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ASSESSMENT OF THE IMPACT OF LOCOMOTION ON ANIMAL WELFARE

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Summary

Locomotion is an important element of the animal's activity. It may take various states as regards gait and speed. Moreover, it supports all main behavioural functions in that locomotion enables the animal to act properly, in space and time, serving its different needs. For this reason impaired locomotion is an important threat to survival in free living animals, and probably perceived as such in all animals, including the domesticated species.
The impact on welfare in farm animals should be considered in relation to this multifunctional nature of locomotion. But then the question arises as to how to assess the impact of impaired locomotion in proportion to other conditions affecting the animal?
We propose to follow the decision support model for integrated welfare assessment developed by Bracke et al. 2002a. Fundamentally, welfare is assessed from the state of the biological needs of the animal. This welfare definition provides transparency and allows scientific verification. A list of biological needs has been worked out for sows, but analogous lists are easily made for other species. The model allows systematic weighting of the consequences of impaired locomotion in the various biological functions such as foraging behaviour, body care and safety. The model allows not only an assessment of impairment due to lameness, but also of the consequences of environmental restraints as inconvenient floors.

Introduction

Locomotion is an important element of the animal's activity. Healthy, free-living animals move around in their living environments, often in species-specific ways and at various gaits and speeds. Locomotion supports all main behavioural functions in that it enables the animal to act properly, in space and

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time, serving its different needs. For this reason impaired locomotion is an important threat to survival in free living animals, and probably perceived as such in all animals, including the domesticated species.

Locomotion disorders have a major impact on the welfare status of animals such as dairy cattle, fattening bulls, sows, broilers and broiler breeders (Anon., 2001). Clarkson et al. (1996), for example, report a mean annual incidence of 54.6 new cases of lameness per 100 dairy cows and a mean annual prevalence of 20.6 per cent for 37 farms visited in the UK. Even higher prevalence rates are recently reported by Somers et al. (2003) showing thereby significant differences between types of flooring. Gjein and Larssen (1995) reported a mean prevalence of 13.1% in loose housed sows on partly slatted concrete floors. In the Anon. 2001 paper an international group of welfare scientists determined welfare priorities for cattle, pigs and poultry. In that paper space and flooring (and litter) quality were also highly prioritised for the various categories of farm animals. Locomotion disorders do not only affect animal welfare. They also affect the animal's (re)production, the farmer's workload and income, and the public's perception of the image of the sector as a whole. Because the impacts of impaired locomotion are linked in various ways to animal welfare, it is important to unravel how locomotion as such is a condition of welfare.

The impact of impaired locomotion on farm animal welfare should be considered in relation to the multifunctional nature of locomotion. But then the question arises as to how to assess the overall impact of impaired locomotion on the various facets of animal welfare. We shall propose that a systematic, semantic modelling approach may be used to answer this complex question in relation to available knowledge.

Explanation of concepts

In this paper we will use a wide interpretation of the concept of 'locomotion disorders'. It does not only include disorders with an animal-based etiology that are related to disturbed locomotion, such as lengthy claws and spinal cord injuries. We also include more indirect animal-based problems such as locomotor impairment due to large udders in some dairy cows and the rapid body growth in broilers, and we include specific locomotor problems with an environment-based etiology such as slippery floors. We do not include into the concept of 'locomotor disorders' the restraining of animals as through tethering, even though from an animal welfare perspective this distinction is somewhat arbitrary.

Welfare is defined here as the quality of life as perceived by the animal itself. In their evolutionary history animals have evolved cognitive-emotional systems that help them deal with a variable environment (Wiepkema, 1987). An assessment of welfare requires that all the different states of need satisfaction and frustration must be assessed. It should be noted that while these refer to qualitatively different feelings such as pain, hunger and fear, for welfare assessment it is the intensity, duration and incidence (cf. Willeberg, 1991) of the relevant need states that matter. It should also be noted that this concept of welfare is very similar to the well-known concept of the Five Freedoms (e.g. FAWC, 1992; Webster, 1995). The concept of 'Freedoms' is a practical, be it slightly anthropomorphic concept in that even in the wild animals are not 'free'. Rather, animals non-randomly move around (i.e. by way of locomotion!) in their home range between different functional areas such as resting places, the fouraging areas and water points. With the concept of 'needs' we emphasise a biological concept of welfare that recognises a central place for the animal's perception of its states of satisfaction and frustration. Frustration, in this paper, refers to the inability to obtain a goal or commodity the animal is motivated to obtain. Frustrated animals may vocalise (e.g. gakeln of laying hens deprived of access to a nest box), show aggressive behaviour and show a physiological stress response, indicating reduced welfare.

