





UNIVERSITÀ DEGLI STUDI DI MILANO

### How precise are tools measuring animalbased welfare indicators in dairy cattle?

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1. Introduction – ClearFarm Project and our aim 2. Material and methods 3. Results : a. Market search b. Literature search c. Welfare relevance 4. Conclusions



### INTRODUCTION

#### **ClearFarm project**









# To assess which welfare aspects of cows', heifers' and calves' husbandry can be addressed by available (and validated) technologies.











#### **Literature Search**

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)





Farm 1 system building and Initial testing Farm 2 system validation





Intercept and slope of linear regression did not differ significantly from 0 or 1

Bland–Altman plots (plot included zero with the 95% interval of agreement



Welfare relevance





### Results

#### **Results - market search**



#### PLF technology providers with potential use for animal-based welfare assesment



#### 129 technologies / 67 providers / 21 countries

#### **Results- market search**





Full list can be found at:

https://www.frontiersin.org/articles/10.3389/fvets.2021.634338/full#supplementary-material



## External validation rate - 14% of commercially available sensors with validation records:

- 1. Accelerometers (30%)
- 2. Cameras (10%)
- 3. Load cells (8%)
- 4. Milk sensors (8%)
- 5. Boluses (7%)

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#### High performance (precision and accuracy)

- Accelerometers non-active bahaviour (e.g. lying and standing), rumination, grazing time
- Load cells- water and feed intake, body weight (calves)

#### Lower performance (precision and accuracy)

- Accelerometers active behaviour, feeding time, drinking time, rumination (for calves and heifers)
- Load cells locomotion score,
- Cameras- locomotion score, BCS
- Boluses body temperature (cows, calves and heifers), rumen pH
- Milk sensors mastitis detection, milk quality

### Welfare relevance





Indicator	Good feeding	Good housing	Good health	Appropriate behavior
Body temperature	+-	+-	+	-
Body condition scoring	+	10 10	+	2 <u>—</u> 2
Lameness		+-	+	1.775
Mastitis	<del></del>	+-	+	
Water consumption	+	8 <u>23</u>	+	+
Drinking duration	+-	8 <del></del>	+-	+
Rumination	+	+	+	+
Rumen pH	+	855	+	(177):
Grazing time	+	+	+	+
Feeding intake	+	12	+	+
Feeding time	+	855	+-	+
Active behavior		+	+	-
Non-active behavior		+	+	+

<sup>a</sup>Symbols +, +-, - refer to "very relevant," "moderate," and "not relevant" evaluation, respectively. From: <u>https://doi.org/10.3389/fvets.2021.634338</u>

#### Welfare relevance





#### **Good feeding:**

- No prolong hunger or thirst



#### Good health:

- Free from injuries and disease
- should not suffer pain induced by inappropriate management





#### Welfare relevance





#### Good housing:

- thermal comfort
- resting comfort
- enough space to move freely



#### Appropriate behavior:

- expression of social behavior,
- expression of other behaviors,
- good human-animal relationship,
- positive emotional state







### Conclusions

#### Conclusions



- 1) To increase actors' trust toward the PLF technology and prompt sensor-based welfare assessment, validation studies are needed.
- 2) Sensor technologies, also those with lower performance, can provide useful information on animal health and well-being.
- 3) Integration of PLF technologies in current protocols for animal welfare assessment would make them more robust

## Thank you for your attention!

Follow us at www.clearfarm.eu









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