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BODY COMPOSITION – ENERGY EXPENDITURE

Validation of dual, X-ray absorptiometry (DXA) for body composition assessment in piglets and in term human neonates.

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The reproducibility, accuracy and precision of DXA (Hologic QDR 2000, INFANT whole body software 5.64, 1993) was assessed by scanning 13 piglets (1 471 to 5 507 g) in triplicate. In four, the fat content (FC) was increased with porcine lard added around the abdomen allowing 17 additional measurements. DXA estimates of body weight (BW), bone mineral content (BMC) and FC were compared, respectively, with BW measured by electronic scale and with chemical analysis of piglets after complete homogenization of the whole carcass. FC was determined by gravimetric method after fat extraction and calcium content was determined by atomic absorptiometry. The reproducibility of DXA measurements was 0.09% for BW, 1.95% for BMC and 5.35% for FC; DXA estimates for BW, BMC and FC were significantly correlated with scale BW ($r = 0.999$), chemical calcium ($r = 0.992$) and chemical fat ($r = 0.971$). Regression analysis showed that BW was accurately measured, but FC was overestimated (+ 11%) by DXA. From these results, conversion formulas were calculated to express DXA accuracy as a dispersion of DXA values below and above the reference values; it was called *precision* and was expressed as the mean difference in reference percentage between the converted DXA value and the reference value. The DXA precision was excellent for BW and BMC as the mean difference (± 1 SD) was 0.01 (± 0.23)% and 0.05 (± 4.44)%, respectively. For FC, this difference was 22.11 (± 90.91)%. For measurements ($n = 22$) performed in the piglets

with more than 250 g FC (which is the case in most human neonates weighing more than 2 000 g), the difference between DXA FC and chemical FC was reduced to 1.54 (± 8.85)%. Thirty appropriate for gestational age term human neonates (BW: 3 065 \pm 239 g) were scanned during the first week of life. BMC and FC were, respectively, 54 \pm 6 g HAP and 470 \pm 92 g, which corresponded to 26.4 \pm 2.6 g of calcium and 427 \pm 82 g of fat. These results were close to the reference values previously determined by chemical analysis in liveborn and stillborn infants. This study suggested that DXA is accurate and reliable for the measurement of calcium and fat contents in human neonates. Further refinements would be beneficial for determining the fat content in infants weighing less than 2 000 g.

Low cost measurement of body composition with oxygen-18 enriched water.

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Total body water (TBW) and body composition are important parameters of nutrition status in various clinical situations. The most direct and precise measurement of TBW involves labeling the subject with ²H and/or ¹⁸O enriched water. Whereas ²H₂O is cheap, ²H measurements in biological fluids are technically difficult. On the other hand, ¹⁸O measurements are very easy to do but the cost of regular (10%) ¹⁸O-enriched water prohibits its widespread use in the assessment of body composition. Water drawn at the early steps of the distillation process is proportionally much cheaper than 10% water.

The aim of this study is to demonstrate that 2% ¹⁸O-enriched water can be used for measuring TBW at low cost (ca 25 ECU or 150 FF per dose per subject). Plasma,