

**THE WELFARE OF
PIGS, CATTLE AND SHEEP
AT SLAUGHTER**

A

COMPASSION IN WORLD FARMING TRUST

report by

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FOREWORD

‘All animals are equal, but some animals are more equal than others.’ There is more than a little irony in this declaration by Orwell’s pigs when we consider our relationship with domestic animals – particularly their deaths. We euthanase some, we slaughter others. We grieve over the deaths of some, we don’t even think about the deaths of others – or prefer not to. And yet for the animals, the main participants in the action, the event itself has the same potential for pain, stress and fear, whether it is a companion or a farm animal. We owe them each a similar obligation to minimise that stress, regardless of their species. The fact that the killing of farm livestock is on such a large scale that it is considered as ‘a system’ inevitably obscures concern for the individual animal, but there is no reason to suppose that the individual animal is not as vulnerable to the pain associated with a botched job as if it were being killed as an isolated act.

This report by Peter Stevenson of the Compassion in World Farming Trust follows the line of previous reports, in an honourable tradition set by Ruth Harrison’s ‘Animal Machines’, by drawing together published scientific work for the benefit of a wider readership. The sequence of events between stunning and death has been the subject of study for many years and the report concentrates on some of the most recent work. It exposes failures in ‘the system’ of killing animals. Apart from contravening the law, which requires that stunning should render an animal instantaneously insensible to pain until death supervenes, society is party to thousands of individual killings which are associated with avoidable suffering. The system will never, by its nature, be perfect, but imperfections which are due to inadequate equipment, traditional misconceptions, cheeseparing on costs and insufficient concern for suffering are inexcusable.

This report concerns us all, but particularly those of us who are in any way associated with the production of animals for human consumption. We should continue to question whether the costs, in the currency of animal suffering, of providing our traditional rashers of bacon and Sunday joints can be too high.

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INTRODUCTION: WELFARE AT SLAUGHTER

The legal position

The Slaughterhouses Act 1974 provides that, subject to certain exceptions, animals must be stunned before they are killed. Section 36 of the Act stipulates that stunning must render the animal instantaneously "insensible to pain until death supervenes".

What does slaughter involve?

Slaughter is traditionally a two stage process: stunning followed by neck cutting. This can be reduced to one stage with cardiac arrest stunning which, as will be seen later, potentially represents a significant welfare advance.

Two forms of stunning are used for sheep in the UK, stunning with a captive bolt and electrical stunning. The latter is the method used more frequently.

Pigs are usually stunned electrically, although carbon dioxide stunning is used by at least five slaughterhouses in the UK, one of these being the largest pig slaughterhouse in the country.

The principal method of stunning cattle is the captive bolt, although many calves are stunned electrically. Electrical stunning of adult cattle is being introduced into the UK from New Zealand.

After stunning there follows what is called sticking. The animal's throat is cut or, in the case of pigs and, in many abattoirs, cattle, blood vessels in the chest are cut. Sticking may be performed while the animal is still prone. Alternatively the animal may be shackled by a rear leg after stunning and hoisted up on to a rail where it is then stuck.

Problems that can arise at slaughter

Traditionally the purpose of stunning is to render the animal unconscious (and thus insensible to pain) but not to actually kill it. Death is caused by loss of blood following sticking. This kind of stunning is called (in the case of electrical stunning) head-only stunning. Inherent within it is the danger that it is reversible, i.e. animals may regain consciousness before death occurs, which will result in very considerable suffering.

To avoid this danger it is vital that the period of unconsciousness induced by stunning should be longer than:

the interval between stunning and sticking plus the time taken for sticking to induce brain death.

PIGS

Summary of problems

Two principal threats to welfare are suggested by an examination of the scientific literature:

- a) a high proportion of pigs may not be adequately stunned due to the use of too low a current as a result of applying too low a voltage, and
- b) a significant number of pigs may be regaining consciousness before death.

Inadequate stunning

Anil (1991a) concluded that a minimum current of at least 406 mA (milliamperes) is needed effectively to stun pigs for a sufficient length of time. He added that in order to produce this amperage at least 150V (volts) must be used.

