Detrended fluctuation analysis as a complementary tool to assess Japanese quail locomotor behaviour in welfare related studies

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The work evaluates the organization and complexity of quail temporal pattern of locomotion in diverse welfare related experimental situations using Detrended Fluctuation Analysis (DFA). DFA provides information on the organization and complexity of temporal patterns of behavior, and has been proposed as a non-invasive tool to evaluate stress-related responses in poultry. The aim was to assess the usefulness of this mathematical tool in the context of animal welfare. Firstly, DFA showed that quail temporal pattern of locomotion in their home box or in a novel environment (stressful situation) has a fractal organization with long-range autocorrelations (i.e. ongoing behaviour is influenced by what has occurred in the past). Secondly, an increase in environmental complexity induced by scattering feed on the home box ground was associated with an increase in the complexity of the locomotor pattern. This pattern change occurred without affecting the total time spent ambulating, suggesting that DFA can provide additional information beyond that obtained with traditional behavioural analysis. Thirdly, in an open-field test, no differences in organization and complexity of the active period of the locomotor time series (i.e., after regaining locomotor activity) were observed between quail lines selected for a low- rather than a high-stress plasma corticosterone stress response, nor in quail treated with anxiolytic drugs (Diazepam or Propofol). These results suggest that during open-field active period, when fear responses are likely less strong and other motivations are the ambulation driving forces, birds with different initial emotional states have a similar ambulatory organization. Fourthly, DFA detected changes during a 3 days habituation period to a novel home environment, shifting the temporal dynamic towards a less random and more predictable pattern. In all, results suggest that the complexity of temporal pattern of locomotion depends on the experimental situation. Changes in the environment or habituation to a novel environment can alter the patterns, however variation in the bird's emotional state does not alter the pattern once this activity is regained. DFA can be considered a useful tool to assess behavioural temporal patterns in different welfare scenarios, detecting changes that complement results obtained with traditional behavioural analysis tools.

Keywords: Behaviour organization and complexity, fractal analysis

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POULTRY SCIENCE
JOURNAL

9th European Symposium on Poultry Welfare

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IX EUROPEAN SYMPOSIUM ON POULTRY WELFARE
Uppsala, Sweden
17-20 June 2013