

Tighter control of relative humidity improves murine breeding performance – a retrospective analysis

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Aim of the study:

In the current study we aimed to investigate the effect of relative humidity (RH) on breeding performance of mice. The breeding of mice housed with RH controlled steadily at cage level was compared to breeding of mice housed in cages with RH controlled less steadily at room level. The comparison was done on data for eight months (January to August) and pups per litter, preweaning mortality and total litter loss was compared between the groups. Data were collected on mice of various backgrounds. The rationale for the study was to evaluate potential effects of RH on breeding performance. An improvement of breeding performance could potentially reduce the number of breeding mice being used for research.

Study design

For group 1 an air handling unit capable of controlling RH (ScanClime®) was used to control RH at minimum 55%. In group 2 a setup with an air handling unit not controlling RH was used, and the animals in this system were subject to RH controlled at room level. The statistical analyses used were t-test comparing the groups after checking the data for normal distribution and binomial testing was used when appropriate (GraphPad Prism 7). The data collection was performed as part of routine data collection on breeding from the facility. Welfare assessments were performed daily and the housing of animals complied to regulations set by the Home Office UK.

Results

RH was kept at 55% and above in group 1, where RH was controlled at cage level, whereas group 2 was subjected to RH varying from 34 to 76%. Over 2000 litters were born in the period of data collection.

- The number of pups per litter was significantly higher for group 1 ($p < 0.001$). The same was found when only investigating mice C57BL/6 strains ($p < 0.001$) (figure 1+2).
- Total litter loss registered at weaning was significantly higher in group 2 ($p < 0.01$) (figure 3).
- No significant difference was found in preweaning mortality (graph not shown).
- To investigate how the variations in RH affected breeding performance standard deviations for the RH in gestational period and preweaning period postpartum were compared to the pups per litter and total litter loss. No connections between the variation in RH and pups/litter could be found using this method. However, low variation in RH the first week after birth was associated with the lowest total litter loss observed (figure 4).

