



**Solution for farmers
Dairy cows monitoring**

www.e-stado.net



COW 15

LACTATION GROUP 2
all parameters
are correct

COW 32

LACTATION GROUP 1
all parameters
are correct

COW 27

LACTATION GROUP 1
reduced rumination
time: 8 hours



BARN INTERIOR

moderate heat stress, THI=74



The management of dairy farm



The management of dairy farms requires not only excellent knowledge in the field of farm, health and nutrition of cows, but also current and complete information about their well-being. The modern cow, due to her genetic potential, is able to produce huge amounts of milk, but her body is also very sensitive to any changes, both internal and external. Directing the entire metabolism towards production potentially limits the cow's ability to take full advantage of defensive mechanisms against adverse environmental factors, which results that any metabolic imbalance is usually rapid and far-reaching. Therefore, it is necessary to constantly monitor the welfare of an individual animal 24 hours a day and to take rapid preventive actions.

The welfare of cows



The welfare of cows is closely related to their health, fertility, productivity and longevity. All factors directly affect the economic result of the farm, which is why the **e-stado** system was designed to provide the necessary information regarding the health and well-being of cows and their reproductive cycle.

Effective detection of heat



Not so long ago, heat symptoms were easy to detect and effective breeding constituted a very large percentage. However, intensive addition of HF blood to the domestic population resulted in a significant increase in cow mass. In addition, currently built cowsheds with concrete or slatted floors, whose surface is generally covered with slurry, cause cows to move with great caution. This is due to the fact that the hooves are not adapted to such a surface because nature has constructed them for soft grassy areas. An unfortunate attempt to mount a friend cow can be very painful or result in a serious injury. It is also worth noting that the heat itself has been shortened ; as long as 100 years ago the average heat lasted about 20 hours, **while for a modern cow this time has decreased to 6 hours** (Yashid et al., 2005) **and often manifests during the night hours** when there is peace in the barn. Studies show that with the increase yield, the heat is also shortened and amounts to: 6 hours at 30 liters of milk per day to just 2 hours at a production of 50 liters (Lopez et al, 2004).

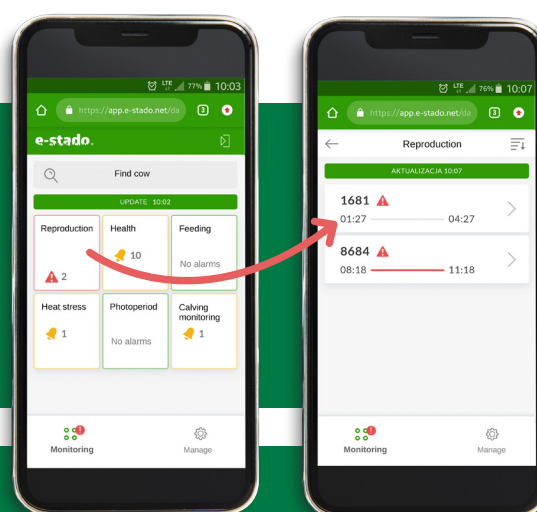
Thus, heats are becoming more and more difficult to detect which results in a significant extension of the calving interval. It is assumed that the time from calving to pregnancy should in cows with high yields not be longer than 360-380 days. Each day above this threshold brings measurable losses. It has been calculated that in 200 cows farm in US that cost of additional open day varies from USD 3,5 to 4,7 depending on production level. This cost consists of a decrease in milk production, costs of insemination and treatment, and possible culling of a cow. The loss of income from the sale of heifers, which must be allocated to replacement, is also significant. The longer the period without pregnancy, the higher daily cost is (De Vries, 2006). Assuming that average calving interval on farm is 400 days **than potential loss varies from USD 80 to 160 per cow.**

24h

The **e-stado**[®] system provides 24 hour a day monitoring of the cow's activity and other indicators related to the phases of the reproductive cycle, such as nutritional activity, rumination and body temperature. The intelligent algorithm, which has a built-in breeding calendar, very precisely determines the start date of heat and calculates the optimal insemination period on this basis.



