A N A L E L E

UNIVERSITĂŢII DIN ORADEA

FASCICULA

EDUCAŢIE FIZICĂ ŞI SPORT

EDITURA UNIVERSITĂŢII DIN ORADEA

2019

Annals of the University of Oradea. Physical Education and Sport Fascicle

Review indexed in: Index Copernicus, Directory of Open Acces Journals (DOAJ), Worldcat, Platforma Editorială Română (SCIPIO)
The review is issued under the aegis of **The University of Oradea, Department of Physical Education, Sport and Physical Therapy**

Editorial Office Address:
University of Oradea, Department of Physical Education, Sport and Physical Therapy
1 Universităţii Street, 410087 Oradea, Romania
http://www.fefsoradea.ro/Fascicula_Educatie_Fizica_si_Sport/index.html,
e-mail: journal@fefsoradea.ro

E-ISSN 2286-2870, ISSN 1224-5100

CONTENTS

Analele Universităţii din Oradea. Facicula Educaţie Fizică şi Sport
E-ISSN **2286-2870**, ISSN **1224-5100**

XXIX, **2019,** pp.1-9
Article no. **29101-854**

THE EFFECTS OF A PHYSICAL ACTIVITY PROGRAM ON BODY COMPOSITION AND PHYSICAL CONDITION IN THE OVERWEIGHT ADULT

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Abstract: The main purpose of the study is to analyse the effects of a physical activity programme on the body composition and physical condition of the overweight adult. Starting from the assumption that, with the decrease of the period of time available for physical activities combined with an erratic eating, the overweight/obesity phenomenon associated with increased risk factors for cardiovascular diseases has become an important issue which the contemporary society is facing. Therefore, the organised physical activity adapted to the needs of each individual seems to be the most viable solution for the improvement of the general health. The study has been carried out on two subjects, a 21 year old male and a 45 year old female, for a period of three months in which they followed a 60 minutes/day, 7 days/week physical activity programme, accompanied by minor changes in their eating habits. In order to establish the efficiency of the training programme, the subjects underwent a series of measurements with the purpose to determine their body composition and stamina both at the beginning, as well as at the end of the three months of physical activity. The results obtained prove that only through the introduction of an aerobic physical activity and muscle toning programme may the health and physical condition reported to the state of health be improved both at the young adult as well as in middle aged subject.

Key words: physical activity, obesity, health, bodily composition, physical activity, eating

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INTRODUCTION

Obesity is presently seen as a disease which characterizes the beginning of the third millennium (Navarro et al., 2017). Recent studies have shown that approximately 2.1 billion people in the whole world suffer from obesity or are overweight (Smith and Smith, 2016), 40% of them being adults (Tseng et al., 2018). These figures must be considered an alarm for the whole of humanity concerning the magnitude this modern disease is reaching. Obesity is mainly associated with an erratic lifestyle, unhealthy eating and the lack of physical activity, nevertheless it may have several causes, among which chronic diseases and genetic causes are most commonly met. Independent on the motives which lay at the foundation of weight gain over the admissible limits, one thing is certain, i.e. the negative effects obesity has on the state of health, such as: diabetes, cardiovascular diseases, different types of cancer, hypertension, etc. (Tseng et al., 2018).

To combat obesity, improve physical conditions and health, the most effective prophylactic and/or therapeutic intervention is physical activity. Physical activity has a role in both the improvement of the physical condition in relation to the health of obese and overweight people as well as in a prophylactic context in the case of healthy population (Corbin and Lindsey, 1984 cited by Șerbescu, 2008). In order to maintain and improve our health all we need is our own body to start moving every day, systematically and methodically, respecting the human physiology (Dejardin, 2008). Moreover, scientific proof certifies that those people who are more active from a physical point of view present a lower risk of getting sick (Kassirer si Angell, 1998).

Both obesity as well as physical activity in order to lose weight and maintaining the state of health does not represent any new study issue. Obesity is an issue which has been quite studied in the past few years, both in what the causes are concerned as well as the effects it has on the overall health of adults (Flegal et al., 2016; Inoue et al., 2018; Yumuk et al., 2015; Powell et al., 2015; Ștef et al., 2019) and children as well (Lobstein et al., 2015; Gupta et al., 2012; Van Cleave, 2010; Waters et al., 2019; Geserick et al., 2018; De Bont et al., 2019). Some studies have been carried out in order to observe the effects regular physical activity has on the composition of the body and the physical condition (Șerbescu et al., 2006; Nagy et al., 2016; Battaglia et al., 2016), and the mood of the participants (Ilieș et al., 2018; Tătar et al., 2018) or in fighting obesity (Baidog and Herman, 2018; Whooten et al., 2018; Wiklund, 2016; Hills et al., 2011).

The results of regular physical activity together with a proper and healthy eating lacking in fat have on the composition of the body are well known (Chin et al., 2016; Ferry et al., 2014), therefore rarely these two key elements in the weight loss process are separately analysed. The present study sets to determine whether physical activity plays an independent role or not in the weight loss process of overweight or obese people.

MATERIALS AND METHODS

PARTICIPANTS

The study was carried out on two participants. They were selected according to a series of indicators such as age, gender, weight, profession, etc.

Subject 1 (S1) is a 21 years old male student weighing 98.5 kg with a BMI of 30.12 being classified as a class I obese. The subject does not have any hereditary-collateral pathologic antecedents. Has a sedentary lifestyle, lacking in physical activity and based on a hyperlipidic diet comprising carbonated drinks and fast food.

Subject 2 (S2) is a 45 years old female, economist, weighing 76.2 kg with a BMI (28.43) which exceeds a little the admissible limits (Jensen et al., 2013) therefore the subject is considered to be overweight. The subject does not have any hereditary collateral pathological antecedents, physical deficiencies and personal pathological antecedents. The body weight exceeding the admissible limit is due to the sedentary lifestyle, lack of physical activity and erratic eating.

ASSESSMENT OF PARTICIPANTS

The anthropic-physiometric assessment of the subjects was carried out through measurements of the main anthropic-physiometric indicators (i.e. height, weight, circumferences, corporal composition) in accordance to the standard procedures (Marfell-Jones et al., 2006).

Weight measurement was carried out with an analogic scale which had an error range of ±0.1 grams. The weighing was carried out in kilograms and hundreds of grams, in the morning after defecation and urination.

The body height was measured with the height measurer between the vertex and the plantar plate. The subjects kept an orthostatic position with the M1 articulations extended, a straight spine and the heels united; the vertical rod of the height measurer touches the heels, the cleftal and spine aligned with the scapula. (Cordun, 2009).

The Body Mass Index (BMI) was determined considering the age, sex, height and bone constitution using the following formula: $BMI=\frac{\text{weight (kg)}}{\text{heigh (m)}^2}$. The results were compared with the scale of normal BMI values according to age in order to classify the subjects and the risk of illness due to excess weight.

The thickness of the subcutaneous fat (subcutaneous folds) was measured in millimetres, using body fat caliper. The measurements were carried out only on the right side of the subjects, while for a better accuracy they were repeated three times, the final value being considered the average value of the three. The subcutaneous fold was measured on the abdomen, biceps, flank, subscapular and on the thigh. The measurements were carried out both at the beginning as well as at the end of the physical activity period.

The values obtained following the measurement of the subcutaneous fold were used to determine the optimum body composition and weight of the subjects, using formulas developed by the National Center for Sports and Exercise Medicine (Drăgan, 2002): *adipose tissue (%)* = (the sum of all five plies (mm) x 0.15) + 5.8 + BD (m^2) – *where BD = body surface calculated with the help of the Du Bois nomogram (Du Bois and Du Bois, 1916 cited by Șerbescu, 2008)*; *the real adipose tissue (kg)* = real body weight (kg) x adipose tissue (%); *real weak mass (kg)* = real body weight (kg) – adipose tissue (kg); *optimum weak mass (kg)* = real body weight (kg) x 75%; *optimum adipose tissue (kg)* = optimum weak mas x 25% (female)/15-17% (male); *optimum body weight (kg)* = optimum weak mass + optimum adipose tissue.

The perimeters were measured in centimetres using a tape measurer. The dimensions of the perimeter of the chest, waist, abdomen, both arms, relaxed and contracted, both fore arms, both thighs and calfs all in a state of relaxation and contracted. These procedures were carried out both at the beginning of the programme as well as at the end.

The estimation of the daily *dietary calorie's consumption* was carried out through an analysis over a seven day period. During this period the daily calories intake was estimated taking into consideration the table comprising the caloric content of each food. The daily calories intake has been established for a menu considering the three main dietary principles (carbohydrates, fats, proteins) carrying out a characterisation of the diet depending on the recommended percentage of nutrients.

The estimation of the maximum oxygen consumption (VO_{2max}) was carried out using the Astrand test (Astrand and Ryhming, 1954). A 40 cm ladder was used for males and a 33 cm one for females. The duration of the physical effort was 6 minutes; the intensity of the aerobic effort was submaximal for each subject (600 kgm/min - S1, 500 kgm/min - S2), the rhythm of the climb was given by a metronome. The prediction of the maximum oxygen consumption (VO_{2max}) was established considering the heart frequency measured for the last 15 seconds of each minute, multiplying the value by 6 and respectively by 4 (Heyward, 1998), the results being compared with the Astrand-Ryhming nomogram.

The motric assessment consisted in the appreciation of the articular mobility, muscle force, balance coordination and effort capacity by finalising the trials comprised in the Hettinger

motric test battery. There is a score comprised between 1 and 10 for each exercise, the maximum score being 100 points; the scores which exceed 65 points are considered to be good scores (Sbenghe, 1987).

TRAINING PROGRAMME

The physical activity programme was carried out on a period of three months, between the 1st of March and the 1st of June 2019. During this period, the subjects underwent a daily 60 minutes training programme. The type of training was chosen based on the assessment of the subjects which was carried out before the start of the programme, as well as on the recent research in this field. It seems that the aerobic training (AT) is the optimum type of training in order to lose weight and reduce body fat (Stasiulis et al., 2010); while a physical activity programme based on AT is required for the increase of weak mass for overweight or obese adults (Willis et al., 2012). Therefore, the training programme was created mainly of AT combined for superior results with upper body toning exercises. The intensity of the physical effort was determined based on the VO_{2max} and it is comprised between 50 and 85% of its total value. The sequence of the exercises during the training sessions follows a pre-set order for the entire implementation period of the programme: preparing the body for effort (10 – 13 minutes; with the increase of the cardiac flow up to 120 bpm); the fundamental part, which comprises: intense walk/running (30 minutes); climbing - descending stairs (10 minute); abdominal-lumbar-pelvic muscle toning exercises (15 minute); effort recovery which consists in a 5 - 8 minute stretching session.

Due to the deficient physical condition of the subjects, the programme was divided into two steps (i.e. one month and a half for each step). the differences between the two steps is the vigorous walking in step 1 and running in step 2, while the increase of the intensity of the exercise involves climbing and descending stairs as well as the number of repetitions for each toning exercise.

RESULTS AND DISCUSSIONS

Following the careful examination of the dietary habits of the subjects for the week comprised between the 22nd of February and the 28th of February 2019, the total amount of calories consumed was determined and therefore a characterisation of the diet based on the recommended percentages of the main nutrients was developed. During this period, S1 ingested an average of 2326.2 kcal/day, respectively 16283.4 kcal/week. Therefore, his diet is considered to be hypoglucidic, hyperlipidic and hyperproteic. S2 consumed an average an average of 2356.8 kcal/day, namely 16497.6 kcal/week, with a diet in which the main nutrients are found in quantities considered to be normal (table 1).

Table 1. Calories and main nutrients intake for the two subjects

Indicators	Subject 1			Subject II		
	Energetic value	Percentage of major nutrients	Recommended percentage of nutrients	Energetic value	Percentage of major nutrients	Recommended percentage of nutrients
Total calories/week	16283.4 kcal			16497.6 kcal		
Total calories/day	2326.2 kcal			2356.8 kcal		
Glucids/day	1030.4 kcal	44.29%	55%	1242.8 kcal	52.73%	55%
Lipids/day	801.9 kcal	34.47%	30%	777.6 kcal	32.99%	30%
Proteins/day	367.6 kcal	15.84%	15%	321.6 kcal	13.64%	15%

Before the start of the actual training programme, minor changes in the diet of the two subjects were taken into consideration. Therefore, the dietary changes of S1 were represented by the elimination of sweet carbonated drinks and snacks. Considering this change, the average

amount of calories consumed per day decreased by 700 kcal/day; this is a sure and sustainable way of losing weight according to the American Center for the Control and Prevention of Diseases. Due to a normal and balanced diet in relation to the recommended percentage of nutrients, the changes brought to the diet habits of S2 were less severe, the reduction occurring for the quantity of carbonated drinks (a reduction of approximately 400 kcal/day).

In the first step of the programme, due to the lack of physical condition, the subjects were not able to maintain a constant running pace for the whole 30 minutes, therefore the aerobic training consisted in intense walking. Based on the VO_{2max} of 1.8 l/min it was estimated that the value of the intensity of the effort for S1 must be comprised between 0.9 – 1.53 l/min, meaning a speed of 4 – 5.9 km/h and a consumption of 4.5 and 7.65 kcal/min. The total calories consumption for S1 during the 30 minutes of intense walking was an average of 68.4 kcal. S2 with a superior VO_{2max} (1.9 l/min), the value for the intensity was also increased (0.95 – 1.61 l/min), consuming between 4.75 – 8.05 kcal/min for a speed comprised between 5.6 – 7.2 km/h. The total calories consumption for S2 for the whole 30 minutes of intense walking was an average of 52.9 kcal (Table 2).

Table 2. Calories burnt by the two subjects during the training programme

First stage of training								
Indicators / Exercises	Subject I				Subject II			
	Duration (min)	Kcal consumed	Kcal consumed per training	Kcal consumed per week through training	Duration (min)	Kcal consumed	Kcal consumed per training	Kcal consumed per week through training
Walking	30	68.4	306.2	2143.2	30	52.9	235.8	1650.6
Stairs	10	132.2			10	101.3		
Toning	15	105.5			15	81.6		
Second stage of training								
Indicators / Exercises	Subject I				Subject II			
	Duration (min)	Kcal consumed	Kcal consumed per training	Kcal consumed per week through training	Duration (min)	Kcal consumed	Kcal consumed per training	Kcal consumed per week through training
Running	30	267	517.2	3620.5	30	210	403.6	2824.9
Stairs	10	138.6			10	107.2		
Toning	15	111.7			15	86.4		

The training which consists of climbing and descending stairs, S1 burnt 132.2 kcal for the 10 minutes of intense continuous effort, while S2 burnt only 101.3 kcal.

The toning training consisted in exercises for the strengthening of the abdominal-lumbar-pelvic muscles. By carrying out this type of exercises S1 burnt 105.5 kcal during 15 minutes of intense effort, while S2 only 81.6 kcal.

The average amount of burnt calories for a training session for both subjects was 306.2 kcal for S1 respectively 235.8 kcal for S2. This brings forward an induced a deficit of approximately 2143.2 kcal per week for S1 and 1650.6 kcal for S2.

An intermediate assessment was carried out at the end of the first step. It has been observed a substantial increase in the VO_{2max} of both subjects (Table 4), the training intensity increasing in accordance. S1 improved the VO_{2max} from an initial value of 1.8 l/min to 2.18 l/min, managing to run with a constant speed comprised between 4.8-6.4 km/h, the calories consumption being of 8.9-11.3 kcal/min. The total calories burnt in the 30 minutes of running increased with 198.6 kcal (from 68.4 to 267 kcal) for S1. The VO_{2max} for S2 increased from 1.9 l/min to 2 l/min, managing to maintain a constant running pace comprised between 5.8 and 7.5 km/h, with an average calories consumption of 7-9.1 kcal/min. The total amount of calories burnt during the 30 minutes of running increased with 157.1 kcal (from 52.9 to 210 kcal) for S2.

The increased intensity for the stairs exercise determined an increase concerning the calories burnt by the two subjects. Therefore, S1 burnt 138.6 kcal during 10 minutes of intense continuous physical effort, while S2 burnt 107.2 kcal.

