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CASE STUDY ON CARDIAC FREQUENCY DURING THE PHYSICAL EDUCATION CLASS OF THE 5TH GRADE. ASPECTS RELATING TO THE PREPARATION OF THE BODY FOR EFFORT AND SELECTIVE INFLUENCING OF THE LOCOMOTOR APPARATUS

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ABSTRACT. The paper underlines the results of cardiac frequency recordings taken during a physical education class at 5th grade level, aspects relating to the preparation of the body for effort (stage 2) and the selective influencing of the locomotor apparatus (stage 3) throughout the course of ten lessons with various themes and goals, on a number of four 11 years old, male gender subjects. After recording and processing the data with the aid of materials indispensable for such a study, namely Polar M400 watches and H7 belts, we have performed their interpretation on the average cardiac frequency both at the beginning as well as in the end of stages 2 and 3 in order to observe the dynamics of the effort recorded during this part of the lesson and to see whether it is an ascending one towards the fundamental part of the physical and sports education class.

***Keywords*:** dynamic of effort, cardiac frequency, physical education class, Polar M400 watch, H7 belt.

REZUMAT. ***Studiu de caz privind frecvența cardiacă în cadrul lecției de educație fizică și sportivă la clasa a V-a: aspecte cu privire la pregătirea organismului pentru efort și influențarea selectivă a aparatului locomotor***. Lucrarea subliniază rezultatele înregistrării frecvenței cardiace în cadrul lecției de educație fizică și sportivă la nivel de clasa a V-a, aspecte cu privire la pregătirea organismului pentru efort (veriga 2) și influențarea selectivă a aparatului locomotor (veriga 3) pe decursul a zece lecții cu teme și obiective diferite, având un număr de patru subiecți de sex masculin și vârsta de 11 ani. După înregistrarea și prelucrarea datelor cu ajutorul materialelor indispensabile unui astfel de studiu precum ceasuri Polar M400 și centuri H7, am facut interpretarea acestora pe media frecvenței cardiace atât la începutul cât și la finalul verigilor 2 și 3 pentru a observa dinamica efortului care se înregistrează pe această parte a lecției și dacă este una ascendentă spre partea fundamentală a lecției de educație fizică și sportivă.

***Cuvinte-cheie*:** dinamica efortului, frecvența cardiacă, lecția de educație fizică și sportivă, ceas Polar M400, centură H7

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Introduction

The authors of this paper believe that an interpretation of the values for cardiac frequency for stages 2 (preparation of the body for effort) and 3 (selective influencing of the locomotor apparatus) is very useful for all those involved in the education system in order to verify the hypothesis stating that "the dynamics of effort in the physical education class records an ascending curve throughout the first three stages" (Raţă & Raţă, 2008, p. 51). Participation at 10 lessons with various themes and goals for the physical education class of the 5th grade at the "Ion Creangă" Middle School from Cluj-Napoca, has allowed for the gathering of a series of data regarding cardiac frequency throughout the entire duration of a lesson for the four male gender subjects, with the aid of four Polar M400 watches and four H7 belts. After data processing, we were interested in cardiac frequency at the beginning and conclusion of stages 2 and 3, and had the possibility to analyse the evolution of such cardiac frequency on these stages.

Objectives

The objective of the study was the monitoring of the average cardiac frequency in 5th graders during the physical and sports education class for stage 2: preparation of the body for effort, and stage 3: selective influencing of the locomotor apparatus, with an aim at analysing the effort's diagrams on these two stages.

Materials and Methods

The place of development of this study was the „Ion Creangă" Middle School from Cluj-Napoca, 5th grade, and the duration of the study was ten classes starting with the first recording on November 5 2015 and ending on April 12 2016. Throughout the study, the subjects were 4 males with the following particularities (table 1):

Table 1. Particular characteristics of the subjects

Subject	Name	Age	Gender	Height/weight	Level of preparation
S1	P.A.	11 years	M	165cm/65kg	Good
S2	S.G.	11 years	M	160cm/53kg	Good
S3	G.D.	11 years	M	160cm/50kg	Average
S4	F.I.	11 years	M	158cm/51kg	Average

The indispensable materials used for the development of such a study are: Polar M400 watches (Figure 1) and H7 belts (Figure 2) for recording of the cardiac beat:

Figure 1. Polar M400 watch (Time 2 Sport, n.d.)

