Animal welfare methodology and criteria

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Summary: The concepts of welfare and comfort are relatively new to the veterinary field. For a long time, it was thought that these concepts were equivalent to the absence of pain, stress and suffering, but such a comparison is imprecise. In addition, the application of objective and quantitative criteria to pain and stress has not been as easy as was initially thought. The concept of stress has evolved considerably since the term was coined by H. Selye in the 1950s to denote the non-specific response of an organism to any excessive demand. It is now well established that neurohormonal stress responses do not depend on the physical nature of the stressor, but on the way in which this is perceived and presented to the animal which is exposed to such a situation. The study of stress reactions therefore provides an insight into the subjective world of the animal. Suffering cannot be confined to physical suffering alone, as animals are capable of undergoing mental suffering.

Research into the welfare and comfort of animals implies a study of the ability of an animal to express basic species-specific behaviour in the environment in which it is placed. Any discomfort produced by husbandry conditions may be detected through anomalies in the expression of this behaviour, or by examining preferences expressed by animals offered a free choice.

All of these elements provide an objective and quantifiable approach to welfare and suffering in animals. But society must determine what is acceptable or not on the basis of these criteria.


INTRODUCTION: SUFFERING AND WELFARE

The position of animals in society is principally governed by a utilitarian concept. Companion, sport and farm animals are subordinate to the interests of human beings, who have a duty to ensure the protection of animals, in view of their utilitarian value. According to such ethics, animals may be exploited by man, but only if they are not subjected to avoidable suffering. Consequently, utility refers to the fate of the animal: in the case of fighting bulls, suffering during a bullfight is acceptable because it is part of the rules of this spectacle; in the case of farm animals, any suffering which accompanies slaughter must be kept to a minimum; in the case of laboratory animals, any suffering has to be balanced against the anticipated benefits, in terms of knowledge gained from the results of experiments.

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Some believe that such an attitude is too anthropocentric, and that animals should be regarded as having intrinsic value, and not just utilitarian value. According to this ethical concept, the animal is provided with certain qualities, irrespective of any subordinating relationship to human beings. In common with any other object or living thing, an animal has the right to be respected from the moment it is born, simply by virtue of being present in the world. Such a concept is definitely incompatible with any systematic exploitation of animals by human beings, who would thus be reduced to a role as a gatherer.

The utilitarian concept is the only view which allows for subordination of animals to the interest of human beings. The farm animal has an economic utility, just as the companion animal has a social utility, and the sport animal a recreational utility. Any desire to limit suffering which might arise from the creation of such a link of subordination presupposes the possibility of identifying with precision the causes of such suffering and the way in which suffering is expressed by the animals. This is not easy, and often the observer who is required to make a judgement tends to do so on the basis of his own subjectivity, as if an equivalence existed between the subjective world of domestic animals and that of human beings.

For a long time, veterinarians have recognised the need to avoid unnecessary suffering in the animals under their care, and this is written into the French Rural Code. However, the concept of suffering held by veterinarians is usually restricted to physical suffering, which is coupled with the idea that domestic animals have a low sensitivity to pain. Topical ethical concerns expressed by society go beyond the simple idea of pain, and the negative terms “pain”, “suffering” and “stress” are gradually being replaced by the positive terms of “comfort” and “well-being”. This semantic transition has a practical significance. As in the medical field, there is a tendency to substitute maintenance of health for the eradication of disease, and a concern for welfare is no longer exactly the same as the elimination of suffering.

Concern for welfare is relatively recent in animal production and veterinary medicine. Traditionally, animal scientists aim to improve performance, while veterinarians attempt to treat or prevent diseases which have an effect on production. The idea that it is sufficient to have animals in good health at an acceptable level of production to guarantee their welfare is no longer sustainable.