Modelling

We propose to follow the principles used to develop a computer-based decision support system for integrated welfare assessment as described in Bracke et al. (2002a, 2002b). The system is called SOWEL (from SOw WELfare) because it was designed to help to assess the welfare status (on a scale from 0 to 10) of pregnant sows in a wide range of housing and management systems. The modelling approach provides transparency and allows scientific verification of the welfare assessment in that scientific statements are collected in the database and analysed to construct a welfare model consisting of a list of attributes of housing systems and their weighting factors. Weighting factors are derived from what is scientifically known about the attributes as described in the scientific statements in the knowledge base. The principles used to calculate weighting factors are formally described. They are based on the different types of measurement such as impacts on mortality and morbidity, on behaviour and on stress-physiology. The larger the (known) impact on biological functioning the higher the weight of an attribute in the

model. The computer-based format for the welfare model forces the user to make underlying assumptions explicit and to use generic principles (rather than ad-hoc solutions). It also allows upgrading when new scientific information will become available in the future.

Although it has not been specifically designed to assess locomotor disorders, SOWEL can be used as an example of how to determine the impact of impaired locomotion on welfare (see next section).

SOWEL contains a so-called semantic model, i.e. a model based on the meaning of what is stated in scientific statements. Such a semantic model could be constructed for welfare because a lot of knowledge is available about welfare, while this knowledge base is not (yet) sufficient to construct a stochastic model. This was also true for the assessment of the risk of tail biting, for which we also constructed and tested a semantic model, called PIGTAIL (Bracke et al., submitted). For some specific locomotor disorders sufficient knowledge may be available to construct stochastic models. However, to incorporate the results from a wide range of studies on a wide range of disorders a specific 'locomotor disorder' model could be designed to help to assess the risk for such disorders in different housing and management systems. Such a model could be linked as a module to the welfare model to help to specify in more detail the relationships between locomotion disorders and welfare.

Assessment of welfare implications of locomotion disorders

An assessment of the impact of locomotor disorders on welfare starts with a review of the literature. A lot of research is done on this subject. A Pubmed search showed 2354 and 1057 hits for lameness and locomotor disorders respectively. However, adding the search-term 'welfare' resulted in only 31 and 3 hits respectively. When 'lameness' and 'locomotor disorders' were combined with 'frustration' as a search term only 1 paper was found, which was hardly relevant to the subject. This illustrates that the relationship between locomotor disorders and welfare has received relatively little attention (Galindo and Broom, 2002) and that this is especially true for the welfare implications related to the frustration of needs other than the most obvious such as pain and production-related aspects.

Overall welfare assessment requires taking into account the impacts of locomotor disorders on all (welfare) needs. In SOWEL a list of biological needs has been worked out for pregnant sows, but analogous lists are easily made for other species. We formulated a generic, hierarchically-organised list

of welfare needs in Bracke et al. (1999). This list includes the following elements:

- Food & water
- Rest: Get to resting area, ly down, get up
- Social contact
- Reproduction, incl.
  - Mating, incl. searching for a mate
  - Nest building (in pre-parturient sows)
  - Providing maternal care for offspring
- Locomotion and other movements
- Exploration
  - Explore novelty, stimulation (avoid boredom)
  - Learn
  - Fourage (rooting in pigs, grazing in cattle, scratching in poultry)
  - Play (when young)
- Body care
  - Groom, scratch
  - Wallow (in pigs)
- Evacuation (dunging, urination)
- Thermoregulation
- Respiration
- Health
  - To reduce illness
  - To reduce injuries
- Safety
  - To reduce danger
  - To reduce aggression

It follows directly from this list that locomotion disorders have consequences for the degree of satisfaction and frustration of various welfare needs.

The most important ones include the avoidance of pain ('Health', 'To reduce injuries'), the need for safety and the ability to be able to get to resources (the need for 'Locomotion and other movements').

Animal welfare requires that the amount of pain suffered from lameness and other locomotor disorders is kept to a minimum. It subsumes under the need for health, which is identified as a separate welfare need because animals may clearly suffer when ill. 'Health' logically fits in the list of needs because sickness behaviour and patho-physiological mechanisms can be regarded as separate cognitive-emotional systems, which have a function to help the animal survive in its so-called environment of evolutionary adaptation. For example, an animal that suffers pain, stops putting weight on that limb, thereby facilitating recovery. It should also be noted that like other needs, the need for

health may interfere with other need states. In particular, feelings of illness may (partially) block other motivations (e.g. hunger).