The research carried out in cooperation with the **Warsaw University of Life Sciences** confirmed the very high compatibility of the **e-stado**[®] system indicators with the actual heat identified by a veterinarian and confirmed by biochemical blood tests.



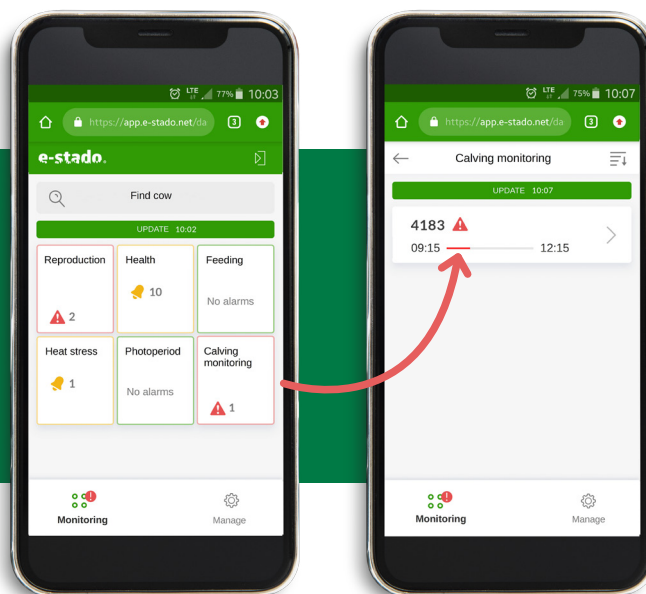
The **e-stado**[®] system effectively detects the heat in heifers and cows kept both, in free-stall and tied-up barns.

Calving monitoring



The cow is preparing to release the calf much earlier than the visible symptoms of an approaching birth appear. Studies have found that rumination begins to gradually decrease 2 weeks before calving and drastically decreases on the day of delivery. If everything proceeds correctly, the cow returns to his rumination pattern within a week (Bar and Solomon, 2010). However, birhts become more difficult and **it is estimated that 20 - 30% of calving requires human intervention.**

However, the mere observation of rumination will not provide information on all the threats. In high yielding multiparous cows there is a high probability of developing postpartum retention. The disease, despite its name, may also occur before delivery, but it usually occurs up to 24 hours after calving. The first symptom is numbness, decrease in rumination and defecation and lowering of the temperature. After a few hours, the cow lays down and rumination stops completely. Retention is particularly dangerous during evening deliveries, as a lack of rapid intervention may result in irreversible changes and demise of the cow. Studies show that **in cows with a yield over 9,000 l milk, the risk of milk fever is about 10%.**



The e-stado® ear biosensor monitors the temperature, rumination, physical activity, standing and laying of the cows and their immobility during the perinatal period. The tail biosensor monitors the calving process. The farmer has constant insight into the development of the situation on his smartphone and receives a text message just before the birth. Retention before or after birth also generates an alarm.



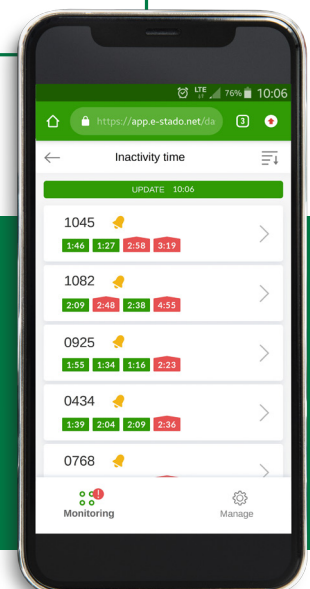
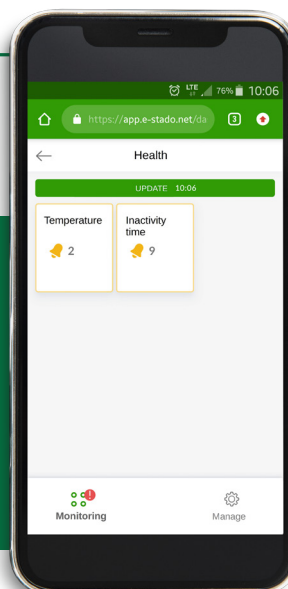
Health monitoring

