Chapter 13. Stress physiology

Pregnant sows in stalls suffer chronic stress from hunger and confinement

Most animals are able to make a number of changes when challenged by their environment. For example, an animal that is too hot may start to sweat. This is a physiological response to the challenge. Pigs don't sweat, but can wallow or seek shelter from the sun. In this case, the animal has made a change in his or her behaviour to try and cope with the environment. Both behavioural and physiological changes serve to return the animal to some optimal state or equilibrium.

Pigs challenged by heat can adapt by seeking the shade or wallowing

When environmental conditions become difficult and the animal fails to cope, we describe it as being under stress or as having poor welfare. Failure to cope reduces the animal's fitness and this can be measured. If the animal succeeds in coping then the amount that the animal has to do in order to cope can also be measured. If coping is easy, then there is little effect on welfare. For example, pregnant sows are kept on a restricted diet. This prevents obesity but they suffer from hunger. If the sow has access to fibrous bedding or pasture she can cope with the stress of hunger through increasing gut fill without putting on excessive weight.

Some scientists argue that stress in itself isn't necessarily bad, provided that the animal can cope with it. Suffering occurs when an animal faces a stress that he or she cannot cope with.

Opportunity to root enables sows on a restricted diet to cope with hunger

Environmental factors that lead to stress are called stressors and the individuals under stress show stress responses. Stress responses depend on the type, intensity and duration of the stressor and on the characteristics of the animal. Responses to stress have been divided into acute, or short-term,

and chronic, or long-term, responses. An example of an acute stressor might be the approach of a predator or an attack made by a pen-mate. A chronic stressor might be the close confinement of sows in stalls for several months during pregnancy.

Information about a stressor is processed in the brain, which then informs the body how to respond via the nervous system or by the release of hormones. The most commonly measured physiological responses to acute stress are the increased secretion into the blood of:

1. Glucocorticosteroids from the hypathalamo-pituitary-adrenal axis e.g. cortisol
2. Catecholamines from the sympatho-adrenal system e.g. adrenaline

Action by the sympatho-adrenal system is much quicker than the hypathalamo-pituitary-adrenal axis. Catecholamines can increase heart-rate and prepare the animal for 'fight or flight' as first demonstrated by Canon in 1914. The hypathalamo-pituitary-adrenal response was first recognised by Selye in 1932.

Although the regulation of these systems can also be affected by chronic stress, they are more difficult to measure because of efficient feed-back mechanisms. Chronic stress can however, affect the regulation of these systems. This is most noticeable if an animal suffering from chronic stress then becomes subject to an acute stressor. For example, sows that have been housed in sow stalls and then transferred to farrowing crates suffer from chronic stress caused by close confinement. The process of farrowing is an acute stressor and this on top of the chronic stress can have serious consequences for the regulation of several hormones including cortisol and adrenaline. This in turn can have detrimental effects on the birth process itself (Baxter and Petherick, 1980)

Both acute and chronic stress can affect changes in a range of other hormones including:

- Insulin
- Prolactin
- Growth hormone
- Vasopressin
- Opioid peptides

Stress can lead to an increase in body temperature, a decrease in weight gain and suppression of the immune system. Stress can therefore have a direct bearing on the animal's health. Several studies have shown that animals suffering from stress are more susceptible to diseases (Broom, 1987).

The elimination of stress for farm animals is therefore not only important from an animal welfare point of view, it is also important from an economic point of view. This is because stress can reduce health status, decrease growth rates and impair reproductive functioning.

Piglets naturally stay with their mother until 13-17 weeks old. Early weaning is highly stressful

In intensive pig production, the early weaning of piglets at 3 to 4 weeks is recognised as a highly acute stressor. This is due to a number of reasons:

- Removal from their mother
- Change in diet
- Taken away to an alien environment
- Mixed with other unfamiliar piglets

At 3 to 4 weeks of age, immunity that is passed on by the mother via her colostrum is beginning to wane. At the same time, the natural immunity of the piglet is still very immature. As a result, they are very prone to disease at this stage. The acute stress caused by weaning is enough to further suppress the already weakened immune system and many piglets fall ill. In many cases, the illnesses can lead to bouts of diarrhoea from which the piglets usually recover. However, in recent times a new disease has been affecting weaned pigs across the world. The disease is called Post-weaning Multi-systemic Wasting Syndrome (PMWS) and can cause very high rates of mortality (see Chapter 14 on disease).

Producers have responded by trying to reduce the stress suffered by piglets. Three examples illustrate the point:

1. The disease has lead some pig producers to postpone weaning till at least 32 days so that the piglets' immune system is more able to cope with stress caused by weaning.
2. Many pigs in the UK are bred in outdoor units and then transported after weaning to rearing units. The stress of transport led to high mortality amongst pigs with PMWS. It is now common to rear the piglets for several weeks after weaning until they are better able to cope with the stresses of transport.
3. Sparsholt College used to segregate piglets with the disease to prevent it from spreading. They found that the stress of isolation resulted in a very high death rate. They now keep the piglets in their original groups.

These examples illustrate the importance of reducing stress to the health of piglets. They also show how stressful isolation and early weaning can be, especially if followed by transportation. All should be avoided on health and welfare grounds wherever possible. In the United Kingdom, the Meat and Livestock Commission (2002) have published advice on controlling PMWS, PDNS and other diseases which includes:

- Limiting mixing
- Reducing stocking density
- Reducing group size
- Avoiding tooth clipping
- Providing good nutrition
- Improving air quality

This advice is designed to reduce stress in pigs, whilst improving biosecurity and nutrition. All should be seen as good practice whether or not a farm has a PMWS problem.

Summary

Animals try to adapt when challenged by their environment. Stress and poor welfare result when they cannot adapt. Stress hormones appear in the blood.

Many causes of stress and poor welfare have been described in this book such as:

- Hunger
- Early weaning
- Crowding
- Mixing
- Aggression and
- Confinement

Stress can reduce immunity to disease, growth and reproduction.

A number of measures to reduce stress have been recommended for farms with diseases like PMWS, a condition which makes piglets very sensitive to stress. These measures can also be recommended for all farms, irrespective of disease status, to reduce stress and improve welfare.