Electromagnetic induction of insensibility in animals: a review

A Small*, D McLean‡, JS Owen§ and J Ralph#

† CSIRO Livestock Industries, FD McMaster Laboratory, Locked bag 1, Armidale, NSW 2350, Australia
‡ Advanced Microwave Technologies, University of Wollongong, Building 42, Northfields Avenue, Wollongong, NSW 2500, Australia
§ PO Box 5227, Manly, QLD 4179, Australia
# Wagstaff Cranbourne Pty Ltd, 15 Moorakyne Avenue, Malvern, VIC 3144, Australia
* Contact for correspondence and requests for reprints: Alison.small@csiro.au

Abstract

The prevention of unnecessary suffering at slaughter is considered to be an imperative and, as such, the majority of animals slaughtered under industrial conditions are stunned prior to slaughter by mechanical, electrical or gas inhalation means. However, many Orthodox Jewish and Muslim communities do not accept pre-slaughter stunning. Those Jewish and Muslim communities that do accept pre-slaughter stunning require that any such stun is fully reversible in order to meet the requirements of their religious laws. Head-only electrical stunning is widely used in sheep, as it is a reversible method of stunning, but in cattle, the stun duration can be so short that the animal may regain consciousness during exsanguination. The concept of using electromagnetic radiation to induce insensibility has been proposed. Early attempts to induce insensibility and death in laboratory species were successful, but the technology to apply the technique to larger animals was not available at that time. More recently, however, technological advances have led to new work in the areas of transcranial magnetic stimulation and microwave irradiation, both of which are potential methods of inducing a recoverable stun in larger species.

Keywords: animal welfare, cattle, humane slaughter, livestock, recoverable stun, stunning

Introduction

Animals as meat have long provided an important source of dietary protein to human beings. It is understood that we have an obligation to care for the animals and ensure that the process of slaughter is carried out in such a way as to minimise suffering. The earliest written guidelines on care of animals and slaughter are found in the religious texts of the Torah (the Pentateuch, the most sacred writings of Judaism) and the Qur'an (the Muslim scripture). One of the most important aspects in these texts is the requirement that the animal must be alive, undamaged and healthy at the point of slaughter. Furthermore, the texts stipulate the manner in which the animal shall be slaughtered — a single rapid cut of the throat, using an extremely sharp knife. This method of slaughter is the fundamental requirement of Jewish and Muslim communities around the world, otherwise the meat produced is considered unclean and unsuitable for human consumption.

Notwithstanding the strict requirements of these religious texts, a need for improving welfare of slaughtered animals has led to the development of methods of rendering the animal insensible or unconscious prior to the cutting of the throat. Throughout the past century and longer, the process of slaughtering animals for human consumption, except for some Jewish and Muslim markets, has included pre-slaughter stunning, as described in regulations and guidelines, such as the OIE Terrestrial Animal Health Code, the European Regulation EC 1099/2009, the Australian Primary Industries Standing Committee Model Code of Practice for the Welfare of Animals: Livestock at Slaughtering Establishments and in USDA regulations 9 CFR Ch III Part 313. A number of the methods of stunning available have been accepted by some Jewish and Muslim markets in certain parts of the world, on the proviso that the stun is fully reversible, and the animal would recover fully if the throat was not cut, ie the stun does not render the animal dead. For example, head-only electrical stunning, which is fully recoverable, is widely used in sheep slaughter globally. In this method, an electric current is passed through the brain, resulting in insensibility with brain activity similar to that seen in an epileptic fit. However, when applied to cattle, electrical head-only stunning has met with a degree of criticism, particularly in terms of the duration of stun, which may not be long enough to allow death to occur as a result of blood loss prior to the stun wearing off.

Wotton et al (2000) stunned two-year old cattle using currents of 0.86 to 1.70 Amps and recorded the return of rhythmic breathing as an indicator of a return to consciousness. They found that the tonic phase duration varied from 2 to 21 s; the clonic phase ended 30 to 102 s