Ear vein puncture in diabetic minipigs for measurement of blood glucose.

Department 2028, department 251.

Background:
Pigs with diabetes need to have their blood glucose measured regularly in order to monitor their blood glucose levels and regulate their insulin dose appropriately. Typically a minipig in a sub-chronic study (e.g. 6 months) needs to have its blood glucose measured at least once weekly and on indication, meaning that a minipig potentially needs to have its blood glucose measured 30-40 times during a study. Stress will affect the measured glucose values, and therefore the blood samples need to be obtained without causing stress in the pigs.

Existing procedure(s):
Since a blood sample cannot be obtained without stress by venipuncture in pigs, typically surgically implanted permanent catheters are used. Diabetic, hyperlipidaemic pigs, however, tolerate permanent catheters poorly due to hypercoagulability of the blood and increased risk of catheter failure, catheter-related infections and thrombosis, which may in the end lead to premature euthanasia. Blood glucose can also be measured by a handheld glucometer using just a small drop of blood from e.g. an ear vein. The procedure is more difficult in minipigs compared to LYD pigs, and no treats can be given during the procedure, since this will affect blood glucose values. Ear vein puncture may be very stressful even for normally socialised pigs, thereby potentially affecting both the welfare of the animals and the measured blood glucose values. In some instances, if the pigs are very stressed, it may not be possible to obtain a blood sample at all, impacting the study quality and the possibility for regulating the pig optimally.

Description of the initiative:
The aim of the initiative was to make ear vein puncture accepted in the pigs using goal-oriented training and optimisation of the ear vein puncture technique. Clicker training was used together with ordinary training, where the minipigs were gently trained in the different steps of the procedure. In addition, an optimized procedure was made, involving cleaning the skin on the ear and use of local analgesic creme before all ear vein punctures.

The method was applied first in 8 normal minipigs to optimise the methods in pigs where no blood glucose measurements were needed, and then in approx. 25 diabetic, hyperlipidemic minipigs where blood glucose measurements were needed at least once weekly and on indication (suspicion of too high or too low blood glucose).

Results:
The training of the minipigs and the new procedure made ear vein puncture much less stressful to the pigs (and to the technicians performing the procedure), and no samples were missed due to stressed or uncooperative pigs.

Conclusion:
By goal-oriented training and optimisation of the procedure for ear vein puncture it was possible to reduce the stress related to the procedure thereby leading to improved animal welfare, improved data quality and refinement of studies in diabetic minipigs.

Impact of initiative:
A typical study with diabetic, dyslipidemic pigs includes approx. 50 animals, and typically one study per year can be run.

Perspectives:
This method can be applied by other researchers using diabetic (mini)pigs in long term studies.