For ethologists (scientists specialising in the study of behaviour), the concept of well-being goes far beyond considerations of production performance and physical health (10). According to ethologists, farm animals have not only physiological needs (such as nutritional and thermoregulatory requirements) but also behavioural needs. If these behavioural needs cannot be satisfied, intense frustration results, and the animals may then undergo mental suffering. This is the case of a caged hen which cannot have a dust bath or brood its eggs, or a pig on slatted or cement flooring which is unable to root. From this point of view, animal welfare cannot be defined without taking into account behaviour and mental states. This is similar to the attitude of the World Health Organisation, which has proposed that human health be defined as a state of physical and mental well-being.

The concept of well-being in animals therefore expresses a desire to reintroduce “spirit” into the mechanical world of intensive husbandry: animal products purchased by consumers should come not from animal machines but from live and sensitive creatures, endowed with their own subjectivity.
The purpose of this article is to review the concepts of pain, suffering and well-being, and the objective criteria which can be used to define the corresponding states.

PAIN

Pain is a sensory experience which should be distinguished from suffering, which is an emotional state and the opposite of well-being.

This distinction is easy to make. However, pain may itself be the origin of suffering, and pain can be difficult to detect in farm animals. Pain is defined as “an unpleasant sensory experience caused by an actual or potential threat, which induces protective motor and autonomic reactions, leading to avoidance behaviour which may alter the specific behaviour of the individual, including social behaviour” (11). This definition is already tainted by anthropomorphism, because it is based on the definition proposed for human beings by the International Association for the Study of Pain. In other words, pain in animals has not really been studied as such, only to the extent that any studies have been conducted in an attempt to understand the physiological mechanisms of pain in human beings.

In the absence of characteristic symptoms or specific biochemical changes (2), pain is usually evaluated by combining a certain number of criteria:

- observation of motor, autonomic or behavioural responses to a stimulus suspected of being painful, or to circumstances surrounding the perception of this stimulus

- comparison with the human situation: a stimulus known to be painful in human beings may be regarded as equally painful in animals, unless the contrary is proved

- pharmacological testing: reactions should disappear after the administration of an analgesic or after the blocking of nerve conduction.

It is important to note that the possibility of listing a number of criteria to discern pain does not solve the problem at all. To take the specific example of pain possibly produced by an injectable product, to date there is no standard procedure which can demonstrate with certainty that the product in question does not produce residual pain at the injection site (e.g. the controversy surrounding the mode and site of administering bovine somatotropin) (6).

STRESS

For persons concerned with welfare, stress is regarded as a source of pain and suffering, and therefore as something to be avoided. Stress is a priori easier to measure than well-being, and biological procedures conducted in test-tubes seem to be more objective than behavioural procedures. It is therefore tempting to equate the absence of stress with well-being. Inspired by this reasoning, physiologists have proposed the use of stress indicators to evaluate well-being among farm animals (7).

Stress indicators

The dynamics of stress reactions depend on a complex mechanism: on the one hand a cabled neuronal system with rapid transmission (a few seconds at most between
perception of the stressor and catecholamine release), and on the other hand a neuroendocrine system with numerous intermediaries and an interval of several minutes before the adrenocortical response occurs (4, 7).

**The sympathetic and adrenomedullary system**

This system may be regarded as a functional entity rather than an anatomically defined system. It comprises the orthosympathetic branch of the autonomic nervous system and the adrenal medulla, which is the equivalent of a sympathetic ganglion. Activation of the sympathetic and adrenomedullary system is manifested by noradrenaline release at nerve endings, secretion of adrenaline into the bloodstream and, to a limited extent, release of noradrenaline by the adrenal medulla. Only a small proportion of the noradrenaline released at the endings of sympathetic nerves passes into the blood.

Apart from the effect on the cardiovascular system (increase in the rate and force of cardiac contractions, increase in arterial pressure, redistribution of visceral blood towards muscles and the brain), catecholamines released during stress have powerful metabolic effects (glycogenolysis and lipolysis) which make energy available for actions. At the renal level, vasoconstriction of autonomic origin is manifested by diminished glomerular filtration of sodium ions. Simultaneously, stimulation of renal beta-adrenoreceptors activates the renin-angiotensin-aldosterone system.