Figure 2. H7 Belt (Polar, n.d.)

With the aid of such materials we have recorded cardiac frequency during each second of the physical and sports education class and, at the end of the lesson, the watch offers us the recording about the average cardiac frequency throughout the class as well as the diagram for effort during the activity, by means of the Polar Flow web service (Figure 3).

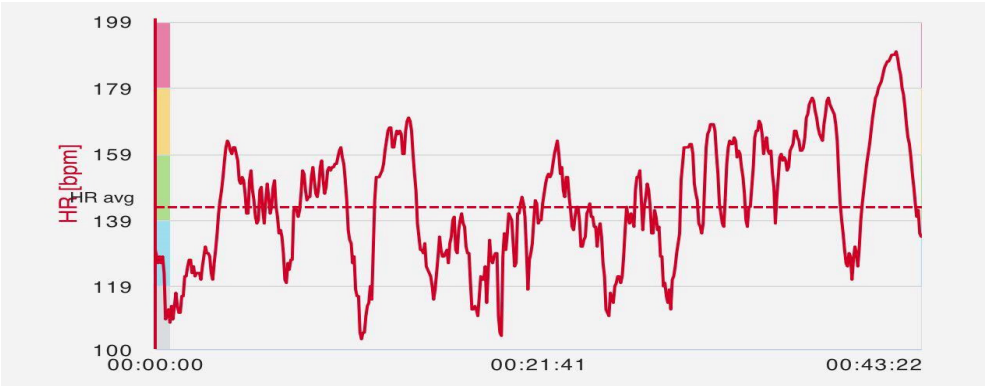

Figure 3. Cardiac frequency recording model for Polar watch and H7 belt

The interpretation of results was achieved based on the recordings of each subject in part throughout the ten lessons with different themes, the emphasis being placed on the average cardiac frequency at the onset and conclusion of stages 2 and 3.

Lesson 1 - Date: 05.11.2015, Theme: Strength: development of strength in the muscles of the abdomen and back;

Lesson 2 - Date: 12.11.2015, Theme: Basketball: consolidation of dribbling and shooting hoops;

Lesson 3 - Date: 19.11.2015, Theme: Football: consolidation, in match conditions, of ball hitting with the inner side of the foot.

Lesson 4 - Date: 28.01.2016, Theme: Speed: development of speed in the form of relay race; Basketball: Consolidation of dribbling in the basketball game; Endurance: development of endurance in an aerobic regime;

Lesson 5 - Date: 08.03.2016, Theme: Basketball: Consolidation of hoops' shooting; Strength: development of general strength;

Lesson 6 - Date: 15.03.2016, Theme: Gymnastics: evaluation of buck jumps when the buck is placed transversally;

Lesson 7 - Date: 22.03.2016, Theme: Gymnastics: evaluation of buck leaps; Endurance: development of endurance in an aerobic regime;

Lesson 8 - Date: 05.04.2016, Theme: Basketball: consolidation of dribbling and hoop shooting; Endurance: development of endurance in an aerobic regime;

Lesson 9 - Date: 08.04.2016, Theme: Evaluation: standing jump; Endurance: development of endurance in an aerobic regime;

Lesson 10 - Date: 12.04.2016, Theme: Speed: development of reaction speed with take-off from different positions; Basketball: consolidation of dribbling and basketball passes using two hands and starting from the chest area;

Actuating systems during the ten physical education classes recorded for stage 2 - preparation of the body for effort, with duration of approximately 8 minutes, have had the same succession of exercise, namely:

● walking and variants of walking (toe walking with arms raised, heel waling with hand behind the head, walking while raising one knee up-forward, thrust walking).

● running and variants of running (light running, running with ankle play, running while raising the knees up-forward, running while swinging the calves forward, springing while raising arms alternatively, jumping while raising arms alternatively, running with added pace, running with stepped pace, backward running, accelerated running).