Early detection of diseases in cows is crucial not only in effective treatment and minimizing the effects of diseases but also in reducing the costs of the therapy. The biggest problems are transition period diseases such as ketosis, abomasum displacement, metritis and acidosis. Studies show that in Europe 30 - 45% of cows suffer from subclinical ketosis, while only 0.5% of the population has clinical symptoms (Rutkowski, 2017). **Losses caused by metabolic diseases are estimated at € 100-200 per cow per year and lameness detected too late amounts to up to € 100 per each case** (Guard, 2008). These amounts include costs of treatment, used medicines, drop in production and premature culling.

That is why it is very important to constantly monitor the health of cows, promptly diagnose and treat immediately. In general, the first sign of a problem for the farmer is a decrease in yield in the following days. Many farmers in such a situation measure the temperature, unfortunately most metabolic disorders, at least in a non-acute state, proceed without changing the temperature. Only the so-called clinical symptoms of the disease, visible a few days after it appears in the body, tell us what kind of problem we are dealing with.

However, the cow's organism reacts to the disease much earlier and the first symptom is declining time of rumination. Research show that **ketosis, abomasum displacement and mastitis reduce rumination even 4 days before the onset of clinical symptoms**. In the case of metritis, there is also a fever in more severe cases. Cows react similarly to the first symptoms of **lameness, decrease in rumination predates clinical symptoms even by 7-9 days** and the activity of cows decreases. A slightly different course is shown by acute acidosis, which is manifested by a strong breakdown of rumination, but it is a one-day reaction.

The **e-stado®** system continuously measures body temperature, checks rumination time and monitors activity as well as the time of inactivity. Cows for which those parameters deviate from the norm are shown in the health alert. This information precedes clinical symptoms by several days



Monitoring of nutritional activity



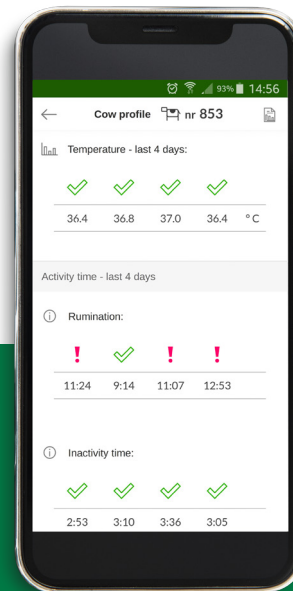
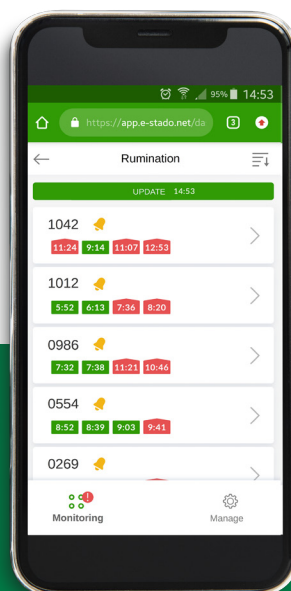
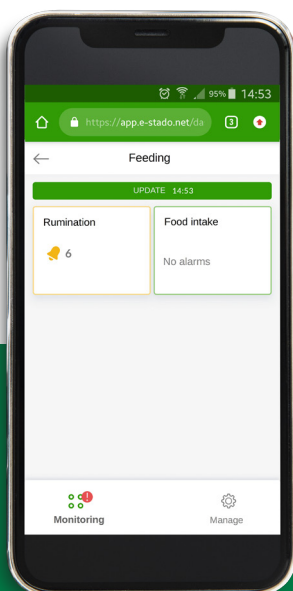
The cow's nutritional activity comprises the intake and preliminary grinding of the feed and its further rumination. The cow spends 3 to 6 hours a day on feed intake (longer in the pasture). Under natural conditions, the rumen served as a feed storage, which was later chewed, mainly during the night hours when feeding was not possible. Under the conditions of a modern barn, rumination occurs throughout the day and should last from 7 to 8.5 hours. **Increasing or decreasing the total time of nutritional activity indicates a problem with the diet or the feed quality.**