Stress results in increased catecholamine release and a change in the metabolism of these neurohormones, making them more widely available. The activity of enzymes involved in synthesis increases considerably; this is particularly true of tyrosine hydroxylase (TH), the limiting step in catecholamine synthesis, the activity of which triples. Dopamine-beta-hydroxylase (DBH) activity doubles, while the activity of phenylethanolamine-N-methyl transferase (PNMT) increases by approximately 50%. These increases in activity are regulated by neuronal activity in the case of the first two enzymes, and by adrenocorticotrophin (ACTH) and glucocorticoids for PNMT. Simultaneous with this increase in synthetic capacity, there is a decrease in the activity of enzymes involved in catecholamine catabolism. Other changes may intervene at the level of catecholamine receptors and transduction systems. For example, during chronic stress, there is a diminution in the density of beta-adrenergic receptors and reduced activity of adenylate cyclase.

Physiologists have made considerable progress in recent years towards establishing techniques capable of measuring the activity of the sympathetic nervous system. Until the end of the 1970s, it was necessary to undertake fluorimetric analysis for measuring levels of urinary metabolites of catecholamines, or to assess the physiological and metabolic effects of catecholamines (arterial pressure, blood glucose, heart rate). Heart rate alone was found to be of limited value. Preference is now given to measuring variability of the cardiac R-R interval in response to different stimuli. It was formerly necessary to deduce the parasympathetic component from responses to atropine, but now spectrometric analysis has enabled two constituents to be distinguished in human beings, one of high frequency (approximately 0.25 Hz) of vagal origin, and one of low frequency (approximately 0.1 Hz) of sympathetic origin.

The sophistication of analytical procedures (radio-enzyme techniques, gas chromatography with mass spectrometry, high-performance liquid chromatography with electrochemical detection) makes it possible to measure plasma catecholamine concentrations directly. Noradrenaline concentrations in venous blood depend largely
on the release and clearance of noradrenaline in the corresponding areas of skin and muscle. Arterial blood is therefore preferable, but muscular activity remains the principal factor responsible for variation. Measurement of circulating noradrenaline does not provide a sufficiently accurate indication of the rate of release of this neurotransmitter at the level of synapses, unless there is simultaneous measurement of noradrenaline clearance following injection of a radioactive tracer.

Various other compounds released by sympathetic nerve endings at the same time as catecholamines have been proposed as a means of measuring the activity of the sympathetic nervous system, ranging from the enzyme dopamine-beta-hydroxylase and neuropeptide Y to chromagranin A. However, these measurements have given disappointing results. Determination of noradrenaline metabolites, such as dihydroxyphenyl glycol (DHPG), mainly of intraneuronal origin, and methoxyhydroxyphenyl glycol (MHPG), mainly of extraneuronal origin, have proved to be useful indicators of sympathetic system activity. Taking into account activation of the renin-angiotensin II-aldosterone system through sympathetic innervation, measurement of the concentration of circulating renin has also been proposed as an index of sympathetic activity. In fact, under certain conditions, there is better correlation between diastolic blood pressure and plasma renin concentration, than between this variable and circulating noradrenaline concentration.

**Pituitary-adrenal axis**

Release of glucocorticoids by the adrenal cortex is secondary to activation of the hypothalamo-hypophyseal system. Corticoliberin (corticotropin releasing factor [CRF]) is the essential link in activating the pituitary-adrenal axis. CRF is discharged into the portal system, and results in ACTH release by corticotropic cells of the anterior pituitary. The ACTH passes into the bloodstream, stimulating the synthesis and release of glucocorticoids in the adrenal cortex.

