

## HORSE HEART RATE VALUES AT DIFFERENT TIMES OF TRAINING, RECORDED IMMEDIATELY AFTER EXERCISE AND 10 MINUTES AFTER EXERCISE

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### *Abstract*

*Generally, cardiovascular adaptations that occur in increase transport capacity and oxygen consumption in muscle during exercise in the horse are: increase of cardiac output (CO) by increasing heart rate (HR) and less systolic ejection volume (SV), redistribution of blood flow from inactive to the active territories, associated with increased venous return through muscle and respiratory pumps, increase the capacity of blood oxygen transporting with improved extraction and its retention in the muscles. A standard way of sport horses to respond to physical exercise is to increase cardiac output, possibly by increasing the HR and SV. The present paper analyzes the heart rate evolution and dynamic at 15 sport horses, during 3 periods of training. Assessment of heart rate was effectively executed indirectly (via stethoscope). Appreciated immediately after exercise heart rate increased in all 3 months of training proportional to speed, reaching a maximum of  $81,86 \pm 1,14$  cardiac movements / minute in the third month, at a speed of 550 m / minute and decreased at 10 minutes after effort, in all 3 months of training, reaching a minimum of  $53,40 \pm 0,74$  cardiac beats / minute in the third month at speed of 350 m / minute. Statistically the differences were insignificant in most cases were traced.*

**Key words:** Heart rate, sport horse, training

### INTRODUCTION

Flawless operation of metabolic pathways providing ATP, but dependent on oxygen, is inextricably linked with the capacity of some organs and systems to ensure a continuous flow of O<sub>2</sub> to the muscle during labor [2].

This flow starts when air enters in the respiratory ways and until the oxygen gets to be used in aerobic processes run in the mitochondria. From the alveolar-capillary membrane O<sub>2</sub> coupled with hemoglobin is transported by blood vessels to the muscle in exercise.

This physiological phenomenon of transport and distribution of precursors, including oxygen, has in center the vital effector - heart – which during the effort and training is adjusting the activity depending on their intensity and duration.

Generally, cardiovascular adaptations that occur in increase transport capacity and

oxygen consumption in muscle during exercise in the horse are:

- increase of cardiac output (CO) by increasing heart rate (HR) and less systolic ejection volume (SV).
- redistribution of blood flow from inactive to the active territories, associated with increased venous return through muscle and respiratory pumps.
- increase the capacity of blood oxygen transporting with improved extraction and its retention in the muscles.

A standard way of sport horses to respond to physical exercise is to increase cardiac output, possibly by increasing the HR and SV [3].

### MATERIAL AND METHOD

The present paper analyzes the heart rate evolution and dynamic at 15 sport horses, during 3 periods of training.

Assessment of heart rate was effectively executed indirectly (via stethoscope). Indirect

listening offers the examiner a comfortable position, without having to manipulate the animal. The chest-pieces of the stethoscope is inserted between the olecranon and axilla and the examiner sits sideways, on the left side of the horse. The hand that is free rest on the horse. The sounds will be: cardiac beat, pericardial sounds or/and the extra-cardiac ones. The main normal heart sounds are: first heart sound or systole, second heart sound or diastole [4].

## RESULTS AND DISCUSSIONS

At speed of 350 m/min., immediately after effort in the three periods, the recorded values were very close (60.7 beats/min., 62,2 beats/minute, 64,6 beats/minute).

Values obtained after 10 minutes were also very close to normal resting values (54,8, 55 and respectively 53,4 beats / minute).

Table 1. Average values of heart rate recorded immediately after exercise and 10 minutes after exercise during 3 periods of training

Speed (m/min)	After exercise (distance 3000 m)					
	1st month		2nd month		3rd month	
	Right away	after 10'	Right away	after 10'	Right away	after 10'
350	60,70 ± 1,63	54,80 ± 1,20	62,20 ± 1,20	55,00 ± 1,25	64,60 ± 0,85	53,40 ± 0,74
450	66,60 ± 1,22	54,60 ± 1,54	67,06 ± 1,22	54,73 ± 1,35	72,40 ± 0,97	57,73 ± 0,71
550	79,13 ± 1,10	60,13 ± 2,42	80,20 ± 0,92	53,00 ± 1,14	81,86 ± 1,14	57,06 ± 0,70

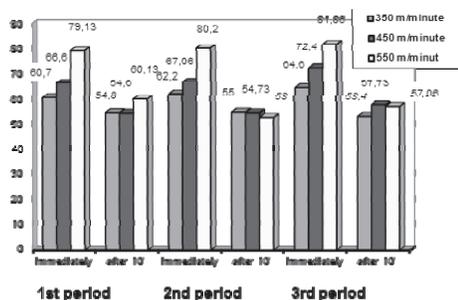


Fig. 1. Average values of heart rate immediately after exercise and 10 minutes after exercise in the 3 periods of training

At speed of 450 m/min., immediately after effort, the recorded values were slightly higher than those recorded at speed of 350 m/minute. Also in the 3<sup>rd</sup> training period at

speed of 450 m/min the average value was a little higher than those recorded at the first 2 training period (66,6 beats/min., 67,06 beats/min., 72,4 beats/minute).