Due to the structure of the cow's gastrointestinal tract and its high sensitivity to changes in the feed composition, a good nutritional strategy is to use same ration for as long as possible. This allows to stabilize the time of feed intake, rumination and rumen function. In practice, this is difficult to implement, as cows change technological groups, a new silo is opened or the supplier of concentrates changes. This may result in disturbances of rumen functions and microflora changes which can last up to 2 weeks. **Any such variation results in a decrease in milk production and measurable losses for the farmer.** Knowing the time of rumination allows to monitor these changes and correct them accordingly.

Among the nutritional factors, the amount of fiber in the feed has the greatest influence on the time of rumination; the cow needs about 1 hour to chew 1 kg of NDF. A proportion of roughages to concentrates such as 60:40 in a dry matter of the ration is optimal for correct fermentation in the rumen. However, at the beginning of lactation, this ratio flattens and often even reverses up to 40:60 to increase energy intake and reduce the risk of ketosis. This means, however, that with the increase of concentrate feed in the ration the rumination time will be shorter and consequently reduced production of saliva which buffers rumen pH, and the risk of acidosis will increase. **Analysing the time of rumination is a great tool for monitoring cows during a transition period.**

Another important factor is the appropriate physical form of the roughage. Too much fragmentation shortens the time of rumination and does not allow good utilization of the nutrients. Excessively long cut silage or hay lengthen rumination and as a result reduce the intake of dry matter.

The e-stado® system, by monitoring the time of feeding and rumination, is a great tool for controlling the nutritional strategy from the perspective of the cow's well-being. It also allows to assess the impact of changes in the composition of the ration or its physical form, detects nutritional errors, immediately informs about the deterioration of feed quality.





Photoperiod control

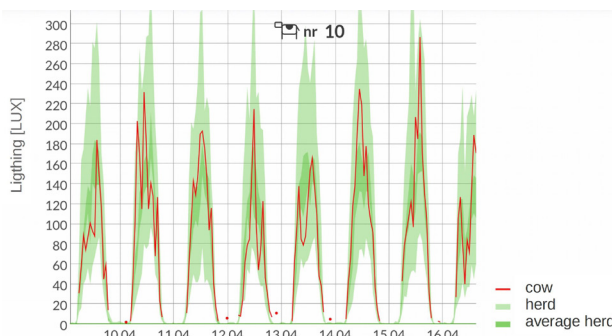
Light plays a very important role in the functioning of the body. It affects the general health and well-being of animals, somatic and hormonal maturation of heifers, reproductive cycle and fertility, manifestation of heat, activity, interest in the surroundings and feed intake.

The hypothalamus contains important centres directing the autonomous nervous system function, the body's water management (regulating the amount of water and feeling of thirst), thermal regulation, the activity of endocrine glands, food intake (hunger and satiety), fat metabolism, carbohydrate (sugar) metabolism, sleep and wakefulness, sexual activity (reproductive cycle, sexual drive) and emotional reactions.

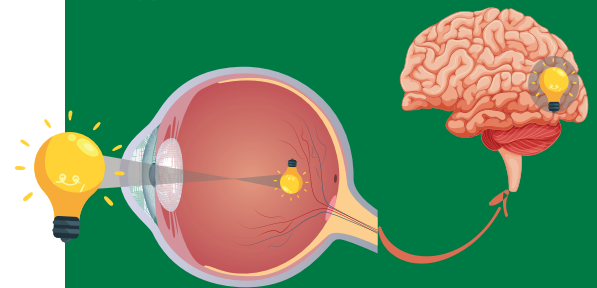
It is assumed that for cows, heifers and calves, the so-called **light day, when lighting at eye level exceeds 150 lux, it should last 16 hours.** Such time with access to light ensures good health of animals and optimal production. In European conditions, the shortest day lasts 8 and the longest 16 hours, which means that for most of the year, animals kept in the livestock buildings require additional lighting. In the nature, during short days the animals limit their activity because it is winter, there is no feed, there are low temperatures and it is necessary to save energy. In a modern farm it is quite the opposite, the time from autumn to spring is the best period for production because barn conditions are optimal and there is a lot of feed. **Therefore, it is necessary to extend and control the light day.**

In experiments with heifers it was found that animals exposed to the light for 16 hours per day reached maturity 24 days earlier, were higher and heavier during delivery and gave more energy corrected milk (ECM) during the first lactation

Thee-stado® ear biosensor has a built-in photovoltaic cell, which is located at the level of the cow's eye. As a result, the system monitors the amount of light available to the animal's eyes 24 hours a day.