An increase of the calories consumed was observed as well during the abdominal-lumbar-pelvic muscles toning exercises, due to the increase in the number of repetitions and intensity. The duration of the exercise remained 15 minutes, S1 burning 111.7 kcal while S2 increased the amount of calories burnt to 86.4 kcal.

The average amount of calories burnt per training session in the second step by the subjects was 517.2 kcal for S1, respectively 403.6 kcal for S2; a considerable increase for both subjects has therefore been observed since the beginning of the programme. This leads to a calorie's deficit of approximately 3620.5 kcal (with 1477.3 kcal more than the 1st step) per week for S1 and respectively 2824.9 kcal (with 1174.3 kcal more than the 1st step) for S2 (Table 2).

In what the measured perimeters are concerned, they were the object of a series of measurements both at the beginning as well as at the end of the training programme. An improvement of the pre-existent situation was observed for both subjects during a final assessment, in the sense that all the perimeters taken into consideration for the measurements underwent functional improvements and decreased in dimensions.

Taking into account the case for S1 there has been a cumulated loss of 21 cm. The largest loss was noticed in the abdominal area where the perimeter dropped with 5 cm (from 101 to 96 cm), followed by the chest (- 4cm; from 112 to 108 cm) and the thighs (- 3.5 cm for the left thigh; - 2.5 cm for the right thigh). S2 lost 29.5 cm of the total value of all 10 measured perimeters. The greatest deficit was recorded in the abdominal area, its dimension decreasing with 10 cm (from 99 to 89 cm) followed by the chest and waist (both losing 5 cm).

Following the physical effort of the past three months the amount of adipose tissue has considerably decreased for both of the subjects. In order to determine this indicator, the subcutaneous fat was measured using a body fat caliper, both at the beginning and the end of the programme. The folds for S1 recorded a drop of 11.5 mm (from 132 to 120.5 mm). The major drops in the quantity of adipose tissue were recorded on the abdomen (- 4 mm; from 33 to 29 mm), the thigh (- 4 mm; from 35 to 31 mm) and the flank (- 2 mm; from 23 to 21 mm). For S2 the overall amount of the folds dropped with 10 mm (from 136 to 126 mm). Most of them occurring in the abdominal area (- 4 mm; from 30 to 26 mm), followed by the thigh (- 2.5 mm; from 37 to 34.5 mm) and flank (- 2 mm; from 24 to 22 mm) (table 3).

After three months of continuous and systemic practice of physical exercises, the final results have shown an net improvement of all the parameters taken into consideration at the beginning of the study (weight, BMI, body composition, VO_{2max}); all these being associate with a more pleasant physical aspect and an improved quality of life.

The body weight of S1 suffered a significant drop from 98.5 kg at the beginning of the training programme to 89.8 kg at the end of the programme. Meaning that there has been a total weight loss of 8.7 kg in three months namely 2.9 kg per month, a superior loss to the optimum loss of 1.8 kg/month (Jensen et al., 2013). The real adipose tissue decreased with 4.02 kg (from 27.38 kg initially to 23.36 kg in the end), meaning approximately 1.74% of the total. The value of the BMI also recorded a decrease from the initial values which exceeded 30, by the end of the programme it was 27.46. Even if the subject didn't reach the optimum BMI value of 24 according to the height weight and age, going therefore from first class obesity to overweight. Together with the decrease of all the values the effort capacity of S1 increased. It was therefore observed from the VO_{2max} value which increased with approximately 0,6 l/min (from 1.8 l/min initially to 2.4 l/min in the end) and the superior results obtained during the final Hettinger test, compared to the one at the beginning of the programme (97 final points, compared to 95 initial points) (figure 1 and table 4).

Table 3. The dimensions of the perimeters and of the cutaneous folds of the two subjects before and after the physical activity programme

Indicators	Subject I		Subject II	
	Initial values	Final values	Initial values	Final values
Thoracic perimeter (cm)	97	95	98	93
Abdominal perimeter (cm)	101	96	99	89
Basin perimeter (cm)	112	108	110	105
Left arm perimeter (cm) (relaxation - contraction)	35 - 36.5	34 - 37	29 - 29	29 - 29
Right arm perimeter (cm) (relaxation - contraction)	35 - 36.5	34 - 37	29 - 29.5	29 - 29
Right forearm perimeter (cm) (relaxation - contraction)	30 - 30.5	29.5 - 31	23 - 23.5	23.5 - 24
Left thigh perimeter (cm) (relaxation - contraction)	66.5 - 68	63 - 65	62.5 - 63	58 - 60
Right thigh perimeter (cm) (relaxation - contraction)	66.5 - 68	64 - 66	62.5 - 63	58 - 60
Left calf perimeter (cm) (relaxation - contraction)	45 - 45.5	44 - 45	37.5 - 37.5	37 - 37
Left calf perimeter (cm) (relaxation - contraction)	44 - 45	44.5 - 45	37.5 - 37.5	37 - 37
Abdominal folds (mm)	33	29	30	26
Flank folds (mm)	23	21	24	22
Subcapular folds (mm)	26	25	25	23.5
Thigh folds (mm)	35	31	37	34.5
Biceps folds (mm)	15	14.5	20	20
Folds sum (mm)	132	120.5	136	126

Figure 1. Subject 1 at the beginning and at the end of the physical activity programme

During the three months of training, the body weight of S2 decreased from 76.2 kg to 69.7 kg. Taking into account the 6.5 kg lost during the period and approximately 2.16 kg each month, S2 also exceeded the average value of 1.8 kg/month considered to be the optimum weight loss (Jensen et al., 2013). The adipose tissue dropped with 2.9 kg (from 28.37 kg initially to 25.46 kg in the end), representing 1.56% of the total; maintaining above the normal limits of 25%. The BMI dropped from an initial 28.43 to 26, reaching the end of the programme a level bellow the optimum value of 27, the subject situated as normal considering this indicator. The effort capacity indicated by the VO_{2max} increased with approximately 0,3 l/min (from 1.9 l/min initially to 2.2 l/min in the end). The considerable improvement of the stamina and physical performances of S2 during the programme are highlighted by the results obtained at the Hettinger test, namely 84 points in the end compared to 81 points initially (table 4).

Table 4. The values of the weight, body composition and VO_{2max} of the two subjects before and after the physical activity

Indicators	Subject I			Subject II		
	Initial values	Optimal values	Final values	Initial values	Optimal values	Final values
Real body weight (kg)	98.5	85.6	89.8	76.2	71.4	69.7
BMI (Body Mass Index)	30.12	<24	27.46	28.43	<27	26
Real fat tissue (%)	27.8	16	26.06	28.05	25	26.49
Real fat tissue (kg)	27.38	11.81	23.36	28.37	14.28	25.46
Real weak mass (kg)	71.12	73.87	66.44	54.83	57.15	51.24
VO2max (l/min)	1.8	3.2 - 3.6	2.4	1.9	1.7 - 2.1	2.2

CONCLUSIONS

The present study carried out over a period of three months and having as subjects' people of different ages and gender considered the analysis of the effects a regular physical activity programme might generate on the body composition of adults. Taking into consideration the bleak forecast of an alarming increase of obesity in the near future, such programmes seem to be a sine-qua-non tool for weight loss and the reduction of fat with the increase of muscle mass. The results obtained during the study justify us to state that the state of health, respectively physical condition related to health, may be improved for both a young adult as well as for a middle aged person, independent on the gender, with just minor changes in their diet and with the introduction in everyday life of a 60 minutes physical activity aerobic and muscle toning programme, based on the assessment and prescription of all the determined components.

REFERENCES

Åstrand, P. O., & Ryhming, I. (1954). A nomogram for calculation of aerobic capacity (physical fitness) from pulse rate during submaximal work. *Journal of applied physiology*, 7(2), 218-221.

Baidog, A. & Herman, G.V. (2018). The influence of Sports and Physical Activity on the Metabolic Syndrome: A Systematic Review. *Analele Universităţii din Oradea. Facicula Educaţie Fizică şi Sport*, 28, 39-45.

Battaglia, G., Bellafiore, M., Alesi, M., Paoli, A., Bianco, A., & Palma, A. (2016). Effects of an adapted physical activity program on psychophysical health in elderly women. *Clinical interventions in aging*, 11, 1009-1015.

Chin, S. H., Kahathuduwa, C. N., & Binks, M. (2016). Physical activity and obesity: what we know and what we need to know. *Obesity Reviews*, 17(12), 1226-1244.

Corbin, C., & Lindsey, R. (1984). *The ultimate fitness book*, Leisure, New York, USA.

Cordun, M. (2009). *Kinantropometrie*, Editura CD PRESS, Bucharest, Romania.

de Bont, J., Casas, M., Barrera-Gómez, J., Cirach, M., Rivas, I., Valvi, D., ... & Vrijheid, M. (2019). Ambient air pollution and overweight and obesity in school-aged children in Barcelona, Spain. *Environment international*, 125, 58-64.

Dejardin, P. (2008). Prevention du vieillissment. *Kinesitherapie scientifique*, 491, 5-10.

Drăgan, I. (2002). *Medicina sportivă*, Editura Medicală, București, Romania.

Ferry, B., Gavris, M., Tifrea, C., Serbanoiu, S., Pop, A. C., Bembea, M., & Courteix, D. (2014). The bone tissue of children and adolescents with Down syndrome is sensitive to mechanical stress in certain skeletal locations: a 1-year physical training program study. Research in developmental disabilities, 35(9), 2077-2084.

Finkelstein, E. A., Khavjou, O. A., Thompson, H., Trogdon, J. G., Pan, L., Sherry, B., & Dietz, W. (2012). Obesity and severe obesity forecasts through 2030. *American journal of preventive medicine*, 42(6), 563-570.

Flegal, K. M., Kruszon-Moran, D., Carroll, M. D., Fryar, C. D., & Ogden, C. L. (2016). Trends in obesity among adults in the United States, 2005 to 2014. *Jama*, 315(21), 2284-2291.

Geserick, M., Vogel, M., Gausche, R., Lipek, T., Spielau, U., Keller, E., ... & Körner, A. (2018). Acceleration of BMI in early childhood and risk of sustained obesity. *New England Journal of Medicine*, 379(14), 1303-1312.

Gupta, N., Goel, K., Shah, P., & Misra, A. (2012). Childhood obesity in developing countries: epidemiology, determinants, and prevention. *Endocrine reviews*, 33(1), 48-70.

Heyward, V. H. (1998). *Advance Fitness Assessment & Exercise Prescription*, The Cooper Institute for Aerobics Research, Dallas, USA.

Hills, A. P., Andersen, L. B., & Byrne, N. M. (2011). Physical activity and obesity in children. *British journal of sports medicine*, 45(11), 866-870.

Ilies, D. C., Buhas, R., Ilies, M., Ilies, A., Gaceu, O., Pop, A. C., ... & Baias, S. (2018). Sport activities and leisure in Nature 2000 protected area-Red Valley, Romania. *Journal of Environmental Protection and Ecology*, 19(1), 367-372.

Inoue, Y., Qin, B., Poti, J., Sokol, R., & Gordon-Larsen, P. (2018). Epidemiology of obesity in adults: latest trends. *Current obesity reports*, 7(4), 276-288.

Jensen, M. D., Ryan, D. H., Apovian, C. M., Ard, J. D., Comuzzie, A. G., Donato, K. A., … & Yanovski, S. Z. (2013). 2013 AHA/ACC/TOS Guideline for the Management of Overweight and Obesity in Adults. *Circulation*, 129(25 suppl 2), S102–S138.

Kassirer, J. P., Angell, M. (1998). Losing Weight - An Ill-Fated New Year's Resolution. *New England Journal of Medicine*, 338(1), 52–54.

Lobstein, T., Jackson-Leach, R., Moodie, M. L., Hall, K. D., Gortmaker, S. L., Swinburn, B. A., … & McPherson, K. (2015). Child and adolescent obesity: part of a bigger picture. *The Lancet*, 385(9986), 2510–2520.

Marfell-Jones M, Olds T, Stewart A, & Carter L. (2006). International Standards for Anthropometric assessment. *International Society for the Advancement of Kinanthropometry (ISAK).* South Africa: Potchefstroom.

Nagy, K., Șerbescu, C., & Ciobanu, D. (2016). The efect of a physical activity program of the health related fitness and quality of life on a female student group from Oradea, Romanian. *Journal of Physical Therapy*, 21 (37), 50-58.

Navarro, E., Funtikova, A. N., Fíto, M., & Schröder, H. (2017). Prenatal nutrition and the risk of adult obesity: Long-term effects of nutrition on epigenetic mechanisms regulating gene expression. *The Journal of Nutritional Biochemistry*, 39, 1–14.

Powell, K., Wilcox, J., Clonan, A., Bissell, P., Preston, L., Peacock, M., & Holdsworth, M. (2015). The role of social networks in the development of overweight and obesity among adults: a scoping review. *BMC Public Health*, 15(1), 996.

Sbenghe, T. (1987). *Kinetologie ptofilactică terapeutică și de recuperare*, Editura Medicală, București, Romania.

Serbescu, C., Flora, D., Hantiu, I., Greene, D., Laurent Benhamou, C., & Courteix, D. (2006). Effect of a six-month training programme on the physical capacities of Romanian schoolchildren. *Acta Paediatrica*, 95(10), 1258–1265.

Smith, K. B., & Smith, M.S. (2016). Obesity statistics. *Primary Care: Clinics in Office Practice*, 43(1), 121-135.

Stasiulis, A., Mockienė, A., Vizbaraitė, D., & Mockus, P. (2010). Aerobic exercise-induced changes in body composition and blood lipids in young women. *Medicina*, 46(2), 129.

Steff, M., Verney, J., Marinau, M., Perte, S., Pereira, B., Bryant, E., ... & Thivel, D. (2019). Toward a Romanian version of the Three-Factor Eating Questionnaire-R21 for children and adolescents (CTFEQ-R21): Preliminary psychometric analysis and relation with body composition. Developmental period medicine, 23(1), 45-53.

Șerbescu, C. (2008). *Condiția fizică a școlarului mic*, Editura Universității din Oradea, Oradea, Romania.

Tătar, C. F., Herman, G.V., & Pețan, P. (2018). Sport and physical activity engagement in Romania. *Geosport for Society*, 8(1), 40-50.

Tseng, E., Zhang, A., Shogbesan, O., Gudzune, K. A., Wilson, R. F., Kharrazi, H., ... & Bennett, W. L. (2018). Effectiveness of policies and programs to combat adult obesity: a systematic review. *Journal of general internal medicine*, 33(11), 1990-2001.

Van Cleave, J. (2010). Dynamics of Obesity and Chronic Health Conditions Among Children and Youth. *JAMA*, 303(7), 623.

Whooten, R. C., Perkins, M. E., Gerber, M. W., & Taveras, E. M. (2018). Effects of Before-School Physical Activity on Obesity Prevention and Wellness. *American Journal of Preventive Medicine*, 54(4), 510–518.

Wiklund, P. (2016). The role of physical activity and exercise in obesity and weight management: Time for critical appraisal. *Journal of Sport and Health Science*, 5(2), 151–154.

Willis, L. H., Slentz, C. A., Bateman, L. A., Shields, A. T., Piner, L. W., Bales, C. W., … & Kraus, W. E. (2012). Effects of aerobic and/or resistance training on body mass and fat mass in overweight or obese adults. *Journal of Applied Physiology*, 113(12), 1831–1837.

Yumuk, V., Tsigos, C., Fried, M., Schindler, K., Busetto, L., Micic, D., & Toplak, H. (2015). European Guidelines for Obesity Management in Adults. *Obesity Facts*, 8(6), 402–424.

Submitted:	Revised:	Accepted and published online
May 15, 2019	August 18, 2019	September 05, 2019

Analele Universităţii din Oradea. Facicula Educaţie Fizică şi Sport
E-ISSN **2286-2870**, ISSN **1224-5100**

XXIX, **2019,** pp.10-18
Article no. **29102-855**

THE USE OF EXERGAMES AS TEACHING METHOD IN MOTOR ACTIVITIES

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Abstract: Nowadays video games and IT are main sources of information and spending free time for more and more adolescents creating dependence and being highlighted as a risk factor regarding physical inactivity and obesity. New trends and research found a way to change 180 degrees the negative view of sedentary video games and mixt up video games with sports activities and developed "the exergames" a new way to practice sports exercises through video projections and video games. Our study purpose was to analyze the opinions and perceptions of Romanian Physical Education teachers about the new ways of practice sports activities with "the exergames", the reasons for using this method, the benefits, and obstacles. The research had as experiment sample 58 Romanian Physical Education teachers with different ages, gender, and experience, the method of research used for this experiment was the questionnaire with closed and open questions. The results of the questionnaire showed that the majority of Romanian Physical Education teachers don't know about video games involved in sports activities but are open minded regarding new ways of teaching, the reasons for the pro-attitude for introducing these ways involve: they encourage youth to practice sports doing what they like and generating joy with different kind of exercises. Conclusions of our study highlighted the need for rethinking the ways of teaching Physical Education and Sports activities in Romanian educational system, innovating and be open minded.

