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Repeatability and reproducibility of an on-field device for measuring low- to high-frequency muscle force ratio.

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CONTEXT : Low-Frequency Fatigue (LFF) :

- refers to a long-lasting impairment of muscle contractility, induced by a fatiguing physical task.
- is assessed by the low- to high-frequency force ratio produced by an electrically stimulated muscle (L/HF ratio).

A recent portable device¹ (MYOCENE, Liège, Belgium) has been developed to measure the quadriceps L/HF ratio (called Powerdex value, expressed in percentage) of sport practitioners, in the field : LF = 20 Hz ; HF = 120 Hz.

OBJECTIVES :

To evaluate the repeatability and reproducibility of Powerdex measurements, under field conditions.

METHODS :

16 healthy volunteers. One familiarization session (MYOCENE measures).

Two experimental sessions (over two weeks) :

1. Repeatability: test-retest on two consecutive Powerdex measurements (seven minutes apart),
2. Reproducibility: repeated Powerdex measurements, influenced by the combined effect of time of day (8:00 a.m., 12:00 p.m. and 5:00 p.m.) and daily activities.

Participants were asked to refrain from any sport activity from the day before.

Conditions : same operator, same device, same electrical stimulation process, same position of the skin electrical stimulation electrodes, for all measurements.

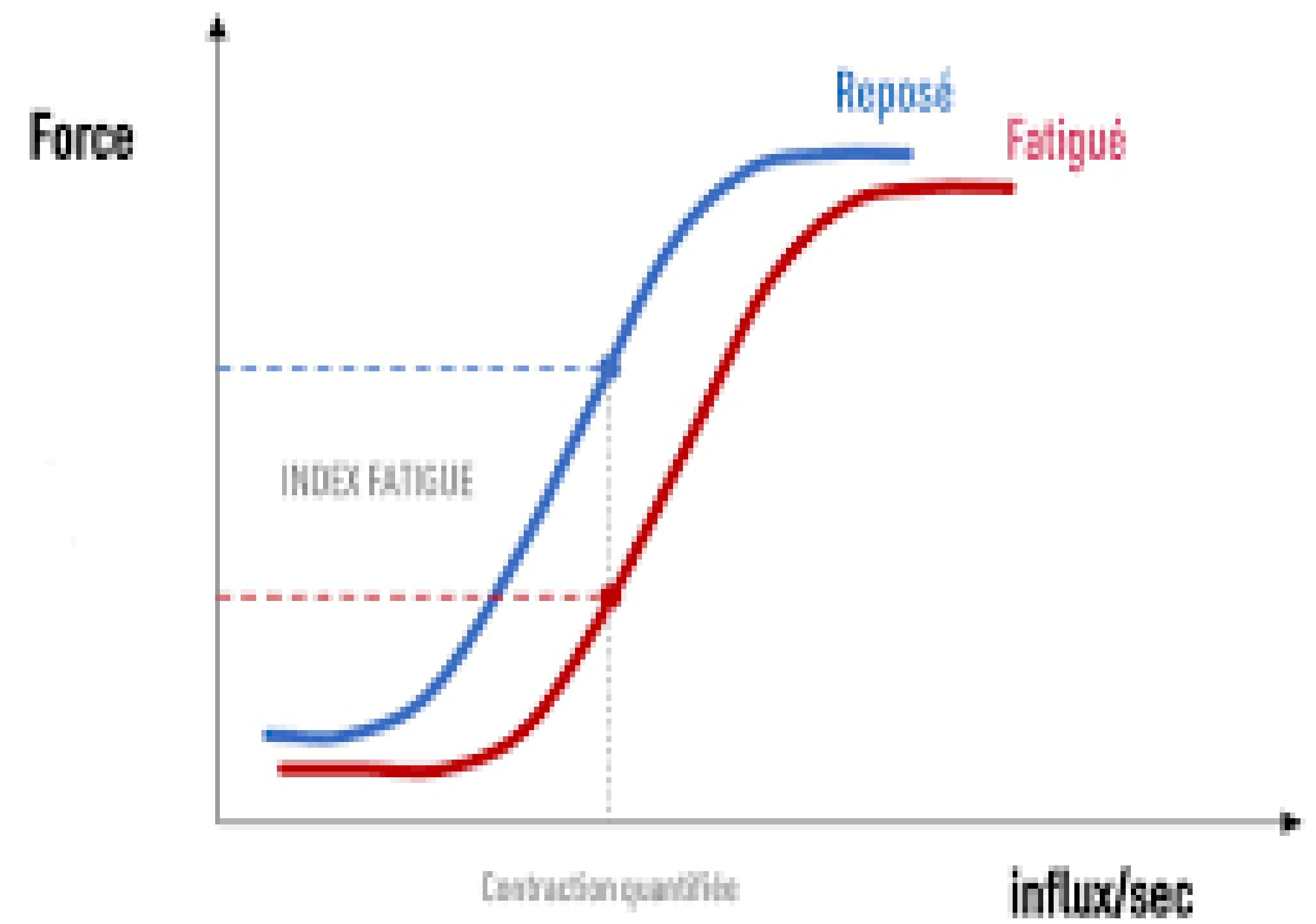


Figure 1: schematic relationship between the evoked force and the frequency of stimulation: rested vs fatigued muscle.

RESULTS :

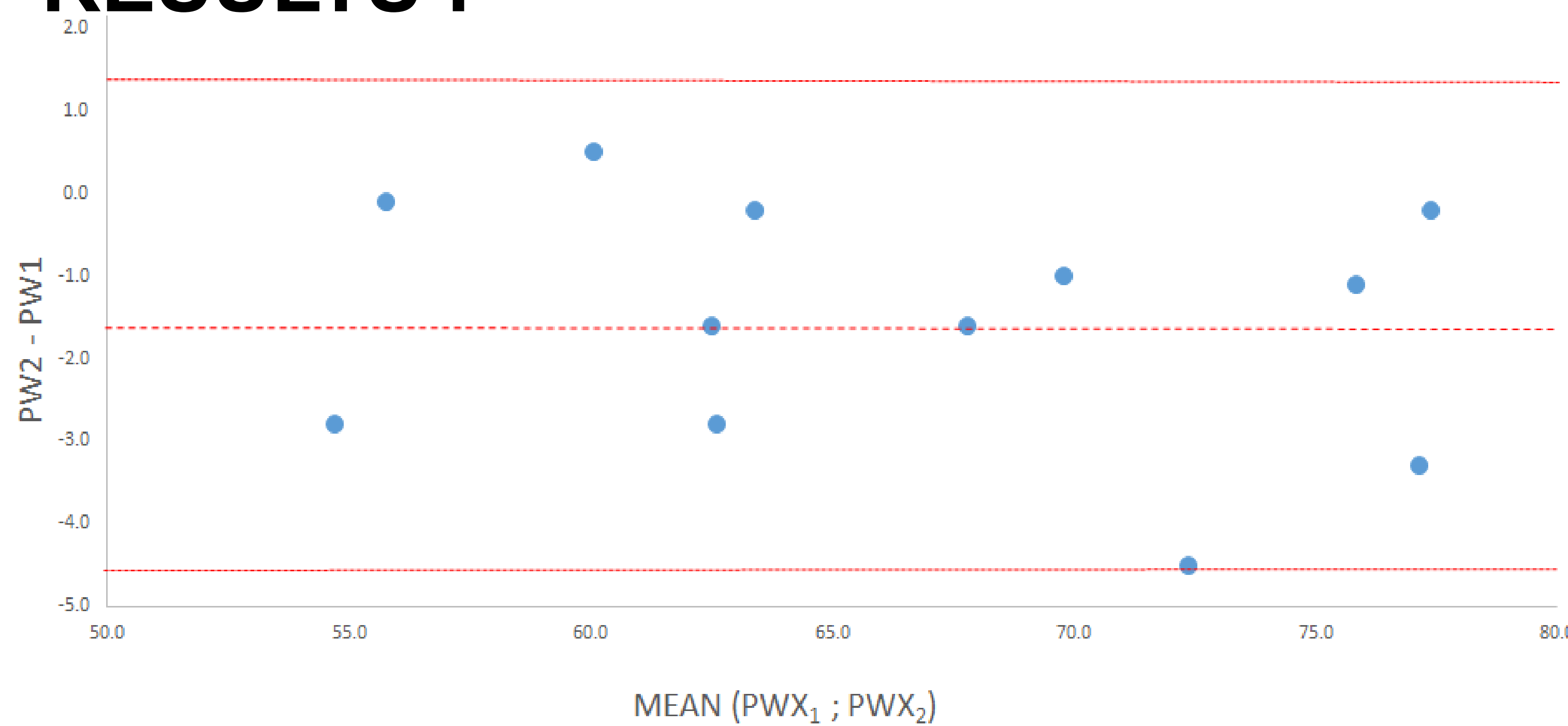


Figure 2: Bland-Altman plot for repeatability.