Glucocorticoids amplify and relay the mobilisation of energy induced by catecholamines. They reduce glucose capture by a certain number of tissues, and increase glucose formation from non-lipid substrates, promoting neoglycogenesis and inducing protein catabolism. The outcome is an increase in glucose available for immediate use or storage, according to the state of energy balance. Another important property of glucocorticoids released during stress is to avert excessive cellular reactions to aggression. The best known example is inflammation. The anti-inflammatory activity of corticoids released during the stress reaction is sustained by two complementary mechanisms: on the one hand, inhibition of synthesis and release of pro-inflammatory cytokines by accessory cells of the immune system, principally monocytes and activated macrophages, and on the other hand, induction of synthesis of lipocortin, an intermediary protein which inhibits phospholipase A

It is easier to measure the activity of the pituitary-adrenocortical system than that of the sympathetic system and the adrenal medulla, to such an extent that there is a tendency to make the increase in circulating corticosteroids the operational definition of stress. Glucocorticoids circulate in the blood in a form bound to a globulin, corticosteroid-binding globulin (CBG), and also to albumin, but to a lesser extent and at a weaker binding affinity. Only a very small proportion of cortisol circulates in free (unbound) form. Cortisol (or corticosterone in some species) is usually assayed by radio-isotope techniques. A blood sample is not always necessary, as the pronounced
lipophilic affinity of cortisol means that it passes readily into saliva. The correlation between concentrations of free cortisol measured in plasma and in saliva is usually high, approximately 0.80-0.90. Contrary to what one might expect, the flow rate of saliva does not affect the amount of cortisol measured in this way. ACTH can be assayed in plasma by radio-immunological techniques, but the kinetics of appearance and disappearance are more rapid than for cortisol. Circulating concentrations of ACTH and cortisol vary during the course of a day: the maximum occurs at the end of the nocturnal period in diurnal species, and the minimum at the end of the day. To this nycthemeral rhythm is added a diurnal cyclicity with a period of approximately 150 minutes, with peak secretion occurring at mealtimes.

Detection of an increase in adrenocortical hormones is not always possible during chronic stress. To reveal the possible occurrence of hyperactivity of the pituitary-adrenal axis under these conditions, a suppression test exists, which detects diminution of sensitivity of the pituitary to feedback provided by corticoids. The test involves administering a high dose of dexamethasone – or preferably cortisol – in the evening, followed by measurement of the extent of diminution of blood cortisol in a blood sample taken the next morning. It is also possible to perform an ACTH stimulation test for excessive adrenal reactivity.

Significance of stress indicators

On the basis of the criteria described above, it is easy to understand the perplexity of physiologists when they found high plasma concentrations of cortisol and catecholamines in animals kept under conditions which were believed to be better than those of intensive husbandry, as for example in calves kept in groups on straw, in comparison with battery calves kept in individual pens (16). To understand this paradox, it is necessary to return to the concept of stress itself (4, 8, 14).

The concept of stress emerged from the concept of homeostasis. Following the work of C. Bernard at the end of the last century, physiologists demonstrated that maintenance of a constant internal environment, despite fluctuations in the external surroundings, is possible only if the body has regulatory processes which overcome excesses and deficiencies. Any constraint on the body (a stressor) brings about a counter-reaction to regain the initial equilibrium: this is the stress reaction. The purpose of this response, to preserve homeostasis, is always the same regardless of the initiating stimulus; the response is therefore non-specific. As the body is constantly exposed to stimuli which upset homeostasis, stress is inevitably present throughout life, from birth to death. Hence the title given by H. Selye, inventor of the stress concept, to his book: “The stress of life” (17).

Not all stimuli which upset homeostasis are necessarily unpleasant, and some can be very agreeable, such as play activity. Selye proposed the terms “eustress” and “dystress” to distinguish pleasant from unpleasant stress, although he did not provide arguments to justify this distinction.