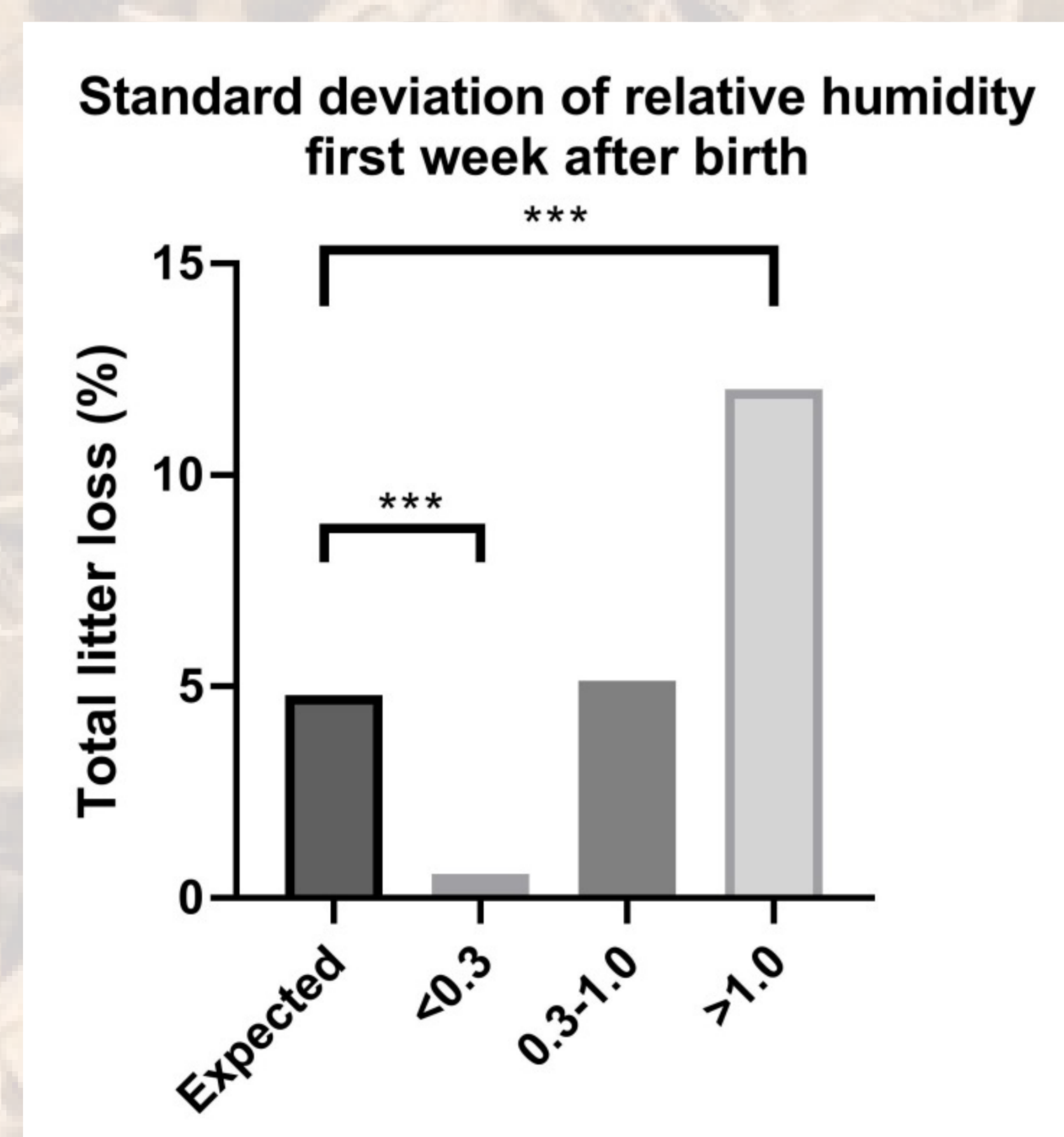


Figure 4 Standard deviation of relative humidity in the first week postpartum compared to the total litter loss preweaning. The expected value is the average of all values of total litter loss. *** $P < 0.001$.

■ Group 1 (RH 55-70)
■ Group 2 (RH 34-76)

