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# Measuring Methods to Evaluate Husbandry Quality

## Are Well-being and Stress Measurable for Horses?

*In the evaluation of animal husbandry systems animal appropriateness plays a major role in addition to the economic factors. Diseases and drops in animal performance are often linked to poor husbandry conditions. But in order to evaluate if one form of housing is more appropriate for horses than other types, the well-being of the animal would be a good indicator. In addition to the behavioral observations, there are now methods available with which the physiological parameters can be documented. Within the framework of a research project, the measurements of heart frequency variability and fecal cortisol metabolite concentration by horses took place. In addition, the behaviour of the animals was evaluated by video analysis.*

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### Keywords

Horse husbandry, stress, HRV, cortisol

One expects horse stables to meet both the needs of the humans who use them (low investment costs, labour saving, accessible horses) as well as the needs of the horse. It is, however often difficult to find the right solutions to meet both the farm and animal needs.

Our domestic horses hardly differ in behaviour from their wild ancestors. Their needs are also similar to a great extent to those of wild horses [1]. But does a stabled horse perceive more stress than a life in free wilderness? Or have they become so accustomed to the frequently used single husbandry that they become more stressed in a group situation. In order to find the answer to these questions, the comfort of the horses must be assessed.

No unified definition exists in the literature for the concepts "well-being" or "stress". But from paraphrases of these words, one could state that "Well-being occurs when the animal is in harmony with his environment". Stress describes a state of being in which the organism indicates a specific adaptation reaction to different strains [2, 3].

### Measuring Heart Rate Variability

Heart rate variability (HRV) is often measured for scientific studies, in both humans and

animals. The basics of HRV have, for the most part, been researched in human medicine and in the areas of sport science [4].

Since they vary, the intervals between the individual heartbeats can be determined with this analytical method. Here the focus is on the regular adaptation ability of the heart to internal and external stress. The vegetative nervous system is also active in regulating the heartbeat. Thus the HRV can give an indication on the individual stress condition of an organism. In the evaluation of this stress, a distinction is made between the parameters of time and frequency as well as non-linear parameters. Computer programs (i.e. HRV Analysis Software) can be helpful in the analysis and evaluation of HRV.

For the documentation of HRV two special electrodes are used which are attached to the horse with a stomach belt (Fig. 1). The data receiver and storage are also attached to the belt in the form of a wristwatch.

In the evaluation of the data, different husbandry systems are considered in terms of the stress impact on horses. It became apparent that the Parameter SD2 of the Poincaré Plots was best suited to evaluate the husbandry systems, since these react to changes through long term stress situations. The frequency parameter HF (High Frequency) was also well-suited. This is under the clear influence of the parasympathicus, a part of the

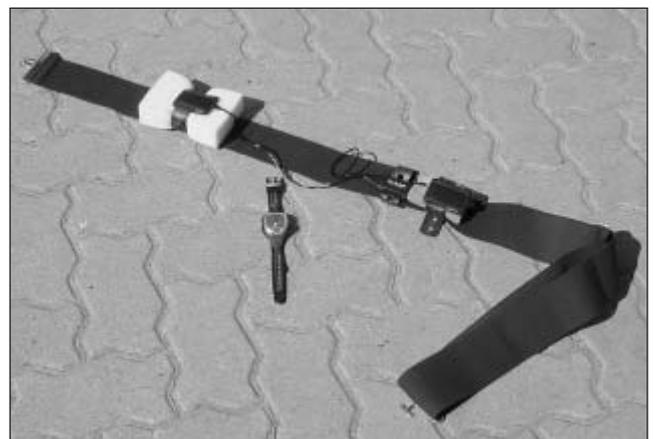


Fig. 1: HRV-measuring device for horses

vegetative nervous system, which stands for relaxation. But the measured parameters show a reaction to external influences, such as for example climate changes. This became very clear as a storm rolled in during a measurement. The results of this measurement are in contrast to a measure of the same six horses during group and single box husbandry under normal climate conditions (Fig. 2). An increase in stress leads to an increase in the SD2 values and to a reduction in the HF values.

### Concentration of Faecal Cortisol Metabolites

Cortisol is a hormone, which develops in the adrenal cortex under stress. In the case of stress and also of pain, an increase in this hormone is measurable in the blood. The blood withdrawal itself is a stress factor for horses, so that the value gives no information on the stress situation, with regard to the form of housing.

Studies with radioactive cortisol in pets [5] have shown, however, that cortisol metabolites are excreted with faeces and can be measured with an enzyme immunoassay. The faeces can simply be gathered without disturbing the animal. But in commonly kept animals, good documentation is needed in order to exclude a misidentification of the faeces. It is also important to freeze the samples within one hour, since even storage at room temperature leads to an increase in the cortisol metabolite concentration. The passage through the intestines causes a delay in excretion. This is about 24 hours in horses, so that the concentration of cortisol metabolites represents the stress level of the previous day.

In considering various husbandry variations for horses, most horses show an increase in stress during individual yard husbandry in comparison to group housing. However, in the measurement results there were several deviations, which can probably be traced back to external environmental influences.

