POSSIBILITIES OF AUTOMATIC ASSESSMENT OF COWS' WELFARE

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Introduction

More and more, animal welfare is becoming an integral part of food quality. Monitoring of welfare can provide a guarantee to consumers that the products they buy are from healthy animals that were kept in ways that are in accordance with good farming practice (Krebs et al, 2001). But efficient production systems are creating certain animal welfare problems usually (Faser, 2003)

Loose housing of cows with application of the automatic systems becomes nowadays favoured in the whole world. However, as automation lessens contacts between human and animal to minimum, possibilities to discover individual animal's welfare and health problems in proper time decrease. Conventional welfare assessment methods are mostly based on various behavioural observations and tests, clinical health examinations and management registrations. Therefore the need to automate the welfare and health control has become apparent. Although biological processes involving living organisms have always been considered as too complex to be monitored and controlled in an automatic way, today new emerging technologies offer possibilities to develop full automatic on-line monitoring and control of many of these processes (Berckmans, 2004). It has also been suggested that the combination of data used for health management and selected indicators of animal welfare may be used to track changes in welfare over time (Krebs et al, 2001).

Data sources for automatic welfare assessment

There are several databases, automatic measurement systems and other means that can provide data to characterize the state of welfare in modern loose-housing cowsheds.

1. Microclimate monitoring can provide information about animals' environment and thermal comfort (Aland et al, 2001, Poikalainen et al, 2003, Pajumägi et al, 2002).
2. Static and dynamic models describing the heat-exchange processes in animal-sheds make it possible to simulate and investigate the microclimate dependence on building materials and

construction. Taking into account the thermal comfort aspects in these models it is possible to design more animal-friendly cattle-sheds improving by that the welfare (Kokin et al, 2001, 2003).

3. Ordinary data registered at contemporary loose housing cowsheds is used mainly for farm management, but some data of management information system (MIS) can also be used as indicators that characterize the welfare level. Individual production level, milk composition, activity of cows etc. and changes in these can be used to monitor changes in welfare over time.

4. The automatic measurement of leg loads and their dynamics can provide a basis for the detection of leg disorders. It can be used to characterize satisfaction of the cow during milking through the kicking behaviour (Ahokas et al, 2004).

5. Automatic registration of skin movement can also provide information about the breathing parameters.

6. The vocalizations and vocal behaviour of cattle are potentially useful indicators of physiological and psychological status of cows (Watts and Stookey, 2000).

7. Activity monitoring by pedometers or special collars produce data of general behavioural activity level that is normally used as indicator of heat. But this method may be also a useful tool for the animal welfare assessment (Wechsler, 1995).

Altogether 29 sensors for cows are described in recent literature to measure deep body temperature, body weight, udder health, oestrus, breath emissions, biting rate in grazing cows and others (Berckmans, 2004). Still additional parameters specifically characterizing animal welfare can be worked out to provide valuable information on welfare and health status of cows.

Concept of automatic welfare assessment

The development of remote data acquisition methods, choosing of proper welfare indicators and elaboration of specific software makes it possible to create an automatic system for monitoring welfare and health status of cows (Figure 1). The heart of the system is a computer with database of individual animals and specific software for data processing. Input data for that system is to be provided by farm management subsystems, controllers of milking parlour or automated milking system (AMS) and specific modules for physiological data acquisition (e.g. to register leg load or breathing data) integrated into separate subsystem of data flow. The acquisition and analysis of typical farm management data regularly saved to databases as well as acquisition and analysis of additional behavioural and health management data and other specific welfare indicators may be integrated on the basis of software applications specially developed for that purpose.

