find any studies related to health components of physical fitness in case of students from Romania, and the comparison of the results of the ascertaining assessment could not be put in a concrete form.

Another limit was the lack of the financial resources and personnel needed to continue the study of motor and health components in order to establish the criteria based reference standards and implicitly the specific action zones for a representative sample group for Romania.

A limit may be the PAQ-C questionnaire which contains general questions, which allows the examination of the problem in general and not in detail.

Conclusions/Proposals/Perspectives of the Thesis

In our country the number of overweight and obese children has increased significantly. The number of children in a class that attend different contests within the National Olympiad of School Sports is small, and we consider that it is paradoxical for the assessments in physical education classes to be performed exclusively based on motor performance. We consider that in order to avoid certain risks resulted from insufficient physical activity, the biomotor potential level of school children must be related to health as well. Not all children in a class are dreaming about performances and competitions, but all of them want to be healthy!

We consider that a new vision is needed in the approach of the physical education classes in Romania and it is important for the students to get to know from early age the concept of fitness and to receive a feedback any time it is necessary. The priority of physical education specialists should be for all students to practice with pleasure any organized sports

activity and to develop their knowledge related to the advantages offered by a high level of physical fitness.

We appreciate that the challenges of the upcoming years will bring the specialists in physical education test batteries for competitive sports as well as for assessment of the health components within school institutions. Certain tests for disabled children could be improved and develop, and lessons related to nutrition could be implemented.

The database created in the first study offers the possibility to compare the level of motor and health components of physical fitness with other international studies and it creates premises favorable for the development of a new test battery in Romania for the assessment of health components of physical fitness. We consider that the applied tests raise the interest of the parents, are fun, increase intrinsic motivation and mobilize the students in order to get them into the healthy fitness zone. We appreciate that categorizing students into the NI or NIHR (which do not meet the minimal health criterion) raises the interest of society through the power and tenacity in gaining HFZ by improving their own physical fitness. A poor motor result obtained at the moment may upset the participants and also create indifference on their part.

The question may occur: Is the assessment of physical fitness a matter of performance or a matter of health? We do not wish to say that one is more important than the other, but we have to ponder the absolute priority in relation with the student.

The results registered by the assessment of health components of the subjects included in the study, also presented in the article called *„Components of Health Related Fitness Among Children in Middle School Within the Bihor – Hajdú-Bihar Euroregion”*, confirm that the assessment of health components of physical fitness designed to fulfill the expectation of children and their parents, as well as current scientific recommendations, is necessary in Romania as well. Introducing a test battery in a form similar to FITNESSGRAM or NETFIT, as well as establishing the criteria based reference standards and implicitly the specific action zones, would represent the solution to this problem.

NETFIT may become an inspirational factor for other European states, and Romania, by new educational and scientific research strategies, may introduce ROFIT into middle school as well as high school. The newly created test battery could raise the interest of students for physical activity by: objectivity, confidence in the instruments used, its interactive way (some of them being accompanied by music), the possibility to monitor own results on an online platform and its principle of focusing on health standards.

For this purpose we propose the performance of a *field research* for the assessment of health components of physical fitness on a sample group representative for Romania including the other regions of the country as well: Banat, Bucovina, Dobrogea, Maramures, Moldova, Muntenia, Oltenia and Transylvania.

In order to establish the criteria based reference standards and implicitly the specific action zones for skeletal muscle fitness and flexibility, we must monitor the results obtained in the *field research* and perform certain statistical analyses similar to those found in the papers written by the authors Pedro, Laurson, Kaj & Csányi (2015) and Pedro, Laurson, Karsai & Csányi (2015). To establish the reference standards in case of body composition and aerobic fitness we have to perform a *lab research*. In order to assess the prevalence of metabolic syndrome in case of middle school children, we need anthropometric measurements: height, weight, skinfold thickness, hip circumference, as well as to determine the percentage of adipose tissue, blood pressure, blood tests: glucose, cholesterol and triglyceride levels. For assessing aerobic fitness we can use the treadmill test.

We propose certain reconsiderations regarding assessment in physical education and sports classes in regard of the following aspects:

a) in case of motor results interpretation, physical fitness to be taken into account related to the student's state of health;

b) the amount of work performed by a student is hard to measure because the genetic inheritance and growth rate is different for each individual, and the assessment results may be easily tricked by the *cleverer* individuals;

c) more research within the field of physical education and sports in order for the concept of fitness and its elements to have a more supported theoretical development;

d) elaborate new strategies to develop physical fitness;

e) increasing the number of PES classes from 1-2 classes to at least 3 classes per week for all grades between 5^{th} and 8^{th} grades.