Oral Communication(s)

THINK SLOW, SOLVE SMART: INSIGHTS FROM THE SHEEP MODEL OF COGNITIVE AGING AND DECLINE

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The sheep model is increasingly recognized as a valuable tool in translational research on brain aging, particularly in studying cognitive decline and neurodegenerative diseases (1). Due to its convoluted encephalon, extended lifespan, and natural cognitive decline, sheep offers a useful alternative to murine model (2). Research on physiological brain aging and executive cognitive functions in sheep holds significant implications for both veterinary and human medicine, with potential benefits for livestock management, sustainable farming, and understanding neurological disorders (3). This study aims at assessing cognitive decline related to aging and sex in sheep, investigating learning ability, memory, and cognitive flexibility. We therefore observed 42 Sarda sheep, divided into three ages subgroups, sex-balanced: four months (lamb; N=14), ten months (adult; N=14), and ten years (old; N=14). They were housed separately in six paddocks, by sex and age, under standard conditions. Cognitive testing was conducted in a diamond-shaped maze (4×4m) made of pallets and gates, with a central obstacle. The experiment included three tasks over two consecutive days: a training phase to establish lateralization, a learning task to evaluate memory, and a reversal task to assess adaptability. Environmental conditions and time of testing were standardized. All tasks were video recorded to monitor behaviOral Communication(s) parameters, task completion times, and reward preferences. Analysis of variance (ANOVA) examined age, sex, and trial effects, followed by post-hoc Bonferroni tests ($p<0.05$). The study, compliant with Italian animal experiment laws, was approved by the national ethics commission (authorization n°827/2024-PR, Italian Ministry of Health). Old sheep took longer to solve the maze in the training phase ($p<0.001$) but showed high adaptability, reducing latency in successive trials. They were calmer and had the highest success rate in reaching food rewards ($p=0.000$). Sex had a global effect on learning performance, with females completing memory tasks faster than males ($p=0.035$); while sex did not significantly impact the reversal task, a trend suggested an effect on flexibility ($p=0.080$). BehaviOral Communication(s) stress indicators, such as vocalization frequency, decreased over trials, thus confirming the effectiveness of training. Bleating was significantly related to age, with lambs being the most vocal ($p<0.001$). Lateralization patterns revealed a general left-side preference, with lambs exhibiting greater right-side lateralization ($p=0.008$). Over 90% of the animals completed the learning task, and nearly 70% passed the reversal task. Notably, as trials increased, completion time decreased, indicating strong cognitive association (training: $p<0.001$; reversal task: $p=0.002$). This work reinforces the validity of sheep as a model for cognitive research, highlighting age-related cognitive patterns and adaptability. Future research should explore correlations between stress and cognitive performance, as well as the influence of personality traits and hormonal levels to refine cognitive assessments.

References

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