In his study Anil failed in six attempts to stun pigs with 75V. Moreover, 38% of the pigs (8 out of 21) stunned with 100V were not stunned satisfactorily and recovered within 10 seconds.

The complete failure of stunning with 75V and the partial failure at 100V are particularly alarming as, as Anil points out, the voltages used in commercial practice can be as low as 75V (Anil 1991b).

He concludes that at least 150V must be applied and that "this means that quite a high proportion of pigs in the UK may not be adequately stunned, as much stunning equipment in commercial use has outputs of less than 150V" (Anil 1991b).

It should be stressed that Anil's suggested minimum current is substantially less than that recommended by Hoenderken (1978). He stated that a current of 1.3A (amperes) is needed effectively to stun 98% of pigs.

In Hoenderken's work the stunning tongs were placed on the neck behind the ears and the stun duration was less than 1 second. These are unfavourable conditions in which to induce a stun and thus require considerably higher current levels. Nonetheless, commercial stunning conditions may not always be ideal and it may be best to adopt a cautious approach and opt for the higher current. Certainly the Ministry of Agriculture's Code of Practice recommends that 1.3A be used (MAFF, 1992) as does Gregory (Gregory, 1991). At least 240V are needed to produce such a current.

In any event, whether the voltage needed for a proper stun is a minimum of 150V or 240V, the practice of many UK abattoirs of using less than 150V is clearly unacceptable.

Danger of pigs regaining consciousness

Even where 150V or more are used, there is a danger of pigs regaining consciousness during bleeding out or even before sticking when long stun-to-stick intervals occur.

Anil (1991a) has said that "one of the first indications of a return towards consciousness is the onset of rhythmic breathing". He found that where pigs are stunned at 150V for 3 seconds, the average time to return of rhythmic breathing is 41 seconds. That figure increases to 44 seconds where 150V are applied for 7 seconds. He also found that all the pigs remained unresponsive to a nose pinprick for at least 38 seconds (when a current of more than 406 mA was used).

If the period of anaesthesia provided by the stun lasts for 38 seconds, then the stunning-to-sticking interval plus the time from sticking to loss of brain responsiveness must amount to less than 38 seconds.

Gregory and Wotton (1986) found that on average the time from sticking to loss of brain responsiveness in pigs was 18 seconds, although this could rise to 23 seconds in the case of some animals.

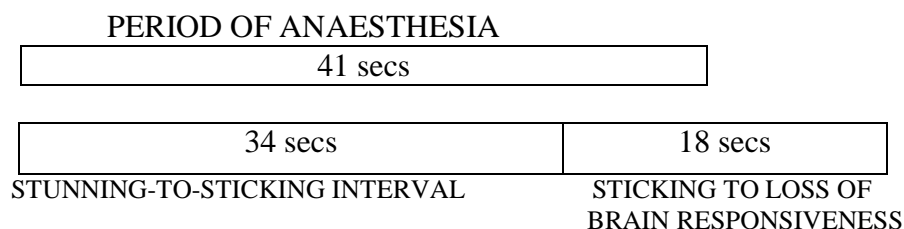
On the basis of these figures Anil (1991a) has recommended that the stunning-to-sticking interval should not exceed 15 seconds. In practice, however, Anil (1991b) has found the average stunning-to-sticking interval is over twice as long as his recommended maximum. For 534 pigs examined the average was 34 seconds and as long as 120 seconds in the worst cases. Anil (1991b) has described the stunning-to-sticking interval as "a very important problem".

In conclusion, it can be seen in Figure 1 that the average stunning-to-sticking interval plus the time to loss of brain responsiveness are considerably longer than the average period of unconsciousness induced by stunning. Accordingly there must be a very real danger that many pigs may regain consciousness during bleeding out or even before sticking.

This danger has been highlighted by Wotton et al (1992) who refer to "the large variations in the delay between stunning and sticking which could allow the pig to regain consciousness before it dies through exsanguination".

