

# Effect of phobic emotion on nociceptive withdrawal reflex (NWR) in healthy subjects.

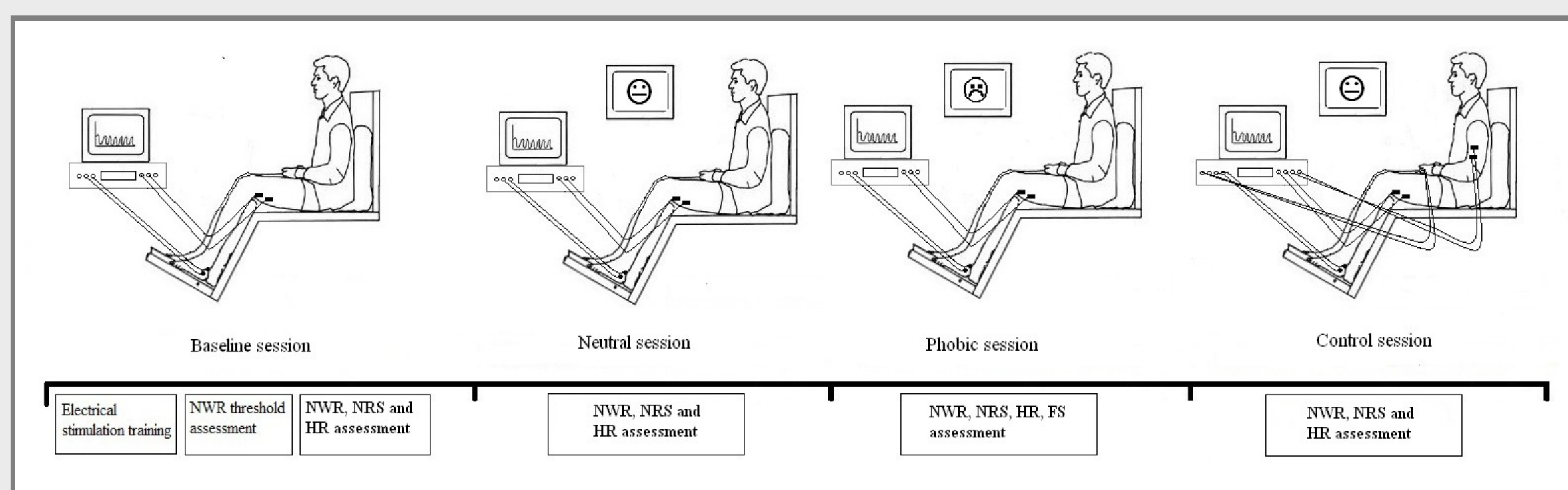
Gaia Fragiotta, M. Serrao, F. Cortese, F. Pierelli

“Sapienza” University of Rome Polo Pontino, Department of medico-surgical sciences and biotechnologies, Latina, Italy

**Introduction:** Emotions have powerful effects on pain processing. It is known that psychological reactions induced by emotional pictures activate descending pain-modulatory pathways affecting the amplitude of nociceptive flexor reflex (NWR). Previous studies focused mainly on pain modulation during pleasant and unpleasant stimuli. To stress the feeling of unpleasantness and to investigate the effects of a specific disturbing emotion such as phobia, we studied the effects of phobic visual stimuli on spinal nociception in healthy subjects.

**Materials and Method:** We recorded the nociceptive flexor reflex (NWR) and the pain-related perception (NRS) in lower limbs in 16 healthy volunteers (7 men and 9 women, mean age  $31.4 \pm 6.7$ ), during 4 recording sessions: baseline session, neutral session, phobic session and control session (fig.1,3). Before the recordings, each subject was invited to fill out the following questionnaires: State-Trait Anxiety Inventory (STAI-X1 and STAI-X2) and Fear Inventory (FI) of The Cognitive Behavioural Assessment-2.0 (CBA-2.0) and the Disgust Scale-R (DS-R). Then participants were instructed by the investigator to look at a monitor during the recordings. In the baseline session, no images were projected; then subjects were invited to watch a video characterized by a neutral or a phobic content in the neutral and phobic session respectively. The content of the phobic video was chosen for each subject based on the results of the FI scale. The neutral video was proposed again during the control session which was performed after a time lapse of about 30 minutes. NWR was evoked by stimulating the sural nerve in the lower limb (fig.1). During each recording session we measured the heart rate through a pulse oximeter. Each subject was asked to give a numerical evaluation of the perceived fear after the phobic session, using a 10-point scale in which 0 represented no fear, whereas 10 represented extreme fear. Repeated measures ANOVA on rank was used to evaluate the effect of phobic emotion on NWR amplitude. NWR amplitude has been reported as mean  $\pm$  standard error of the mean (SEM).

Fig. 1 Experimental setup.



