Automatic monitoring of calves' behaviour for a precision weaning approach

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Introduction

Dairy calves' future performance and **antimicrobial consumption** are influenced by their **health status** during the first weeks of life (Soberon *et al.*, 2012).

Neonatal calf diarrhea and **bovine respiratory disease** have been associated with **reduced growth** and **increased age at first calving** (Cramer *et al.*, 2016).

Illness conditions change **feeding** and **activity behavior**, often prior to the peak day of disease (Duthie *et al.*, 2021).

Automatic monitoring system can be useful to recognize **behavioral alterations** and to early detect sick calves (Sun *et al.*, 2021).

Aim of the study

Investigate the **contribution**
of an **accelerometer ear tag monitoring system (AMS)**
in the **management** of **pre-weaned dairy calves.**

How?

*Exploring the **relationship between health alarms** (HA) developed by the AMS, **clinical status**, **feed intake** and **growth performance** of calves.*

Materials and methods

Experimental-teaching dairy farm of the University of Bologna

28 holstein female calves equipped with an **accelerometer ear tag monitoring system** and monitored for the first **90 days.**

The **AMS** records **activity (low, mild and hing intensity)** and **rumination time** and generates a **Health Index (HI; 0-100).**

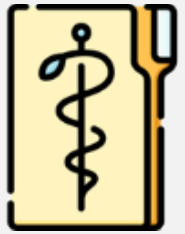
Low activity contributes to reduce the **HI** until the value of **86**, when a **Health Alarm** (**HA**) is sent.

Materials and methods

For the first **75 days,** calves were housed in **individual pens** and fed with **milk twice daily**, **pelleted calf starter** (*ad libitum* from day 0) and **long hay** (*ad libitum* from day 30 of age).

Calves were **weighed fortnightly** and **clinically assessed 3 times a week** (following *Wisconsin's Calf Health Scoring* protocol).

Individual feed intakes were **recorded daily** for the first 75 d.



Clinical checks were carried out at **day 0, +1, +2** and **+3** from the **HA.**

Materials and methods

Cluster analysis was performed to divide calves in **3 different groups** based on the **number of HA recorded.**

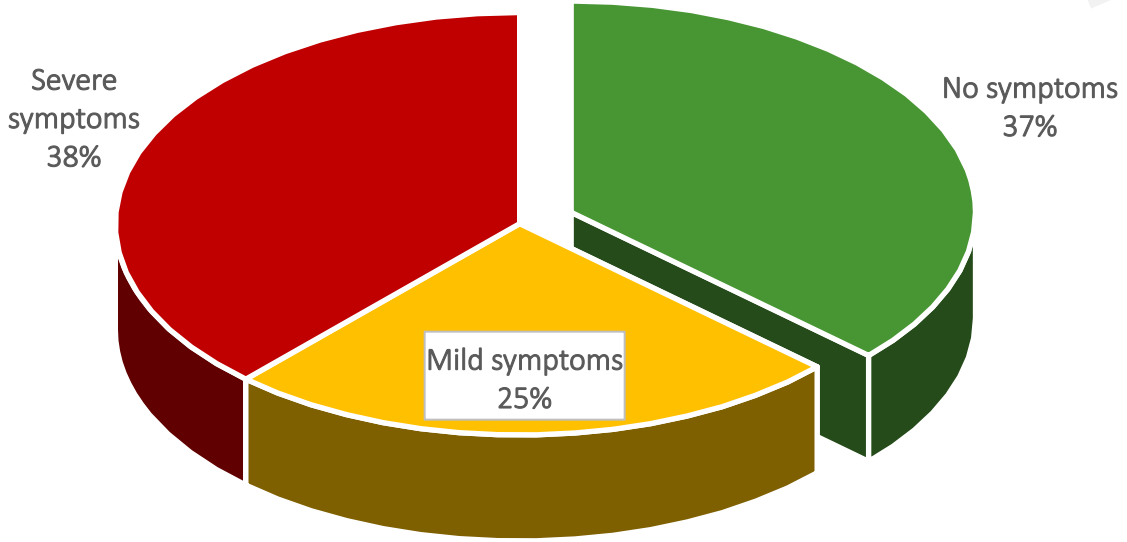
Data of **milk** and **feed intakes** and **growth rate** were **compared among clusters**, having as **fixed effects age**, **cluster**, and their interaction, and the **calves as random effect**.

