Dirk Breer and Wolfgang Büscher, Bonn

Calf Activity Measurement

For the first time calves on two farms were equipped with activity sensors during rearing. The objective was to test the suitability of the sensor system as an early warning system for diseases. Relevant data are compared with the information usually provided by automatic milk feeders. With the leg pedometers under scrutiny here, it was possible to detect deviations from normal behaviour very early. On the average (with 150 calves in the test with a morbidity of 10%), it was possible to detect decreases in animal activity two days before visible symptoms were discovered and one day before the automatic milk feeder generated an alarm message.

There is no doubt that a large herd of animals is more demanding to look after than a small group. What can be achieved in passing with small numbers of animals, demands a lot of time, experience and a practised eye for large groups of animals. Accordingly, as herds tend to increase in size, electronic tools for the acquisition of information are gaining in importance. This is also true for calves. The motivation of the diploma thesis to improve the animal care situation of calves arose from the experience that on many farms calves are not getting the attention they need. For animal welfare reasons, the resulting high loss rates to be observed on many dairy farms should not be accepted.

Most specialists know electronic activity measuring only from a dairy farming context, where activity measuring is used to support oestrus detection. In comparison with purely visual detection, the hit rate is quite high in this application. In combination with additional information on milk yield and composition (acquired via conductivity measurements), activity measuring can help detect metabolic disorders as well. The operating principle of the activity sensors used here is that of impulse counting. Every change of place of an 'inert' measuring element is logged electronically and stored in a memory module until it is read out via an antenna [1].

A special feature of DeLaval's ALPRO system is that it actively transfers the activity information to a management pc once per hour. In comparison with the standard technology, in which the information is read out during milking, the ALPRO system has a high temporal resolution. With this technology, it is relatively easy to recognise spontaneous behaviour and biorhythms as well as deviations there from. Weighing approximately 800 g, the collar does not handicap the animals much.

When, where and how were the tests carried out?

The tests were carried out between 2 July and 21 October 2005 on two different farms equipped with automatic milk feeders. The differences between the test farms were small with regard to their management or feeding systems, but the numbers of calves on both farms differed. The following overview (*Table 1*) contains key data about the 'test farms':

Results

Very few studies of time-related behavioural patterns of calves have so far been reported. Therefore, our particular interest was to see if it is possible to detect a biorhythm by means of the technology used in the test. A characteristic biorhythm can be recognised in *Figure 1*. The calves were particularly active during the early morning hours and in the evening. During the night and in the afternoon the animals rested, but in the afternoon their activity level was considerably

Table 1: Test farms and their relevant characteristics

features	farm 1 (near Dörpen/Emsland)	farm 2 (near Papenburg/Emsland)
groups and size	2 with 25 animals each	2 with up to 21 animals
animals in test	150	42
Rrace, provenence, sex	German Simmental (purchase) m cross-bred (purchase) m Vorderwald (purchase) m	Holstein-Friesian (own breeding) m and f German Simmental (purchase) m
supplementary feeding	TMR containing chopped star, concentrates, maize (ad lib); additionally whole maize grains (ad lib)	maize silage, calf concentrate, hay, (everything ad lib) but unmixed
animal care	two persons (farm manager and son)	farm manager's son (almost exclusively)

Dipl.-Ing. agr. Dirk Breer took his diploma in the "Livestock Technology" section at the Institute for Agricultural Engineering of Bonn University, Nussallee 5, D-53115 Bonn. Prof. Dr. Wolfgang Büscher is head of the "Livestock Technology" section;. e-mail: *buescher@uni-bonn.de*

Keywords
Animal activity, herd management, process quality

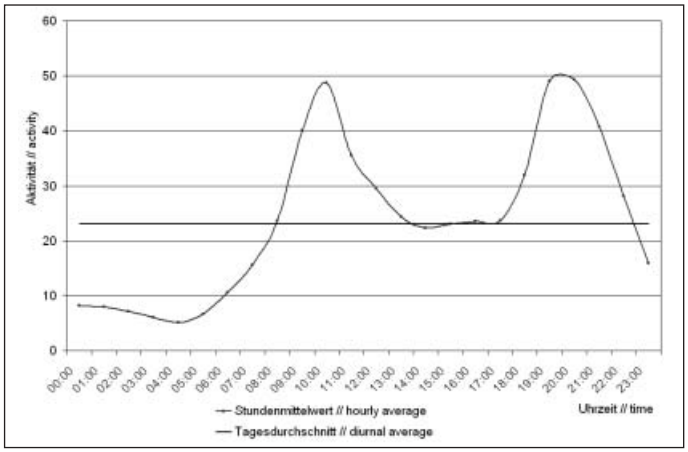

Fig. 1: Typical biorythm of the calves on one of the test farms

higher than during the night. The two peaks of the activity signal are almost at the same level. This confirms the camel-model with two peaks put forward by [2] in describing the daily course of animal activity. It is clear to see, too, that the daily average, represented by the red line, and the hourly average are rarely at the same level. Obviously, the level of activity depends on daylight hours, on feeding times and on the timing of surveillance walks.

