Reconciling productivity and welfare in intensive pig husbandry: a challenge for the year 2000

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Summary: In the first part of this paper, the authors discuss the growing concern of consumers for farm animal welfare, and the attitude adopted by veterinarians to cope with this new and more humanitarian concept of intensive husbandry. The effects of intensification of pig production on the ability of pigs to adapt, and the behavioural, husbandry and health consequences of the principal stress factors in pig rearing are reviewed and illustrated by examples from recent research. In conclusion, the authors discuss the importance of constructive integration of welfare into pig production, in training courses and in actual application.


INTRODUCTION

Over the past two decades, major concern has been expressed by society for the welfare of animals. This concern is part of a general, broadly anti-industrial movement, in which welfare has become a keyword, although the meaning of this term may differ from one individual to another.

Respect for animal welfare has become an ethical, scientific, social and political problem. Animals used in research and agriculture are the two principal groups which arouse concern. Intensive production is often considered cruel, and certain husbandry practices judged incompatible with the well-being of animals. Pig production has not escaped criticism, particularly with regard to types of housing which restrict social contacts and motor activity. Although at first ridiculed and rejected because of its ecological character, this animal rights movement has grown sufficiently to compel some countries to change their legislation. Thus, in the United Kingdom, it is now illegal to construct individual farrowing crates, and in Sweden lactating sows may not be confined to farrowing crates for more than one week. Ethical rules have been promulgated by the Farm Animal Welfare Council of the United Kingdom. These rules (updated in 1993) identify the following five fundamental requirements which have to be satisfied to protect farm animals from suffering: freedom from hunger and thirst – by ready access

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to fresh water and a balanced diet to maintain full health and vigour; freedom from discomfort – by providing an appropriate environment, including shelter and a comfortable resting area; freedom from pain, injury or disease – by prevention, or rapid diagnosis and treatment; freedom to express normal behaviour – by providing sufficient space, proper facilities and company of the same species; and freedom from fear and distress – by ensuring conditions and treatment which avoid mental suffering. This extensive definition is open to different interpretations.

**ROLE OF VETERINARIANS**

There are various aspects of the role of the veterinarian in animal welfare. Undeniably, the veterinarian, by virtue of professional training, improves the welfare of animals by diminishing their suffering, through medicinal and surgical interventions. The veterinarian should also be able to evaluate (qualitatively and quantitatively) the stress factors present on a farm, and assess the potential impact of these factors on the behaviour, physiology and performance of animals in the short, medium and long term. However, the basis and components of this diagnostic approach to welfare are still poorly developed in veterinary medicine, in comparison with other disciplines, for various reasons. The discipline of welfare itself is only in the early stages of development, and the technical difficulties of an overall approach must not be underestimated. In addition, the training in veterinary medicine is characterised by a reductionist and mechanistic approach. Such voluntary oversimplification makes it difficult to comprehend multifactorial problems. Animal welfare problems are inherently complex, as it is difficult to establish a causal link on account of the number of interactions and the time interval between cause and effect. Nevertheless, veterinary literature from the past two years suggests that there is a trend towards greater involvement in this field. However, there does exist a certain resistance to this subject, which is reflected by the small number of scientific articles devoted to welfare in certain veterinary periodicals.

**INTENSIFICATION OF PIG PRODUCTION**

Intensification of pig production has positive and negative consequences. One of the positive consequences of current meat production is the provision of a minimum quantity of animal protein to consumers. Since the 1940s, meat consumption has been linked to the standard of living. Current low production costs provide universal accessibility. However, there are many negative effects of intensification. One of the chief consequences is to bring together large numbers of pigs in an impoverished environment with few stimuli (poor in exteroceptive stimuli), and with a minimum of space for individual pigs, restricting exercise. The social structure of groups of pigs has been completely disrupted by segregating animals by age group and physiological status.

