

TIMELY TOPICS

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Rumination and activity monitors detect metabolic disease

Early postpartum health disorders negatively impact cow well-being and are associated with significant economic losses for dairy farms due to losses in milk production, increased risk of culling and death, increased treatment cost and reduced reproductive performance. As a result, dairy farmers have developed and implemented intensive health monitoring programs to keep their cows healthy and productive. Unfortunately these monitoring programs are usually costly, time consuming, and require qualified labor.

Rumination and activity monitors that automatically monitor health have the potential to detect disorders earlier, while reducing the cost of health monitoring. Dr. Matias Strangeferro and Dr. Julio Giordano, Cornell University, compared the performance of an automated health monitoring system (AHMS) that combines rumination time and physical activity to the gold standard of clinical diagnosis by farm per-

Activity monitors identified cows with ketosis 1.5 days earlier and DA's 3 days earlier than clinical diagnosis.

sonnel. They found the system was most effective at identifying cows with metabolic and digestive disorders. Sensitivity to identify cows with metritis and mastitis was lower and could be explained by less severe systemic illness. Cows with displaced abomasum (DA), ketosis, metritis and mastitis were identified earlier by the monitoring system than by farm personnel.

The study evaluated:

(1) the performance of an automated rumination and physical activity monitoring system to identify cows with metabolic and digestive disorders, metritis and mastitis based on a Health Index Score (HIS).

(2) the interval between an AHMS-generated alert and the day of clinical diagnosis by farm personnel.

(3) the rumination, activity, and AHMS-generated alert patterns for cows that suffer health disorders.

At approximately four weeks before calving, 1,121 animals (451 heifers and 670 second lactation and greater) were fit-

ted with a neck-mounted electronic rumination and activity monitoring tag (HR Tags, SCR Dairy, Netanya, Israel) to monitor rumination and activity before calving until at least 80 days post-calving. Data recorded by individual tags was transferred to the system software (Dataflow, SCR Dairy, Netanya, Israel) automatically through antennas in the cow barns.

A Health Index Score (HIS) with a scale of 0 to 100 was generated for each individual cow based on rumination and activity data. The HIS is generated by the system software through a series of internal algorithms (proprietary to SCR Dairy). An HIS of 100 represents a cow with an ideal pattern of rumination and activity and is most likely to be healthy. An HIS value of less than 86 may indicate the presence of a health disorder and can serve as an alert system.

The research team HIS report included cows with an HIS of less than 86 points to evaluate

Ability of HI Score to Identify Cows with Health Disorders

Disorder	Cows detected Se, % (95% CI)	HI <86 to CD (d)
DA (n = 41)	98 (93-100)	-3 (-3.7 to -2.3; P<0.01)
Ketosis (n = 54)	91 (83-99)	-1.5 (-2.3 to -1.0; P<0.01)
Indig. (n = 9)	89 (68-100)	-0.5 (-1.5 to 0.5; P=0.28)
All metabolic & dig. (n = 104)	93 (89-98)	-2.1 (-2.5 to -1.6; P<0.01)



Ability of HR System to Identify Cows with Disease

Disease	Cows detected % Se (95% CI)	HR Flag to DCD (days)
Mastitis (n = 165)	53 (45-61)	-0.6 (-1.1 to -0.2; P<0.01)
Clinical (n = 123)	58 (49-67)	-1.2 (-2.7 to 0.3; P=0.12)
Subclinical (n = 42)	41 (26-57)	-0.5 (-1.0 to -0.1; P=0.02)
By Pathogen		
E. Coli. (n = 31)	81 (67-95)	-0.5 (-1.1 to 0.2; P=0.18)
Gram + (n = 39)	49 (32-65)	-0.5 (-1.4 to 0.5; P=0.31)
Staph. Aureus (n = 11)	46 (17-77)	-1.4 (-4.1 to 1.3; P=0.23)
No growth 48 h (n = 25)	48 (28-69)	-0.2 (-1.4 to 1.1; P=0.78)

Gram (+) = *Streptococcus agalactiae*, *Streptococcus dysgalactiae*, *Streptococcus uberis*, *Streptococcus species*, *Staphylococcus species*, *Actinobacillus pyogenes*.



the ability of the monitoring system to identify cows diagnosed with health disorders by farm personnel.

The fresh cow monitoring program for the farm is comprehensive. Farm personnel conducted clinical evaluation of cows on a daily basis and all had two to 10 years of experience monitoring cow health. After calving cows were examined daily from one to 10 days in milk (DIM). The clinical examination included: direct observation, general appearance and attitude, presence of the placenta, evaluation of vaginal discharge, foot health, udder health, manure consistency, rectal temperature, urine ketones (KetoStix, Bayer Diagnostics, NY), and rumen function. Milk culture was performed on all cows at the beginning of lactation (first milking) and on the day of a mastitis diagnosis. For any cow not diagnosed with metritis before eight DIM, transrectal massage of the uterus was conducted to obtain and evaluate uterine discharge. The progression of milk production and changes in daily milk weights (difference between recorded and expected milk) were also used to identify cows with health disorders during the lactation.

After 10 DIM, cows were monitored daily following the same criteria, except that urine ketones were only evaluated in cows suspected to have ketosis, uterine discharge in cows suspected to present metritis, and rectal temperatures in cows

suspected to present metritis, mastitis or other infectious disorders. Cows that suffered health disorders after 10 DIM were monitored daily, or more frequently as needed, until recovery.

Because the HIS does not confirm the occurrence of disease or indicate the type of disease affecting the cow, a positive outcome was defined as an HIS of less than 86 during at least one day during the five days preceding, the day of, or two days after the disease clinical diagnosis by farm personnel. The sensitivity of the HIS was defined as its ability to identify cows with a clinical diagnosis.

The AHMS system had an overall sensitivity of 93% for all digestive and metabolic disorders combined, with a sensitivity of 98% for DA's, 91% for ketosis and 89% for indigestion.

Cows with ketosis were identified 1.5 days earlier than by farm personnel and DA's were identified three days earlier by the AHMS than clinical diagnosis by farm personnel. Automated monitoring of rumination and activity could be a useful tool to identify cows suffering metabolic and digestive disorders in dairy herds.

The AHMS was effective in identifying cows with clinical cases of mastitis caused by E. coli, but less effective in identifying cows with mastitis not caused by E. coli. The AHMS sensitivity for all cases of mastitis was 53%, but for E. coli infections was 81%. This may be because cows show fewer symptoms for some forms of mastitis infection. The overall AHMS sensitivity for cows with metritis was 55% and cows were identified 1.5 days sooner than clinical diagnosis by farm personnel. However, cows with metritis had some obvious differences, depending on the severity of the case as determined by farm personnel. Sensitivity of the AHMS for cows treated with Ampicillin (more severe cases) was 83%, and for cows treated with Ceftiofur (milder cases) was 49%.

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