The stress theory was one of the few non-specific theories available to pathology between 1950 and 1960. This led to the popularity of this theory among animal scientists and veterinarians of the time, who were confronted with nutritional disorders and alterations in health which could not be explained by traditional pathological factors. The simple theories led to simplistic explanations. Stress was supposed to affect farm animals because these had been rendered more sensitive to stress by genetic selection which favoured anabolism and growth, via the somatotropic axis, to the detriment of
catabolism, controlled by hormones of the corticotropic axis. Misfortune did not come singly, for animals genetically susceptible to stress were also placed at a disadvantage by the combined effects of nutrition and confinement.

To maintain that farm animals were rendered more susceptible to stress in this way, provided an explanation of why the animals reacted in an exaggerated manner to aggressions occurring during life, from weaning to slaughter, including transport (7, 12). Inevitably, the animals would develop what Selye called adaptation disorders (gastric ulcers, decreased resistance to pathogens) (9), and this made them ideal candidates for various forms of anti-stress therapy, ranging from vitamins and tranquillisers to antibiotics and sulfamides.

However, what would have made a good story proved disappointing, in that the so-called stress-susceptible animals were found to be far less susceptible than they should have been according to the theory (7, 15). Research on pigs showed that the key stress hormones, namely catecholamines (adrenaline and noradrenaline) and pituitary-adrenocortical hormones (ACTH and glucocorticoids) were practically identical in stress-susceptible and normal animals.

**Contribution of psychology**

Research on stress followed a different line between 1970 and 1980, due to results obtained in the field of psychology (13). In attempting to analyse psychic distress in persons exposed to difficult circumstances, clinical psychologists were quick to recognise the inadequacy of a linear model of the stimulus/response type, such as proposed by Selye, to explain the effects of stress on the body. A different model was therefore proposed, termed a “transactional” model, as it depended on the reactions of the subject not to the situation itself but to the transaction of the subject with the situation: the subject evaluates the situation being confronted, in terms of expectations and personal resources. Stress is produced when the subject realises that its resources are inadequate. The value of the transactional model is in shifting attention from the reaction itself to strategies suitable for coping with the reaction, which comprise problem-focused strategies (attempts to change the situation) and emotion-focused strategies (attempts to change emotions caused by the situation; for example, distancing or denial) (Fig. 1).

Transactional models have now replaced linear models in the field of stress biology. As in the case of psychic distress, it can be shown that neurohormonal responses to stress do not depend on the physical nature of the situation, but on the way the subject confronts the situation (5). One of the best examples is provided by the results of experiments on capacity for control, conducted by Weiss in the early 1970s (19). Weiss compared the consequences of administering uncontrollable electric shocks with those of controllable shocks in rats connected electrically to the same shock generator. Rats in the “controlling” group were able to end the shocks by turning a wheel with their forefeet. Rats in the “non-controlling” group had no opportunity to alter the administration of shocks, the course of which depended entirely on the behaviour of the rats in the “controlling” group. Some rats were kept under the same test conditions without the administration of shocks. At the end of the experiment, the frequency of stomach ulcers was higher in the rats of the controlling group than in the other two groups.

The importance of behavioural control in the physiological consequences of stress can also be demonstrated in farm animals (8). Behavioural control is not the only psychic factor involved: the ability to predict is also important. This applies to information
Environmental stimulation

Central state of emotional activation

Psychobiological personality
- genetic factors
- early influences
- previous experiences

Energy metabolism
Cardiovascular system

"Internal environment"

Diagram illustrating interactions between environment, behavioural responses and neuroendocrine activation

Neurohormonal reactions are not directly dependent on the provoking situation, but rather on the emotional state induced by this situation, which is itself dependent on genetic factors and previous experience. Moreover, neuroendocrine activity modulates the ability to perceive and to represent the provoking situation, as well as the ways in which emotion is expressed by behaviour (adapted from 1, with the permission of the authors)

available to the animal on the way in which a situation will evolve with time, and the consequences of any action the animal may take. The mode of distribution of feed, in the case of animals fed intermittently, illustrates the importance of prediction: when feed is offered at the same time every day, after a warning signal, the weight gain is better than when the same amount of feed is distributed irregularly without a signal (18).