### Behavioural Evaluation with Video Analysis

In comparison to direct observation, video analysis enables observation of the animals without disturbing or influencing them. In addition, the replaying of a video allows multiple viewings and slow motion. A disadvantage here is that sounds (for example neighing or snorting) can usually not be documented.

Several methods exist for film evaluation. The analysis according to a certain time scheme, in which for example the video is

only viewed every five minutes, means a great easing of work, but can also lead to large deficits in information [6]. Short term types of behavior, such as, for example social contact, changes in location and drinking habits can thus be missed. Longer term processes (for example, the time in which the animal stands, lies and moves) can be more realistically documented.

In contrast, in the case of continual video evaluation, short term animal activity is documented in addition to the long term types of behaviour. Decisive here is the analysed time segment and the total length of the evaluation time. A disadvantage is certainly the great personnel and technical requirements, but computer programs exist (i.e. Interact or Observer) to ease the work. In addition to individual animal monitoring, they also make the simultaneous evaluation of several animals in a group situation possible. This is, among other things, meaningful for the determination of herd hierarchy. The herd order can also have an influence on the well-being of the animals. On the basis of video observations, the position within the herd can be derived and considered in later analyses.

Husbandry systems can also be observed with regard to their use of area. In a husbandry system with different functional areas, a video analysis in the Institute for Production Engineering and Building Research showed that the horses only used the neighbouring yard for movement if it was linked to the purpose of feeding or drinking or if they wanted to play. In contrast they used the yard more for resting (dozing and lying).

### Conclusions

In order to obtain information on the well-being and stress in horses, several methods should be used in combination, because it is not possible to use one method to determine the comfort level of the animal. Particularly in the evaluation of husbandry quality, several factors and individual animal differ-

ence play a large role. In the selection of suitable analysis methods it must be noted that the process used may not cause behavioural disruption, pain or stress for the horses.

Particularly advantageous in this case are the video analyses and the determination of the cortisol metabolites in faeces, since these methods require no measurements on the animal itself. The measurement to determine the HRV did not, however, lead to a disturbance in the horses after they became accustomed to the equipment.

Studies have shown that a continuous video evaluation is indispensable if the behaviour of a group of horses is being considered with regard to the social contacts. However, the evaluation of physiological parameters shows stress situation in the horses, which would not be evident based on the video monitoring. Furthermore, factors such as seasonal climate, illness, use and handling of the animals must also be considered.

### Literature

Books are marked by •

- [1] • *Bachmann, I.*: Das natürliche Verhalten der Pferde. In: Pferde in der Steppe und im Stall. Zoologisches Museum der Universität Zürich (Hrsg.), Zürich, 1998, S. 41-49
- [2] *Borell, E. von*: Stress and coping in farm animals. Arch.Tierz., Dummerdorf, 43 (2000), S. 144-152
- [3] • *Schlichting, M. C.*: Zur Feststellung von Wohlbefinden mit Hilfe verschiedener Indikatorensysteme. Deutsche Veterinärmedizinische Gesellschaft e.V., Tagung der Fachgruppe Verhaltensforschung, Grub, 1990, S. 118-122
- [4] • *Hottenrott, K.*: Grundlagen zur Herzfrequenzvariabilität und Anwendungsmöglichkeiten im Sport. In: Herzfrequenzvariabilität im Sport. Prävention-Rehabilitation-Training, Hottenrott, K. (Hrsg.), Czwalina Verlag, Hamburg, 2001, S. 9-25
- [5] *Palme, R., und E. Möstl*: Bestimmung von Kortisolmetaboliten im Kot von Nutztieren zur nichtinvasiven Erfassung von Belastungen. Aktuelle Arbeiten zur artgemäßen Tierhaltung 2000, KTBL-Schrift, 403. Auflage (2001), S. 9-17
- [6] *Bockisch, F.-J.*: Aussagefähigkeit von Tierbeobachtungen in Abhängigkeit vom Beobachtungsintervall. Schriftenreihe der BLT-Grub, 3. GfT-Seminar, 1983, S. 1-19

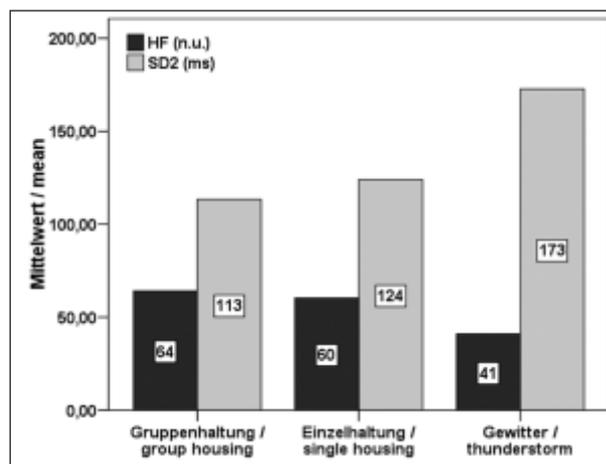


Fig. 2: Measuring stress exposure in a horse group