Results and discussion

Characteristics of 28 calves involved

	Mean
Body weight at birth, kg	36.68 ± 5.44
Body weight at weaning, kg	89.65 ± 12.14
Age at weaning, days	74.56 ± 8.08
Average daily gain at 60 days (ADG 60), kg/d	0.65 ± 0.13
Average daily gain at 90 days (ADG 90), kg/d	0.76 ± 0.14

Clinical checks after health alarms (HA)



Mild or severe symptoms were detected in the 63% of clinical checks performed after HA.

Results and discussion

Cluster analysis

Based on number of the health alarms (HA) received in the first 90 days of life, calves were divided into 3 clusters (C1, C2, C3).

	Clusters		
	C1	C2	C3
HA received in the first 90 days, n./calf	0 - 1	2 - 3	> 3
Calves, n.	11	11	6

Results and discussion

Milk and hay intake and average daily gain (ADG) for cluster

	Clusters			sem	p-value
	C1	C2	C3		
Milk intake, L/d	4.97	4.96	5.05	0.1	0.647
Hay intake, g/d	143.7	134.4	115.0	14.7	0.586
ADG 60, g/d	0.68^{a}	0.68^{a}	0.52^{b}	0.05	0.027
ADG 90, g/d	0.84^{a}	0.77^{ab}	0.64^{b}	0.05	0.016

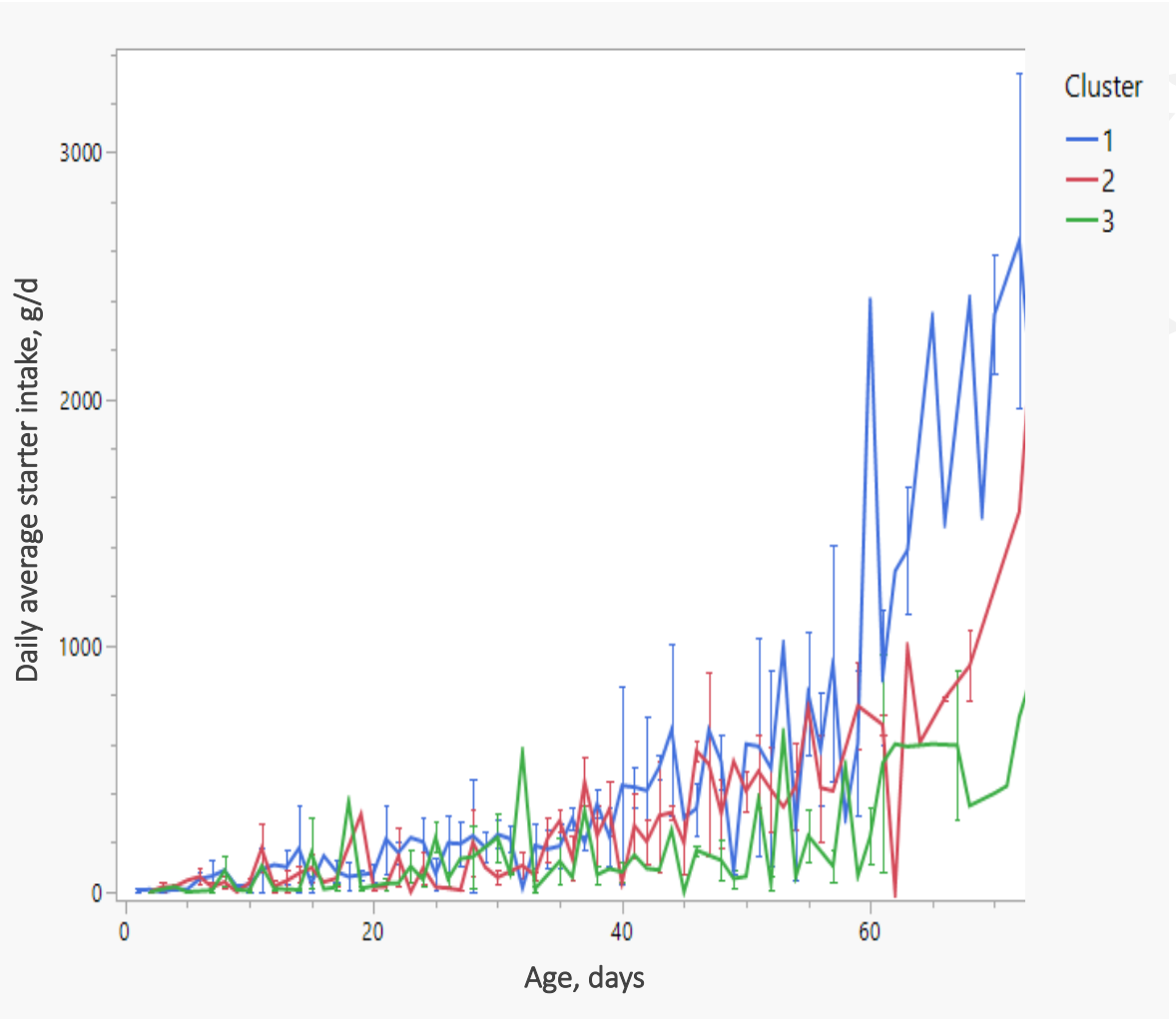
Milk and hay intakes showed no differences among the 3 clusters.