Light reaches through the lens to the bottom of the eye, where it is converted into a nerve impulse, which is transmitted to the brain by the optic nerve, where it is perceived as a visual image. Light simultaneously activates two areas of the brain: pineal gland and hypothalamus.



In simplified terms, it can be said that in the absence of light, the pineal gland is active, and with the light level increasing, the pineal gland slows down and the hypothalamus becomes active. The pineal gland produces, among others, melatonin, the sleep hormone.

In many studies on cows, it was shown that extending the lighting time to 16 hours a day resulted in a production increase from

10 to 15%



Detecting heat stress



The cow feels best in the temperature range from +16 to +22 C, which is called the thermal-neutral zone. It performs very well at lower temperatures, also below zero C, but it has thermal regulation problems already above +22 C. This is because the production of milk is associated with the release of a large amount of heat. The cow with a daily output of 45 liters of milk produces as much heat as the radiator with a 2000W output. If the conditions around the animal do not allow a quick release of heat, the body overheats.

In central European conditions, such a situation occurs in the period from spring to early autumn, especially when high humidity is persists in the facilities. These are considered conditions of heat stress.

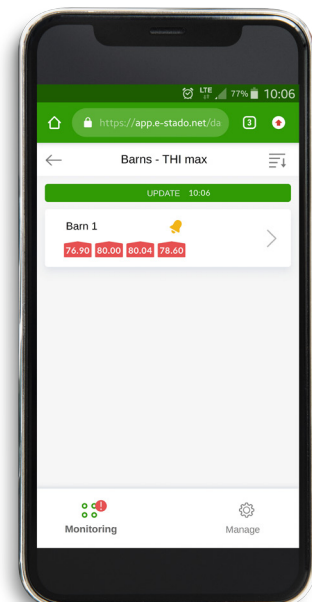
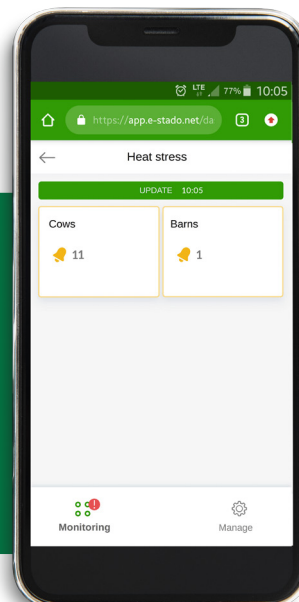
Already at 23 C and 45% humidity, a high performance cow begins to feel the effects of heat stress - body temperature increases, and so does the breath rate. Animals try to cope with the problem through decreased activity, looking for shade and drafts, less feed intake, panting and less frequent rumination.

The first effect of heat stress is the reduction of milk yield by 15-30% and more under severe stress. As a result, this leads to a decline of the entire lactation curve and **annual production up to 20%**. The composition of milk also changes, the level of fat and protein decreases, the number of somatic cells increases. Because the metabolism and functioning of the whole body is disturbed in cows which have experienced prolonged heat stress, reduction in fertility up to 30% is observed, detection of heat is more difficult, mortality of calves increases and animal resistance is reduced.

Because the cow has poor mechanisms to deal with the heat stress, it is necessary to constantly control the building's parameters and body temperature of the animals in order to react quickly when conditions causing heat stress arise.



The e-stado® system continuously monitors the temperature and humidity in the cowshed and constantly controls the body temperature of the cow. It informs of the situation in the form of legible information and charts on an ongoing basis.



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