Methane emissions and rumen fermentation in heifers differing in phenotypic residual feed intake

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Selection of feed efficient animals by way of improved residual feed intake (RFI) has been suggested as a mitigation strategy against enteric methane production. This study aimed to characterise methane emissions, rumen fermentation and total tract digestibility in beef heifers differing in phenotypic RFI. Individual dry matter intake (DMI) and growth were measured in 22 heifers, [(initial live weight 455 kg (SD = 17.1)] offered grass silage (dry matter digestibility = 766 g/kg) *ad libitum* for 120 days. Rumen fermentation (transesophageal samples) and total tract digestibility (indigestible marker) were measured. Methane production was estimated using the sulphur hexafluoride tracer gas technique over two 5-day periods during weeks 3 and 11. Residuals of the regression of DMI on ADG and mid-test $BW^{0.75}$, using all animals, were used to compute individual RFI coefficients. Animals were ranked by RFI into high (inefficient), medium and low groups. Statistical analysis was carried out using the MIXED procedure of SAS. Overall ADG and daily DMI were 0.6 kg (SD = 0.07) and 7.8 kg (SD = 0.24), respectively. High RFI heifers consumed 9 and 14% more ($P<0.05$) than medium and low RFI heifers, respectively. Rumen propionic acid and acetate:propionate ratio tended ($P<0.10$) to be higher in high compared to low RFI heifers. Rumen pH, other fermentation variables and total tract digestibility did not differ ($P>0.10$) between RFI groups. Methane production (g/d) was lower in periods 1 ($P>0.10$) and 2 ($P<0.05$) for low than high RFI heifers, with medium RFI animals being intermediate. Methane production per kg DMI was similar ($P>0.05$) for the RFI groups. Results indicate that selection for RFI will reduce methane emissions without affecting productivity of growing beef heifers.

Temperature and humidity influence milk yield and quality in Scottish dairy cows

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A better understanding of the response of livestock to current and future weather patterns is essential to enable farming to adapt to a changing climate. We investigated the effects of recent weather patterns on milk yield and milk fat content in an experimental dairy herd in Scotland over 21 years. Holstein Friesian cows were either maintained indoors with summer grazing or were continuously housed. Milk yield was measured on a daily basis and fat content (%) was sampled once a week. We calculated a Temperature Humidity Index (THI) from daily measurements of air temperature and humidity from an on-site outdoor weather station. Data from ~1400 cows were analysed using Restricted Maximum Likelihood. We found that THI influenced milk yield, and the shape and magnitude of the effect depended on whether animals were inside or outside on the test day. Animals produced more milk when they were indoors than outdoors, largely due to differences in diet. The milk yield of cows outdoors was lower at the extremes of THI than at intermediate values, declining more steeply at higher THI values than at lower ones. The highest yields were obtained when THI, measured at 9am, was ~55 units. Cows indoors decreased milk yield as THI increased. Fat content was lower at the upper extreme of THI than at intermediate values in both environments. These results show that milk yield and quality are impacted by extremes of THI under conditions currently experienced in Scotland. Potential decreases in productivity owing to predicted increases in THI over the 21st century may be offset through changes in farm management practices or selective breeding from animals that are more resilient to weather-related stressors.