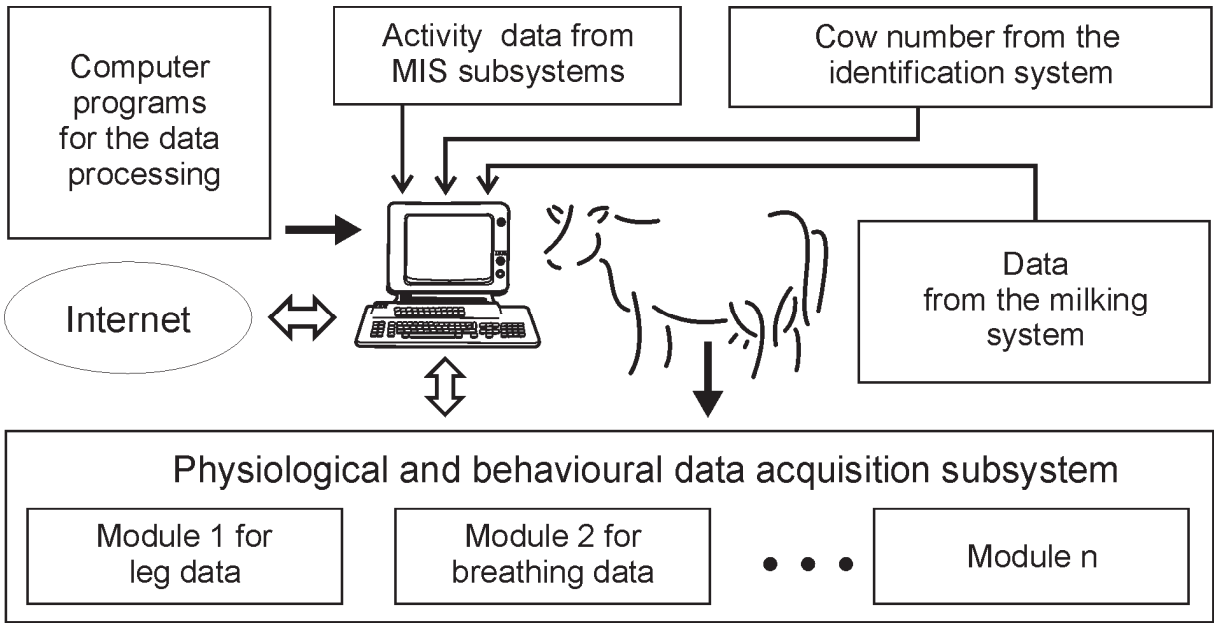

Figure 1. An integrated system for automatic data collection and health and welfare monitoring of cows

An example of the automatically registered leg load during milking is given in Figure 2a. This data could be analysed for example by using leg load index (LLI) that indicates the partial load of a leg in relation to the body weight (Figure 2b) (Poikalainen et al, 2004).

The distant monitoring of the measurements and their analyses can be performed with the help of Internet-based systems. The development of remote data acquisition methods and choosing of specific welfare indicators makes possible the creation of remote data acquisition and analysis network for monitoring and comparing the welfare of animals in different farms.

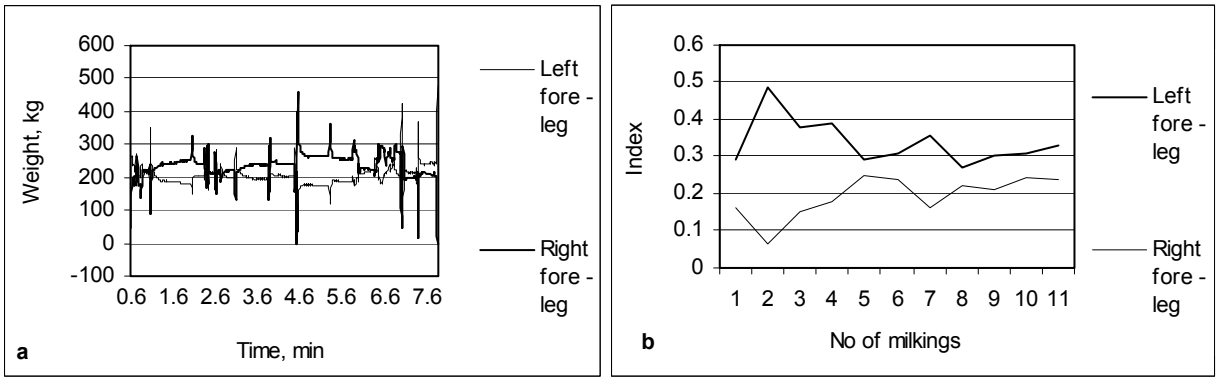

Figure 2. Foreleg load dynamics of a cow during one milking (a) and changes of LLIs during subsequent 11 milking (b)

Besides welfare assessment the analysis of acquired data may be used as a basis for development of methods and future research of different welfare aspects, prevent animal health problems and food quality risks, etc.

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