Figure 1. PIGS.

Period of anaesthesia induced in pigs by stunning compared with stunning-to-sticking interval, plus time from sticking to loss of brain responsiveness. Times given are averages.



Incorrect positioning of electrodes

In their 1984 Report the Farm Animal Welfare Council stated that in a high proportion of cases the positioning of electrical tongs was inaccurate (FAWC, 1984, para. 128).

The Ministry of Agriculture's Code of Practice (MAFF, 1992) emphasises that the positioning of the electrodes is critical. They should be placed between the eye and ear on each side of the animal's head.

Incorrect positioning can have the following consequences:

- a) the stun may not be instantaneous with the result that the pig may feel the electric shock before becoming unconscious,
- b) the pig may be paralysed rather than being rendered unconscious; this means that it may remain sensible to pain without the ability to express its condition due to paralysis,
- c) low currents may be administered which can result in a short stun (less than 1 second),
- d) the pig may not be stunned at all.

Any of these consequences involve a breach of the Slaughterhouses Act 1974. Despite the critical importance of this factor, we believe that incorrect positioning continues to be not uncommon.

Head-to-back stunning

In head-to-back stunning the electrodes are applied so that they span both the brain and the heart.

The danger of pigs regaining consciousness has led a number of scientists to conclude that a method of slaughtering pigs that fibrillates the heart at the same time as it stuns the brain is likely to be more humane than head-only stunning (Gregory and Wotton, 1986; Wotton et al, 1992). With such stunning, death will be caused by the cardiac arrest and the animals will not be vulnerable to excessive stunning-to-sticking intervals and incorrect sticking.

Gregory and Wotton (1986) found that on average sticking took 18 seconds to induce loss of brain responsiveness in pigs, whereas cardiac fibrillation took 19 seconds. Clearly, therefore a pig in which a cardiac arrest is induced will die much more quickly after the stun than one whose death is caused by sticking. The former will not be at risk of regaining consciousness in the event of a prolonged stunning-to-sticking interval or inaccurate sticking.

Head-to-back stunning can, however, lead to carcass damage in pigs and so is little (if at all) used by the industry. Compassion in World Farming Trust believes that carcass quality should not be accorded higher priority than the welfare of the pigs. Moreover, a breach of the law, the Slaughterhouses Act 1974, is involved where an animal recovers consciousness before death. It should be added that head-to-back stunning need not cause blood retention in the carcass (Warris and Wotton, 1981).

It must be emphasised that with cardiac arrest stunning the electric current must pass through the brain as well as the heart. If it does not, instantaneous unconsciousness will not be induced and the cardiac arrest will, of course, be painful.

Carbon dioxide stunning

Carbon dioxide stunning is in use as an alternative method for stunning pigs. In Denmark most pigs are stunned by this method, although it is used by only a minority of slaughterhouses in the UK.

Some scientists have challenged its use on welfare grounds. Hoenderken (1983) stated that it caused a stressful period of excitement lasting on average 26 seconds.

Gregory et al (1990) observed that carbon dioxide is an unpleasant gas because of its pungency and because it induces a sense of breathlessness. Gregory (1992) has emphasised that although these effects would only last for the initial period of inhalation "they may be sufficient to render the method unpleasant or even inhumane". Hyperventilation and escape behaviour are clearly observed in pigs subject to this form of stunning.

In the light of the distress caused to the pigs, Compassion in World Farming Trust believes that the use of carbon dioxide stunning should be brought to an end.

CATTLE

Calves

A large number of calves are stunned electrically. This is likely to produce an average period of unconsciousness of 18 seconds (Anil, 1993, personal communication). This is a significantly shorter period of unconsciousness than that induced by electrical stunning in other species.

A major welfare problem has been highlighted by a recent study which shows that calves can take a much longer time than other species to lose their brain function following neck sticking (Anil et al, 1992). As a result some calves show clear signs of recovery after sticking.