ADG resulted significantly lower for C3 and C2 compared to C1.

Results and discussion

Daily starter intake for cluster, g/d

Age, days	Clusters			sem	P-value
	C1	C2	C3		Cluster*age
0-15	15.0	79.0	38.2	107.2	1
15-30	321.0	248.2	138.5	99.6	0.999
30-45	627.1^{a}	417.5^{ab}	285.0^{b}	100.4	0.050
45-60	933.2^{a}	586.7^{ab}	431.4^{b}	109.2	<0.001
60-75	1239.3^{a}	756.0^{ab}	577.9^{b}	124.0	<0.001

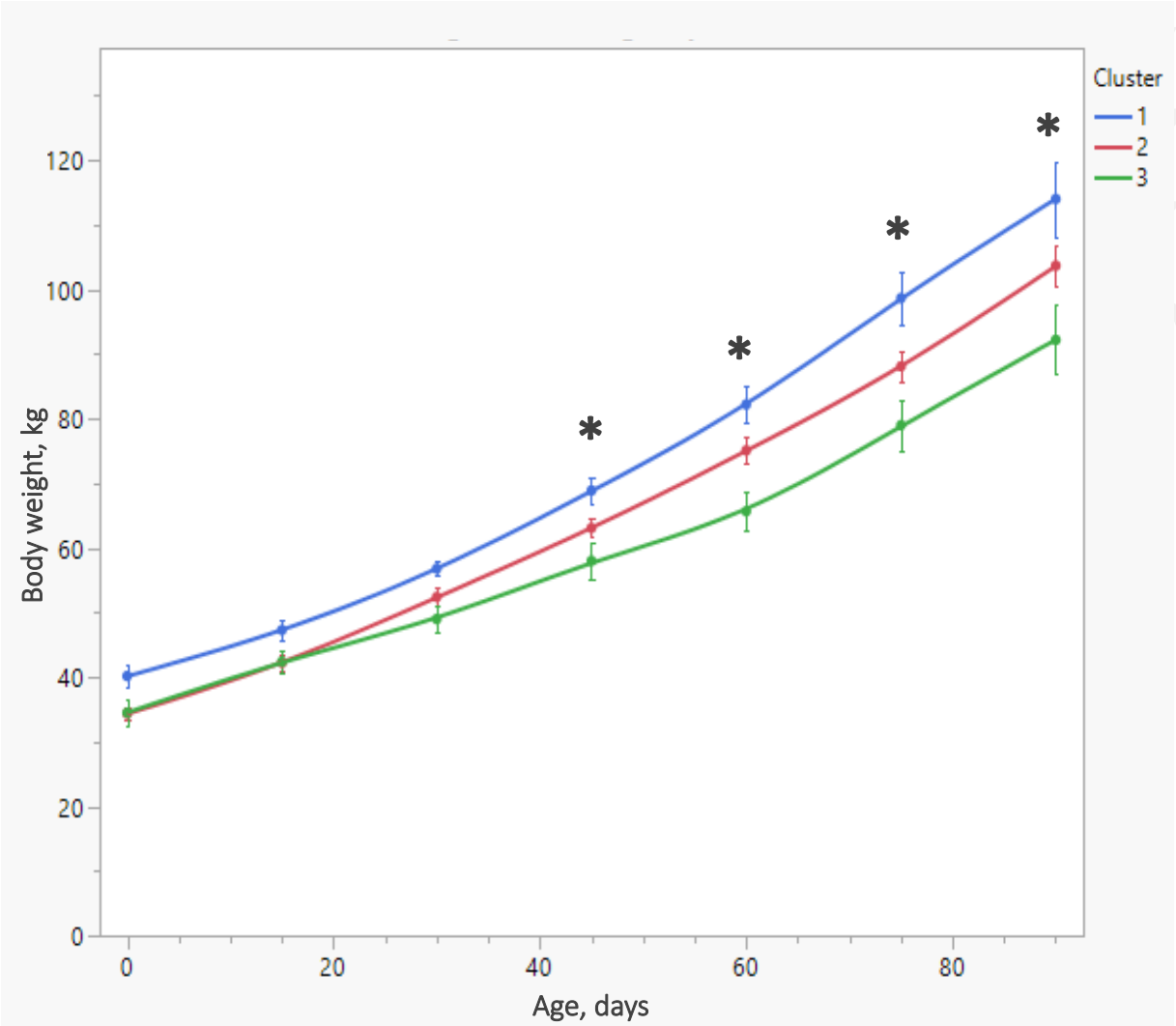


Daily average starter intake resulted significantly lower for C3 compared to C1 starting from day 30 of age.

Results and discussion

Body weight for each cluster, kg

Age, days	Clusters			sem	P-value
	C1	C2	C3		Cluster*age
0	39.1	33.5	33.8	2.7	0.998
15	51.4	45.1	43.2	2.1	0.999
30	63.8	56.6	52.7	1.7	0.197
45	76.1^{a}	68.2^{ab}	62.2^{b}	1.5	<0.05
60	88.4^{a}	79.8^{ab}	71.7^{b}	1.7	<0.01
90	113.1^{a}	102.9^{ab}	90.6^{b}	2.8	<0.001



Mean body weights recorded at 45, 60 and 90 days were lower for C3 compared to C1.

Conclusion

Lower growth rates and feed intakes were found in calves with health issues detected by the AMS even when clinical symptoms were not evident.

Automatic monitoring of calves' behaviour reveals the potential to promptly detect weaker or sick calves that need to be managed adequately with a precision weaning approach.

Ongoing studies

Development of a **precision weaning protocol** based on:

- **body weight at birth**
- **environmental temperature**
- **health status** as recorded by **AMS**

48 calves involved:

Study of the **relationship among serum protein content**, **colostrum quality** and **behavioral patterns.**

Analysis on recorded data concerning **suckling, intake** and **rumination behaviour.**

Comparison between **recorded values** of **feed intake** and those **estimated** by exploiting the **NASEM 2021** equations.

Thank you for your attention

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