Key words: electronic devices, computer sports games, sports training, physical education

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INTRODUCTION

Scientific research recommends that reducing sedentary lifestyle among children and adolescents is a priority in combating and preventing obesity, identifying as negative impact elements watching television and playing videogames (Rosenberg et al., 2008). Other research articles proved that among people that live a sedentary lifestyle appears the greater risk of sickness comparing with those that have an active lifestyle and participate in motor and sports activities (Sieverdes et al., 2012). Nowadays video games gained popularity among the youth population but

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it is also present in adults and middle-age population lifestyle due to the progress of technology that surrounds us everywhere (Brach et al., 2012). The novelty of our research comes from changing the idea that video games are absolutely negative elements in youth lifestyle and presenting the new generation of interactive video games that are able to improve sports capacity simulating physical exercise and different sports activities.

Modern civilization brings new technology and learning methods offering good opportunities for developing skills and socializing, scientists researching the role, efficacy, and opportunities that this digital environment has to offer (Soltani and Vilas-Boas, 2017). Though research articles presented many reasons for physical inactivity such as lack of time and skills for practicing PE, lack of capable PE instructors, lack of support may influence the quality and quantity of PE activity (Lindberg et al., 2016).

Nowadays technology tried to imply physical interaction between the user and the device so the game industry and game controllers facilitate this kind of interaction developing technologies like Wii Balance Board and Microsoft Kinect. These kind of technology were the basic step for developing new kind of movement interactive games named exergames – games with exercises (Yoosin and Yang, 2010), is an alternative to the static traditional video game the influenced the sedentary behavior (Staiano and Calvert, 2011).

Exergames are a new entertaining alternative to the traditional PE lessons that has evolved rapidly in this digital and interactive era, having incorporated exercises with the main purpose of increasing physical activity and reducing sedentary lifestyle habits (Nani et al., 2018).

The benefits of exergames were presented in many research investigations proving the beneficial for both mental and physical health of anyone who practices exergames (Staiano and Calvert, 2011; Baranowski et al., 2012).

PE pedagogy always tried to innovate its teaching methods and keep up with new emerging technology including into their lessons visual or audio stimulus. Video games can fulfil both visual and audio stimulus and can be applied to improve attention, executive functions, and reasoning (Neugnot-Cerioli et al., 2015). Exergames characteristics are based mainly on control, rhythm, machines, workout, or sensory parameters being linked to a much bigger movement category of games that promote and maintain health (Brox et al., 2011; Lee, 2012).

Some other research proved that exergaming, through their engaging and encouraging values, can develop physical activity levels of youth, discovering that due to the complex connection between physical exercises and electronic games PE can be an entertaining and fun activity. Also among exergaming proprietie, researchers affirm the following: can increase motivation for participating in motor and physical activities and can improve and maintain health in a realistic environment (Peng, 2011).

Specialists designed exergames to offer real-time augmented information with a measurable effect and variable of interest (reaction time, force) providing related information to the user (Giggins and Persson, 2013).

Regarding sedentary individuals' scientists discovered that exergames are mounting evidence for developing an active lifestyle and increasing physical activity through video game play physical elements that imply exercise and motor activity, increasing both health and exercising motivation for performance (Rosenberg et al., 2008; Song et al., 2010).

The purpose of the research was to present a new way in teaching physical education and to identify the knowledge existing in our country in this direction and also to ask the physical education teachers their opinions and their suggestions about exergames effects on the human body.

Our research started from the assumption that exergames have a good influence on the human body, increase the body resistance, and also life satisfaction, enthusiasm, fun, and positive emotions, developing also relationships and building cohesion, being a new way to practice sport and also fulfill many physical education aims.

PURPOSE

The purpose of the research was to present a new way in teaching physical education and to identify the knowledge existing in our country in this direction and also to ask the physical education teachers their opinions and their suggestions about exergames effects on the human body.

HYPOTHESES

Our research started from the assumption that exergames have a good influence on the human body, increase the body resistance, and also life satisfaction, enthusiasm, fun, and positive emotions, developing also relationships and building cohesion, being a new way to practice sport and also fulfill many physical education aims.

MATERIALS AND METHODS

The research had as methods the questionnaire of opinions with the main aim to know the opinions of the physical education teachers about exergames and their influence on the human body. The questionnaire was built on a five scale fixed answer giving the opportunity of choosing the level of accordance with the affirmations or to choose between variants of answers. The responses were based on the statements of our research sample using a five-point scale. The next step we coded the responses and introduced the data in the program SPSS 22.0, after which we statistical processed the data and we created tables, graphics, and conduct de analyses. The following step was to use the results to create descriptive information and cross-table analyses. The results of our investigation are presented in the results section. This investigation was performed in accordance with the Declaration of Helsinki (2013) and approved by the Ethics Committee before the commencement of the study. It also met the ethical standards for Sport and Exercise Science Research.

Sample of the research

In our research, we had a number of 58 physical education teachers with different teaching grade, age, and gender. As we can see in figure 1 – regarding the gender of the responders, the sample of teachers was formed from 32 male respondents, representing 55% from the total, and 26 female respondents, representing 45% from the total. All the participants to survey gave their written consent for analyzing and presenting their responses for our research study and to be public released.

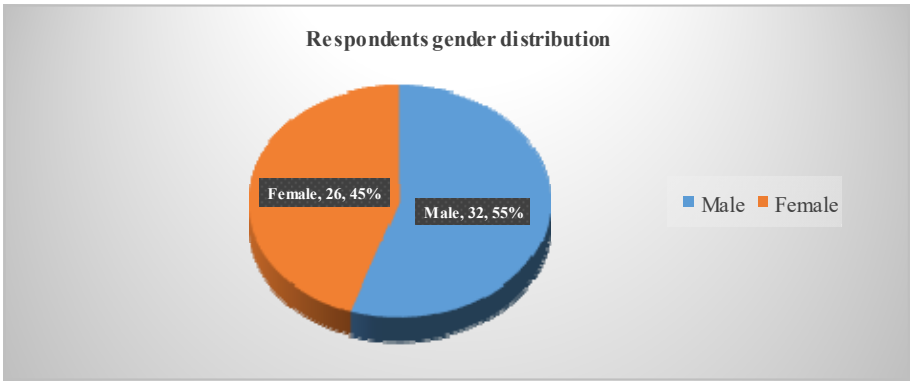

Figure 1. The distribution of the respondents regarding their gender

Regarding the age of the respondents we had 18 teachers under 25 years old, representing 31.03% from the total; 12 teachers between 25-30 years old, representing 20.69% from the total; 14 teachers between 30-35 years old, representing 24.14% from the total; 10 teachers between 35-

40 years old, representing 17.24% from the total; and over 40 years old we had 4 teachers, representing 6.90% of the total (figure 2).

As for the degree that teachers from our research sample had we can observe the following: 10 teachers, representing 17.24% from the total, had no teaching degree; 32 teachers, representing 55.17% from the total, had the definitive degree; 12 teachers, representing 20.69% from the total, had a second degree in teaching; and 6 teachers, representing 10.34% from the total, had the first degree in teaching (figure 3).

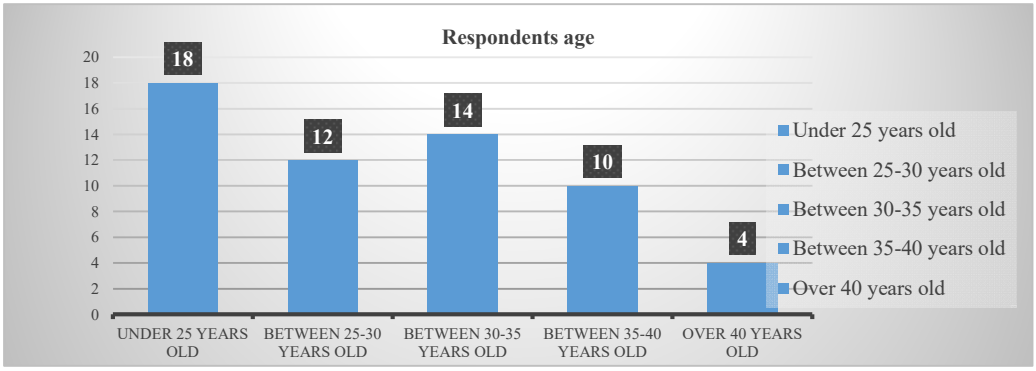

Figure 2. The distribution of the respondents regarding their age

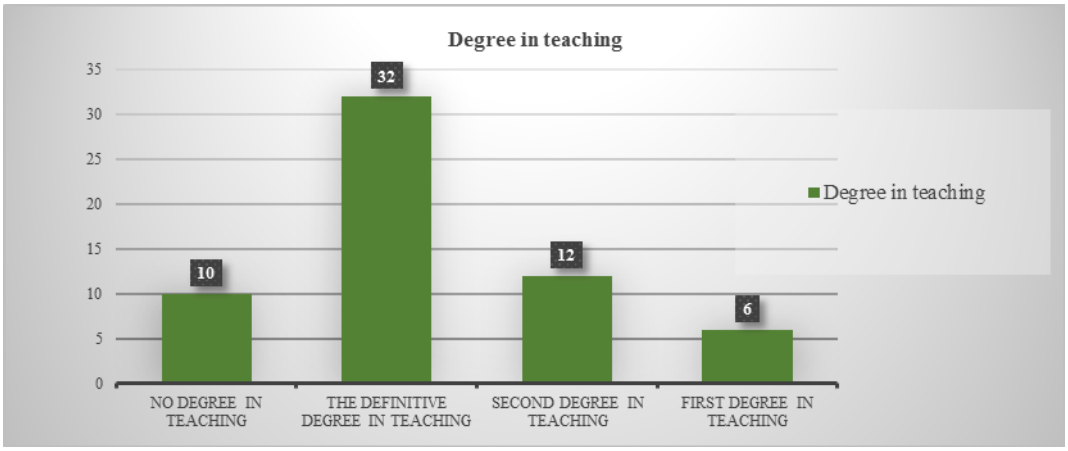

Figure 3. The distribution of the respondents regarding their degree in teaching

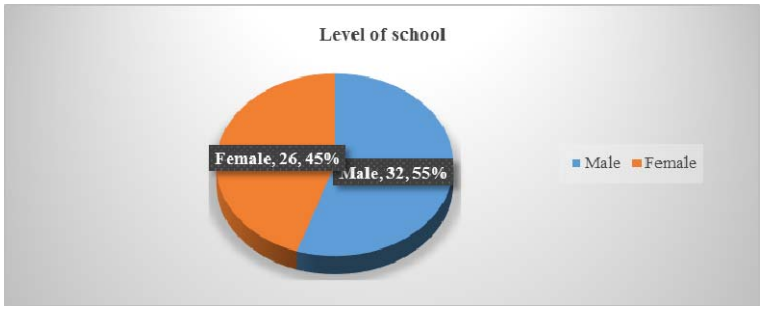

Figure 4. The distribution of the respondents regarding the level of school

Regarding the level of education school we had 42 teachers, representing 72.41% from the total amount, that activate in the gymnasium schools; 13 teachers, representing 22.41% from the total, that activate in the high school and 3 teachers, representing 5.17%, activate at the university level (figure 4).

RESULTS

The next phase of our research was to gather the information and answers from our respondents and to interpret the results of our investigation. The result of the research was as follows:

At the first item of our questionnaire we asked our respondents if they are familiar with exergames, WII, kinetic or interactive IT movement games, and the answers were as follows: 39 respondents, representing 67.24% from the total, heard about this kind of interactive IT movement games as an alternative to classic physical education classes; 19 respondents, representing 32.76% from the total, never heard or saw something like exergames.

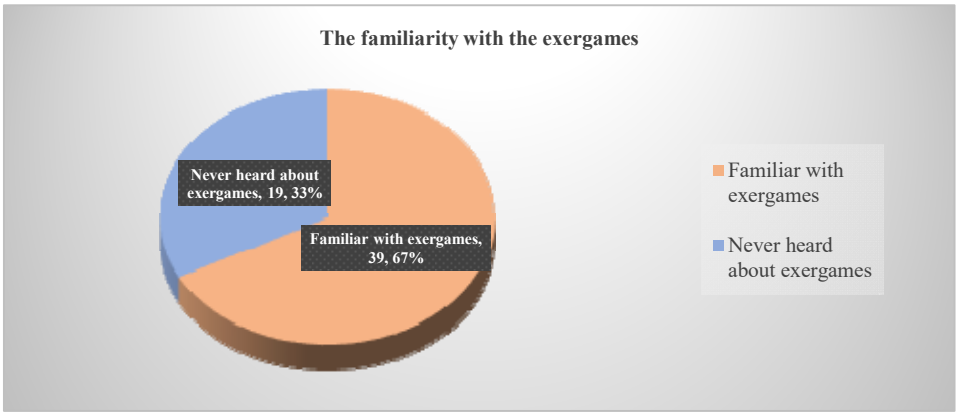

Figure 5. Item No.1 – The familiarity with the exergames

At the second item, we asked our sample of teachers on what activities they think exergames would be suitable for use. We can see in Table 1 the responses of our sample: at the first point the usage of exergames as an extra-curricular or optional activity the majority of the respondents give five points to the extra-curricular or optional activity; at the usage of exergames as a way to improve physical training activity the majority of the respondents give a middle 3 point; as for the usage of exergames for recovery activity the majority of the respondents give maximum points; for the motor learning usage of exergames the majority give 5 points; and also for the usage of exergames for disability students the majority of the respondents give 4 points.

Table 1. Item 2 the usage of exergames

Name of the activity suitable for exergame usage	1	2	3	4	5
1. Extra-curricular or optional activity	1	3	4	8	42
2. Physical training	2	8	23	15	10
3. Recovering activity	0	6	6	16	30
4. Motor learning	3	5	7	20	23
5. Exergames for disability students	7	10	13	20	8

At the third item we ask our sample of teachers to choose between five variants of answer (no potential, some potential, considerable potential, good potential, and huge potential) for the current statement: "exergames have the following potential in using it in physical education and sport classes", the answers of the questionnaire were as we can see in Figure 6: the majority of teachers consider exergames having a good potential (28 of them representing 48% from the total) or a considerable potential (20 of the respondents representing 35% from the total), few respondents see a huge potential (3 respondents) and also few see some potential (6 respondents) and just 1 of the respondents affirm that exergames have no potential at all.

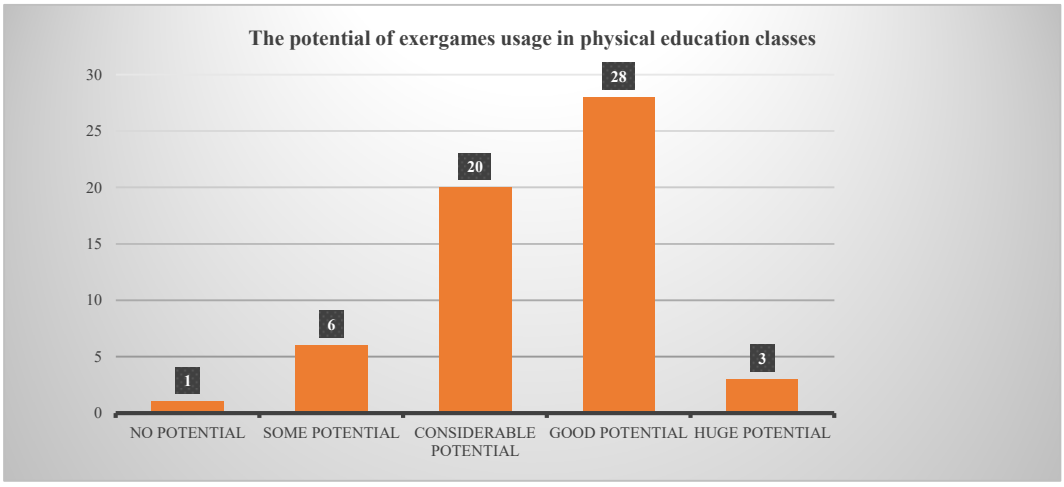

Figure 6. The potential of exergame usage in physical education classes

The next item of our questionnaire asks the teachers to choose between no potential and potential of exergames in the following direction: maintaining health and physical condition, encourage the physical activity of students, improve social relationships, learn or adapt to new motor learning exercises, psychological relaxation and having fun. The answers were as separated on gender (Table 2), as we can observe little differences between the gender have occurred the majority in each case see a good potential in all the direction proposed the differences between genders being insignificant statistically.

