

# The effects of land transport on animal welfare

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## Summary

Animal welfare during and as a result of transport can be assessed by using a range of behavioural, physiological, pathological and carcass-quality indicators that are described in this paper. Measures of the extent of any disease, injury or mortality resulting from, or exacerbated by, transport are important because health is an important part of welfare. Many of the indicators are measures of stress as they involve long-term adverse effects on the individual. Factors affecting the welfare of animals before, during and after transport which are discussed are: definition of the responsibilities and competence, attitudes to animals and need for training of staff; planning of journeys and methods of payment of staff; laws and retailers' codes; genetics, especially selection for high productivity; rearing conditions and experience; the mixing of animals from different social groups; handling and loading procedures; driving methods; space allowance; increased susceptibility to disease and efforts to minimise the spread of disease.

## Keywords

Cattle – Equine – Handling – Loading – Pig – Poultry – Sheep – Stress – Transport – Welfare.

## Introduction

A high proportion of all farmed animals are transported at some stage in their lives, sometimes to places where food is more readily available, sometimes to a different owner or a different place of keeping, and sometimes to slaughter. The handling, loading, transporting and unloading of animals can have very substantial effects on their welfare. The welfare of an individual is its state as regards its attempts to cope with its environment (5) and includes both the extent of failure to cope and the ease or difficulty in coping. Health is an important part of welfare whilst feelings – such as pain, fear and various forms of pleasure – are components of the mechanisms for attempting to cope and so should be evaluated where possible in welfare assessment (9, 12, 17). Where an individual is failing to cope with a problem, it is said to be stressed. Stress is an environmental effect on an individual which overtaxes its control systems and reduces its fitness or appears likely to do so (16). If the environment just causes stimulation, or useful experience, or an adrenal cortex response that has no adverse consequences, the individual is not stressed. Animal protection is a human activity which is directed towards the prevention of poor welfare in the animals. Where poor welfare associated with the transport of animals is prevented, there is an immediate

financial advantage because mortality rates and carcass downgrading are reduced. There can also be a long-term economic advantage because many of the general public, being aware of animal transport and concerned about animal welfare during transport, take account of this when deciding whether or not to buy animal products (6, 7, 8, 26).

In this paper the methodology for assessing the welfare of the animals during handling and transport is briefly explained (14). Some of the various factors that affect the likelihood of poor welfare, including the effects of disease, are then discussed. These are the factors which have been taken into account in formulating the World Organisation for Animal Health (OIE) Guidelines on animal welfare in relation to transport. The Guidelines were approved by the International Committee during the 73rd OIE General Session in May 2005.

## Assessing welfare

Welfare indicators which can be used to assess the welfare of animals being handled or transported are listed in Table I. Some of these are measures of short-term effects whilst others are more relevant to prolonged problems (11,

**Table I**  
**Measures of welfare during and after transport**

Measure	Reference
Behavioural measures of aversion	29, 30, 31, 64, 65
Behaviour measures indicating difficulty in coping	28, 38, 40, 44, 51, 53, 59, 71
Physiological measures indicating difficulty in coping	1, 14, 20, 37, 40, 42, 45, 49, 56, 58, 59, 60, 62, 71, 72
Measures of immune system function	14, 25, 43
Measures of injury in live animals	33, 67, 68
Measures of clinical disease	14, 22, 69, 74
Carcass measures	3, 14, 33, 55, 67, 68
Mortality measures	14, 48, 73, 74
Measures of later reproduction or growth	24, 66, 67

16, 21). Where animals are transported to slaughter, the measures of short-term effects such as increased physiological responses, behavioural responses, injury or mortality are most commonly used; however, some animals are kept for a long period after transport, and measures such as increased disease incidence or suppression of normal development give information about the effects of the journey on welfare (Table I).

As Hall and Bradshaw (29) explain, information on the stress effects of transport is available from five kinds of study:

- a) studies where transport, not necessarily in conditions representative of commercial practice, was used explicitly as a stressor to evoke a physiological response of particular interest (33, 54)
- b) uncontrolled studies with physiological and behavioural measurements being made before and after long or short commercial or experimental journeys (2, 3, 20, 42)
- c) uncontrolled studies during long or short commercial or experimental journeys (28, 46)
- d) studies comparing animals that were transported with animals that were left behind to act as controls (40, 48)
- e) studies where the different stressors that impinge on an animal during transport were separated out either by experimental design (4, 15, 18) or by statistical analysis (31).

All of these methods are of value because some are carefully controlled but less representative of commercial conditions whilst others show what happens during commercial journeys but are less well controlled.

