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Evaluation of inter-observer reliability of animal welfare indicators: which is the best index to use?

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In animal welfare studies, the use of the appropriate index when calculating inter-observer reliability can cause the inclusion or the exclusion of a promising indicator, which in turn has a strong impact on the robustness of a welfare assessment protocol. In this study, we compared the performance of the most popular agreement indexes (i.e. Scott's π, Cohen's k, k_PABAK, Holsti's H, Krippendorff's α, Hubert's Γ, Janson and Vegelius' J, Bangdiwala's B, Andrés and Marzo's Δ, and Gwet's γ (AC_1) to evaluate inter-observer reliability of welfare indicators in the case of dichotomous categorical (e.g. yes/no) animal-based indicators and the presence of two observers. The dataset was created using observations obtained from assessments conducted on nine dairy goat farms in Italy and Portugal using the AWIN protocol. Udder asymmetry was chosen as an example of a dichotomous categorical indicator; the concordance rate ranged from 75% to 100%. Our results show that Cohen's k (by far the most frequently used agreement index in animal-welfare studies), Scott's π and Krippendorff's α were affected by a paradoxical behaviour: in some circumstances, where the concordance between observers was very high, they showed unacceptably low values. On the contrary, other less known and used agreement indexes, such as Bangdiwala's B and Gwet's γ (AC_1), showed values very close to the concordance rate, independently from its value. For confidence intervals calculation, besides the most commonly used closed formulas of variance estimates, we used the bootstrap and exact bootstrap methods. Both methods turned out simpler when compared to the implementation of closed variance formulas and provided effective confidence intervals not only for Scott's π and Cohen's k, as already reported in published literature, but for all the considered agreement indexes. Our results can be extended to any welfare assessment indicator, even in different species or contexts of application, when two independent observers assess dichotomous variables at the same time.

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Alternative farrowing systems for sows can affect litters performance?

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Within the intensive pig production systems, one of the major criticized welfare issues involves the housing in the confined systems in individual crates for sows at the farrowing and during lactation. This system is primarily used with the aim of reducing piglet crushing by providing greater control during the sow posture changes, but they have severe implications for sow welfare. However, considering that piglets' death mainly occurs during the first 24–72 hours postpartum, confining the sow beyond this period may not be necessary for the piglet's survival. The aim of this study was to investigate the effects of different housing systems at the farrowing on piglet mortality and growth besides to sow's welfare (behaviour and shoulders lesions) and performance (number of weaned piglets).
The study involved 21 sows, assigned to one of 4 farrowing systems: Conventional crate (CC) in which sow was kept in the crate for the entire lactation (28 d), and 3 alternative pens (APa, APb, APc) in which sows were confined only for 4 days after farrowing. The APs differed for pen size and position of the temporary farrowing crate (in the middle of the pen in APc or lateral near to a wall in APa, APb).
Different farrowing systems did not affect significantly the rate of piglet crushed (1,6), the number of weaned piglets (12,1) and the piglet average daily gain (233,6 g/d). Significant differences were instead observed when considering the time of occurrence of the crushing events with fatal outcomes. Piglet mortality due to crushing in the first 24 hours after farrowing was significantly higher in CC than in the APc (86% vs. 20% respectively). Even after 72 hours post-partum there was a significant difference only between CC and APc systems, being significantly lower in CC than in APc ($p = .03$). Among APs systems, APc had therefore the lowest loss of crushed piglets when the cage is closed, the period when piglets crushing was significantly higher than after opening ($p = .041$). However, after opening, the APc system resulted in the highest in crushing deaths ($p = .008$).