Table 2. The potential of exergames

The potential of exergames in the following direction:	**Gender distribution**			
	Women (n=26)		**Man (n=32)**	
	No potential	**Good potential**	**No potential**	**Good potential**
1. Maintaining health and physical condition	2	24	0	32
2. Encourage physical activity of students	0	26	1	31
3. Improve social relationships	4	22	1	31
4. Learn or adapt to new motor learning exercises	2	24	2	30
5. Psychological relaxation and heaving fun	1	25	1	31

At the final item of our questionnaire, we ask the sample of respondents to choose on a scale (from 1 to 5) the possibility of using the exergames in their physical education classes. The

answers to this item (Table 3) show that teachers would use this kind of materials but the majority have no space, founds or knowledge, but have a good attitude towards new ways of practicing sport and attracting their students to interesting activities.

Table 3. The possibility of using exergames in the physical education classes

The motives for using or not the exergames to the physical education classes	1	2	3	4	5
1. Sufficient of insufficient space for the good use of exergames	38	10	5	4	1
2. Financial or no financial support from the school	43	5	3	5	2
3. The limited time of the physical education classes	23	10	11	8	6
4. Knowledge about using the exergames	15	10	7	8	8
5. My attitude toward using this kind of activities	3	5	10	18	22

DISCUSSIONS

The results of our investigation show that most of the teachers that were part of the research sample are familiar with exergames and some of them even used the technology. Regarding the usage of this new technology, the majority of our respondents think that exergames are a good way of spending time for extra-curricular or optional activities, recovering activity and for motor learning, also some of them think that these games are good for physical training and to help students with disabilities.

Similar results of a positive influence of exergames were found in other scientific research that scientifically demonstrated that people that involved in digital interactive games with use of physical exercise provide significant improvement in heart rate, increase of oxygen uptake and energy consumption being similar to traditional physical education exercise effects (Peng et al., 2011).

Other similar results of our investigation regarding the potential of exergames in using them in the physical education lessons show that the respondents in our sample group consider that this kind of exercise has a good potential or considerable potential and also contribute to maintaining health and physical condition, encourage physical activity, improve social relationships, learn new motor skills and also use them for psychological relaxation and heaving fun.

Some scientific research papers discovered that exergame programs develop life satisfaction (Wang et al., 2008), socialization, enthusiasm, entertaining, fun and positive emotions, giving the opportunity and motivation for practicing physical exercise (Patsi et al., 2012; Bianchi-Berthouze et al., 2007).

Besides its numerous physical benefits, exergaming have also many social benefits being an important argument for physical education teachers for implementing this kind of video methods in their curriculum fulfilling the pedagogical principles and methods requirement.

According to scientific researcher Sinclair et al. (Sinclair et al., 2007), exergames are a practical method for combating sedentary and decelerate obesity at people with "increased screen time and decreased physical activity". Also, the majority of the research emerges the idea that exergames are focused on energy expenditure and physical outcomes being associated with improving heart rate and caloric expenditure in its exercises (Duncan and Dick, 2012; Smallwood et al., 2012).

Other researchers discovered that the interest for exergaming increased for usual fitness lessons and the elementary school children increased also their motivation for participating in physical education classes that use exergames (Sun, 2012; Garn et al., 2012). Also, the benefits of using Run Wii Fit were discovered by many scientists that concluded that exergames improve the motivation of obese youth for practicing physical activities.

Other researches highlighted that new technologies can have major impact on sports training and psychomotor development (Szabo et al., 2019a) but also can have negative impact on

physical health being mandatory to use prophylaxis sports like swimming (Szabo et al., 2019b).

The motor activities, whether organized, the physical education and sports lessons, or sports training, either free or competitive, have at this age a strong ludic character, aiming both at developing motor skills physical and social skills (Sopa et al., 2018).

Also, our research shows that teachers would use this kind of materials but the majority have no space, founds or knowledge, but have a good attitude towards new ways of practicing sport and attracting their students to interesting activities.

The limitations of our study

The prior limitation of our study was the number of participants to the study, we had the responses of only 58 PE teachers from Romania. Another limitation was the level activity of our respondents we accepted PE teachers only from the gymnasium and high school but in near future, we want to apply the questionnaire also at the primary school level and university physical education. Also, the method that we applied, the questionnaire method, has its limitation and could not sum all the opinions of our sample.

CONCLUSIONS

The purpose of our investigation has been to describe the perceptions of PE teachers from Romania for using the exergames. We also wanted to examin the possible obstacles, difficulties, and reasons that PE teachers from our country use or don't use exergames as a teaching method.

The results showed that PE teachers from Romania are familiar with exergames, WII, kinetic or interactive IT movement games, the majority of our respondents 67.24% heard about this kind of interactive IT movement games as an alternative to the classic PE classes. Also, our respondents consider that exergames are a suitable extra-curricular or optional activity offering most of their maximum votes. As for the usage of exergames as a way to improve physical training the PE teachers are not 100% convinced that exergaming is an effective method and consider them to be more of a recovery, relaxing and motor learning way to use.

The results of our questionnaire showed that PE teachers consider that exergames have good potential or a considerable potential for using as a method of teaching in PE lessons. Also consider that exergames havegood efficiency in maintaining health and physical condition, encourage the physical activity of students, improve social relationships, learn or adapt to new motor learning exercises, psychological relaxation and having fun.

Even if the PE teachers recognize that exergames are a proper method for fulfilling the objectives of PE lessons the answers of the last item in our questionnaire show that Romania is not prepared to use new technology because of insufficient space, no financial support, limited time and little knowledge to use this method, although their attitude towards using new methods of teaching is open.

REFERENCES

Baranowski, T., Baranowski, J., O'Connor, T., Lu, A. S., Thompson, D. (2012). Is enhanced physical activity possible using active video games? *Games Health J,* 1(3): 228–232.

Bianchi-Berthouze, N., Kim, W. W., Patel, D. (2007). Does body movement engage you more in digital game play? and why? *In Proceedings of the 2nd international conference on Affective computing and intelligent interaction.* Berlin: Springer-Verlag, Page 102-113.

Brach, M., Hauer, K., Rotter, L., Werres, C., Korn, O., Konrad, R., Göbel, S. (2012). Modern principles of training in exergames for sedentary seniors: Requirements and approaches for sport and exercise sciences. *International Journal of Computer Science in Sport,* 11, 86–99.

Brox, E., Fernadez-Luque, X., Tollesfsen, T. (2011). Health gaming -Video game design to promote health. *Applied Clinical Informatics,* 27, 128–142.

Duncan, M. J., Dick, S. (2012). Energy expenditure and enjoyment of exergaming: A comparison of the Nintendo Wii and the Gamercize Power Stepper in young adults. *Medicina Sportiva,* 16, 92–98.

Garn, A. C., Baker, B. L., Beasley, E. K., Solmon, M. A. (2012). What are the benefi ts of a commercial exergaming platform for college students? Examining physical activity, enjoyment, and future intentions. *Journal of Physical Activity & Health,* 9, 311–318.

Giggins, O. M., Persson, U. M., Caulfield, B. (2013). Biofeedback in rehabilitation. *Journal of Neuro engineering and Rehabilitation,* 10, 3–11.

Harriss, D. J., Atkinson, G. (2013). Ethical standards in sport and exercise science research: 2014 update. Int J Sports Med; 2013; 34: 1025-1028.

Lee, S. (2012). Project Injini: Developing cognitive training games for children with special needs. *Games for Health Journal,* 1, 69–73.

Lindberg, R., Seo, J., Laine, T. H. (2016). Enhancing physical education with exergames and wearable technology. *IEEE Transactions on Learning Technologies*, 9 (4), 328-341.

Nani, S., Matsouka, O. Antoniou, P. (2018). Can ten weeks intervention with exergames contribute to better subjective vitality and physical health? *Sport Science for Health, Publisher Springer Milan.*

Neugnot-Cerioli, M., Gagner, C., Beauchamp, M. H. (2015). The use of games in paediatric cognitive intervention: A systematic review. *International Journal of Physical Medicine & Rehabilitation*, 3(4).

Patsi, C., Antoniou, P., Batsiou, S., Bebetsos, E., Lagiou, K. (2012). Exergames and their effect on emotional state in people with Schizophrenia. *Balk Mil Med Rev (BMMR),* 15(4):275–281.

Peng, W., Lin, J. H., Crouse, J. (2011). Is playing exergames really exercising? A meta-analysis of energy expenditure in active video games. *CyberPsychol Behav Soc Netw,* 14:681–688.

Rosenberg, D. E., Bull, F. C., Marshall, A. L., Sallis, J. F., and Bauman, A. E. (2008). Assessment of sedentary behavior with the International Physical Activity Questionnaire. *Journal of physical activity & health*, 5, S30.

Sieverdes, J. C., Ray, B. M., Sui, X., Lee, D. C., Hand, G. A., Baruth, M. (2012). Association between leisure-time physical activity and depressive symptoms in men. *Med Sci Sports Exerc*, 44, 260–265.

Sinclair, J., Hingston, P., Masek, M. (2017). Considerations for the design of exergames. *Paper presented at the Proceedings of the 5th international conference on computer graphics and interactive techniques in Australia and Southeast Asia,* 289-295.

Smallwood, S. R., Morris, M. M., Fallows, S. J., Buckley, J. P. (2012). Physiologic responses and energy expenditure of kinect active video game play in schoolchildren. *Archives of Pediatrics & Adolescent Medicine,* 166, 1005–1009.

Soltani, P., Vilas-Boas, J. P. (2017). Sport Exergames for Physical Education. *Information Science and Technology,* Fourth Edition, IGI Global, 4, 7358-7367.

Song, H., Kim, J., Tenzek, K. E., Lee, K. M. (2010). The effects of competition on intrinsic motivation in exergames and the conditional indirect effects of presence. *In: Annual Conference of the International Communication Association*, Singapore, 3, 1-8.

Sopa, I. S., Pomohaci, M., Szabo, D. A. (2018). How do sports competitions help in the process of socialization of students (10-12 years old). Analele Universităţii din Oradea – Fascicula Educaţie fizică şi sport, Rev. no. XXVIII, pp. 5-17.

Staiano, A. E., Calvert, S. L. (2011). Exergames for physical education courses: physical, social, and cognitive benefits. *Child Dev Perspect,* 5(2):93–98.

Sun, H. (2012). Exergaming impact on physical activity and interest in elementary school children. *Research Quarterly For Exercise & Sport,* 83, 212–220.

Szabo, D. A., Neagu, N., Teodorescu, S., Pomohaci, M., Sopa, I. S. (2019a). Modalities of exploitation the information provided by Click & Scout program in preparing volleyball attack players. *International Journal of Applied Exercise Physiology,* Vol. 8, No. 2.1., p. 775-782.

Szabo, D. A., Neagu, N., Teodorescu, S., Pomohaci, M. & Sopa, I. S. (2019b). Does smart electronic devices influence the body deficiencies development at kids who practice swimming?, *International Journal of Applied Exercise Physiology*, Vol. 8, No. 2.1., p. 768-774.

Wang, E. S., Chen, L. S., Lin, J. Y., Wang, M. C. (2008). The relationship between leisure satisfaction and life satisfaction of adolescents concerning online games. *Adolescence*, 43(169), 177–184.

Warburton, D. E., Nicol, C. W., Bredin, S. S. D. (2006). Health benefits of physical activity: the evidence. *Canadian Medical Association Journal,* 174(6):801–809.

Yoonsin, O., Yang, S. (2010). Defining exergames & exergaming. In: Meaningful play 2010 conference proceedings, in *East Lansing*, MI, USA on the campus of Michigan State University, 1-17.

Submitted:	Revised:	Accepted and published online
July 6, 2019	October 22, 2018	December 6, 2019

Analele Universităţii din Oradea. Facicula Educaţie Fizică şi Sport
E-ISSN **2286-2870**, ISSN **1224-5100**

XXIX, **2019,** pp.19-23
Article no. **29103-856**

EVOLUTION OF SPEED IN SECONDARY SCHOOL STUDENTS

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Abstract: Given the multilateral development of the human personality, physical education is an integral part of the training and education of the youth, contributing to the successful fulfillment of the general tasks in the direction of human formation in society. The objective and natural connection with the other components of multilateral education is determined by the social needs, by the context in which people must develop from all points of view, both physically and mentally, in order to be able to work efficiently, creatively. Among the motor qualities/capacities, the forms of manifestation of speed extend their manifestation area either on the development of coordination, force and not least on the capacity of the body to sustain an intense physical effort in order to achieve an objective in the shortest time with a relatively constant efficiency, which justifies the interest of those who approach the subject. Given the biological and physiological conditionality regarding the forms in which the speed is manifested, the moment when the pedagogical intervention on their evolution occurs is one of great importance. The present paper aims to highlight how speed evolves as a result of the effects of practicing physical education.

Key words: evolution, motor qualities, speed, physical education, secondary school

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INTRODUCTION

Given the multilateral development of the human personality, physical education is an integral part of the activity of training and educating the youth, contributing to the fulfillment of the general tasks in the direction of human formation as a member of a community (Cristea and Sabău, 2017). Formation of the students' habit of systematically practicing physical exercise should be carefully followed and guided so that the practice gradually becomes a habit.

The physical and mental qualities are the product of three essential factors: heredity, the natural and social environment and education (Lloyd et al., 2013). What is the contribution of each

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factor in the formation of the human personality, in what proportions do they coexist and how are they interwoven are only a few questions to which the specialists are still looking for an answer. But one thing is certain: man and his qualities are perfectable through education (Cârstea, 1999). On the other hand, the achievement of the objectives of physical education is possible only if it is systematically pursued to carry out essential purposes for motor training and their education, among which is the development of motor qualities (Baroga, 1984).

Over time, the ”conditional” character of the level of development of motor qualities in relation to the quality of forming and consolidation of motor skills has often been emphasized (Mitra and Mogoș, 1977); however, sometimes for objective reasons (the amount of physical education activities), the concern oriented towards the development of motor qualities is secondary.

Data from bio-psycho-motor and pedagogical research have shown that in order to organize the instructional-educational process according to the demands of contemporary life regarding the preparation of school youth, it is imperative to have a clear representation on the developmental stages of children (Buhaș et al., 2018). Middle school age or pre-adolescence is the period in which the pupils with whom the pedagogues work in the secondary school falls and is characterized by the beginning of the physical maturity of the individual, being a stage of intense formation of the personality and the moral conscience. ”It is very difficult or almost impossible to establish precisely some temporal benchmarks of these psycho-physical transformations, as there are so many individual and regional differences” (Epuran, 1976, p. 96).

The indices of the development of the motor qualities increase by themselves due to life, up to a certain age and then begin to decrease in a differentiated rhythm, determined by several variables of which are mentioned: nutrition, family environment, social environment, economic environment etc. Through the special training process, the development of the motor quality indices can be accelerated, a phenomenon identified with the syntagma ”motor quality education” (Cârstea, 1999, p. 23).