For economic reasons, manpower has also been reduced to a minimum by automation of management and environmental control, hence diminishing contacts between the farmer and the animals. The number of animals per unit of labour is one of the most important economic factors. Intensification of pig production has also led to new epidemiological challenges arising from the large size of units (5) and the multifactorial nature of disease problems, which are difficult to tackle. Fortunately, pigs
are highly adaptable in their behaviour, demonstrating a remarkable capacity to adapt to environmental conditions which are very different from those experienced in natural conditions. However, there is a threshold of tolerance beyond which the animals find it difficult to adapt. This is shown by changes in behaviour which could be called deviations. In livestock farming, such alterations serve as indicators of an imbalance between the animal and its environment, which may lead to disorders of physiological equilibrium or may be expressed solely by behavioural disorder without apparent organic involvement (23). In either case, the outcome may be an impairment of growth and reproduction. From a simple mechanistic approach, the effect of acute physiological imbalance on performance is easy to understand and accept. However, the implications of a change in behaviour for productivity and health are more difficult to accept. Cannibalism is one of the most common forms of aberrant behaviour, and its adverse effects are indisputable, visible and quantifiable. However, it is more difficult to admit that the stereotyped behaviours of sows, their rest/activity rhythm, or the behaviour of the producer towards them affect their reproductive performance.

**STRESS AND WELFARE**

A review of the scientific literature demonstrates the difficulty (or impossibility) of reaching a consensus on the most appropriate definitions of stress and animal welfare (27). In this respect, it is understandable that these concepts are also difficult to interpret for the veterinarian operating in industrial medicine, where the objective is to help producers to increase production. The welfare concept is more difficult to introduce into population medicine than into an individualistic medical approach, as the individual is merely regarded as an element of the group. It is also more difficult to apply the holistic approach of welfare, where a negative result often arises from many causes, to population medicine. Such an approach is very different from the "one cause – one effect" model used in veterinary medicine to solve numerous production problems.

As intensive husbandry favours the group to the detriment of the individual, welfare is hard to assess by means of the customary performance and health criteria. Although it has been demonstrated that productivity is not invariably diminished by suboptimal welfare, this view is still held in some quarters (8). Such an attitude fails to take into account the multiple relationships between risk factors present on the farm. Such relationships are not always easy to demonstrate, analyse and classify, and their role in the appearance of a problem is often difficult to assess, particularly when the interactions are remote in the time sequence. For example, one long-term negative effect observed in the most productive herds in terms of numerical productivity is their high turnover rate (21). The presence or absence of an immediate relationship between cause and effect can be illustrated with reference to *Escherichia coli* diarrhoea. In an immediate approach, the relationship between *E. coli* and diarrhoea leads to treatment and recovery of the animal. However, temporary and subclinical dysgalactia in a sow can be responsible for a relative deficiency of colostral immunity, thus enabling pathogenic *E. coli* to exert harmful effects. In practice, treatment is administered regardless of the origin of the condition. By contrast, the approach of preventive medicine necessitates the identification of risk factors.
STRESS FACTORS IN THE HERD

The following sections are devoted to stress factors which may affect the welfare of pigs in intensive husbandry. These factors are presented in chronological order of pig production, namely from puberty to farrowing, then from suckling to fattening. This choice is dictated by the need to reflect the structure of pig production, divided into breeder, breeder-fattening and fattening units. However, the slaughter stage is not included here, as this is covered by another article in the present volume.

There are numerous possible definitions of the term “stress”. For the purposes of this article, the state of stress is defined as the physiological and behavioural reactions developed by the animal to adapt to a new or aggressive external stimulation. These are capable of disturbing the homeostatic equilibrium of the body under extreme conditions (11). In a chronic state of stress, the body responds in an adaptive manner by secreting an excessive quantity of corticosteroids; this has major adverse effects on the digestive, immune and reproductive systems, and on metabolism (25).

Puberty and mating

The often restricted possibilities for interaction between male and female pigs in modern buildings can have important consequences on the performance of future breeding animals. Hemsworth et al. (15) demonstrated that social isolation has an adverse effect on the sexual behaviour of boars. In fact, physical contact with females or even other males during the growing period facilitates the early development of sexual behaviour during the pre-pubertal period. The presence of sexually mature females is also important in maintaining the sexual activity of young boars up to one year of age (16).

Pregnancy

The attitude of the pig producer towards the animals has a profound influence on the productivity of the herd and on the well-being of pigs. Hemsworth et al. (18) demonstrated that pigs handled unpleasantly or inconsistently developed a fear of human beings, an increase in plasma corticosteroids, and a slower growth rate. The quality of the man/animal relationship seems to affect breeding animals in particular. Aversive treatment of very brief duration (shock with a battery-operated prodder applied for less than a second) reduced the pregnancy rate from 87.5% to 33.3%, and also reduced testicular size in boars (17). Seabrook and Darroch (30) observed that sows which were handled roughly or maltreated produced 8% fewer piglets per litter than sows treated gently, and the mortality rate of piglets up to 3 weeks of age was 27% greater.

