DIFFERENCES IN THE EFFECTS OF THE SAME KINESIOLOGICAL CONTENT MEASURED IN TWO DIFFERENT WAYS

Marija Lorger, Mateja Kunješić Sušilović, Marijana Hraski

Abstract: In kinesiologic education, diagnostics have a very special place in planning and programming the exercise content, but also monitoring the effects of the work. The exercise intensity expressed through the heart rate measurements is mainly measured manually (palpaction) and during measurement there is a possibility of measuring error especially if it is measurer inexperienced or insufficiently trained. This may result in inaccurate measurement results, so the purpose of this paper is to compare the results of heart rate measurement during performing the same workout content on physical education lesson measured by palpation and heart rate monitors for the purpose of determining differences insaid measurement methods. In this research were participated by 34 female students of the 2nd year of the Faculty of Teacher Education of the University of Zagreb. The values of heart rate during the performance of the polygon obstacles were monitored by a heart monitor. Their results were compared with the results of the same polygon that were measured manually (palpation) in a previous study, whose sample consisted of the female students of the 1st and 2nd year of the Faculty of Teacher Education University of Zagreb (N = 103). Well trained measurers can safely measure HR by manual technique (palpation) as demonstrated by the t - test results in this study where no statistically significant differences were found in the results HR measured with palpation and measurement results with heart monitors.

***Key words**:*female students, palpation, heart rate, heart rate monitor

Introduction

The term diagnosis is most commonly mentioned in the field of medicine, but it's often associated with other areas, including the area of kinesiology which cannot exist in scientific and practical activities without monitoring certain conditions and phenomena (Heimer, 1996). Prskalo and Sporiš (2016) emphasize that the cybernetic approach and the interdisciplinary of

kinesiology emphasize its scientific component. Thus, in kinesiological education that "springs out" from kinesiology as a substantive science, diagnostics have a very marked place especially during the planning and programming of exercise content as well as monitoring the effects of work. Physical education, at all levels of education, aims at improving somatic and mental development, preventing bad posture and development of deformity, and creating habits for physical exercise throughout the lifetime, and controlling such processes also requires certain measurements and diagnosis of conditions and changes (Heimer, 1996). Improvement of the teaching or training process cannot be accomplished without the use of diagnostics, which is a fundamental condition for the implementation of a quality exercise process or a valid diagnostic of the current condition of the subject (Findak, 2011). In addition, determination of the subject's condition is also the basis for individualization, ie performance of work according to the individual profile of the subject participating in the kinesiological process (Findak, 2011). Accordingly, each student should be allowed to practice properly according to their anthropological status (Beiner, 2002, according to Findak, 2007), and an important role in this is monitoring the intensity of work during the physical education class. The intensity of exercise expressed through the heart rate is mainly measured manually (palpation) (Sabolić, Lorger, Kunješić, 2015; Tomljenović, Radošević, Grahovac, 2009), but in literature it can still be find examples in which heart rate are monitored through a heart rate monitors during work (Kolenko, 2017; Lorger, 2014; Lorger, 2009; Šafarić, Babić, Kunješić, 2009). When measuring the heart rate with palpation, there is a possibility of measuring error (perhaps more importantly) especially if it is inexperienced or insufficiently trained. This can lead to unreliable measurement results, so the aim of this paper is to compare the results of heart rate when performing the same work contents on the physical education class measured by palpation and the heart rate monitors for detecting possible differences in the measurement results.

Methods of work

The study was attended by 34 students of the 2nd year of the Faculty of Teacher Education of the University of Zagreb, whose heart rate frequencies during the execution of the polygonal obstacle were monitored by a heart rate monitor. Their results were compared with the results of the same polygon obstacle that were measured by palpation in the earlier survey, whose sample was the 1st and 2nd year students of the Faculty of Teacher Education (N = 103) (Lorger, Kunješić, Jenko Miholić, 2016). The students were well trained to measure

heart rate by palpation. The polygon obstacle consisted of well-trained and adopted kinesiological structures based on mastering coordinating tasks and improving aerobic-anaerobic abilities of students. Data processing was performed using the Statistics 13.0. Descriptive particle parameters were calculated for the purposes of the work, and differences in the measurement results were tested by t - test.

