# INVESTIGATION OF THE ACCURACY OF A NEW HEART RATE METER FOR USE IN EXERCISING HORSES

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## INTRODUCTION

Heart rate (HR) is a major variable frequently determined when evaluating athletic horses exercising on the track or treadmill (Foreman et al., 1990 ; Rose and Hodgson, 1994 ; Couroucé, 1999). Therefore, a reliable means of measurement of HR is of great importance.

## MATERIAL AND METHODS


Fig. 1 : Telemetric ECG electrodes and transmitter.


Fig. 3 : Polar HRM electrodes and transmitter.

### Apparatus

• Telemetric ECG

Three adhesive electrodes (3M, Sydney, Australia) were applied on the left side of the horse and then connected to the transmitter (Fig. 1) with the HR signal transmitted by telemetry to the receiver (Danika, Copenhagen, Denmark- Fig. 2).

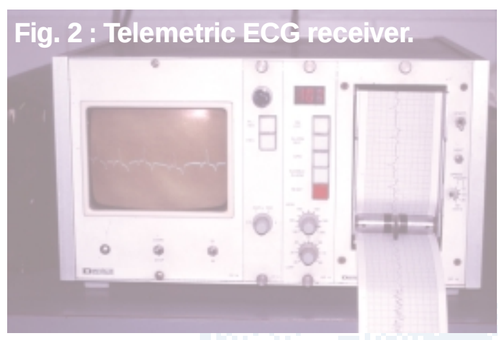
Fig. 2 : Telemetric ECG receiver.

• Polar Heart Rate Meter (HRM)

Two electrodes were placed on the left side of the horse (Fig. 3) with the HR signal transmitted by telemetry to a portable (wrist) receiver (Polar Vantage XL; Baumann & Haldi, a Polar company, Finland - Fig.4).


Fig. 4 : Both devices in place.

### Horses and measurements

Six untrained Standardbred horses (5 geldings and 1 mare), aged 2 1/2 to 10 years, were used in the study.

All horses performed a standardized exercise test on a 10% inclined treadmill (2 min at 2 and 4 m/s and 1 min at each of 6, 8 and 9 m/s).

The telemetric ECG was recorded continuously throughout the exercise period and the Polar HR meter stored data every five seconds. The paper speed of the telemetric ECG was verified using a stopwatch.

### Data analysis

HR was measured for the telemetric ECG by counting the number of R-R intervals in a 5-sec period.

Data from the Polar receiver were downloaded with a suitable interface to a computer and analysed with the Polar Horse Trainer software.

Then, HRs from each measurement method were compared using a least squares linear regression analysis.

## RESULTS

There was a highly significant correlation ($p<0.001$) between the Polar HRM and the telemetric ECG determination of HR ($r = 0.995$ ; $n = 233$ - Fig. 5). When HRs below and above 200 bpm were considered separately, the correlation coefficient was lower for HRs greater than 200bpm, with the Polar HRM giving slightly higher values when compared to the ECG.

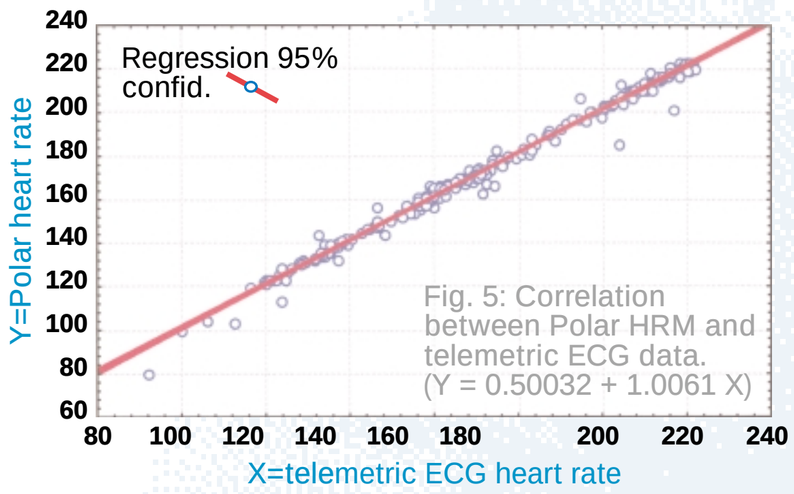

Fig. 5: Correlation between Polar HRM and telemetric ECG data. (Y = 0.50032 + 1.0061 X)