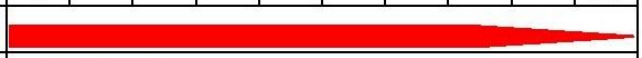
AIM

A recent classification of motor qualities, divides them into three groups, called motor capacities: conditional capacities, coordinative capacities, intermediate capacities (Tudor, 1999), given that the use of the name of motor capacity (conditional and coordinative) is still used in Europe since 1968 (Dragnea and Bota, 1999). Since there is some incompatibility between the international and Romanian terminology due to the difficulties of translation, we will continue to use the phrase ”motor qualities” instead of skills. For a long time, specialists in the field have sought to be as close as possible to the truth in relation to the optimal periods of development of motor qualities (Thiebault and Sprumont, 1998). Table no. 1 summarizes the author's opinion on this aspect (Drăgan, 1997). From the analysis of this graph it follows that the optimal ages most favorable in terms of yield for the development with specific means of speed and coordination are the lowest, which also implies the proper improvement of the vegetative functions that support and serve the motor activity (circulation, respiration, vasomotricity, internal secretion etc.). ”Only the close correlation and the corresponding level of the morphological development and the functionality of the somatic and vegetative systems can ensure the development to a high degree of improvement of the motor qualities, which are necessary to achieve the current performances, extremely high in sports worldwide” (Drăgan, 1997, p. 58).

The formation of a broad base of motor skills, as well as the development of motor qualities, is one of the basic objectives of physical education in schools (Trifa, 2016). The motor qualities have to be approached and developed in a balanced way according to the particularities of age, gender, level of training, material conditions.

The purpose of this approach is to highlight the correlation between scientific knowledge data and objective reality

Table 1. The evolution of the motor qualities
(Data source: Drăgan, 1997)

No.	MOTOR QUALITIES	AGE
		0 ... 30+
1	SPEED	
2	STRENGHT	
3	COORDINATION	
4	ENDURANCE	

OBJECTIVES

To conduct preliminary research (applicative type) we proposed the following goals:
- the study of the specialized literature;
- establishing the sample classes;
- performing the tests;
- the statistical-mathematical interpretation of the results and the comparative study of the values;
- conclusions regarding the results obtained.

MATERIALS AND METHODS

The sample under evaluation consisted of a number of 96 people (52 boys and 44 girls) in each grade of the secondary school (5^{th} to 8^{th} grade), students of ARTS HIGH SCOOL in Oradea (table 2).

Table 2. Sample structure

GRADE	GIRLS	BOYS	TOTAL
V	12	11	23
VI	15	13	28
VII	8	13	21
VIII	9	15	24
Total/grade	44	52	96

The test of speed capacity assessment consisted of running on the distance of 50 m. The starting line as well as a corridor with a width of 1.25 m were marked with milestones placed every 5 m. The timing was done manually, with the help of an electronic stopwatch. The 50 m speed running test was run with free start (self-controlled) and timing on the move, with each subject entitled to 2 attempts; the best attempt was counted.

The collected data were processed using the statistical tools of Microsoft Office 2010, using those indicators that allow a more complex analysis of the samples. The graphics were realized using the EXCEL program, which is efficient and easy to use.

RESULTS

The synthesis of the results obtained at the 50 m speed test, measured in seconds, tenths and hundredths of a second, are materialized in table 3.

As can be seen, the evolution of speed development is neither linear nor in total agreement with the evolution of biological, physiological or psychological age features (Epuran, 1976; Dragnea and Bota, 1999), and can be influenced by other factors, of a subjective nature.

The rate of evolution of the average by both gender and class expressed as a percentage is illustrated in table 4.

Table 3. Synthesis of the results on 50 m speed test

Gender	Av./grade		Boys		Girls	
Initial/Final Test	IT	FT	IT	FT	IT	FT
Grade/Class						
5th grade	8.90	8.61	8.61	8.31	9.18	8.88
6th grade	8.89	8.60	8.70	8.43	9.08	8.80
7th grade	8.40	8.31	8.40	8.04	9.25	8.71
8th grade	8.48	8.30	8.33	8.14	8.86	8.60

Table 4. Evolution of average performance (in percentage) by gender and classes from IT to FT

Class	**IT → FT Boys** (%)	**IT → FT Girls** (%)	**IT → FT Average by classes** (%)
5th	3.49	3.27	3.26
6th	3.11	3.09	3.27
7th	4.29	4.84	1.18
8th	2.29	2.94	2.13

The optimal difference from the previous class (the vertical difference) and the evolution of the maximum value makes us say that:

- maximal increasing was registered in the 7th class (compared to the 6th), both for girls and boys;
- the largest increase was for girls on the same level;
- the smallest increase was registered in the 8th class (compared to the 7th), both for girls and boys;
- the increase was better for girls then boys on this level;
- the highest increase in class average was in 6th class (compared to 5th);
- the smallest increase of the class average was in the 7th class (compared to the 6th).

DISCUSSIONS

Finding by comparison the trends of evolution, involution or plateau of the somatic and motor parameters, offers a relevant synthesis on the determining factors regarding the morphological and functional growth and development of the students in the secondary school. The speed evolves according to the maturation of the morpho-functional substrate nervous and muscular (Wilmore and Costill, 2002) and because these two systems do not evolve in parallel, the speed can be efficiently influenced only during certain periods of life (Manno et al., 1993).

The results highlight by confirming known aspects of the specialized literature, but also paradoxes:

- 12-15 years is the period when the reaction time reaches the value of the adult (Manno, 1996) and the evolution of the velocity occurs mainly on account of the increase of the force;
- The evolution of the performances shows a very low degree of homogeneity, highlighted by the difference between the genres and the class averages (7th class);
- Although at the level of the 8th class the expectations are the highest due to the level of hormonal metabolism, the maturation of the cerebral cortex, the balance of the superior nervous processes, the natural acquisition of force etc. (Wilmore and Costill, 2002), the results are modest especially for boys;
- In part, the objective situation may be due to the insufficient evolution of the technique in relation to the level of development of the supporting motor qualities;

Given the biological and physiological conditioning, the development of speed at this age level should be a priority objective, combined with the acquisition of an appropriate technical component and the development of the other forms of manifestation of motor qualities and combined motor qualities (Marinău, 2017). All methods and means are likely to give results, but they must be chosen according to subject (age, level of training, other characteristics), the objective pursued and its particularities as well as the material means available.

Aknowlegments

The data are part of the graduating paper of the second author, guided by the first author. All three authors had the same contribution.

REFERENCES

Baroga, L. (1984). *Educarea calităților fizice combinate*, Editura Sport-Turism, București.

Buhaș, S., Herman, G., Ștef, M. (2018). Aspects regarding speed development in football game in 12-14 years old children. *GeoSport for Society*, 8(1), 21-29.

Cârstea, Gh. (1999). *Educație Fizică - fundamente teoretice și metodice*, Editura Casa de Editură Petru Maior, Târgu Mureș.

Cristea, D., Sabău, A.M. (2017). Aspects related to the conduct of the physical education class in the primary school. *Analele Universității din Oradea. Fascicula Educație Fizică și Sport*, 27, 10-16.

Dragnea, A., Bota, A. (1999). *Teoria Activităților Motrice*, Editura Didactica și Pedagogică, Bucuresti.

Drăgan, D. (1997). *Atletism ABC*, Editura Librăriile Crican, Oradea.

Epuran, M. (1976). *Psihologia Educației Fizice*, Editura Sport-Turism, București.

Lloyd, R. S., Read, P. M., Oliver, J. L., Meyers, R. W., Nimphius, S., Jeffreys, I. (2013). Considerations for the Development of Agility During Childhood and Adolescence. *Strenght and conditioning Journal*, 35(3), 2-11.

Manno, R. (1996). *La biologie du sport*, CCPS-MTS, București.

Manno, R., Aquili, N., Carbonaro, G. (1993). Evoluzione e sviluppo delle abilità motorie. SDS, *Rivista di culturasportiva*, 28(29), 77-86.

Marinău, M. (2017). Issues concerning the use of strengh and power practice, during the preparatory period, for U19 youth football players. *GeoSport for Society*, 6(1), 7-13.

Mitra, Gh., Mogoș, Al. (1977). *Dezvoltarea calităților motrice*, Editura Sport-Turism, București.

Thiebault, C., Sprumont, P. (1998). *L'enfant et le sport*, Edition De Boeck, Bruxelles.

Trifa, I. (2016). The contribution of play fighting to thre emotional development of children. *Analele Universității din Oradea. Fascicula Educație Fizică și Spor*t, 26, 25-30.

Tudor, V. (1999). *Capacitățile condiționale, coordinative și intermediare – componente ale capacității motrice*, Editura RAI, București.

Wilmore, J. H., Costill, D. L. (2002). *Physiologie du sport et du exercice*, Edition De Boeck, Bruxelles.

Submitted:	Revised:	Accepted and published online
July 6, 2019	October 22, 2018	December 13, 2019

Analele Universităţii din Oradea. Facicula Educaţie Fizică şi Sport
E-ISSN **2286-2870**, ISSN **1224-5100**

XXIX, **2019,** pp.24-32
Article no. **29104-857**

A FUNCTIONAL APPROACH TO INTERPRETING SPIROMETRY TO FEMALE STUDENTS FROM OTHER FACULTIES OF THE UNIVERSITY OF ORADEA

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Abstract: Background & objectives: Pulmonary function tests have evolved as clinical tools in diagnosing and management of respiratory diseases as they provide objective information about the status of an individual's respiratory system. The assessment of patients and program outcomes is the crucial element of a PR program. This study was aimed to evaluate pulmonary function by spirometry and to interpret in terms of functional way. Methods: To determine the pulmonary health of young people, we evaluated 50 female students from different faculties of the University of Oradea with no history in professional sports. The pulmonary functions were recorded on a computerized spirometer (Vitalograph ALPHA brand model # 6000); the parameters measured were: VC, FVC, FEV_1, FEV_1%VC, FEV_6, PEF, FEF 25, FEF 50, FEF 25/75 and MMVind Interpretation & conclusions: From the present investigation it can be concluded that the students present all types of presumptive clinical diagnosis (normal, obstructive, restrictive and mixed deficit) with different degrees of severity. From a functional point of view, it can be said that students develop bad *breathing* habits – or simply *don't know* how to *breathe properly*

Key words: pulmonary function, lung volumes, Spirometric values, young adulthood

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INTRODUCTION

The history of Pulmonary Rehabilitation (PR) dates back over decades and certain PR elements over centuries. The evidence of PR's effectiveness has considerably strengthened and

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increased over the past forty years. During this time, the role and impact of PR has been firmly established and is now considered a key component in management of chronic respiratory disease (Garvey et al., 2013).

Also, Pulmonary Rehabilitation can help to gain strength, reduce symptoms of anxiety or depression, and makes it easier to manage routine activities, work and outings or social activities.

The literature on pulmonary rehabilitation has increased substantially and provided justification for including pulmonary rehabilitation in practice guidelines for primary and secondary care. The crucial element of a PR program is the assessment of patients and program outcomes (Peno-Green et al., 2009).

The clinical reasoning process in cardiorespiratory physiotherapy begins with the collection of both subjective and objective data (Holdar et al, 2013). The data collected shall then be explained and interpreted. An important step in clinical judgment is spirometry, a powerful tool that can be used to detect, follow, and manage patients with lung disorder.

How Crapo R.O. (1994) specifies, the pulmonary-function tests are useful in diagnosing and managing pulmonary diseases. It can identify abnormalities of lung function that might otherwise be overlooked and can exclude the possibility of some respiratory disorders such as chronic obstructive pulmonary disease.

Smith et al., (2010) have used FEV_1, FVC and FEV_1/FVC to determine the effect of changing guidelines during a longitudinal study of young adults.

Rochat et al., (2013) developed spirometry reference equations for a central European population between 8 and 90 years of age that can be implemented in a wide range of clinical settings. The largest forced vital capacity (FVC) and forced expiratory volume in one second (FEV1) were selected. All other parameters [FEV1/FVC ratio, peak expiratory flow (PEF), mean expiratory flow at 75%, 50%, 25% of expired volume ($MEF_{75, 50, 25}$)] were taken from the trial with the largest sum of FVC and FEV1.

For spirometry, many parameters can be calculated but most do not add clinical utility and should not be routinely reported. Only FVC, FEV1, and FEV1/FVC need be routinely reported. Measurement of slow VC and calculation of FEV1/VC are a useful adjunct in patients with suspected airflow obstruction. Reporting FEV1/FVC (or FEV1/VC) as a decimal fraction, and not reporting it as a percentage of the predicted value for this ratio, will help to minimize miscommunication (Culver et al., 2017)

MATERIAL AND METHODS

Subjects:

This study was conducted in the University of Oradea, Athletics Hall, in bodybuilding room.

To determine the pulmonary health of young people, we evaluated 50 female students from different faculties of the University of Oradea with no history in professional sports. The mean age and body height were 20.42±1.83 yrs., respectively 164.55 ±5.43cm. Students were enrolled in sports such as handball, basketball, volleyball, aerobics and fitness. Subjects with history of pulmonary diseases were excluded from the study. The experimental protocol was explained to all.

Determination of pulmonary function measurements:

The pulmonary functions were recorded on a computerized spirometer (Vitalograph ALPHA brand model # 6000), The parameters measured were: VC (vital capacity), FVC (forced vital capacity), FEV_1 (forced expiratory volume in 1 sec), FEV_1%VC (ratio to FEV_1 to vital capacity expressed as a percentage), FEV_6 (forced expiratory volume in six seconds), PEF (Peak expiratory flow), FEF 25, FEF 50, FEF 25/75 (maximal (mid-) expiratory flow at 25%, 50 %, 25%-75% of the forced vital capacity), MMVind (Maximal voluntary ventilation). All the measurements were conducted in standing posture with nose clipped. For each volunteer three satisfactory efforts were recorded.

RESULTS & DISCUTIONS

When personal data has been collected each subject was asked if they are smokers, non-smokers or ex-smokers. The results were 24% smokers, 68% non-smokers and 8% ex-smokers.

Holmen et al., (2002) from Norway, shows a survey conducted in 1995-1997 in which a total of 6811 students (aged 13-18 yrs. without asthma), 1.342 (20%) reported current smoking, 2.993 (44%) reported never-smoking, 2.476 (36%) occasional smokers. Daily number of smokers increased with age and was more pronounced to females.

Compared to Romania where, proportion of daily smokers of cigarettes, persons aged 15 and over are 20.5%; 32.7% men and 9.1% women, in Norway this proportion is 12.5%; 12.7 men and 12.3 women (Eurostat. Statistic explained, 2015).

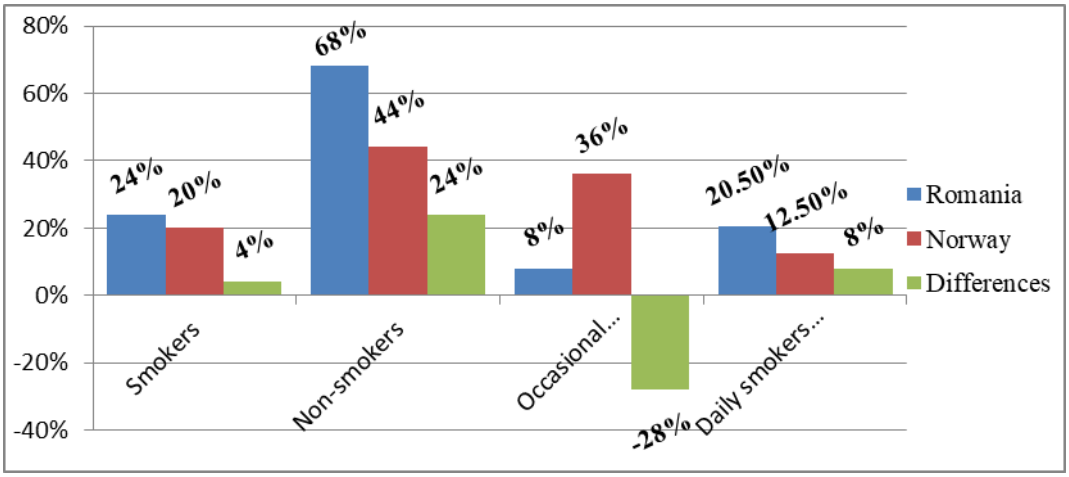

Figure 1. Tobacco consumption

It can be seen that the proportion of daily smokers in Romanian population is higher by 8% compared to Norway.

To the comparison between research studies, we have more smokers by 4%, but the positive thing is much bigger difference to non-smokers. We have 24% more non-smokers in the group of students.