As can be seen in *Figure 2*, the activity level of the calves tends to increase with age. However, this increase differs from calf to calf, and it has a low coefficient of determination.

Unlike the age of the calves and contrary to expectations, the ambient temperature did not have a significant influence on animal activity. The calves had been expected to become less active with rising ambient temperatures, but a decrease in activity was not discernable in the averages for the whole group of calves. On the other hand, the measurements were carried out at relatively high ambient temperatures.

How do diseases manifest themselves?

The possibility of detecting diseases early on the basis of reduced animal activity offers interesting perspectives. By means of the electronic activity measurements, it was possible to identify diseased calves at least two days before the animal keepers classed them as 'diseased' and initiated treatment. This is best explained with the aid of an example. *Table 2* lists the behavioural anomalies of a calf that had to be treated twice during rearing for serious respiratory diseases. It also lists the dates on which the calf was treated as well as the alarm messages from the automatic feeder. Successes of treatment were also evident in rising activity levels displayed on the computer screen. The colours of the signals on the screen stand for the following phenomena:

- yellow light: activity decrease (< 50 % compared with day before)
- red light: activity decrease (> 50 % compared with day before) or decrease on several consecutive days

With the help of the alarm system tested here, the calf would have been recognised as diseased much earlier than by purely visual detection. A 'yellow light' indicated reduced animal activity as early as three days before the calf was first treated and four days before it was treated for the second time. With the help of this alarm system, the calf in question could have been subjected to closer supervision and medical treatment earlier.

One may ask, of course, if the other electronic parameters captured by the automatic milk feeder could not have triggered an early warning as well. *Table 2* provides some relevant information about the above-mentioned calf.

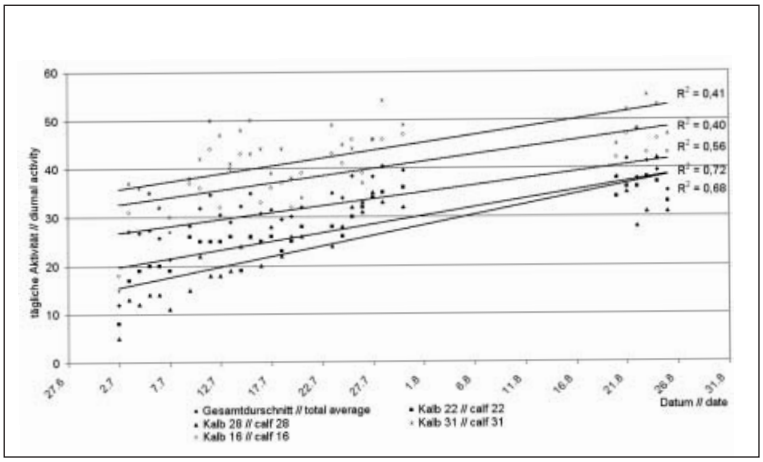

Fig. 2: Influence of age on the activity level of the calves in the test

Date	Behavioural anomaly	Reaction or message to the farmer
21. 8. 2005	activity decrease < 50 %	*yellow light on screen*
22. 8. 2005	activity decrease over two days	*red light on screen*
	decreased sucking rate	alarm message from automatic milk feeder
23. 8. 2005	calf visibly diseased —>	(successful) treatment of calf
3. 9. 2005	activity decrease < 50 %	*yellow light on screen*
5. 9. 2005	activity decrease over three days	*red light on screen*
	decreased sucking rate	alarm message from automatic milk feeder
7. 9. 2005	calf visibly diseased —>	renewed (successful) treatment of calf

Table 2: Typical record for a calf falling ill twice

Conclusion

The tests have clearly shown three benefits:

- It is possible to detect diseases early (with positive economic consequences).
- Animal surveillance in larger groups becomes easier and less time-consuming.
- Animal keepers can provide evidence of the 'well-being' of the animals, which may become very important for purposes of quality assurance and traceability demands in the future.

Literature

[1] *Klindtworth, M.*: Prozesssteuerung in der Milchviehhaltung. DLG-Merkblatt 312, DLG, Frankfurt/M., 1999

[2] *Pederson, S., and K. Sällvik*: Climatization of animal houses, heat and moisture production at animal and house levels. 4th report of working group. International Commission of Agricultural Engineering, Section II, 2002