The average value of 1<sup>st</sup> and 2<sup>nd</sup> period were very close to each other

After 10 minutes of effort values recorded were very close: 54,6 beats/min., 54,73 beats/min., 57,73 beats / min).

At speed of 550 m/min., immediately after effort, the recorded values in the three training periods were very close to each other and the value in the 3<sup>rd</sup> period was also higher compared with the first two periods (79,13 beats / min, 80,20 beats / minute and 81,86 beats / minute).

Testing the significance of differences at speed of 350 m/min immediately after exercise, the differences between the three periods are not significant (Table 2).

Table 2. The significance of differences between the values of heart rate to 350 m / min, immediately after exercise

Period	350 m/min. immediately after effort			Calculated t	Table t (t α) p<0,05	Significance
	$\bar{x}_1$	$\bar{x}_2$	d			
1st-2nd	60,7	62,2	1,5	-0,72	2,04	NS
1st-3rd	60,7	64,6	3,9	-0,99	2,04	NS
2nd-3rd	62,2	64,6	2,4	-1,62	2,04	NS

The same can be observed at 10 minutes after exercise, the differences were not significant between the three training periods (Table 3).

Table 3. The significance of differences between the values of heart rate at 350 m / minute at 10 minutes after effort

Period	350 m/min. immediately after effort			Calculated t	Table t (t α) p<0,05	Significance
	$\bar{x}_1$	$\bar{x}_2$	d			
1st-2nd	54,8	55,0	0,2	-0,11	2,04	NS
1st-3rd	54,8	53,4	-1,4	0,98	2,04	NS
2nd-3rd	55,0	53,4	-1,6	1,09	2,04	NS

At speed of 450 m / min, immediately after effort, there were distinct differences between 1st-3rd period and 2<sup>nd</sup>-3<sup>rd</sup> period. Between 1<sup>st</sup> and 2<sup>nd</sup> period the differences were insignificant (Table 4).

Table 4. The significance of differences between the values of heart rate at 450 m / min, immediately after exercise

Period	450 m/min. - immediately after effort				Table t (t α)			Significance
	$\bar{x}_1$	$\bar{x}_2$	d	t	p<0,05	p<0,01	p<0,001	
	1st-2nd	66,60	67,06	0,46	-0,23	2,04	-	
1st-3rd	66,60	72,40	5,80	-3,66	-	2,76	3,67	**
2nd-3rd	67,06	72,40	5,34	-3,42	-	2,76	3,67	**

Also at speed of 450 m / min, but 10 minutes after exercise, the test of significance differences resulted insignificant differences, like the speed of 350 m / min (Table 5)

Table 5. The significance of differences between the values of heart rate to 450 m / minute at 10 minutes after effort

b	350 m/min. immediately after effort				Table t (t α)	Significance
	$\bar{x}_1$	$\bar{x}_2$	d	Calculated t		
	1st-2nd	54,60	54,73	0,13		
1st-3rd	54,60	72,40	17,80	-1,83	2,04	NS
2nd-3rd	54,73	72,40	17,67	-1,96	2,04	NS

At speed of 550 m / min immediately after exercise situation are no different, resulting insignificant differences (Table 6).

Table 6. The significance of differences between the values of heart rate at 550 m / min, immediately after exercise

Period	350 m/min. immediately after effort				Table t (t α)	Significance
	$\bar{x}_1$	$\bar{x}_2$	d	Calculated t		
	1st-2nd	79,13	80,20	1,07		
1st-3rd	79,13	81,86	2,73	-1,71	2,04	NS
2nd-3rd	80,20	81,86	1,66	-1,13	2,04	NS

At 10 minutes after exercise, at speed of 550 m / minute situation is different resulting significant differences between 1<sup>st</sup> and 2<sup>nd</sup> period, insignificant differences between 1<sup>st</sup> and 3<sup>rd</sup> period and between 2<sup>nd</sup> and 3<sup>rd</sup> period the differences are statistically distinct (Table 7).

Table 7. The significance of differences between the values of heart rate at 550 m / minute at 10 minutes after effort

Period	450 m/min. - immediately after effort				Table t (t α)			Significance
	$\bar{x}_1$	$\bar{x}_2$	d	t	p<0,05	p<0,01	p<0,001	
	1st-2nd	60,13	53,00	-	2,56	2,04	-2,76	
1st-3rd	60,13	57,06	-	1,21	2,04	-	-	NS
2nd-3rd	53,00	57,06	4,06	-2,83	-	2,76	3,67	**

## CONCLUSIONS

Appreciated immediately after exercise heart rate increased in all 3 months of training proportional to speed, reaching a maximum of  $81,86 \pm 1,14$  cardiac movements / minute in the third month, at a speed of 550 m / minute and decreased at 10 minutes after effort, in all 3 months of training, reaching a minimum of  $53,40 \pm 0,74$  cardiac beats / minute in the third month at speed of 350 m / minute.

Statistically the differences were insignificant in most cases were traced.

Evolution of heart rate during the three training periods shows that regardless of horse training level, after 10 minutes the heart rate returns to values slightly above normal at rest (40 beats per minute).

Recovery heart rate after 10 minutes from exercise cessation in all three periods and at different speeds reveals high horse training level

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