Animals experiencing reduced ambulation, will probably experience a sense of insecurity, i.e. a lack of safety, e.g. due to slippery floors or other restrictions of movement, including restrictions resulting from locomotor disorders. This reduces their chances of escaping from dangers. Many farm animals such as poultry and pigs perceive the stockperson as a threat and are motivated to avoid an approaching human. Locomotion is also necessary to avoid conspecifics when animals are housed in groups, and impairment will frustrate the need to be able to avoid aggression. We also formulated a general need for locomotion to indicate that animals need space to do the things they are programmed (by their evolutionary history) to do, i.e. to reach the various resources necessary for normal biological functioning such as (searching for) food and water, resting places (such as perches in poultry), nest building (in pre-parturient sows and laying hens), play (in young animals) and body care (e.g. grooming in cattle, wallowing in pigs). Available knowledge about how locomotor disorders affect each of these behavioural functions can be systematically categorised.

Studies on locomotor disorders specify the relationships between on the one hand risk factors, which are often attributes of the housing and management system, and animal-based measures of lameness or other locomotor disorders on the other hand (eg. Somers et al. 2003). The studies may measure various aspects of the disorder. Gait scores are frequently used. Gait scores, in fact, take into account the speed of locomotion, but especially also indications of asymmetry, such as in step-length, head- and loin-movements. Morphological measures include clinical findings during claw trimming, x-rays and histological abnormalities. General heuristic rules may give rough indications about how to weight the different measures. In general, it could be proposed, pathological changes are more serious than non-pathological changes, because larger impediments of biological functioning generally have larger impacts on welfare than smaller impediments. Abnormalities with longer duration and incidence clearly also have more impact on welfare. Another heuristic rule is to assume additivity unless knowledge is available to specify other types of relationships. Such a rule is necessary to deal with the fact that many interrelationships exist between diseases (Faye et al., 1986) which have only partly been elucidated.

In this way an inventory can be made of the ways attributes of housing and management systems are known to affect locomotor disorders and welfare. With this knowledge of the facts and a limited number of heuristic rules it is possible to systematically 'add up' the weights and determine the overall impact of a given disorder on welfare. A similar welfare-impact assessment can be made for a single risk factor such as slippery floors, compared to other impacts such as the deprivation of social contact or inadequate feeding.

It can be anticipated in advance that such an integrated approach to welfare assessment will lead to the observation that both positive and negative consequences may be observed simultaneously. Improved welfare, e.g. loose-housing of sows or the provision of a wallowing pool in pigs on pasture, will give welfare benefits (improve the need for social contact, to move around and to perform species-specific wallowing behaviour and thermoregulation under high environmental temperatures). Such welfare measures, however, may also lead to increased welfare problems such as increased aggression and lameness in groups of sows and lameness due to irregular, frozen soil in the autumn and winter period in pigs on pasture. This lead to a final observation, namely that it is important both to recognise that locomotor disorders have major impacts on the various welfare needs of farm animals, and to recognise that welfare is more than just the avoidance of pain and that some measures leading to increased locomotor disorders may nevertheless improve the welfare of farm animals overall.

Conclusions

In conclusion, locomotor disorders have major impacts on farm animal welfare, esp. for dairy cattle and broilers. It's impact does not just concern pain, but also the frustration of a wide range of (welfare) needs. Although relatively little is known specifically about the welfare implications of disturbed locomotion and although welfare is a rather complex concept involving many need states, a systematic procedure previously used for modelling welfare assessment in pregnant sows gives structure to this complex issue, providing transparency and the possibility for scientific verification. Specific models could be developed to further specify the impact of locomotor disorders on farm animal welfare.

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PROCJENA DJELOVANJA KRETANJA NA DOBROBIT ŽIVOTINJA

Sažetak

Kretanje je važan element aktivnosti životinje. Može biti različitog oblika s obzirom na hod i brzinu. Osim toga, ono nosi sve glavne funkcije ponašanja, budući da kretanje omogućuje životinji pravilno ponašanje, u prostoru i vremenu, služeći različitim potrebama. Zbog toga je oslabljeno kretanje velika prijetnja opstanku slobodnih živih životinja, a vjerojatno to vrijedi za sve životinje, uključujući i domaće.

Djelovanje na dobrobit domaćih životinja treba promatrati u vezi s multifunkcionalnom prirodom kretanja. No onda se postavlja pitanje kako procijeniti djelovanje oslabljenog kretanja u odnosu na druge okolnosti koje djeluju na životinje?

Predlažemo slijediti podršku odluci o modelu za cjelovitu procjenu, što su razvili Bracke i sur. (2002a). U biti, dobrobit se procjenjuje prema stanju bioloških potreba životinje. Ovakva definicija dobrobiti pruža transparentnost i omogućuje znanstvenu provjeru. Razrađen je popis bioloških potreba za krmače, a analogni popisi mogu se lako načiniti za druge vrste. Model omogućuje sistematsko mjerenje posljedica oslabljenog kretanja u različitim biološkim funkcijama kao što su ponašanje pri traženju hrane, njega tijela i sigurnost. Model omogućuje ne samo procjenu oslabljenja zbog sakatosti nego i posljedice okolišnih ograničenja kao što su neprikladni podovi.

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