| | n | r (r=correlation coefficient) | d (difference between telemetric ECG HR and Polar HR, in bpm) |
|---|---|---|---|
| All HR values | 233 | 0.995 | -1.45 |
| HRs <200 bpm | 171 | 0.991 | -1.33 |
| HRs >200 bpm | 62 | 0.847 | -1.80 |

Table 1: Polar HRM and telemetric ECG measurements: differences and correlation coefficients.

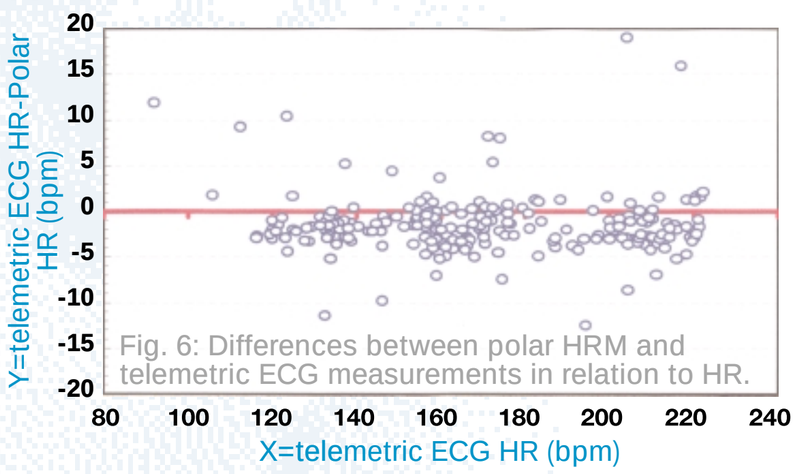

Fig. 6: Differences between polar HRM and telemetric ECG measurements in relation to HR.

## DISCUSSION

Limits of the study :

• HRs of between 80 and 223 bpm were compared in this study.

• There was some difficulty precisely synchronizing telemetric ECG and Polar HRM measurements.

• Artefacts were noted on some of the data from the Polar HRM, possibly due to treadmill interference.

• Only one device was tested.

### Practical issues

• Previous studies have evaluated the accuracy of different HR meters compared to ECG measurements and showed Pearson r correlation coefficients ranging from 0.540 to 0.999 depending on the device tested (Foreman and Rabin, 1984 ; Physick-Sheard et al., 1987 ; Evans and Rose, 1986 ; Sloet van Oldruitenborgh-Oosterbaan, 1988). In this study, the high correlation coefficient ($r = 0.995$, $n = 233$) indicated high accuracy for the Polar device though the HR values were a few bpm higher than those measured using the telemetric ECG. However, at HRs above 200 bpm, accuracy declined, reflected by the weaker correlation ($r = 0.847$).

• The Polar HRM is easy to set up, with no evidence of irritation to the horse. The HR is easy to read on the wrist receiver and recordable for several hours.

## CONCLUSION

**The Polar HR meter provides a non-invasive and convenient means of assessing HR during exercise, with improved accuracy at HRs below 200 bpm. This device can be used effectively on horses exercising on the treadmill, track, when being ridden or in harness.**

**Availability of such a reliable device is important, as measurement of HR during submaximal exercise is one of the mainstays for assessment of fitness (Persson, 1983 ; Couroucé, 1999), work load evaluation and detection of subclinical disease that may impair perfomance (Couroucé et al., 1986 ; Erickson et al., 1987).**

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