The role played by control and prediction capacities in the reactions of an individual to its environment provides a description of the impact of this environment in psychic terms and, consequently, makes it possible to relate the hormonal indicators of stress to the mental operations available to an animal in a given environment. Prediction is based on the ability to use available information to predict the occurrence or absence of a given event. Behavioural control is not only the ability to react to a threatening situation, but arises from the possibility of perceiving the consequences of action, and applying this knowledge to the modification of subsequent behaviour (14).
Control and prediction are the basic elements in what are referred to in psychology as "coping strategies". The possibility of effectively confronting a situation depends not only on the ability of the individual to select the appropriate strategy, but also on the aptitude of the individual to employ, for this purpose, the resources available in the social environment. Psychologists refer to this as "social support". Some examples are applicable to farm animals: in fattening pigs, social support is manifested by the calming effect of individuals of the same social group on behavioural and hormonal reactions to the frustration engendered by inability to obtain the expected reward (7).

The other value of the coping concept is to draw attention to the existence of individual differences in coping strategies, which can explain the wide variation in adaptational ability within the same population. This has recently become the object of systematic investigation in farm animals.

SUFFERING AND PAIN

Suffering is a subjective state which can be engendered equally by harmful stimuli and by purely psychic stimuli, such as the loss of a loved one or the impossibility of obtaining a desired object. To evoke the possibility of suffering in animals immediately raises two extreme attitudes: one consisting of a denial of any possibility of an animal having a subjective life, according to which behavioural manifestations are merely the expression of reflex reactions; and the other based on anthropomorphism, conferring on animals an emotional life comparable in its variety and intensity with that of the observer.

How to approach animal suffering

The current state of knowledge in the neurosciences amply demonstrates that animals are provided with cognitive abilities which, without reaching the degree of development of human beings, are sufficient for us to acknowledge that animals can feel not only physical but also psychic suffering (3). Such suffering has different qualities in different species and, for a given species, these qualities depend on earlier experience.

The principal duty of a person involved with animal welfare is therefore to become acquainted with and to understand the animal. A simple view of the animal is insufficient, as it is necessary to be able to recognise and interpret the reactions of the animal. To achieve this, a certain number of objective criteria are necessary, based on different but complementary approaches, ranging from the evaluation of the state of health to detailed observation of behaviour, including consideration of production performance and the measurement of physiological responses (10).

It is important to bear in mind that suffering has a largely subjective value, and consequently can be measured only at the individual level, and not at the population level. As intensive husbandry favours the group to the detriment of the individual, suffering cannot be easily evaluated on the basis of conventional husbandry and veterinary criteria. In particular, it is now recognised that a high level of production does not imply that there is no suffering involved, although this distinction is seldom accepted in professional circles. In fact, productivity depends on factors external to the animal, such as repayment of construction costs and the cost of feed. Moreover, high productivity can often be achieved in stressed animals, which compensate by increasing their feed consumption.
Suffering and behavioural needs

Ethologists attach great importance to the possibility of animals expressing the spontaneous behaviour of the species to which they belong, without which there is a risk of severe frustration. Thus, a battery hen which cannot take a dust bath or even flap its wings would be equally as frustrated as a bucket-fed calf unable to suckle, or a pig which cannot root in its concrete universe. Such frustration may be permanent or may only occur at certain times of life (e.g. in a sow about to farrow which cannot construct a nest).