This problem can probably be attributed to what is called 'ballooning' of the cut ends of the carotid arteries, i.e. the occlusion or obstruction of the cut. Ballooning serves to impede blood loss from the carotids and to allow vertebral artery blood flow to the head. In cattle the vertebral artery carries a significant amount of blood to the head. Anil et al found that the vertebral artery

blood flow in calves actually increases after sticking from 50ml/min to 270ml/min and concluded that the vertebral arteries could make a significant contribution to sustaining brain function.

They found that responsiveness can be present in the brains of calves for as long as 104 seconds after neck sticking. Moreover, it must be remembered that the average period of unconsciousness induced in calves by electrical stunning is a mere 18 seconds. When these two figures are considered together it is clear that a very large percentage of electrically stunned calves may resume consciousness during bleeding out.

Adult Cattle

The vast majority of cattle are stunned with a captive bolt which penetrates the brain. The animals are stunned by the energy that the bolt imparts to the head. Gregory (1991) has emphasised that the penetration of the bolt into the head does not on its own cause unconsciousness. It is the energy delivered to the head which is crucial.

In their 1984 Report the Farm Animal Welfare Council stressed that the major cause of ineffective captive bolt stunning is incorrect positioning of the bolt (FAWC, 1984, para. 148). The FAWC visited a number of slaughterhouses and concluded that there were far too many cases where penetration had not been at or near the correct position. They added that they saw evidence of a considerable number of double shots.

One survey (carried out some years after the FAWC report) visited 27 commercial abattoirs, evaluating the captive bolt stunning of 1944 cattle (Daly and Whittington).

This survey found that 6.6% of cattle "showed evidence of being less than fully effectively stunned". The authors expressed the view that the overall incidence of 6.6% poor stunning "clearly represents a disturbingly high figure". With some 3,380,000 cattle being slaughtered annually this means that some 223,000 animals may not be properly stunned each year.

In 2.6% of cases the shot was so poorly applied that the animal had to be stunned a second time, with 0.2% requiring a third stun.

The survey concluded that "the poor stunning could be attributed to both inaccurately aimed shots and to low captive bolt speeds". 40.5% of the animals in the survey were shot in a position more than 3 cm. from the ideal position. A fifth (20.9%) were shot over 4 cm. from the ideal position with 8% being shot more than 5 cm. from that position.

Daly and Whittington attributed too low bolt speeds to wear and inadequate maintenance of the pistols. Furthermore, 15% of the abattoirs surveyed used cartridges of lower strength than recommended by the manufacturers, and these abattoirs had a significantly higher incidence of poor stunning.

The Chief Veterinary Officer, Ministry of Agriculture, has written that "clearly, the distress experienced by an animal that has been mis-stunned would be very considerable". (Meldrum, 1992).

In order to address the high incidence of inaccurate shots a new law, the Slaughter of Animals (Humane Conditions) Regulations 1990, requires cattle stunning pens to be constructed so that they restrict the movement of the animal's head so as to permit accurate stunning.

Fears have, however, been expressed that some forms of head restraint may cause distress to the animals. One survey compared the stress experienced by cattle stunned whilst standing free in a stunning box with that of cattle stunned with their heads held in a hydraulically operated chin-lift type of restrainer (Ewbank et al, 1992).

It was found that only 2 out of 55 animals voluntarily allowed themselves to be trapped and stunned with their heads held in the restrainer. The researchers attempted to persuade other animals to use the head restrainer. Some of these exhibited highly aversive behavioural reactions, i.e. struggling, bellowing, total refusal to put head into restrainer.

The average time from entry into the pen to the stun was 5.6 seconds for the unrestrained animals but rose to 34.2 seconds for those persuaded to use the head restrainer. The longer time spent in the pen almost certainly leads to greater stress being experienced by the restrained cattle.

The survey points out that the cortisol level in the blood (an index of stress) taken at sticking averaged 67.6 nmol/litre for the animals stunned while standing free, whereas the mean for the head restrained animals was 143.1 nmol/litre.

The survey concluded that the "enforced usage of this type of head restrainer could be a cause of distress to the cattle involved".