With regard to stage 3 - selective influencing of the locomotor apparatus, the actuation systems are based, in all lessons, on the same analytical exercises for segments and parts of the body, with an average duration of 7 minutes.

Results

Subject 1 in addition to the physical education class, also practices sporting activities within an organized frame, respectively rugby and basketball. The analysis of the cardiac frequency will be performed based on the initial cardiac frequency (FCÎ) and final cardiac frequency (FCF) for all ten lessons, for stages 2 and 3 (Figure 4).

	V1		V2		V3	
Lesson	FCÎ	FCF	FCÎ	FCF	FCÎ	FCF
1	92	116	117	135	120	122
2	111	127	126	147	132	110
3	83	113	137	141	116	141
4	107	121	122	168	141	140
5	89	108	110	120	111	127
6	101	103	107	127	120	130
7	108	125	124	139	129	126
8	109	110	112	168	130	152
9	113	110	120	175	160	153
10	100	105	112	149	134	164
Average	101	114	119	147	129	137

Figure 4. Recordings of cardiac frequency for subject 1

For stage 2, subject 1 has an average of the initial cardiac frequency (FCÎ) for all ten classes, of 119 beats/minute while at the end of the body's preparation for effort; the average is above 147 beats/minute, the highest among all subjects. Up until starting stage 3, C.F (Cardiac frequency) has gone down by a few beats reaching an average of 129 beats/minute, while at the conclusion of this stage recordings indicate, an average of just 8 additional beats, namely 137 beats/minute, the highest values recorded for the average of all ten classes for all 4 subjects.

Subject 2 is a member of the school basketball team, with a good physical training, with the following readings (Figure 5):

	V1		V2		V3	
Lesson	FCÎ	FCF	FCÎ	FCF	FCÎ	FCF
1	92	135	121	156	117	121
2	95	107	106	126	115	105
3	105	135	135	154	108	146
4	96	105	107	132	120	143
5	95	109	113	130	115	150
6	98	101	106	126	123	131
7	100	117	120	138	128	123
8	99	104	110	157	120	148
9	112	117	133	162	150	136
10	95	100	105	149	130	150
Average	99	113	116	143	123	135

Figure 5. Recordings of cardiac frequency for subject 2

For stage 2, subject 2 has an average of the initial cardiac frequency (FCÎ) for all ten classes, of 116 beats/minute while at the end of the body's preparation for effort the average 143 beats/minute.

For the start of stage 3, C.F (cardiac frequency) has gone down to an average 123 beats/minute, measuring the lowest value among all subjects, while at the end of the stage, an average of 12 additional beats, namely 135 beats/minute was recorded, lower than that of subject 1 by two steps.

Subject 3 does not practice any other physical activities and, throughout the ten classes had the following readings (Figure 6):

	V1		V2		V3	
Lesson	FCÎ	FCF	FCÎ	FCF	FCÎ	FCF
1	88	120	112	140	121	126
2	97	125	124	148	130	111
3	90	110	135	140	109	140
4	100	109	120	163	140	145
5	93	107	112	129	115	129
6	100	102	103	119	122	129
7	93	111	119	136	127	123
8	101	103	108	155	125	145
9	113	115	127	160	146	132
10	99	101	103	147	129	149
Average	97	110	116	144	126	133

Figure 6. Recordings of cardiac frequency for subject 3

For stage 2, subject 3 has an average of the initial cardiac frequency (FCÎ) of 116 beats/minute, just like subjects 1 and 2 while, at the end of the body's preparation for effort, the average is 144 beats/minute, measuring the second value after subject 1, with the remark that, during such phase, the subjects were the first to perform their exercise and were the models for the others. For the beginning of stage 3, the average C.F (cardiac frequency) is of 126 beats /minute, while at the end of the stage, the average recorded was 133 beats/minute.