Feed restriction is another stress factor which is important during pregnancy, for it is the main cause of stereotyped behaviour and excessive drinking in sows (31). Stereotyped behaviour consists of sequences of repeated activities in a fixed pattern, having no obvious function. Such behaviour appears among animals which are kept in an impoverished environment, particularly in situations of conflict and frustration. In sows, stereotyped behaviour often takes the form of oral behaviour, such as chewing at chains or bars. Although it has been acknowledged for some time that such behaviour is pathological, it has been demonstrated only recently that a reduction in such abnormal behaviour in sows is accompanied by a 20% increase in litter weight at the time of weaning, attributed to lower energy expenditure by the animal (22). This diminution in stereotyped behaviour was brought about by reducing hunger stress through the feeding
of more voluminous diets (26). Such bulky, fibrous diets respect the restriction in energy and protein required during pregnancy, but provide a greater amount of feed to ingest, due to the incorporation of fibre.

The third stress factor for pregnant sows is housing. In a natural environment, six to seven hours a day are spent searching for feed and moving around. When sows are kept in individual housing, these activities are reduced to zero. This reduction in locomotor activity results in inhibition of immune functions (6) and gives rise to a large number of frustration responses, such as aggressiveness, escape attempts and stereotyped behaviour; it can also result in injuries to the neck of gilts restrained by a collar. Vestergaard and Hansen (32) also observed that the duration of farrowing is prolonged by nearly two hours in tethered sows. Incidentally, tethers are now prohibited in certain European countries. Much research is currently being conducted on various group housing systems, and on some problems specific to group housing, such as individual feeding of sows and reduction of agonistic interactions.

**Farrowing**

The normal behaviour of sows during the hours preceding farrowing is to isolate themselves and construct a nest. This behaviour is subject to strong, spontaneous motivation, and always occurs if suitable material (such as straw) and the necessary space are available. Individual farrowing crates preclude the expression of this behaviour and therefore contravene one of the five fundamental rules listed above. The main reason for restricting the movement of sows in this way during farrowing and lactation is to improve the survival rate of piglets. In fact, newborn piglets are attracted by the soft and warm surfaces normally offered by their dam, which explains the pronounced tendency for piglets to lie against the sow. This exposes the piglets to the risk of being crushed, particularly during the first 48 hours of life. Nevertheless, despite the restriction of movement imposed by individual farrowing crates, the risk of piglets being crushed by the sow is not eliminated. Two of the most exhaustive studies on this subject reported contradictory results. One study found an improvement in survival averaging 0.13 piglet per litter for sows kept in individual crates (4), while the other observed no difference (14). According to Arey (3), keeping the sow in a cage benefits the piglets during the first three days of life, because it is easier to supervise the animals, and 75% of losses occur during this period. Subsequently, the advantages are minimal. To improve conditions for the sow, Fraser et al. (12) developed a modified farrowing crate which provides enough space for the sow to turn round, while retaining the same overall area.

**Suckling piglets**

Among pigs, suckling is accompanied by the exchange of audible information between the sow and her young. The presence of extraneous noise (such as the noise of ventilation fans) during suckling reduces the frequency of suckling initiated by the sow by means of characteristic grunting and, above a certain sound level (85 decibels), such noise increases fighting for a teat by the litter (2).

In nearly all piggeries, piglets are submitted to many painful manipulations during the days following birth: iron injection, ear notching for identification, tooth clipping and castration. These practices are deeply entrenched and it is difficult to question the need for such routine procedures. However, increasing objection to these practices is being expressed by consumers, and in certain countries there is much political pressure to abandon them. The effect of castration age (between 1 and 20 days) on the behaviour
of piglets during the hours following operation and on their weaning weight has been examined recently (20). A reduction in locomotor activity and suckling was observed within six hours after castration, regardless of age. Moreover, the weight gain of piglets castrated at 14 days was greater than that of piglets castrated at one day of age. These manipulations are a source of stress for piglets, and often represent their first contact with human beings. It is therefore essential that other contacts, pleasant for the animal, take place between the producer and the piglets. The animals become less nervous if they are handled gently and regularly.