Other types of head restraint have been developed which aim to apply restraint for a very short time. These seem to work satisfactorily without stress provided that the first time application is successful.

Whether there is a major problem with head restraint will depend to a degree on whether a new stunning box is fitted with a head restrainer or an existing box is modified.

It is without doubt vital to take steps to reduce the high incidence (6.6%) of ineffective stunning. We are, however, concerned that some types of head restrainers cause distress to the cattle involved and may create more problems than they solve.

SHEEP

Stunning-to-Sticking interval

In one survey the stunning-to-sticking interval was measured in over 10,000 sheep at 40 UK abattoirs (Gregory and Wotton, 1984a). 9,487 of the sheep were stunned electrically, with 1,277 being stunned by a captive bolt.

The average stunning-to-sticking interval for the sheep stunned electrically was 21 seconds. In the case of some of these sheep, however, that interval was as long as 46 seconds.

From a welfare standpoint this means that the unconsciousness induced by stunning must last for at least 46 seconds plus the time taken for sticking to lead to brain death.

Time from sticking to loss of brain responsiveness

The time from sticking to brain death will vary with different sticking methods.

Gregory and Wotton (1984b) found that the correct method of sticking, severing both carotid arteries plus jugular veins, took on average 14 seconds to induce loss of brain responsiveness.

From a welfare viewpoint one cannot, however, rely on an average figure. Rather, it is important to establish the time to loss of brain responsiveness for the majority of the sheep population. Gregory and Wotton estimated that 99% of sheep would lose brain responsiveness within 27 seconds of correct sticking.

Putting together a) the stunning-to-sticking interval and b) the time from sticking to loss of brain responsiveness it can be estimated that 99% of sheep would have lost brain responsiveness within 73 seconds of stunning. Put another way, stunning must induce a period of anaesthesia of 73 seconds to avoid the risk of sheep regaining consciousness during bleeding out.

This figure, however, is based on the assumption that all sheep are stuck correctly, i.e. have both carotid arteries and jugular veins severed. As indicated above, Gregory and Wotton (1984b) found that where both carotids and jugulars are severed sticking took on average 14 seconds to induce loss of brain responsiveness. They found, however, that this interval was five times longer - 70 seconds - where only one carotid artery plus one jugular vein was severed. Where only the jugular veins were severed, the time to loss of responsiveness rose markedly to about 5 minutes.

Danger of sheep regaining consciousness

Compassion in World Farming Trust fears that in most cases stunning will not produce a period of unconsciousness of 73 seconds, let alone the longer periods needed where the correct sticking

method is not used. It is generally accepted that electrical stunning produces a period of unconsciousness of 50-60 seconds in sheep.

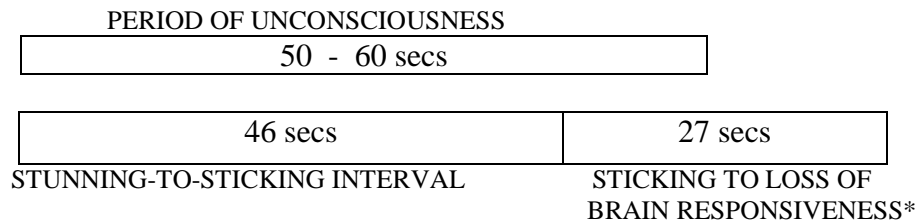
In conclusion, as is illustrated in Figure 2, the period of unconsciousness induced by stunning is inadequate to cover the time needed for the majority of the sheep population to lose brain responsiveness. Accordingly, there is a danger that a significant number of sheep may recover consciousness before death.

This danger is referred to by Gregory and Wotton (1984b) who have said that "the length of the stunning-to-sticking interval in some abattoirs and the likely variation in the adequacy of sticking, calls for a slaughtering method which produces a quicker and more punctual kill". Similarly, they have written (1984c) that "in some abattoirs sticking is carried out inefficiently, both in terms of the time at which it is performed after stunning and the number of blood vessels which are severed".