## Disease, welfare and transport

The transport of animals can lead to increased disease, and hence poorer welfare, in a variety of ways. There can be tissue damage and malfunction in transported animals,

pathological effects which would not otherwise have occurred resulting from pathogens already present, disease from pathogens transmitted from one transported animal to another, and disease in non-transported animals because of pathogen transmission from transported animals.

Enhanced susceptibility to infection and disease as a result of transport has been the subject of much research (17). In transported cattle, especially those transported for long distances, there are substantial welfare problems and economic losses caused by 'shipping fever'. (The term 'shipping fever' is used to describe a range of diseases caused by *Pasteurella* species, bovine respiratory syncytial virus, infectious bovine rhinotracheitis virus, and para-influenza virus 3.) Stress may cause reactivation of viruses that are present in animals from a previous infection.

Many infectious diseases may be spread as a result of animal transport. For example, outbreaks of classical swine fever and of foot and mouth disease can be made worse because animals are transported and in some cases transmit the disease at staging points or markets (47). Major disease outbreaks have very important impacts on animal welfare as well as causing economic problems, and regulations concerning the risks of disease are necessary on animal welfare grounds. If stress is minimised and the mixing of animals and their products is minimised, disease and hence poor welfare can be prevented or made less likely.

## Guidelines that should minimise poor welfare of animals during handling and transport

Laws can have a significant impact on the ways in which people manage animals. Codes of practice can also have significant effects on animal welfare during transport. The most effective of these codes, which are sometimes just as effective as laws, are retailer codes of practice, since retail companies need to protect their reputation by enforcing adherence to them (13).

In order to produce guidelines that can be used to prevent or minimise poor welfare in animals during transport, it is necessary to be aware of the biological functioning of the animals concerned and the attitudes and actions of the people involved in the handling and transport procedures. The remainder of this paper is organised, as in the OIE Guidelines, to consider who is responsible, how these people should be trained, and what is necessary in planning animal transport, the pre-journey period, loading, travel, unloading and actions to be taken if a journey cannot be completed.

## Responsibilities

The welfare of animals during transport is the joint responsibility of all people involved.

These people include: owners and managers of animals, business agents or buying/selling agents, and animal handlers. Although much of the remainder of this text refers principally to the people who are handling, loading or moving animals or to the drivers of vehicles, it is important that owners, managers and agents appreciate their responsibilities.

## Training and competence

People are less likely to be cruel to other individuals if they consider that these individuals are aware and sentient. Non-human animals are regarded as aware and sentient by some people, but as objects valued only according to their use by others. Hence there is a wide range of attitudes to animals and these have major consequences for animal welfare. During handling and transport, these attitudes may result in one person causing high levels of stress in the animals whilst another person doing the same job may cause little or no stress. People may hit animals and cause substantial pain and injury because of selfish financial considerations, or because they do not consider that the animals are subject to pain and stress, or because of lack of knowledge about animals and their welfare. Training of staff can substantially alter attitudes to, and treatment of, animals. If an untrained person is driving a vehicle and in sole charge of tens or hundreds of animals on a transport vehicle, this can easily result in poor welfare at the time and may cause much poor welfare in the future because of the risk of transmission of infectious disease.

## Planning the journey

### Aspects of planning

Adequate planning is a key factor affecting the welfare of animals during a journey. Before the journey starts, plans should be made in relation to:

- preparation of animals for the journey
- choice of road or rail
- the nature and duration of the journey
- vehicle/container design and maintenance, including roll-on/roll-off vessels
- required documentation
- space allowance
- rest, water and feed, and observation of animals en route

- control of disease
- emergency response procedures.

## Genetics of the animals

Some animals are much better able to withstand the range of environmental impacts associated with handling and transport than are others. This variation can be caused by genetic differences, which may be associated with the breed of the animal or with selection for production characteristics. There may be differences between breeds in how they react to particular management conditions. For example, Hall *et al.* (31) found that introduction of an individual sheep to three others in a pen resulted in a higher heart rate and salivary cortisol concentration if the sheep was of the Orkney breed than if it was of the Clun Forest breed. The breed of animal should be taken into account when planning transport.

In some farm species, selection directed towards maximising productivity has consequences for welfare (6, 10). Fast-growing broiler chickens may have a high prevalence of leg disorders, some beef cattle which have grown fast have joint disorders that result in pain during transport, and some strains of high-yielding dairy cows are much more likely to have foot disorders. Modern strains of dairy cows, in particular, need much better conditions during transport and much shorter journeys if their welfare is not to be poorer than the welfare of dairy cows thirty years ago.

