

## Changes in blood parameters and electroencephalogram of cattle as affected by different stunning and slaughter methods in cattle

### ABSTRACT

The present study aimed to provide a comparative analysis of the effects of penetrative stunning, non-penetrative stunning and post-slaughter stunning on biochemical parameters and electroencephalogram (EEG) associated with stress in heifers and steers. Ten animals were assigned to each of the following four treatment groups: (1) animals were subjected to conventional halal slaughter (a clean incision through the structures on the ventral neck at the approximate level of vertebrae C2–C3 – the trachea, oesophagus, carotid arteries and jugular veins) and post-cut penetrating mechanical stun within 10–20 s of the halal cut (U); (2) high-power non-penetrating mechanical stunning using a mushroom-headed humane killer, followed by conventional halal slaughter (HPNP); (3) low-power non-penetrating mechanical percussive stunning using a mushroom-headed humane killer, followed by conventional halal slaughter (LPNP); and (4) penetrative stunning using a captive-bolt pistol humane killer, followed by conventional halal slaughter (P). For each animal, blood samples and electroencephalogram recordings were taken before stunning, post-stunning (if applicable) and post-slaughter, and plasma concentrations of cortisol, adrenocorticotrophic hormone (ACTH), adrenaline, noradrenaline and  $\beta$ -endorphin were determined. Irrespective of the stunning method, except for percentage change in plasma concentrations of noradrenaline, the values of blood parameters attained before and after stunning were not significantly different. The plasma noradrenaline concentration of the HPNP animals was significantly elevated following stunning. Following slaughter, the percentage change of plasma ACTH concentration in the P animals was significantly elevated. Neither stunning method nor sampling time had a significant effect on plasma  $\beta$ -endorphin concentration. On the basis of the EEG results, penetrative stunning seemed to be better in maximising the possibility of post-stunning insensibility, whereas U animals appeared to demonstrate an evident increase in EEG activity which is consistent with the presence of post-slaughter noxious stimuli associated with tissue cut and injury. The U animals had consistently higher, if not the highest, RMS values than did other stunned animals. This indicates a degree of EEG changes associated with stress and pain. On the basis of EEG data, our results suggested that penetrative stunning would be the most reliable method of ensuring insensibility and minimising pain. However, at slaughter, the P animals showed a dramatic elevation in the percentage change of circulating ACTH, suggesting physiological stress response. On a cautionary note, the results are not unequivocal, and it may be that the range of analyses available to researchers at this point of time are not sufficiently specific to allow definitive conclusions to be drawn.

**Keyword:** Stunning; Biochemical parameters; Electroencephalogram (EEG); Blood; Physiological response