Anil and McKinstry (1991) have also emphasised that with head-only stunning animals can regain consciousness when the stunning-to-sticking interval is unduly prolonged.

Figure 2. SHEEP

Time required for 99% of sheep to lose brain responsiveness compared with period of unconsciousness induced by stunning.



*this period will be much longer where sheep are stuck incorrectly

Head-to-back stunning

Head-to-back stunning has been developed as an alternative to reversible, head-only stunning. Head-to-back stunning not only stuns the brain but at the same time fibrillates the heart; this will almost always induce a cardiac arrest. With head-only stunning, exsanguination is the cause of death. With head-to-back stunning, death is caused by the cardiac arrest and exsanguination only has the secondary function of removing blood from the carcass.

There is general agreement among scientists that a stunning method which induces cardiac fibrillation is likely to lead to less suffering at slaughter. The advantage of this method is that the risk of animals regaining consciousness is significantly reduced (Gregory and Wotton, 1984b and 1984c). This is particularly the case where there is either an unduly long stunning-to-

sticking interval or inadequate sticking. It must, however, be stressed that it is essential that the animal's brain is stunned at the same time as (or, preferably, fractionally before) the heart is fibrillated otherwise the animal will feel the pain and distress engendered by a cardiac arrest.

The advantages of head-to-back stunning can be seen from the following studies. Gregory and Wotton (1984b) found that, for 99% of the sheep population the cardiac arrest method was 51 seconds quicker in leading to loss of brain responsiveness than conventional slaughtering procedures which depend on sticking to kill the animal. They stressed that this figure is probably an underestimate as it was calculated on the basis that all sheep have both carotid arteries plus jugular veins severed at sticking, which is most unlikely to be the case.

Gregory and Wotton (1984b and 1984c) found that, in sheep, sticking led on average to loss of brain responsiveness 13-14 seconds more quickly than cardiac fibrillation. They concluded (1984c) that the traditional method which depends on sticking to kill the animal is only likely to produce a quicker kill than the cardiac arrest method where the stunning-to-sticking interval (which on average they found to be 21 seconds) is less than 13-14 seconds. They added that: "This conclusion, however, depends on the assumption that both common carotid arteries are always severed at sticking. Since this cannot be guaranteed, it is suggested that the head-to-back method should be preferred".

Despite the clear advantages of head-to-back stunning for sheep, many British abattoirs fail to use this method, relying instead on head-only stunning with the attendant risks of animals resuming consciousness.

Captive bolt stunning

This involves the firing of a captive bolt into the animal's head. Captive bolt stunning is very effective in sheep and involves a much lower welfare risk than electrical stunning.

Despite this, relatively few British abattoirs use captive bolt stunning for sheep. This is largely because this method is more costly than electrical stunning.

CONCLUSIONS

- 1. Many pigs may not be adequately stunned due to the use of a voltage too low to deliver sufficient current.**
- 2. A significant number of pigs and sheep may recover consciousness during bleeding out. This is primarily due to prolonged stunning-to-sticking intervals and, in some cases, to inefficient sticking.**
- 3. There is general agreement by scientists that head-to-back stunning, which kills by inducing cardiac arrest, is likely to be more humane than conventional slaughter methods. Despite its welfare advantages, many British abattoirs fail to use head-to-back stunning for sheep. For pigs it is hardly used at all.**
- 4. Carbon dioxide stunning of pigs has been condemned by scientists as stressful and even inhumane. Accordingly its use should be brought to an end.**
- 5. The slaughter of calves presents particular problems. Calves can take much longer than other species to lose their brain function after neck sticking. Moreover, electrical stunning induces a much shorter period of unconsciousness in calves than in other species. As a result, many calves may resume consciousness during bleeding out.**
- 6. Many cattle are ineffectively stunned due to inaccurate positioning of the captive bolt and low bolt speeds. The legislative requirement to use head restrainers is intended to reduce the incidence of poor stunning but some types of head restrainers cause distress to the cattle involved and may create more problems than they solve.**

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