## Effects of housing and the animals' experience of humans

Differences amongst individuals in coping ability also depend on housing conditions and the extent and nature of contact with humans and conspecifics during rearing. If animals are kept in such a way that they are very vulnerable to injury when handled and transported, then either this must be taken into account when transporting these animals or the rearing conditions must be changed. An extreme example of such an effect is osteopaenia and vulnerability to broken bones, which is twice as high in hens in battery cages as in hens that are able to flap their wings and walk around (39). Calves are much more disturbed by handling and transport if they are reared in individual crates than if they are reared in groups, presumably because of lack of exercise and absence of social stimulation in the rearing conditions (59).

Human contact prior to handling and transport is also important. If young cattle have been handled for a short period just after weaning they are much less disturbed by the procedures associated with handling and transport (45). All animals can be prepared for transport by appropriate previous treatment.

### Selection of vehicle

Since physical conditions within vehicles during transport can affect the extent of stress in animals, the selection of an appropriate vehicle is important for animal welfare. Similarly, the design of loading and unloading facilities is of great importance. The person who designs the vehicle and facilities has a substantial influence, as does the person who decides which vehicle or equipment to use.

### Social mixing

For cattle, pigs and some other species, any mixing of animals with those not previously housed with them can cause very poor welfare. If pigs or adult cattle are taken from different social groups, whether from the same farm or not, and are mixed with strangers just before transport, during transport or in lairage, there is a significant risk of threatening or fighting behaviour (27, 46, 55). The glycogen depletion associated with threat, fighting or mounting often results in dark, firm, dry meat, injuries such as bruising, and associated poor welfare. The problem is sometimes very severe, in welfare and economic terms, but is solved by keeping animals in groups with familiar individuals rather than mixing strangers. Cattle may be tethered during loading but should never be tethered when vehicles are moving, because long tethers can easily cause entanglement and short tethers cause a high risk of cattle being hung by the neck.

### Space allowance

Before a journey starts, there must be decisions about the space allowance for the animals on the vehicle and the grouping and distribution of animals. For all species, being tied by the neck, body or leg on a moving vehicle can lead to major problems.

Tarrant *et al.* (56) studied cattle at a rather high, an average and a low commercial stocking density, and found that falls, bruising, cortisol and creatine kinase levels all increased with stocking density. It is crucial for good welfare that the stocking density should not be too high.

### Payment of handlers and drivers

The behaviour of handlers towards animals whilst loading and unloading, and the way in which people drive vehicles, are affected by the method of payment. When people are paid more if they load or drive fast, welfare will be worse. Payment of bonuses to handling and transport staff if the incidences of injury and poor meat quality are low improves welfare. Insurance against loss caused by bad handling may reduce incentives for good practice, and so results in injury or poor meat quality.

### Other aspects of planning

All of the factors mentioned so far should be taken into account in the procedure of planning for transport.

Planning should also take account of temperature, humidity and the risks of disease transmission. Disease is a major cause of poor welfare in transported animals. Planning of routes should take account of the needs of the animals for rest, food and water. Drivers or other persons responsible should have plans for emergencies, including a series of emergency telephone numbers to call for veterinary assistance in the event of injury, disease or other welfare problems during a journey.

### The pre-journey period

Once the planning is completed, there are certain actions which should occur before the first animals are loaded, including selection of compatible animals in order to avoid the problems described above. Pre-journey rest is necessary if the welfare of animals has become poor during the collection period because of major physical or social problems. Feed and water should be provided pre-journey if the journey duration is greater than the normal inter-feeding and drinking interval for the animals. When animals will be provided with a novel diet or method of water provision during or after transport, an adequate period of pre-exposure is necessary. Before each journey, vehicles and containers should be thoroughly cleaned and, if necessary, treated for animal health and public health purposes.

Inspection of animals to be transported is important to ensure that animals not fit for transport or likely to transmit disease are not transported. Where an animal handler believes that there is a significant risk of disease among the animals to be loaded, the animals should be inspected by a veterinarian.

### Handling, loading and unloading of animals

The methods used during handling, loading and unloading can have a great effect on animal welfare. Since loading has been shown to be the procedure most likely to be the cause of poor welfare in transported animals, the methods to be used should be carefully planned.

Large animals can be readily moved from place to place by experienced stock-handlers who move so as to take advantage of the animals' flight zone (26, 38). Cattle will move forward when a person enters the flight zone at the point of balance and can be calmly driven up a race by a person entering the flight zone and moving in the opposite direction to that in which the animals are desired to go.

Handling animals without the use of sticks or electric goads results in better welfare and less risk of poor carcass quality. Good knowledge of animal behaviour and suitable facilities are important for good welfare during handling and loading.