Weaning

The weaning of piglets reared in a natural environment takes place gradually at about four months of age (19), whereas in intensive husbandry piglets are separated from the sow between three and four weeks of age. Early weaning is practised principally for economic reasons, taking into account productivity (number of farrowings per sow and per year). In addition, early weaning limits the time for which piglets are in contact with a potential source of infection; this procedure was utilised by Alexander et al. (1) to eradicate certain diseases. However, the “Medicated Early Weaning” advocated by these authors was incompatible with ordinary husbandry. Consequently, “Modified Medicated Early Weaning” (MMEW) was adopted. The MMEW procedure, with weaning at 10-14 days, is becoming increasingly popular. However, ethological studies on weaning at three weeks or less have shown that suckling activity persists and is transferred to other piglets in the group (29). This transferred activity, which may lead to tail biting and abdominal massage, is prevalent among the lightest piglets at weaning, and when there is no substrate (such as straw) in the environment. This abnormal behaviour is also due to the strong motivation of pigs to explore their surroundings, which is difficult to satisfy in the concrete environment of modern piggeries. However, it is undesirable for lactating sows housed in farrowing crates to wean piglets any later than at 4 weeks. In contrast to pens, which facilitate temporary separation of the dam from the piglets so that access to the udder gradually decreases as the piglets grow older, farrowing crates impose continuous cohabitation of the sow with the litter. In these conditions, the sow becomes nervous and agitated during the fourth week of lactation and adopts a sternal resting posture to limit access to the teats by the piglets (24).

For the sows, the stress of weaning is twofold: they are moved from one place to another, and they are regrouped with other sows. The transfer alone engenders a rise in corticosteroids, and it has been shown that isolation of sows for three to four hours after transfer can avert the fighting which often occurs at regrouping (24). However, such isolation is not always easy to implement in existing piggeries, and alternatives need to be examined.

Newly-weaned piglets

Transfer from the farrowing room to the nursery is a major change for piglets. Not only are the animals separated from the dam and have to ingest solid feed, but they have to face a new environment and a new group. Regrouping leads to fighting which persists until an order of dominance is established within the group, usually after 48 hours. As these stress factors are cumulative, the response of piglets will be less severe if they do not occur simultaneously. Producers should be encouraged to form groups using animals which already know each other, as this diminishes the frequency of fighting (13). Dybkjaer (9) recently demonstrated that abdominal massaging, nibbling of one piglet by another, and the sitting posture were most indicative of the presence of stress
factors in the environment, in the same way as a diminution of play behaviour or growth. Enrichment of the environment by introducing play objects – such as a tyre, a ball, straw or other material which may be manipulated by piglets – considerably diminishes the activities of massage and biting.

**Fattening pigs**

The frequency of aggressive interactions during the fattening period is closely related to the available floor area for each animal, the group size and the space available for eating and drinking. Within a group of pigs, the dominant animal has priority access to feed; this is accentuated when feed is restricted. Inadequate trough space encourages competition for feed, excluding the animals which are lower down the social hierarchy (7). Aggression at the trough is increased by the strong tendency of pigs to synchronise feeding periods when kept in groups. However, Schaefer et al. (28) observed a reduction in the frequency of aggressive behaviour when the environment was enriched with play objects, such as tyres or chains.

Pigs have a natural tendency to structure their living space, i.e. to establish a dry and shaded resting area and an area for excreta which is more brightly lit, colder and more moist. The resting area is usually close to the source of feed, on the solid part of the floor, while the area for excreta is close to the source of drinking water, on the slatted portion of the floor. However, this spatial structure disappears when there is inadequate floor space, leading to a deterioration of hygienic conditions. Overpopulation and lack of space are also primary factors leading to tail biting among fattening pigs. These factors increase the restlessness of the animals, which start searching for a material to explore, which becomes the tail of their penmates. The secondary factor responsible for tail biting is the strong attraction of pigs to blood (10). If a bitten tail is bleeding, this attracts the other pigs to chew it and complications develop (infection, abscess formation, reduced growth rate and carcass losses).

**CONCLUSION**

The stress factors described above illustrate the potential negative impact of management and environment on the welfare of pigs. In order to progress towards a more balanced form of intensive production and improve husbandry conditions, the following three points are essential:

a) Take welfare into consideration when making technical decisions.

b) Integrate welfare into preventive veterinary medicine by including diagnostic and therapeutic considerations.

c) Conduct research into new alternatives, and test the practicability of research results already obtained.

The debate which is currently being conducted in certain countries over methods of intensive husbandry may have important consequences for pig production throughout the world. This situation must not be ignored, as respect for animal welfare is, above all, an ethical, social and political matter.

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REFERENCES