Results

Table 1:

Average values, standard deviations and percentage of particles measured by hand and heart monitor

Contents of the work	M Monitor	M Palpation	SD Monitor	SD Palpation	%HR max Monitor	% HRmax Palpation	Differences %HRmax
Polygon 1 A part Start	124,088	104,631	18,195	19,306	70,04	52,36	**17,68**
Polygon 1 A part End	166,412	140,330	14,496	32,432	83,20	70,16	13,04
Polygon 2 A part Start	113,706	112,631	17,699	24,247	56,85	56,31	0,54
Polygon 2 A part End	169,294	141,922	17,637	25,934	80,04	70,96	10,08
Polygon 3 A part Start	116,824	107,980	16,349	19,208	58,41	53,99	4,42
Polygon 3 A part End	168,029	145,281	16,830	21,178	84,01	72,64	12,37
Polygon B part Start	113,147	120,097	11,789	24,223	56,57	60,04	3,47**
Polygon B part End	131,824	**166,582**	19,301	23,525	65,91	83,29	**17,38****

Legend: Mean (M), Standard Deviation (SD)

Comparison of measurement results by heart rate monitor and palpation of identical exercise content, indicates lower heart rate values in palpation measurement in almost all polygon series (graph 1).The only anomaly is observed at manual measurement in the main "B" part of the PE class, where are more average heart rate values than those measured by a heart rate monitor.The results of standard deviations show lower values, respectively better grouping results in all serials measured by a heart monitor. The values of maximum heart rate percentage are based on average heart rate values per minute, ie a higher number of heart beats per minute is followed by a higher percentage of maximum heart rate (graphical representation in Figure 2), and the largest difference between manual and digital measurement in % HRmax were observed at the beginning of polygon 1 in the main „A" part of the class and at the end of the polygon in the main „B" part of the class.

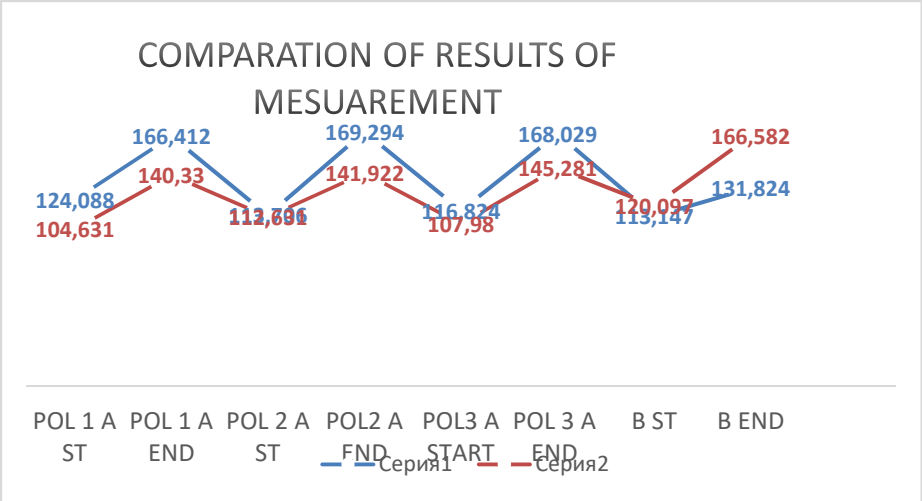

Figure 1: Graphical display result of heart rate measured by monitor and palpation

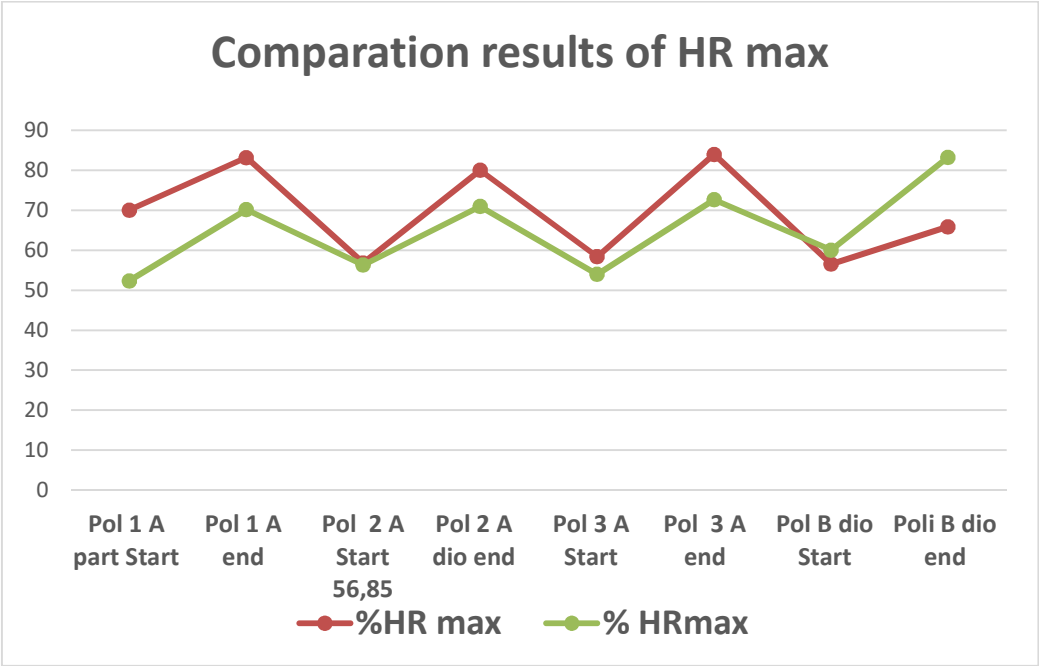

Figure 2: Graphical display of the maximum heart rate percentage measured by heart rate monitor and palpation