## Travel

The way that a vehicle is driven can have great effects on the welfare of the animals being transported. When humans ride in a vehicle, they can usually sit on a seat or hold on to some fixture. Animals standing on four legs are much less well able to deal with disturbances such as those caused by swinging around corners or sudden braking. Cattle, sheep and horses always endeavour to stand in a vehicle in such a way that they brace themselves to minimise the chance of being thrown around, and avoid making contact with other individuals. They do not lean on other individuals and are significantly disturbed by too much movement or too high a stocking density. In a study of sheep being transported on winding or straight roads, Hall *et al.* (32) found that plasma cortisol concentrations were substantially higher on winding than on straight roads.

During journeys animals can become sick or be injured. Such animals can be detected and appropriate action taken if adequate inspections are carried out with sufficient frequency. Hence, on all but the shortest journeys, it is important that there is adequate opportunity for inspection. There are problems with inspecting animals in multi-deck vehicles.

Actual physical conditions, such as temperature and humidity, may change during a journey and require action on the part of the person responsible for the animals. A journey of long duration will have a much greater risk of poor welfare, and some long journeys inevitably lead to problems. Hence good monitoring of the animals with inspections of adequate frequency, and in conditions which allow thorough inspection, is important.

## Post-journey treatment of animals

Unloading procedures have already been briefly referred to. In general, more care is needed at unloading because the animals are more likely to be fatigued, injured or diseased.

An animal that has become sick, injured or disabled during a journey should be appropriately treated or humanely killed. When necessary, veterinary advice should be sought

in the care and treatment of these animals. At the destination, there should be appropriate facilities and equipment for the humane unloading of animals that are non-ambulatory due to fatigue, injury or sickness. These animals should be unloaded in a manner that causes the least amount of suffering. After unloading, separate pens and other appropriate facilities should be available for sick or injured animals. Feed, if appropriate, and water should be available for each sick or injured animal.

After vehicles and facilities have been used for animal transport they may harbour infectious agents that could cause the spread of major diseases. Hence proper disinfection and disinfestations are needed.

On occasion there may be reasons why a journey cannot be completed. Hence drivers and owners should be aware of actions that are necessary in these circumstances.

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## Les effets du transport par voie terrestre sur le bien-être animal

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### Résumé

Le bien-être animal pendant le transport et suite à celui-ci peut être évalué en utilisant un ensemble d'indicateurs comportementaux, physiologiques, anatomopathologiques et axés sur la qualité des carcasses qui sont décrits dans le présent article. Il est important de mesurer l'importance de toute maladie, les blessures ou la mortalité induites ou aggravées par le transport, car la santé est une composante importante du bien-être. Bon nombre des indicateurs sont une mesure du stress puisqu'ils portent sur les effets indésirables à long terme produits sur l'individu. Les facteurs ayant une incidence sur le bien-être des animaux avant, pendant et après le transport sont les suivants : définition des responsabilités et des compétences ; attitudes vis-à-vis des animaux et nécessité de former le personnel ; planification des voyages et modes de rémunération du personnel ; lois et codes des détaillants ; génétique, en particulier sélection en vue d'une productivité élevée ; conditions d'élevage et expérience ; regroupement d'animaux provenant de groupes sociaux différents ; techniques de manipulation et d'embarquement ; règles de conduite des véhicules ; allocation d'espace ; prédisposition accrue aux maladies et actions visant à réduire dans toute la mesure du possible leur propagation.

### Mots-clés

Bien-être – Bovin – Chargement – Équidé – Manipulation – Ovin – Porc – Stress – Transport – Volaille.



## Secuelas del transporte terrestre en el bienestar de los animales

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### Resumen

En este artículo se describen los indicadores de comportamiento, fisiológicos, patológicos y de calidad de las canales que se utilizan para evaluar el bienestar de los animales durante y después de su transporte. Como la salud es un componente significativo del bienestar, es importante cuantificar toda enfermedad, herida o mortandad ocasionada o agravada por el transporte. Los distintos indicadores que evalúan los efectos nocivos a largo plazo que sufre cada animal son, simultáneamente, medidas de su estrés. El autor examina los factores que afectan el bienestar de los animales antes, durante y después de su transporte, a saber, la definición de las responsabilidades y competencias; las actitudes adoptadas frente a los animales y la necesidad de capacitar al personal; la planificación de los viajes y los métodos de pago del personal; las reglamentaciones y requisitos de los minoristas; la selección genética, en particular para la cría intensiva; las condiciones y experiencia de cría; la mezcla de animales de distintos grupos sociales; los procedimientos para desplazar y embarcar animales; las formas de conducir los vehículos; el espacio disponible; el incremento de la susceptibilidad a las enfermedades, y las medidas para reducir al mínimo la propagación de estas últimas.

### Palabras clave

Ave de corral – Bienestar – Desplazamiento – Embarque – Equino – Estrés – Ovino – Porcino – Transporte – Vacuno.



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