**Results:** At mixed ANOVA test, a significant effect of session (three-level within-subject factor) was found on NWR amplitude (main effect,  $F_{3,42}=5.771$ ,  $p=0.002$ ), while no significant effect was found on NWR latency and NRS ( $p>0.05$ ). A marginal but not significant effect of gender (two-level between-subject factor) (main effect,  $F_{1,14}=4.184$ ,  $p=0.60$ ) and session\*gender interaction (main effect,  $F_{3,42}=2.389$ ,  $p=0.082$ ) was found. Post-hoc analysis revealed significant higher NWR amplitude values during phobic session than during the other three sessions (fig.2). In this session

A trend for higher NWR amplitude values in females compared to males was observed. No significant correlation were observed between NWR values and scale scores (all,  $p>0.05$ ).

Fig.2 Results.

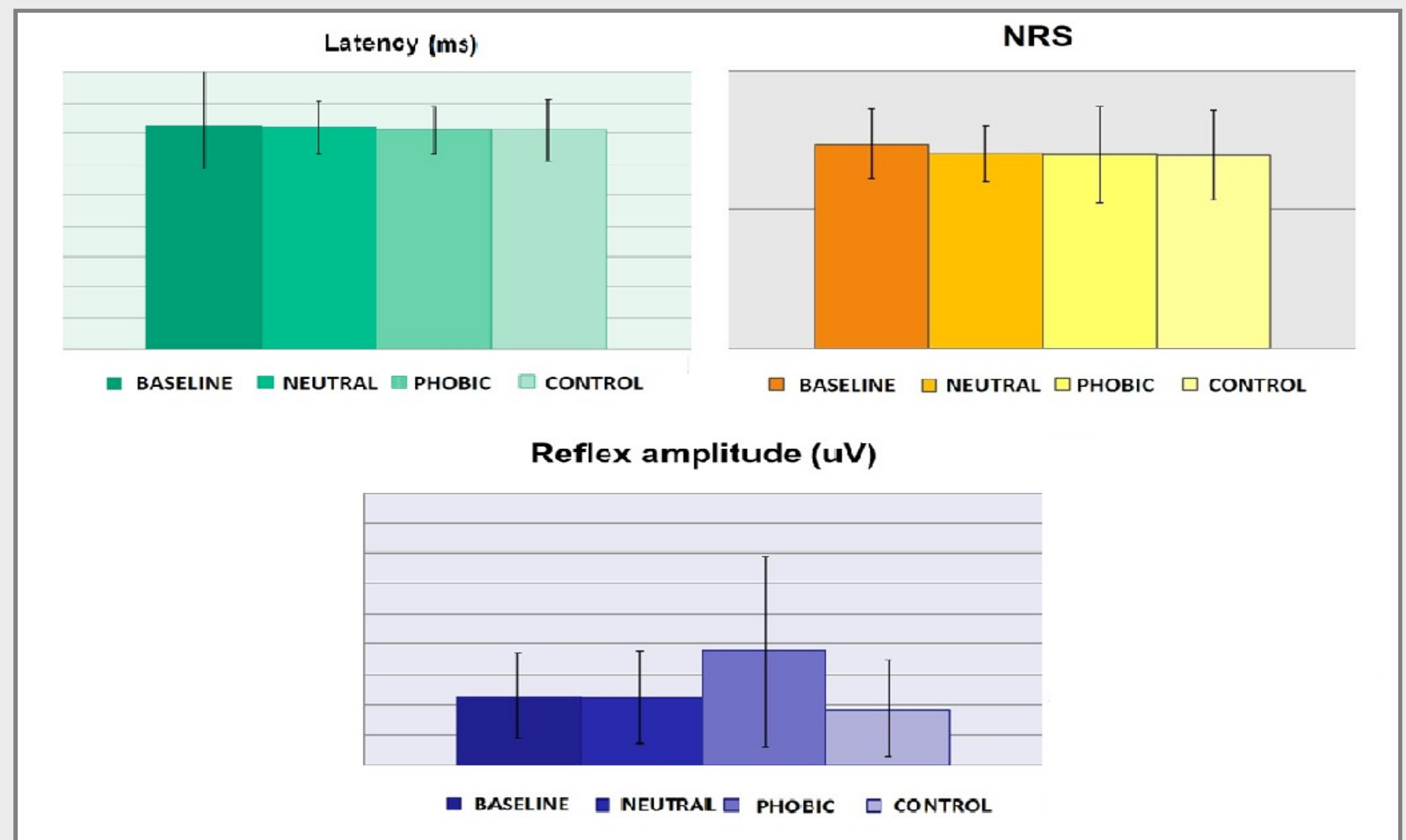
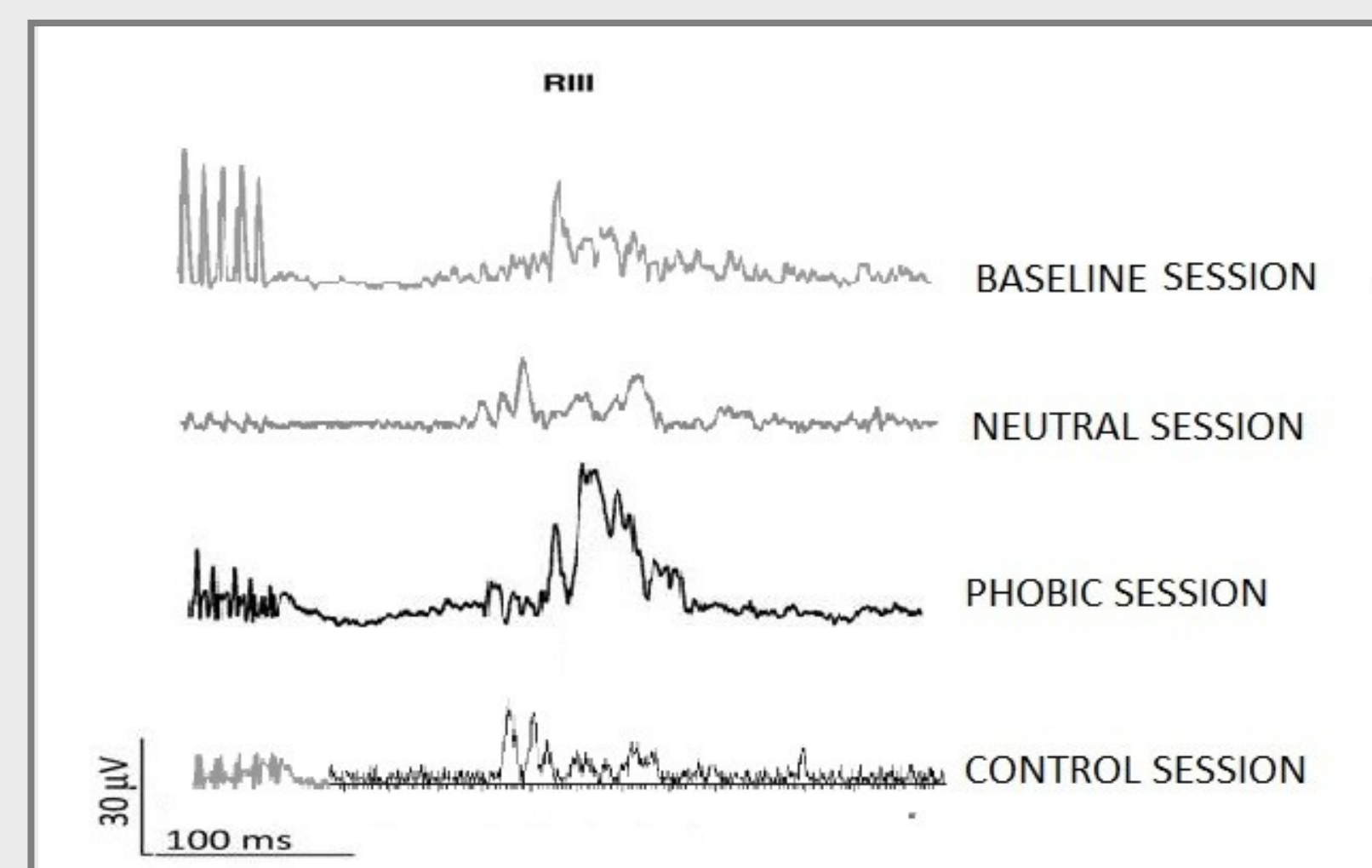