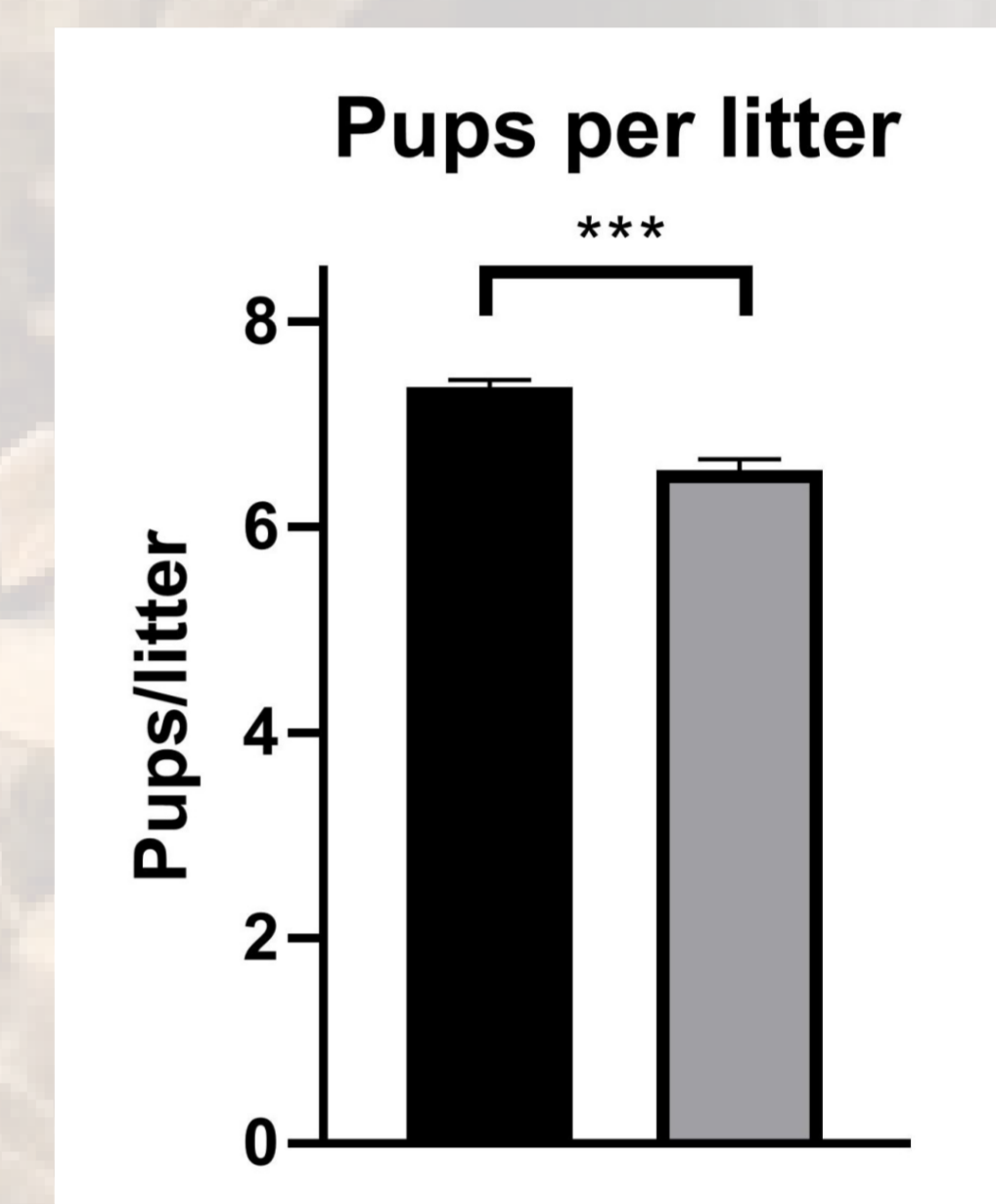


Figure 1 Pups per litter in group 1 and 2. Graph is shown with mean \pm standard error of the mean. *** $P < 0.001$

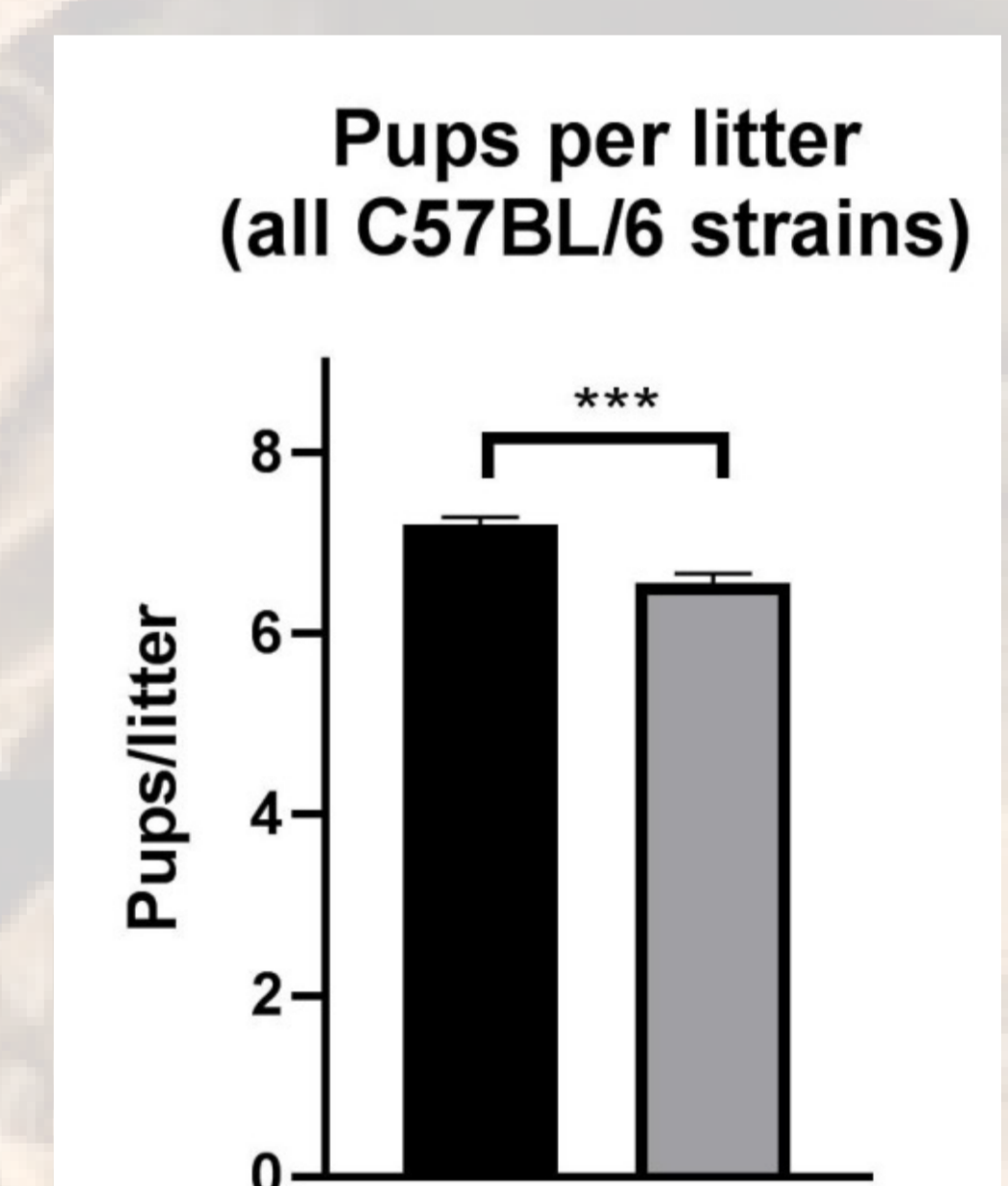


Figure 2 Pups per litter of all C57BL/6 strains in group 1 and 2. Graph is shown with mean \pm standard error of the mean. *** $P < 0.001$

