Body composition estimation in cattle: comparison of imaging and adipose cell size methods

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The aim of present study was to compare three methods for the estimation of empty body (EB) or carcass composition for lactating and growing cattle. 12 Simmental cows (589±45.6 kg of body weight (BW), 290±4.7 DIM) and 10 of their pre-weaning offsprings (10±0.2 mo, 354±32.7 kg of BW), were scanned with ultrasound (US; 9L-RS Linear-Sonde (4.0 MHz); GE) on ischium-sacrum location (adipose tissue thickness). At slaughter, tail-head subcutaneous and perirenal adipose tissues were sampled for cell size measurements (ACS). Cold (4°C, 24h) left half-carcasses were scanned by dual energy X-ray absorptiometry (DXA; iLunar, GE, “Right Arm” mode) to record fat, lean, bone mineral content (BMC) and total masses. Half carcass, blood and the rest of EB (5th quarter fully collected after exsanguination and digestive content removal) was grinded before chemical analyses (lipid, Soxhlet; protein, Dumas). Regressions (R software, v3.6.3) were tested between the variables and lipid and protein masses in EB or carcass. EB contained 73±23.0 (24.2 to 122.2) kg lipid and 72±17.4 (44.3 to 96.1) kg protein. Carcass contained 41±14.2 (13.5 to 69.9) kg lipid and 43±11.2 (25.9 to 58.2) kg protein. EB lipid mass was estimated from BW including the fixed effect of animal type combined with the US adipose tissue thickness (R^2=0.88 and residual coefficient of variation (rCV)=12.0%) or the subcutaneous ACS (R^2=0.82 and rCV=14.3%). Carcass lipid mass was estimated *in vivo* from BW including the fixed effect of animal type combined with the US adipose tissue thickness (R^2=0.91 and rCV=11.7%) or *post mortem* from carcass weight combined with DXA BMC and fat masses (R^2=0.99 and 4.4%) or the perirenal ACS (R^2=0.83 and rCV=15.0%). EB protein mass was estimated *in vivo* only with the BW (R^2=0.98 and rCV=3.7%) and no variables derived of the *in vivo* or *post mortem* methods improved the model. Carcass protein mass was estimated *post mortem* from the cold half carcass weight combined with DXA BMC mass (R^2=0.99 and rCV=3.1%).