Spirometry was carried out in accordance with the current standardization recommendations of the ATS-ERS (Miller et al., 2005)

The results obtained from lung function tests have no meaning unless they are compared with reference values or predicted values.

After the VC (vital capacity) and dynamic pulmonary functions were recorded for all students, the database for subsequent interpretations has been structured.

Vital Capacity (VC) is the largest of the volumes from either a forced (FVC) or a slow (SVC) maneuver. There is little or no difference between VC and FVC (VC-FVC) in normal subjects (Chhabra, 1998).

The subjects in our study do not have history of lung disease; this also comes from the similar average values between VC 60.46±28.98 and FVC 61.98% ±28.06

An algorithm for interpreting spirometry results is given by: Barreiro and Perillo, 2004; Miller and Enright, 2012; Johnson and Theurer, 2014.

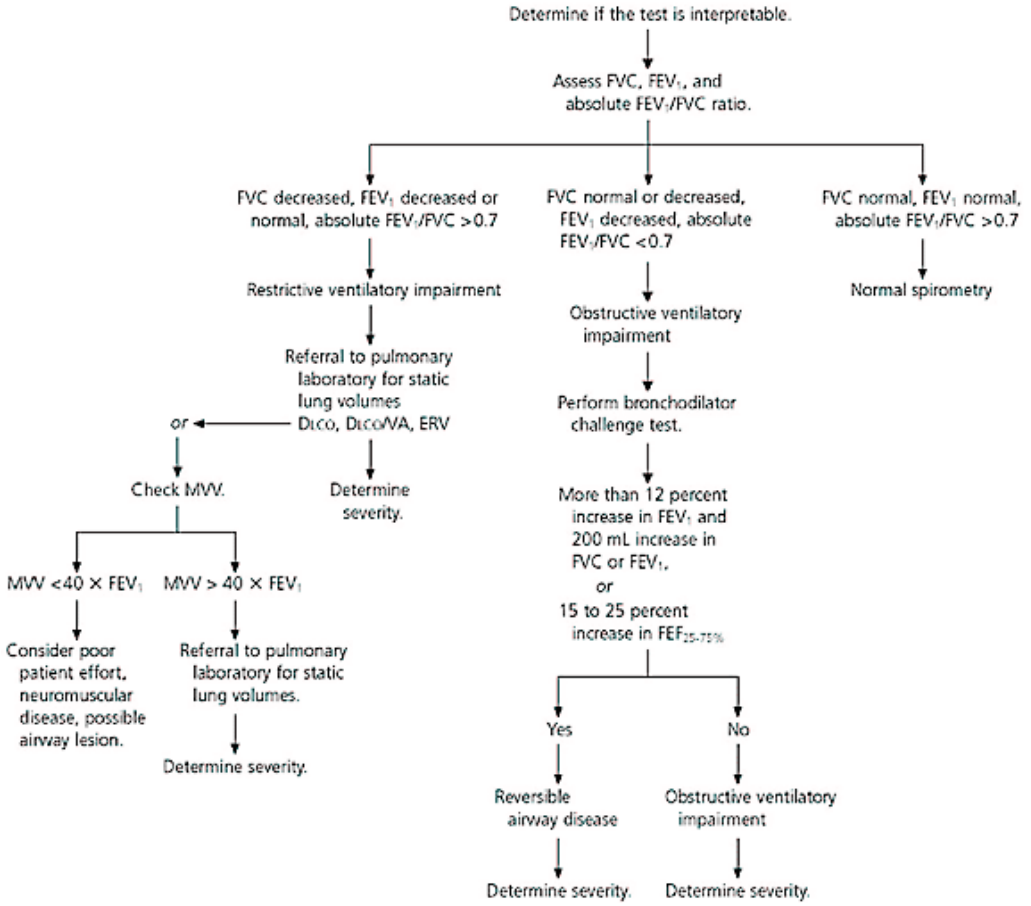

Figure 2. Interpreting Spirometry Results (Barreiro and Perillo, 2004)

For the severity levels of Obstruction/Restriction we have taken into account the patterns disease based on adult ATS/ERS recommendation.

FVC (FEV_6)&FEV_1, % predicted: Normal ≥ 80%; Mild 70-80%; Moderate 60-69%; Moderately severe 50-59%; Severe 35-49%; Very severe <35%

FEV_1/FVC, % predicted: Normal ≥ 70%: Mild 60-69%; Moderate 50-59%; Severe < 50%

We also considered how to define the lower limit of the normal range, presented by Culver (2012).

By applying the algorithm for interpretation of spirometry, as well as the severity of the dysfunctions, we have obtained a presumptive clinical diagnosis.

Table 1. FVC, FEV1, FEV1r parameter extracted from the database

Nr. Crt.	p FVC (litre)	r FVC (litre)	**% FVC**	p FEV1 (litre/sec)	r FEV1 (litre/sec)	**% FEV 1**	p FEV1R (litre/sec)	r FEV1R (litre/sec)	**% FEV1R**
1	3.38	3.71	**110**	2.94	2.98	**101**	0.84	0.80	**95**
2	3.33	3.47	**104**	2.90	2.90	**100**	0.84	0.84	**100**
3	3.73	3.90	**105**	3.25	1.67	**51**	0.84	0.43	**51**
4	3.68	3.66	**99**	3.21	2.57	**80**	0.84	0.70	**83**
5	3.64	3.84	**105**	3.17	2.89	**91**	0.84	0.75	**89**
6	3.99	4.37	**110**	3.49	2.50	**72**	0.84	0.57	**68**

7	4.08	3.91	**96**	3.57	3.23	**90**	0.84	0.83	**99**
8	3.90	3.96	**102**	3.41	2.95	**87**	0.84	0.74	**88**
9	3.64	3.45	**95**	3.17	1.64	**52**	0.84	0.48	**57**
10	3.64	2.91	**80**	3.17	2.39	**75**	0.84	0.82	**98**
11	3.64	2.84	**78**	3.17	2.16	**68**	0.84	0.76	**90**
12	3.77	3.61	**96**	3.29	2.58	**78**	0.84	0.71	**85**
13	3.68	2.99	**81**	3.21	2.30	**72**	0.84	0.77	**92**
14	3.73	3.78	**101**	3.25	2.49	**77**	0.84	0.66	**79**
15	3.68	3.05	**83**	3.21	2.37	**74**	0.84	0.78	**93**
16	3.42	2.71	**79**	2.98	1.97	**66**	0.84	0.73	**87**
17	3.86	2.72	**70**	3.37	2.16	**64**	0.84	0.79	**94**
18	3.86	3.09	**80**	3.37	2.23	**66**	0.84	0.72	**86**
19	3.59	2.61	**73**	3.13	1.58	**50**	0.84	0.61	**73**
20	3.99	3.10	**78**	3.49	1.87	**54**	0.84	0.60	**71**
21	3.95	2.00	**51**	3.45	1.39	**40**	0.84	0.70	**83**
22	3.59	1.57	**44**	3.13	1.14	**36**	0.84	0.73	**87**
23	3.77	2.04	**54**	3.29	1.60	**49**	0.84	0.78	**93**
24	3.37	1.90	**56**	2.94	1.44	**49**	0.84	0.76	**90**
25	3.37	1.64	**49**	2.94	1.48	**50**	0.84	0.90	**107**
26	3.90	1.55	**40**	3.41	1.50	**44**	0.84	0.97	**115**
27	3.90	1.64	**42**	3.41	1.48	**43**	0.84	0.90	**107**
28	3.99	2.24	**56**	3.49	1.34	**38**	0.84	0.60	**71**
29	3.99	1.77	**44**	3.49	1.43	**41**	0.84	0.81	**96**
30	3.77	1.91	**51**	3.29	1.55	**47**	0.84	0.81	**96**
31	3.77	1.81	**48**	3.29	1.38	**42**	0.84	0.76	**90**
32	3.99	1.53	**38**	3.49	1.06	**30**	0.84	0.69	**82**
33	4.26	1.21	**28**	3.73	1.12	**30**	0.84	0.93	**111**
34	3.90	1.79	**46**	3.41	1.18	**35**	0.84	0.66	**79**
35	3.55	1.52	**43**	3.10	1.08	**35**	0.84	0.71	**85**
36	3.55	1.22	**34**	3.10	0.63	**20**	0.84	0.52	**62**
37	3.55	1.02	**29**	3.10	0.78	**25**	0.84	0.76	**90**
38	3.64	1.02	**28**	3.17	0.76	**24**	0.84	0.75	**89**
39	3.77	0.95	**25**	3.29	0.88	**27**	0.84	0.93	**111**
40	3.81	1.02	**27**	3.33	0.82	**25**	0.84	0.80	**95**
41	3.95	1.14	**29**	3.45	0.82	**24**	0.84	0.72	**66**
42	3.37	0.92	**27**	2.94	0.60	**20**	0.84	0.65	**77**
43	3.68	1.36	**37**	3.21	0.90	**28**	0.84	0.66	**79**
44	4.17	1.47	**35**	3.65	0.77	**21**	0.84	0.52	**62**
45	4.17	1.58	**38**	3.65	0.82	**22**	0.84	0.52	**62**
46	3.99	1.77	**44**	3.49	0.65	**19**	0.84	0.37	**44**
47	3.96	1.10	**28**	3.37	0.89	**26**	0.84	0.81	**96**
48	3.46	0.57	**16**	3.02	0.40	**13**	0.84	0.70	**83**
49	3.87	3.08	**78**	3.31	2.22	**65**	0.82	0.71	**85**
50	3.98	4.35	**109**	3.48	2.49	**71**	0.83	0.57	**67**
M	***3.76***	***2.32***	***61.98***	***3.28***	***1.64***	***50.14***	***0.84***	***0.72***	***84.76***
S	***0.22***	***1.05***	***28.06***	***0.19***	***0.73***	***22.71***	***0.003***	***0.127***	***15.37***

FVC=Forced vital capacity; FEV1=Forced expiratory volume - one second; FEV1r=FEV1/FVC ratio (FEV1%) =Tiffeneau-Pinelli index (reactivity index/bronchial permeability); n= predicted values; r= best results obtained; $M = \sum X / N$; S = standard deviation of the sample

In Table 1: FVC, FEV1, FEV1r represent the Spirometry reference values for presumptive clinical diagnosis (Culver et al., 2017).

On the basis of the averages of the reference values obtained by the students, in accordance with table 1, it should be noted that presumptive clinical diagnosis is Restrictive ventilatory impairment: FVC 61.98% ± 28.06, FEV1 50.14 ± 22.71 and FEV1r 84.76 ± 15.37; severity level - Moderate restriction of extra parenchymal cause with combined dysfunction (inspiratory and expiratory), moderately severe obstruction

Individual interpretation of spirometry reference values shows that the students group has all three types of ventilation dysfunctions

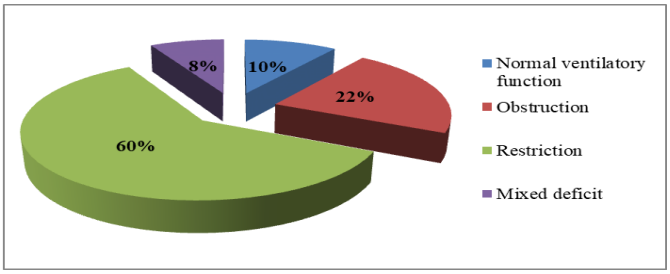

Figure 3. Presumptive clinical diagnosis according to the reference values of spirometry

Figure 3 shows that in presumptive clinical diagnosis dominate Restrictive ventilatory impairment - 60% followed by Normal ventilatory function – 24%, Obstructive ventilatory impairment – 8%, and Mixed deficit – 8%.

Causes of Restrictive lung diseases may be intrinsic or extrinsic to the lung parenchyma. Examples of extrinsic causes are respiratory muscles weakness, chest deformities, or other cardiorespiratory diseases (cardiomegaly, hemothorax, pneumothorax, empyema, pleural effusion or thickening).

Students have no history of lung disease, so the restriction is likely to be of the extra parenchymal cause with combined dysfunction (inspiratory and expiratory)

It shall be specified that values below lower limit of normality (LLN) (PEF and FEF especially $FEF_{25/75}$) are present in all Normal ventilator functions (24%).

The interpretation of values near the LLN is uncertain due to overlapping values between normal low values and those reflecting early disease (Culver, 2012)

In terms of severity level: Restriction is 20% Mild; 20% Moderately Severe; 33.3% Severe; 26.6% Very Severe, Obstruction: 50% Mild and 50% Moderately Severe and Mixed deficit: 25% Very Severe Restriction, Very severe obstruction and 75% Severe restriction and Very severe obstruction.

Before proceeding with a possible functional interpretation of these results, it was necessary to also take into account the other spirometry values.

The FEV_6 - Forced Expiratory Volume after 6 seconds indicates the amount of air exhaled with maximum effort in the first six seconds. This parameter is primarily used to ensure expiratory efforts meet or exceed 6 seconds.

In 2000 Swanney et al., said that "the reproducibility of FEV6 was superior to that of FVC … FEV6 is an accurate, reliable alternative to FVC for diagnosing airway obstruction and that FEV6 is reasonably comparable to FVC for the spirometric diagnosis of restriction. FEV6 is more reproducible and less physically demanding for patients."

When comparing the two averages obtained with the spirometry values, it can be observed that FEV6 67.26±28.32 is greater than FVC 61.98% ± 28.06.

However, this does not influence the clinical diagnosis or severity of diseases. It can be specified, however, that the Moderate severity level is within the range of 60 to 69%. FEV6 values are found to the upper limit, while FVC to the lower limit

DeVrieze and Bhimji (2018) explain the Peak expiratory flow rate (PEFR) as being the maximum flow rate generated during a forceful exhalation, starting from full lung inflation. PEFR primarily reflects large airway flow and depends on the voluntary effort and muscular strength of the patient. For ease of patient interpretation, the colors of a traditional traffic light have been used to designate varying degrees of peak flow limitation (Green, Yellow and Red Zone). Green Zone: ≥ 80%; your asthma is under reasonably good control. Continue your prescribed program of management; Yellow Zone: 50%-80%; Indicates caution. It is time for decisions. Your airways are narrowing and may require extra treatment. Your symptoms can get better or worse depending on what you do, or how and when you use your prescribed medication. You and your healthcare provider should have a plan for yellow zone readings; Red Zone: ≤ 50%; Indicates a medical emergency. Immediate decisions and actions need to be taken. Severe airway narrowing may be occurring. Take your rescue medications right away. Contact your healthcare provider now and follow the plan they have given you for red zone readings.

These should correlate with a written asthma action plan.

The interpretation of PEF results shows that students are at 88% in the Red Zone (indicates a medical emergency) and 12% in the Yellow Zone (indicates caution).

The average obtained is 30.22±13.77which is directed toward the Red Zone. But, from a functional, qualitative point of view, this mark can be interpreted as a low effort by the subjects and also the most likely, low resistance of the expiratory muscles

FEF_{25}, FEF_{50}, FEF_{75} is the Forced Expiratory Flow at 25%, 50%, 75% of FVC and represent the flow rate at the 25%, 50%, 75% point of the total volume (FVC) exhaled. These expiratory flows do not contribute usefully to clinical decision making.

The mid-expiratory flow rate ($FEF_{25–75\%}$) is the average forced expiratory flow rate over the middle 50 percent of the FVC. It can help in the diagnosis of an obstructive ventilator pattern. Because it is dependent on FVC, the $FEF_{25–75\%}$ is highly variable. In the correct clinical situation, a reduction in $FEF_{25–75\%}$ of less than 60 percent of that predicted and an FEV_1/FVC ratio in the low to normal range may confirm airway obstruction (Barreiro and Perillo, 2004)

In our assessments, only 10% of $FEF_{25–75\%}$ cases have values higher than 60% of prediction. The group average recorded low values 36.22±17.73. Only in 16 % of cases is the airway obstruction confirmed, in the other, less than 60% the value reduction is accompanied by FEV1/FVC ratio increased.

The maximal voluntary ventilation (MVV) maneuver is another test that can be used to confirm obstructive and restrictive conditions. The result is extrapolated to 60 seconds and reported in liters per minute. MVV generally is approximately equal to the FEV_1×40 (Barreiro and Perillo, 2004). Evans et al., (2008) and Gold and Koth, (2016), believe that the decrease of MVV depends on poor patient effort, loss of coordination of respiratory muscles, musculoskeletal disease of the chest wall, neurologic disease, and deconditioning from any chronic illness, as well as ventilator defects.