Subject 4 does not practice any other physical activities and had the following readings throughout the ten classes (Figure 7):

	V1		V2		V3	
Lesson	FCÎ	FCF	FCÎ	FCF	FCÎ	FCF
1	90	117	120	136	120	123
2	93	109	108	128	118	108
3	90	110	135	140	109	140
4	108	110	122	132	140	144
5	100	108	111	121	117	131
6	103	105	106	121	123	130
7	95	113	121	137	125	122
8	100	102	109	154	124	144
9	112	113	126	159	144	132
10	96	100	101	146	129	150
Average	99	109	116	137	125	132

Figure 7. Recordings of cardiac frequency for subject 4

For stage 2, subject 4 has an average of the initial cardiac frequency (FCÎ) for all ten classes of 116 beats/minute while at the end of the body's preparation for effort, the average is 137 beats/minute, the lowest reading of the four subjects. For the beginning of stage 3, the average C.F (cardiac frequency) is 125 beats/minute, while at the end of stages, an average of 132 beats/minute was measured, the best average among the subjects.

At the end of stage 1 (set-up of the pupil group), during lessons 3 and 9, all four subjects were punished for indiscipline being assigned to perform 15 squats thus the values taken of the high cardiac frequency of such subjects upon the initiation of the subsequent stage.

From the comparison made among the four subjects, we ensued the conclusion of the study with the aid of the value for average cardiac frequency for stages 2 and 3 for initial cardiac frequency (FCÎ) and for final cardiac frequency (FCF) analysed here in diagram 2 (Figure 8).

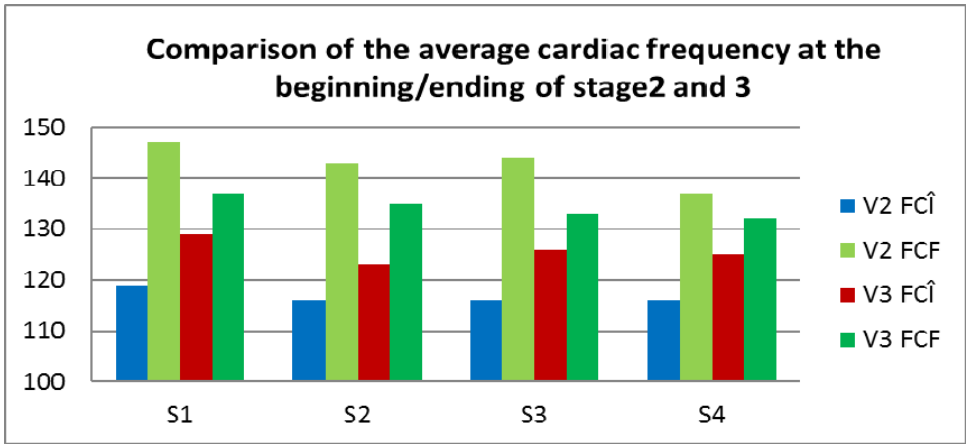

Figure 8. Comparison of the average cardiac frequency at the beginning/ending of stages 2 and 3

The overall comparison of these two stages indispensable for a class of physical education, indicates that cardiac frequency at the beginning of stage 2 is situated around the values of 110-155 beats/minute because the pupils came to class already having high values of cardiac frequency due to the fact that, during the break they performed various activities (running, jumping). The value recorded for stage 3 decreases after the conclusion of stage 2 down to values situated between 123-129 beats/minute due to the time span between the ending of stage 2 and the beginning of stage 3 which was approximately 40-50 seconds during all

ten lessons on record. At the conclusion of stage 2, the average cardiac frequency is higher than the average cardiac frequency at the conclusion of stage 3 which shows that, throughout the lesson, the dynamics of effort does not indicate an ascending curve towards the initiation of the lesson's fundamental phase.

Conclusion

After having analysed the results pertaining to cardiac frequency during the physical education class of the 5th grade, we ascertained that the average cardiac frequency for all 4 subjects during stage 2 (preparation of the body for effort), at its ending, was 143 beats/minute while the average cardiac frequency at the conclusion of stage 3 (selective influencing of the locomotor apparatus) was 135 beats/minute which means that an ascending curve was not recorded throughout these stages. To conclude, a reversal of these stages during the physical education class would offer pupils a better preparation for the initiation of the lesson's fundamental part.

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