Bias = -1.6% ; Limits of agreement : [-4.5 ; 1.4%] (= bias ± 2.97 %)

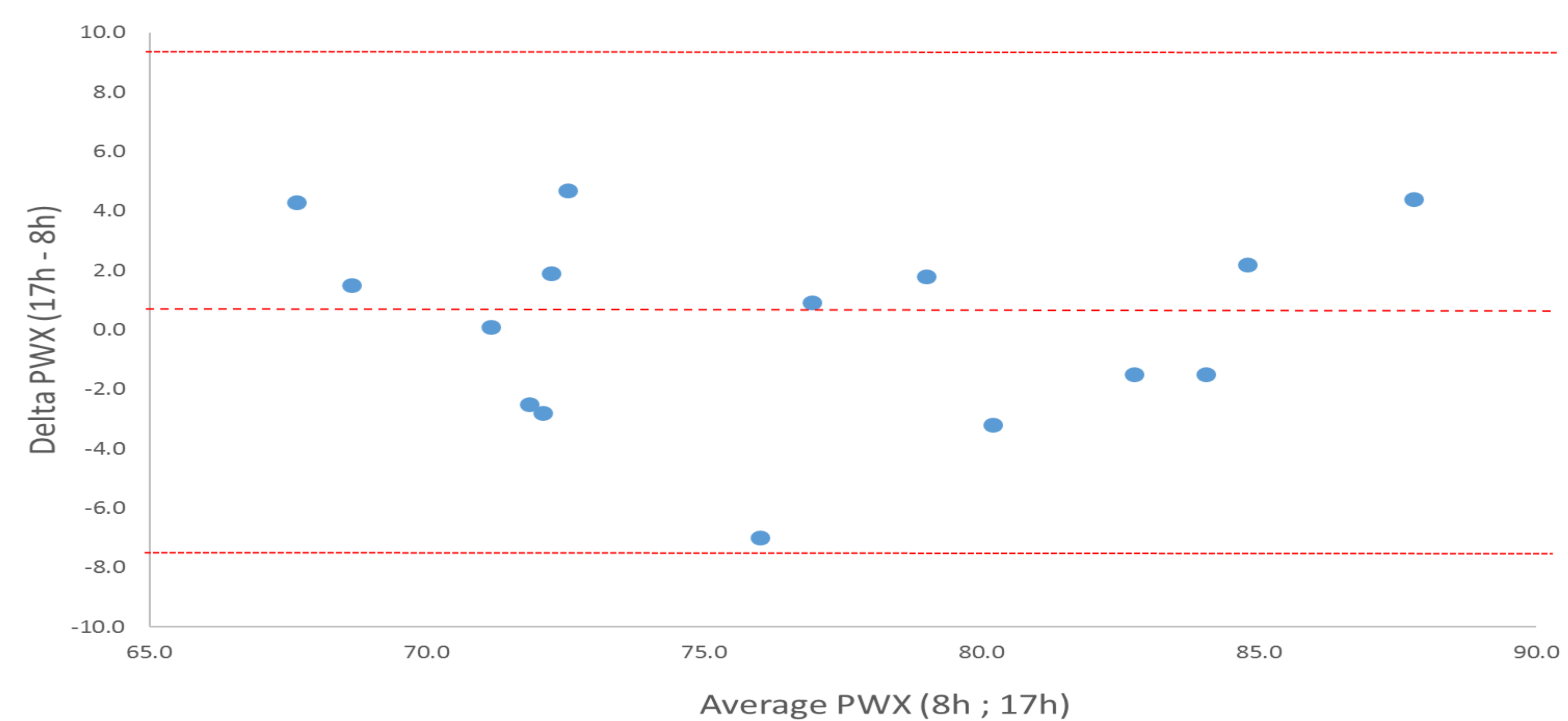


Figure 3: Bland-Altman plot for reproducibility (8:00 a.m. vs 5:00 p.m.).

Bias = 1.2% ; Limits of agreement : [-7.4 ; 9.3%]

Discussion & Conclusion:

The repeatability of the paired Powerdex measurements suggests that a Powerdex depression of at least 3 % is required to conclude to the onset of Low-Frequency Fatigue. Additional studies are needed to more accurately assess the reproducibility of the device, as daily activities may have interfered with the time of day on muscle contractility, either by inducing a slight potentiation or a slight fatiguing effect.

[1] Ridard J. et al. (2022). On-field low-frequency fatigue measurement after repeated drop jumps. Front Physiol. Nov 9;13:1039616.