Verification of the significance of differences in the measurement results

Table 3:

Results of t-test - polygon obstacle

	T-test for Independent Samples– main „A“and main „B“ part of the class (identical measurement contents)				
Group 1 vs. Group 2	M monitor	M palpation	t-value	df	P
M1 monitor vs. M 2 palpation	137,915	129,931	0,671	14	0,513

Well-trained measurers can quite accurately measure the value of heart rate, and with the manual method (palpation). These are also confirmed by the results of the t - tests obtained in this research. Namely, the statistical significance of the difference is not confirmed in the comparison of the measurement results during the performance of the content and the organizational of the same motor motions, but in the measurement results only quantitative differences have been observed.

Discussion

The same form of work (polygon obstacle) and the same kinesiological contents that made the polygon obstacle were applied for this research, whose effects were measured in different ways (Table 1). Manual heart rate measurement was lower in the main “A” part of the class, while in the main “B” part, the heart rate value increased compared to the results obtained by measuring the heart rate monitor. It can be assumed that the results of digital measurement are more reliable than palpation measurements, but as mentioned earlier, well-trained measurers can quite accurately measure heart rate and with palpation method. Concerning the results of measurements in the concrete situation, it is very likely that the observed differences were manifested because the different measurements of the students participated in the two measurements (although the exercise contents were the same). Student engagement during measurement as well as tiredness in the main "B" section of the class, but also possible measurement errors, could also result in higher pulse rates measured by palpation. Since it is an adult, the impressions of the heart monitor should not be a disturbing factor during the measurement even if it cannot be completely excluded. By looking at the load curve, the highest work intensity is observed at the end of the first, second, and third series of polygons (166, 412, 169, 294 and 168,029) for digital measurements, while in the same series for manual measurement results are lower values (140,330, 141, 922 and 145,281). The difference in the benefit of manual measurement at the end of the polygon in the main “B” part of the class indicates that the group measured digital worked more intensively. Therefore, the work of lower intensity eventually came because of fatigue unlike the group that was measured manually. This also supports the values of % HRmax.In the group measured with monitor, the % HRmax ranged in three segments in the zone of maximum loads above 80% HRmax (Vučetić, Šentija, Matković, 2002) while during manual measurement the heart rate count only one "pierced" the maximum load zone. Low load levels (below 60% HRmax) at both measurements were observed at the start of new series of polygons measured after 1 (or 2 minute) rest and the pulse values deliberately "dropped" to

120 and less HR/min. As for the earlier researches that are concerned with the observation of the heart rate value on the PE class, per the estimation of the authors, it is difficult to find the identical form of work and contents measured by the heart monitor, so it is difficult to compare such measurements. Nevertheless, Lorger (2009) measures the heart rate with the monitor during the performance of the polygon obstacle in seventh grade students. The execution of this polygon was in a relatively short time (between 13.00 and 25.00 seconds) and a sudden heart rate jump was observed as the aim was to overcome the obstacles as short as possible, unlike the polygons in this research whose performance lasted 2 minutes which implies lower work intensity.

Conclusion

The aim of this study was to compare the results of heart rate measurements when performing the same work contents on the PE class measured by palpation and the heart rate monitor for detecting possible differences in the measurement results. Lower heart rate values were mostly observed in palpation measurement in almost all polygon series except in the main "B" section of the class where more values of mean heart rate were observed in palpation than those with monitor by the same exercise contents. The t-test results did not show statistically significant differences in heart rate values probably due to good trained measurers but also due to the time lag between the two measurements and the different participating groups, and it would be good to repeat this study in the same group of participants in the experiment and on a larger number of subjects.

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Assist. prof. ***Marija Lorger***, PhD
Faculty of Teacher Education University of Zagreb
Savskacesta 77
10 000 Zagreb, Croatia
E-mail: marija.lorger@ufzg.hr

Mateja KunješićSušilović, PhD
Faculty of Teacher Education University of Zagreb
Savskacesta 77
10 000 Zagreb, Croatia
E-mail: mateja.kunjesic@ufzg.hr

Marijana Hraski, PhD
Faculty of Teacher Education University of Zagreb
Savskacesta 77
10 000 Zagreb, Croatia
E-mail: marijana.hraski@ufzg.hr