These concepts have been incorporated into regulations as statements of behavioural needs. The Council of Europe stipulates that husbandry conditions must respect the physiological and behavioural needs of the animals. The link between physiological needs and behavioural needs is not accidental, as it confers on behaviour the same priorities in the economics of the organism as the composition of the diet or the microclimate. This supposition is difficult to defend in scientific terms, and is based more on anthropomorphism than on objective data. In support, the ethologist currently has two ways of approaching the problem: demonstration of behavioural anomalies and the study of preferences.

In the first case, the aim is to seek anomalies in the expression of behaviour which would signify non-fulfillment of needs, rather in the same way that a deficiency signifies an inadequate supply of nutrients. Abnormal postures and stereotyped movements (very common among zoo animals reared in an impoverished environment) are the most common forms of behavioural disorder. Affected pigs chew or lick objects or perform empty chewing. Affected cattle, both calves and dairy cows, show orolingual stereotypies. However, in calves it does not seem that the licking behaviour is any more common in battery calves than in calves which are left with the cow; the behaviour is simply directed differently. Such abnormal behaviours are evidence of pathological deviation in the neuronal mechanisms which support the organisation of behaviour, and such conditions occur only in certain individuals which have hypersensitive neurochemical systems within the brain. From this finding it would be possible to eliminate the susceptible animals, in rather the same way as with stress-susceptible pigs detected by their response to halothane. However, it would certainly be preferable to adopt another approach, whereby abnormal behaviour is considered as an alarm signal, revealing an imbalance between the animal and its environment. Within this context, the solution would be to alter the environment or to supply the animals with substitution objects which would enable them to express the chewing and licking behaviour which they tend to show under such conditions. For example, in pregnant sows the main factor responsible for the appearance of stereotyped behaviour is feed restriction: the best way of preventing the occurrence of this behaviour is not to overfeed the animals, but to provide access to an inert nutrient, such as straw.

In the second case, the idea is to allow the animal to express a choice, enabling the observer to discover the nature of priorities of the animal. For example, there has been much discussion on the importance of adequate lighting for animals, all the more because there is a tendency to keep intensively-reared animals in darkness to avert uncontrollable excitement. When fattening pigs are given access to an on/off light switch, the light stays on for 70-80% of the time, without pronounced nycthemeral variation. To ascertain whether the light is a luxury or a necessity, the switch can be replaced by a timer which provides light for a few dozen seconds at a time. The animals attempt to switch on the light for a few minutes, but then rapidly lose interest in the switch. When animals in a cold place are able to control infrared lamps, there is a
different pattern, and the frequency of response remains at a high level. This applies only to animals in the impoverished environment of an indoor pen. If the animals are reared outdoors, with access to infrared light within a shelter, they prefer to spend their time rooting instead of getting warm! Through experiments of this type, it is possible to determine the likes and dislikes of the animal, and the relative intensity of the choices, and so design a suitable environment for the animal.

Another way to investigate preferences consists of considering the animal as an operator carrying out a task in an artificial environment, and making the best of the environment in terms of the morphological features of the operator and the way in which its behaviour is organised. Evaluation in ergonomic terms of equipment widely used in intensive husbandry has been particularly negative with regard to feeders, batteries and tethering systems, to cite only the most glaring examples. Risks of injuries and excessive restraints to the execution of basic movements remain too often the rule. Substantial progress has been made, but implementation is extremely slow due to the costs involved and the absence of an approved institution to systematically test all the materials available on the market.

CONCLUSION

Intensive husbandry is often labelled “battery” rearing, which is evidence of the negative image of the environment provided for farm animals. In the design of this environment, productivity demands take precedence over comfort, with the implicit assumption that comfort is not jeopardised if performance remains unaffected. This hypothesis is faulty. At present, it is possible to improve the situation, at greater or lesser cost depending on the systems considered, but without being certain that the gain in comfort arising from an altered environment is sufficient for it to be accepted by society. This is where science yields to politics. Welfare belongs to the domain of pressure groups and, in the final analysis, it is society which must define what is acceptable in the ethical sense.

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REFERENCES