Fig.3 Example of NWR recordings.



**Discussion and conclusions:** The nociceptive withdrawal reflex (NWR) is a reliable index of spinal nociception in humans. Consistent with the notion that various kinds of stimuli (emotional, visual, auditory) can modulate the transmission and perception of pain (Roy et al., 2009; Bartolo et al., 2013), these results show that phobic visual stimuli too, can modulate spinal nociception in healthy humans. Furthermore our results suggest that there are gender differences in the processing of unpleasant visual stimuli with women more susceptible to phobic experiences compared to men. Previous studies demonstrated that the influence of gender on pain processing is a result of several mechanisms, including emotion, which may modulate pain through an interaction of valence (pleasant-unpleasant) and arousal (calm-excited) and that women are more sensitive than men to adverse/stressful events (Bianchini and Angrilli, 2012).

Nociceptive withdrawal reflex facilitation during the phobic session of recordings can be considered an enhanced defence reaction that allows withdrawal both from a noxious stimulus and also from an adverse event such as phobic visual stimuli.

The results confirm that emotional valence influences spinal nociception and in particular phobia seems to increase NWR excitability in healthy humans.

## References:

- Roy M, Piché M, Chen JI, Peretz I, Rainville P. Cerebral and spinal modulation of pain by emotions. *Proc Natl Acad Sci USA*. 2009; 106(49):20900-5.
- Bartolo M, Serrao M, Gamgebeli Z, Alpaidze M, Perrotta A, Padua L, Pierelli F, Nappi G, Sandrini G. Modulation of the human nociceptive flexion reflex by pleasant and unpleasant odors. *Pain Oct*;154(10):2054-9.
- Bianchini M, Angrilli A. Gender differences in emotional responses: a psychophysiological study. *Physiol.Behav.* 2012 Feb 28;105(4):925-32.