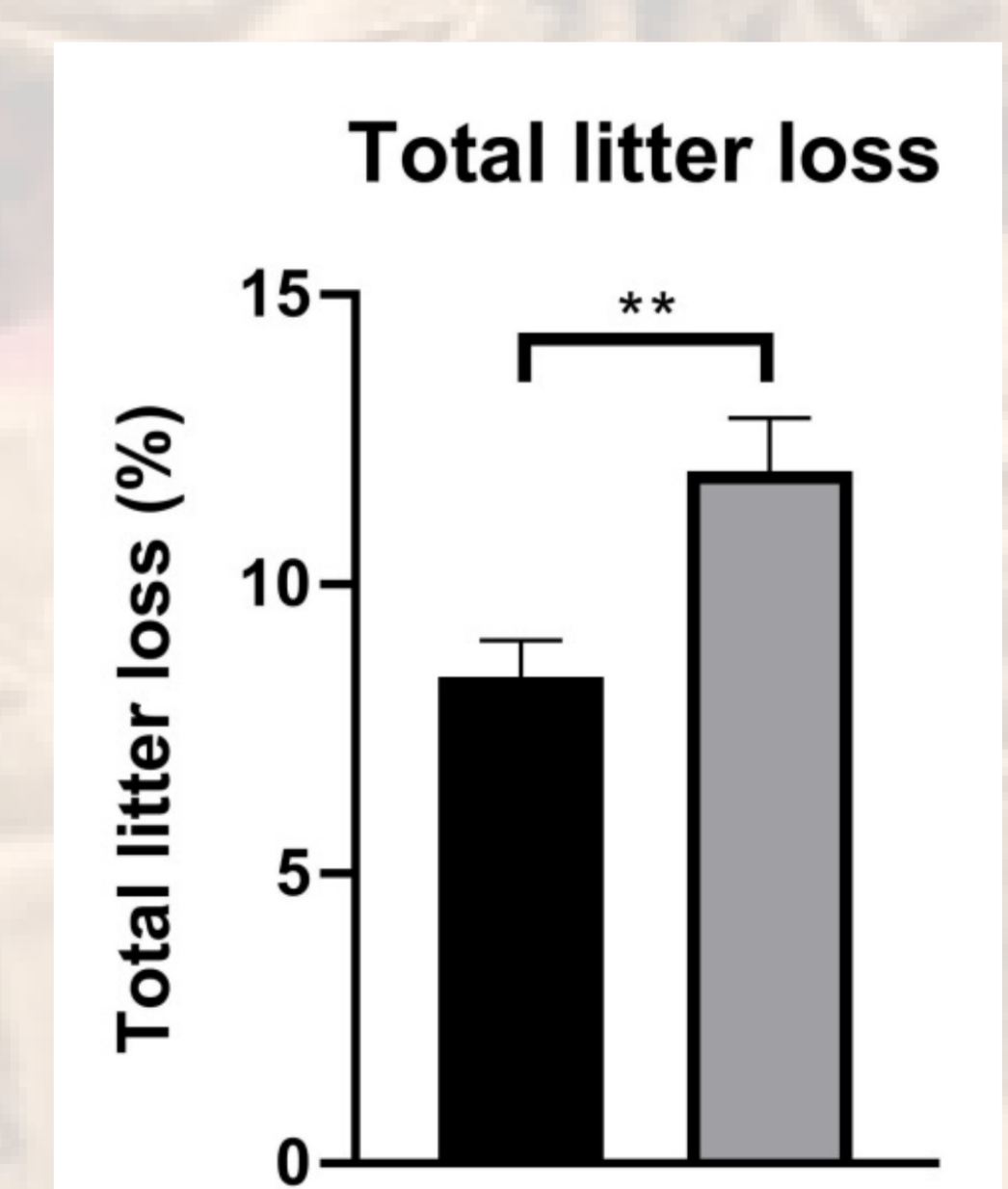


Figure 3 Total litter loss in group 1 and 2. Graph is shown with mean \pm standard error of the mean. ** $P < 0.01$

Limitations

The unit used for adjustment of humidity can only humidify, thus the RH is set to minimum 55% but could go above during periods with high humidity. The animals were housed in different rooms and the breeding data is collected on various strains. The data should be seen as a initial result and we aim to investigate this in further detail. Together with other data we strongly believe that RH affects breeding of mice.

Conclusions

Our results strongly suggest that RH can affect murine breeding performance significantly. When controlling RH to not drop below 55% the mice had more pups per litter and fewer total litters were lost preweaning, when compared to the animals housed under less steadily room controlled RH. Further investigation is warranted on how different levels of stable RH versus variation in humidity affect the breeding performance.