An average of 50.56±23.68 for the MVV assessment (normal ≥0.80) indicates that the MVV is low relative to the FEV1 and suggests poor effort or disease. Most likely it can be interpreted as poor effort more than diseases, because rapid, shallow breathing can compensate effectively for the decreased lung volume

After interpretation of the Spirometry variables, mechanical abnormalities in the respiratory system can be observed. Figure 3 shows that all types of presumptive clinical diagnosis with different degrees of severity are encountered in the evaluation of the student group. Whether FVC,

FEV1, FEV1r represent the reference values, we have taken into account the interpretation of all the spirometry variable for presumptive clinical diagnosis

According to the study published by Lutfi (2017) updating the physiological basis, clinical significance and interpretive approaches to lung volume measurements, a functional approach to spirometry values can be established.

Decreased VC/FVC - Functional meaning:

- decreased/reduced thoracic cage expansion;
- decreased/reduced compliance of the lungs;
- decreased/reduced for both, chest wall expansion and compliance of the lungs;
- so, impossibility to increase the ventilation per minute (to physical effort) which can only by frequency (rapid shallow breathing) can still cope with the demands; this greatly increases the respiratory travail

Decreased FEV_1- Functional meaning:

- decreased/reduced the contraction force of the breathing muscles, especially the forced exhaling muscles;
- decreased/reduced the "springy-ness" or elasticity of parenchyma (decrease the elastic recoil) [emphysema - the lung tissue involved in exchange of gases (oxygen and carbon dioxide) is impaired or destroyed];
- increased the resistance to air flow opposite to peripheral segmentation on airways (chronic bronchitis and asthma)

FEV1r=FEV1/FVCratio (FEV1%) = Tiffeneau-Pinelli index (reactivity index/bronchial permeability) it depends on the strength of the breathing muscles.

- if the force of the breathing muscles is very low, the ability to perform a forced exhale is reduced and the FEV1/FVC ratio will be below the predicted value;
- if the force of the respiratory muscles is preserved, but the thoracic wall is abnormally rigid so that the expiratory position of rest cannot be reached, FEV1/FVC ratio may be normal or increased.

During the clinical reasoning, the therapist analyzes multiple variables contributing to the patient's limited physical capacity and performance. The process is vital, first of all, to make the difference between normal and pathological, and in the case of pathology orientation, the severity level of the pathology should be properly analyzed.

CONCLUSIONS

Within the group of students were 24% smokers, 68% non-smokers and 8% ex-smokers

Evaluation of pulmonary function by use of spirometry revealed all types of presumptive clinical diagnosis with different degrees of severity: 60% - Restrictive ventilatory impairment of the extra parenchymal cause with combined dysfunction (inspiratory and expiratory); 24% - Normal ventilatory function; 8% - Obstructive ventilatory impairment; 8% - Mixed deficit

Following a functional approach, it can be considered:

- decreased compliance of the lungs, chest wall or both*;*
- thoracic wall is abnormally stiff so that the expiratory position of rest cannot be reached*;*
- low resistance of the expiratory muscles*;*
- decreased the contraction force of the breathing muscles, especially the forced exhaling muscles*;*
- poor effort, because rapid, shallow breathing can compensate effectively for the decreased lung volume.

Depending on the deterioration level of the Spirometry values, from the lowest to the least affected, the physiotherapy approach algorithm will be structured taking into account physiological implication.

Although spirometry is a valuable tool, it must be taken in the context of the clinical and functional presentation of the individual being assessed

REFERENCES

Barreiro, T. J., & Perillo, I. (2004). An approach to interpreting spirometry. *American family physician*, 69(5), 1107-1116.

Chhabra, S. K. (1998). Forced vital capacity, slow vital capacity, or inspiratory vital capacity: which is the best measure of vital capacity?. *Journal of Asthma*, 35(4), 361-365.

Crapo, R. O. (1994). Pulmonary-function testing. *New England Journal of Medicine*, 331(1), 25-30.

Culver, B. H., Graham, B. L., Coates, A. L., Wanger, J., Berry, C. E., Clarke, P. K., ... & McCormack, M. C. (2017). Recommendations for a standardized pulmonary function report. An official American Thoracic Society technical statement. *American journal of respiratory and critical care medicine*, 196(11), 1463-1472.

Culver, B. H. (2012). How should the lower limit of the normal range be defined?. *Respiratory Care*, 57(1), 136-145.

DeVrieze, B.W. & Bhimji, S.S. (2018). *Peak Flow Rate Measurement*. Treasure Island, FL: StatPearls Publishing.

Eurostat. Statistic explained (2015). *Proportion of daily smokers of cigarettes, persons aged 15 and over, 2008 or nearest year Health 2015*.

Evans, S., Scanlon, P.D. & Culver, B.H. (2008). Pulmonary function testing. In *Clinical Respiratory Medicine* (pp.147-155).

Garvey, C., Spruit, M. A., Hill, K., Pitta, F., & Shioya, T. (2013). International COPD Coalition Column: pulmonary rehabilitation-reaching out to our international community. *Journal of thoracic disease*, *5*(3), 343–348.

Gold, M.W., & Koth, L.L. (2016). Pulmonary function testing. In *Murray and Nadel's Textbook of Respiratory Medicine (Sixth Edition)*. Vol.1 (pp.407-435).

Holdar, U., Wallin, L., & Heiwe, S. (2013). Why do we do as we do? Factors influencing clinical reasoning and decision-making among physiotherapists in an acute setting. *Physiotherapy Research International*, 18(4), 220-229.

Holmen, T. L., Barrett-Connor, E., Clausen, J., Holmen, J., & Bjermer, L. (2002). Physical exercise, sports, and lung function in smoking versus nonsmoking adolescents. *European Respiratory Journal*, 19(1), 8-15.

Johnson, J.D., & Theurer, W.M. (2014). A stepwise approach to the interpretation of pulmonary function tests. *American Family Physician* 89, 359-66.

Lutfi, M. F. (2017). The physiological basis and clinical significance of lung volume measurements. *Multidisciplinary respiratory medicine*, 12(1), 3.

Miller, A., & Enright, P. L. (2012). PFT interpretive strategies: American Thoracic Society/European Respiratory Society 2005 guideline gaps. *Respiratory care*, 57(1), 127-135.

Miller, M. R., Hankinson, J., Brusasco, V., Burgos, F., Casaburi, R., Coates, R.A., Crapo, R., Enright, P., van der Grinten, C.P., Gustafsson, P., Jensen, R., Johnson, D.C., MacIntyre, N., McKay, R., Navajas, D., Pedersen, O.F., Pellegrino, R., Viegi, G., & Wanger, J. (2005). Standardisation of spirometry. *European Respiratory Journal*, 26, 319-338;

Peno-Green, L, Verrill, D, Vitcenda, M, Macintyre, N, Graham, H, American Association of Cardiovascular and Pulmonary Rehabilitation (AACVPR) (2009). Patient and program outcome assessment in pulmonary rehabilitation: an AACVPR statement. *Journal of Cardiopulmonary Rehabilitation and Prevention*, 29(6), 402-10.

Rochat, M. K., Laubender, R. P., Kuster, D., Braendli, O., Moeller, A., Mansmann, U., ... & Wildhaber, J. (2013). Spirometry reference equations for central European populations from school age to old age. *PloS one*, 8(1), e52619.

Smith, L. J., Arynchyn, A., Kalhan, R., Williams, O. D., Jensen, R., Crapo, R., & Jacobs Jr, D. R. (2010). Spirometry guidelines influence lung function results in a longitudinal study of young adults. *Respiratory medicine*, 104(6), 858-864.

Swanney, M. P., Jensen, R. L., Crichton, D. A., Beckert, L. E., Cardno, L. A., & Crapo, R. O. (2000). FEV6 is an acceptable surrogate for FVC in the spirometric diagnosis of airway obstruction and restriction. *American Journal of Respiratory and Critical Care Medicine*, 162(3), 917-919.

Submitted:	Revised:	Accepted and published online
July 15, 2019	November 20, 2018	December 13, 2019

Analele Universităţii din Oradea. Facicula Educaţie Fizică şi Sport
E-ISSN **2286-2870**, ISSN **1224-5100**

XXIX, **2019,** pp.33-37
Article no. **29105-858**

THE CORRELATION BETWEEN PHYSICAL ACTIVITY AND ACADEMIC RESULTS OF STUDENTS FROM PARTIUM CHRISTIAN UNIVERSITY

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Abstract: Recent studies showed that regularly practiced physical activity is associated with good academic results, a positive impact on cognitive skills and an increase of the IQ. Academic results may be indicators of the intelligence levels of the students, but there are very few researches regarding the effects of physical activity on academic results. This study aims to analyze the relation between physical activity and academic performance. We performed a cross-sectional study on a sample group of 52 students from Partium Christian University. The students filled out standardized questionnaires about their physical activity levels and they indicated their general average grades they had obtained in the first semester of the 2018-2019 academic year. According to the results we encountered a statistically insignificant negative correlation between academic results and physical activity levels (Spearman rho = - 0.121, df = 50, p = 0.39; r = - 0.05, df = 52, p = 0.73,).

Key words: physical activity, academic results, body mass index, student

* * * * * *

INTRODUCTION

The advantages of practicing physical activities by different categories of the population are often presented in the specialty literature. Insufficient physical activity and low values of physical fitness in case of adult people are associated with high morbidity and mortality rates (Blair and Brodney, 1999). According to the National Institute of Statistics (2013), our country has almost the lowest life expectancy in the European Union occupying the 25th place on the list containing the total of 28 member states.

According to studies, sedentary lifestyle may lead to the appearance of certain health problems. Regularly practiced physical activity develops and maintains bone and muscle health, reduces the risk of developing obesity and chronic diseases, depression, anxiety, and induces a state of well-being. In order to maintain and improve cardiovascular fitness, to increase muscle fitness and to maintain bone health, World Health Organization recommends the practiced physical activity to be mostly moderate and intense.

Dishman, Heath & Lee (2013) define physical activity as being "any movement of the body associated with muscle contraction which increases energy consumption over the resting level" (p. 41).

According to World Health Organization (2013), out of the 80% of countries which declared having policies, plans or strategies to increase physical activity levels, only 56% were operational. Only 8% of the countries wished to promote regular physical activity by reducing

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taxes for sports equipment, programmes and memberships in fitness clubs, and increasing taxes for equipment which encourages developing a sedentary lifestyle. Finland and Canada reported the increase of physical fitness of their population in the last decade (Vuori et al., 2004; Muhajarine et al., 2012).

According to the World Health Organization's report (2015), physical activities bring health benefits and reduce the risk of developing cardiovascular diseases or others related to high blood pressure, diabetes or different types of cancer. At the same time, it reduces stress, anxiety and depression and may delay the onset of the Alzheimer's disease. Insufficient physical activity is responsible for 3.2 million deaths annually (Lim et et al., 2012).

In the last few years researchers looked to highlight the advantages that regularly practiced physical activities have on cognitive skills and academic performance (Best, 2010; Sibley and Etnier, 2003).

It has been proven that regular practicing of physical activity triggers a change in the human brain, due to the increased metabolism, oxygenation and blood flow, resulting hormones which promote neurological health (Whiteman et al., 2014; Baidog and Herman, 2018; Papp et al., 2019). Recent studies showed that regularly practiced physical activity is associated with good academic results, a positive impact on cognitive skills (Haapala, 2013), social behavior or relationships (Lees and Hopkins, 2013; Tătar et al., 2018), and the increase of the IQ level (Corder, 1966; Ji-ying and Jie, 2000).

Academic results may indicate the intelligence levels of the students, but there are very few researches about the effects of physical activity on academic results.

For the year 2019, budgetary credits were provided through the education budget allocation, in the amount of 39,394.2 million lei. Identifying the relation between physical activity and academic results may create educational policies and practical study methods, increasing the importance of physical education classes within university education.

Measuring physical activity levels is a precondition for monitoring the health status of the population. The international questionnaire for measuring physical activity (IPAQ - International Physical Activity Questionnaire) represents a self-administered standardized instrument.

IPAQ uses a unit of measurement called metabolic equivalent or MET, that is the metabolic cost (oxygen consumption) of physical activity. A MET is the metabolic equivalent of the body when sitting quietly (approximately 3.5 ml/kg/min or 1 kcal/kg body weight/h) and it refers to the calorie consumption in different situations: walking 3.3 MET/min, moderate-intensity physical activity 4 MET/min, vigorous-intensity physical activity 8 MET/min. The IPAQ values are expressed in MET/min/week.

MATERIALS AND METHODS

The study was performed on a sample group of 52 students, 35 women and 17 men, from the Faculties of Letters, Arts, Economic and Social Sciences of Partium Christian University from Oradea. The students were selected from both urban and rural areas, and the measurements and the filling out of the questionnaires were performed between May the 13^{th} – 14^{th}, 2019. All students gave their consent to this study.

For this study we used the anthropometric method to measure the two somatic indicators: height and weight using a Seca 213 (Marsden, UK) height measure and an Omron BF511 digital scale (Omron Corporation, Kyoto, Japan). We know that the genetic inheritance and the rate of growth and development are different for each person. Thus, after calculating the BMI, the results are compared with the reference values, observing the growth path corresponding to each gender and age. In order to determine these values we used the EXCEL BMI calculator after Barlow (2007) (table 1).

This programme analyses and interprets the results according to the reference values depending on gender and age, providing this way a true image on overweight and obesity among the people of the sample group.

Table 1. Body mass index percentile categories (Barlow, 2007)

BMI Percentile	Nutritional Status
BMI<5 percentile/gender/age	Underweight
BMI between 5-84 percentile/ gender/age	Normal weight
BMI between 85-95 percentile/ gender/age	Overweight
IMC ≥ 95 percentile/ gender/age	Obesity

In order to measure the levels of physical activity, we used the IPAQ questionnaire. The seven questions of the questionnaire are oriented towards the physical activities practiced during the week preceding the filling out of the questionnaire. The questions are related to the frequency and intensity (light, moderate, vigorous) of the activities. The questions refer to sports as well as to other activities performed during free time.

The data of the individual measurements was statistically analysed on a computer using the Statistical Package for Social Sciences software: version 20.0 SPSS Inc. (SPSS). We performed the descriptive analysis (weighted mean (Xp), standard deviation (τ)), the testing of the normality of the distribution with the Kolmogorov-Smirnov test, and we calculated the relation between the two variables using the Pearson and Spearman correlation coefficient (rho).

RESULTS

After processing the collected data, we found that 35 women and 17 men participated to the measurements. The average height and weight values are higher for men than for women by 15.15 cm, respectively 21.42 kg (table 2).

Table 2. Mean values and standard deviations of height, weight, BMI, IPAQ and academic results

Gender	N	Height	Weight	BMI	IPAQ	Academic Results
		M (SD)	M (SD)	M (SD)	M (SD)	M (SD)
Women	35	164.03±7.13	63.40±9.19	23.56±3.21	2367.10±2916.47	8.09±1.20
Men	17	179.18±6.24	84.82±15.42	26.34±3.99	4293.20±2589.98	7.68±1.02

The registered data show that 38 subjects out of the total of 52 had normal weight for their age. A number of 10 subjects were overweight and 3 students were classified as obese (table 3).

Table 3. Distribution of BMI depending on the gender of the subjects

BMI Percentile / Nutritional Status	Women		Men	
	N	%	N	%
Underweight	1	3	0	0
Normal weight	28	80	10	59
Overweight	6	17	4	23
Obesity	0	0	3	18
Total	35	100	17	100

The Kolmogorov-Smirnov test showed a normal distribution of the academic results ($df = 52$, $p = 0.185$) and without a normal distribution in case of the levels of physical activity ($df = 52$, $p < 0.001$). In order to see the correlation between physical activity levels and academic results, we

used the Pearson (parametric) and Spearman (non-parametric) correlation coefficient. It resulted a statistically insignificant negative correlation between the academic results and the levels of physical activity (Spearman rho = - 0.121, df = 50, p = 0.39; r = - 0.05, df = 52, p = 0.73,).

