The recording of grazing time of dairy goats is accurate using the Lifecorder Plus device

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Take home message The use of the Lifecorder Plus is simple and allows to record accurately the grazing time of dairy goats at pasture.

Introduction The recording of daily grazing time in ruminants allows to better understand the sward-animal relationships and the behavioural constraints affecting daily intake at pasture. For grazing goats, very few portable devices have been validated. The Kenz Lifecorder Plus device (LCP, Suzuken Co. Ltd., Nagoya, Japan), based on an uniaxial accelerometer, originally developed for measuring human daily activity level, has been validated recently to record daily grazing time and pattern in dairy cows (Delagarde and Lamberton, 2015). The aim of this study was to compare grazing activity duration as recorded simultaneously by the Lifecorder Plus fitted on the goats's neck and by trained observers.

Materials & methods This validation study was conducted at the INRA experimental farm of Méjusseaume (Brittany, France) in 2015 and 2017 for a total of 173 hour × goat visual observations. The Lifecorder device is placed in a small box, attached to the goat's neck by means of a simple collar. Actual grazing, ruminating, and "other activities" were recorded by trained observers. The Lifecorder device records the average activity level for every 2-min period, with a range of possible values from zero (no activity) to 9 (maximal and permanent activity). Grazing activity was defined by an average activity level within a 2-min period greater than 0.5 as for dairy cows (Delagarde and Lamberton, 2015). Short periods of activity (2 or 4 min) as well as short intra-meal intervals (2 or 4 min) were not considered. Grazing activities were then summed per hour (for standardised statistical analyses) or per validation sequence (Figure 1). The grazing activity duration recorded by the Lifecorder Plus was compared with the actual grazing activity duration recorded manually by observers on a per hour basis, through the calculation of the mean prediction error which is the bias against the y=x axis (Bibby and Toutenburg, 1977), and though the calculation of sensitivity, specificity and accuracy (Visa *et al.*, 2011).

Results & discussion On average, at the hour scale, the correlation between predicted (by the Lifecorder, 52.0 min/h) and actual (by the observer; 50.1 min/h) grazing time was high ($R^2 = 0.87$), with a mean relative prediction error of 0.11, i.e. 5.4 min/h (Figure 1). There was no bias due to the slope (0% of Root Mean Square Error, RMSE), and a small over-estimation of grazing time (12% of RMSE due to the mean bias), the majority of the bias being due to random variation (88% of RMSE). At the scale of the observation sequence (mean duration: 162 min), the mean relative prediction error was only of 0.09, which indicates a good overall accuracy of the device. Sensitivity (proportion of true positive: 0.98) and accuracy (overall concordance: 0.96) were very high and showed that grazing activities were always well detected. Specificity (proportion of true negative: 0.74) was lower, indicating that some other activities were sometimes detected as grazing activity. These results indicate similar to greater prediction quality for recording daily grazing time in grazing goats when compared to the same device or other devices tested on grazing dairy cows. There is no similar published work on grazing goats.
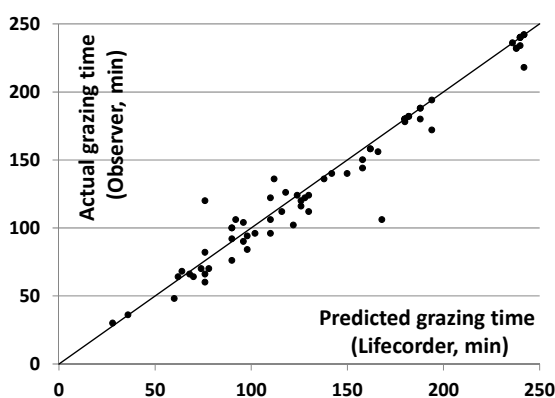

Figure 1 Relationship between grazing time recorded by the Lifecorder and by visual observation (69 sequences of 62 to 242 min of observation).

Conclusion The accuracy, sensitivity and specificity of the Lifecorder Plus to record grazing activities of dairy goats are high. This device can be used to record daily grazing time and nycthemeral pattern of grazing activities in goats at pasture.
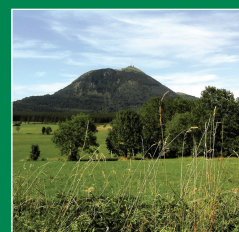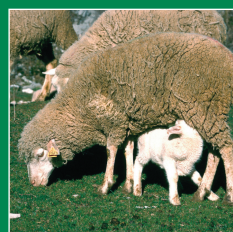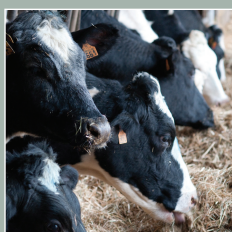
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Symposium on the Nutrition of Herbivores
ISNH 2018

10th INTERNATIONAL SYMPOSIUM on the Nutrition of Herbivores

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