CONCLUSIONS

The number of students with weight problems was higher among men (7 subjects) than among women (6 subjects) reaching a percentage of 25.30% of the sample group.

The correlation between academic results and the levels of physical activity is statistically insignificant (Spearman rho = - 0.121, df = 50, p = 0.39; r = - 0.05, df = 52, p = 0.73,).We met one women and no man in the underweight category.

We consider that there are necessary additional measurements for a larger and representative sample.

REFERENCES

Baidog, A. & Herman, G.V. (2018). The influence of Sports and Physical Activity on the Metabolic Syndrome: A Systematic Review. Analele Universităţii din Oradea. *Facicula Educaţie Fizică şi Sport*, 28, 39-45.

Barlow, S. E. (2007). Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: summary report. *Pediatrics*, 120(Supplement 4), 164-192.

Best, J. R. (2010). Effects of physical activity on children's executive function: Contributions of experimental research on aerobic exercise. *Developmental Review*, 30(4), 331-351.

Blair, S. N., & Brodney, S. (1999). Effects of physical inactivity and obesity on morbidity and mortality: current evidence and research issues. *Medicine and science in sports and exercise*, 31(11), 646-662.

Corder, W. O. (1966). Effects of physical education on the intellectual, physical, and social development of educable mentally retarded boys. *Exceptional Children*, 32(6), 357-366.

Dishman, R., Heath, G., & Lee, I. M. (2013). *Physical activity epidemiology 2nd edition*. Human Kinetics.

Haapala, E. A. (2013). Cardiorespiratory fitness and motor skills in relation to cognition and academic performance in children–a review. *Journal of human kinetics*, 36(1), 55-68.

Institutul Național de Statistică. (2013). *Speranța de viață. București, România*.

Ji-ying, Y., & Jie, Z. (2000). Effects of Basic Gymnastics Exercise on Children's Intelligence Development. *Sports Science*, 20(2), 75-79.

Lees, C., & Hopkins, J. (2013). Peer reviewed: effect of aerobic exercise on cognition, academic achievement, and psychosocial function in children: a systematic review of randomized control trials. *Preventing chronic disease*, 10.

Lim, S. S., Vos, T., Flaxman, A. D., Danaei, G., Shibuya, K., Adair-Rohani, H., & Memish, Z. A. (2012). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet, London*, 380(9859), 2224–2260.

Muhajarine, N., Labonte, R., & Winquist, B. D. (2012). The Canadian Index of Wellbeing: key findings from the healthy populations domain. *Canadian Journal of Public Health*, 103(5), 342-347.

Organizația Mondială a Sănătății. (2013). *Country profiles on nutrition, physical activity and obesityin the 53 WHO European Region Member States. Methodology and summary, Copenhagen*, Denmark: OMS Regional Office for Europe.

Organizatia Mondială a Sănătății. (2014). *Global Status Report on Non Communicable Diseases*.

Organizația Mondială a Sănătății. (2015). *Physical activity strategy for the WHO European Region 2016-2025*. Vilnius, Litvania.

Papp, B. M., Șerbescu, C., Caciora, T., Baidog, A., Olău, V., M. (2019). The Effects of a Physical Activity Program on Body Composition and Physical Condition in the Overweight Adult. Analele Universităţii din Oradea. Facicula Educaţie Fizică şi Sport, 29(2), 1-9.

Sibley, B. A., & Etnier, J. L. (2003). The relationship between physical activity and cognition in children: a meta-analysis. *Pediatric exercise science*, 15(3), 243-256.

Tătar, C. F., Herman, G. V., & Pețan, P. (2018). Sport and physical activity engagement in Romania. *Geosport for Society*, 8(1), 40-50.

Vuori, I., Lankenau, B., & Pratt, M. (2004). Physical activity policy and program development: the experience in Finland. *Public health reports*, 119(3), 331-345.

Whiteman, A. S., Young, D. E., He, X., Chen, T. C., Wagenaar, R. C., Stern, C. E., & Schon, K. (2014). Interaction between serum BDNF and aerobic fitness predicts recognition memory in healthy young adults. *Behavioural brain research*, 259, 302-312.

Submitted:	Revised:	Accepted and published online
July 03, 2019	December 02, 2019	December 30, 2019

Analele Universităţii din Oradea. Facicula Educaţie Fizică şi Sport
E-ISSN **2286-2870**, ISSN **1224-5100**

XXIX, **2019,** pp.38-42
Article no. **29106-859**

ASPECTS REGARDING MOVEMENT COMBINATION POSSIBILITIES TO OPTIMIZE THE THIRD PART OF THE PHYSICAL EDUCATION LESSONS

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Abstract: Developing creativity has been a topical theme in all areas. In the field of physical activity, the term creativity is familiar, whether it is physical education or sports. However, we can see a lack of involvement, creativity in the physical education lesson, both on the part of the teachers and the students from the faculties. In view of these considerations, we believe that our intervention is opportune because in the preparatory part of the physical education lesson, it is possible to associate and realize multiple variants of walking, running, jumping, use of objects, balls, ladders, movement games, etc. and, in this way, the teacher can express his creativity in a particular way. In this regard, we propose a creative development variant, a "creative clock", to support those interested in optimizing the ways to achieve the third link in the physical education lesson.

Key words: physical education lesson, third link of the lesson, analytical exercise

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INTRODUCTION

In the current context, physical education can no longer be considered just a subject in the curriculum, a formal obligation for teachers and students or an exclusively practical activity, constrained in rigid patterns that stopped responding the options of the practitioners or the requirements in the motric education field (Heemskerk et al., 2019). The evolution of the concept of the practice of physical exercise and the emergence of natural factors and social variables impacting the body require developing a long-term strategy, part of coherent educational policies and health, focused on the individual and his needs of integral development (Bota and Teodorescu, 2010; Papp et al., 2019).

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Physically active lessons are designed to increase children's PA levels without reducing academic time by integrating PA into lessons in learning areas other than physical education (Soltero et al., 2019). Recent systematic reviews and meta-analyses have related physically active lessons in school to improved health, enhanced cognitive function and increased academic performance. In this manner of approach, physical education can present as part of their formative motric activities, a coherent system with multiple influences on personality development (Skage and Dyrstad, 2019). This passage can discuss physical education as a subject turned into physical education as a lifestyle (Rață and Rață, 2008; Baidog et al., 2018; Tătar et al., 2018).

ARGUMENT

Analytical exercises are one of the basic means of gymnastics and consist of a variety of movements (artificial) created by the people for the harmonious development of the body morphologically and functionally, to improve opportunities for coordinaton and mobility (Sabău and Boldor, 2015).

Due to the huge diversity of analytical exercises, over the years they were known by different names: exercises of general physical development, harmonious physical development exercises, physical training exercises, exercises for analytical processing and selective musculoskeletal system. All these names demonstrate the wide practicality of this range of exercises.

The term of analytical exercises that is used today is best for correctly defining the means of gymnastics, justifying global processing body movements with the whole body and its segments. Therefore, analytical exercises are all the consciously exercises that are directed to perform all movements with maximum efficiency required by the environment in which people operate in a certain period of time. So, these exercises are aimed at developing the body in the context of interaction between the man and the environment.

Among the functions analytical exercises perform there can be found that of "preparing the body to carry out efforts" (known as the heater body), by Mărcuț and Cucu, 2005.

Preparing the body to carry out efforts is one of the important roles of analytical exercises, that is the third link of the physical education class. Using analytical exercises we can locate movements in all joints and muscle groups that will support the work of the body. Also, by the possibility of rationally dosing the effort by using these exercises, large functions are prepared for the normal activity of all systems, apparatuses and organs.

PROPOSAL

Since the link of the third lesson of physical education raises issues of creativity finding new exercises, we set out to design anaccessible, understandable model that provides effective solutions to students from the faculties of education physical and specialist teachers (Cristea, 2015).

Thuswe placed a position on the face of a clock every hour that can be the initial or the final position of an exercise. The 12 principal positions and derivatives of the body allow multiple combinations with an effective location based on the themes of the lesson (figure 1).

It can be seen that the sequence of these positions is not random, but comply with the composition of complex harmonious physical development with arm exercises in standing, then engaged and trunk movement of twisting, bending, bending and progressive passage in the lower position with liftable stand (in the counter clock wise movement).

The distribution of positions on the dial was as follows:

12 o'clock - standing;

1 o'clock- standing with the arms raised in front;

2 o'clock - standing with arms folded, hands on the shoulders;

3 o'clock - sitting with side arms;

4 o'clock– standing with the legs apart, the trunk bent, arms folded, hands on the neck;

5 o'clock - standing bent away;
6 o'clock -standing with the legs apart, body bent;
7 o'clock - support squat;
8 o'clock - support lying in front;
9 o'clock - seated supported by arms;
10 o'clock – lying on the back with arms in front;
11 o'clock - lying with the arms folded, palms on the ground near the chest.

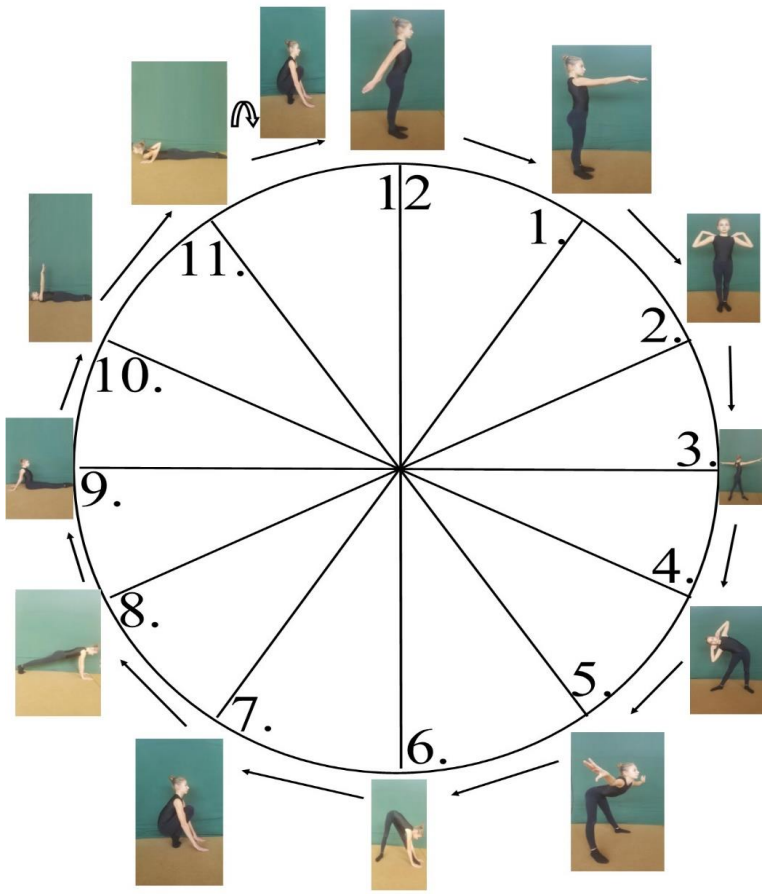

Figure 2. Creative clock

How do we succeed in creating new exercises?
Example:
Ex 1. P.I. Standing:
Ex 1. Standing PI:
1. Lifting the arms forward;
2. Bending the arms, hands on the shoulders;
3. Left side step by stretching the arms sideways;
4. IP comeback;
5-8. to the right.
Ex. 2. PI Standing with the arms forward:

1. Bending arms with hands on shoulders;
2. Step left side and twisting the trunk to the left;
3. Arching;
4. Comeback in IP.
5-8 to the right.
Ex. 3. IP. Standing with the legs apart and the arms sideways:
1. The twisting of the trunk to the left;
2. Comeback in IP;
3. Bending of the trunk to the left with arms folded, hands on the shoulders;
4. comeback in IP;
5-8 to the right.
Ex. 4. IP Standing with the legs apart and the arms sideways:
1. The bending of the trunk in front;
2. Bending of the torso forward;
3. Arching;
4. Comeback in IP.
Ex. 5. IP Support in squat:
1. By jumping, passing in support lying forwards;
2.1800 twist to the left in support lying backwards;
3. 1800 twist to the right in support lying forwards;
4. By jumping, comeback to IP.
Ex. 6. IP. Sitting support:
1. Passing in the lying dorsal position with the arms forwards;
2. Rolling laterally to the left, lying face down;
3. Rolling laterally to the right, lying on the back arms forwards;
4. Lifting of the trunk from a sitting position in support.

DISCUSSIONS

We specified certain fundamental positions of the body that may be the initial, intermediate and final positions of the exercises for harmonious physical development, enabling students and specialized staff to develop their imagination and creativity.

We proposed a taught approach of the exercises for a harmonious physical development, starting in high positions, switching to the lower ones, making the final standing position, respecting the educational requirements.

Movements performed with the arms, the trunk and the legs show a logical, flowing succesion.

The transition from one position to another or by stepping aside (left / right), forward, backward, or by jumping, easily allows the diversification of the exercises so as not to repeat the same position. The exercises proposed by us may also be performed with portable objects.

Innovation and change are essential requirements in physical education lessons to overcome monotony / capping on the one hand and on the other hand the stimulation of an attractive lesson.

CONCLUSIONS

Exercises of harmonious physical development have great significance in the economy of physical education time, the difficulties increase the time allocated to the links.

Harmonious combination of physical development exercises in a form suitable for creativity and ingenuity come from the teacher. This one can combine postures consistent with the objectives of the lesson topics.

Slot assignment circularilyon the dial of the clock face provides an overview of the possibilities of combining them.

Positions of the body can be combined in different times so as to create effective exercises, movements being in a logical concatenation.

The face of the clock proposed supports students and physical education teachers who sometimes, for convenience, use the same exercises that you have learned since childhood.

REFERENCES

Baidog, A. & Herman, G.V. (2018). The influence of Sports and Physical Activity on the Metabolic Syndrome: A Systematic Review. *Analele Universităţii din Oradea. Facicula Educaţie Fizică şi Sport*, 28, 39-45.

Bota, A., & Teodorescu, S. (2010). *Educaţia fizică-Disciplină în planul de învăţământ*. Ed. Discobolul.

Cristea, D. I. (2015). Considerations regarding creativity in physical education class. *Analele Universităţii din Oradea, Fascicula de Educaţie Fizică şi Sport*, 25, 46-50.

Heemskerk, C. H., Lubans, D., Strand, S., & Malmberg, L. E. (2019). The effect of Physical Education lesson intensity and cognitive demand on subsequent learning behaviour. *Journal of Science and Medicine in Sport.*

Marcut, P., & Cucu, B. (2005). *Gimnastica în kinetoterapie*, Editura GMI, Cluj Napoca.

Papp, B. M., Șerbescu, C., Caciora, T., Baidog, A., & Olău, V., M. (2019). The Effects of a Physical Activity Program on Body Composition and Physical Condition in the Overweight Adult. *Analele Universităţii din Oradea. Facicula Educaţie Fizică şi Sport*, 29(2), 1-9.

Raţă, G., & Raţă, G. (2008). Educaţia fizică şi metodica predării ei. *Editura PIM*, Iaşi.

Sabău, A., & Boldor A. (2015). Efectiveness of the means used to develop coordination abilities in the optional activities at pre-school (Kindergarten). *Analele Universităţii din Oradea, Fascicula Educaţie Fizică şi Sport*, 25, 99-106.

Skage, I., & Dyrstad, S. M. (2019). 'It's not because we don't believe in it...': Headteachers' perceptions of implementing physically active lessons in school. *BMC Public Health*, 19(1), 1674.

Soltero, E. G., Parker, N. H., Mama, DrPH, S. K., Ledoux, T. A., & Lee, R. E. (2019). Lessons learned from implementing of garden education program in early child care. *Health promotion practice*, 1524839919868215.

Tătar, C. F., Herman, G. V., & Pețan, P. (2018). Sport and physical activity engagement in Romania. *Geosport for Society*, 8(1), 40-50.

Submitted:	Revised:	Accepted and published online
November 05, 2019	December 12, 2019	December 30, 2019

A N A L E L E UNIVERSITĂŢII DIN ORADEA.
FASCICULA EDUCAŢIE FIZICĂ ŞI SPORT

CONTENTS

E-ISSN 2286-2870, ISSN 1224-5100