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Energy expenditure of elite rugby league and union players during an in-season period, measured using doubly labelled water.

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Total energy expenditure (TEE) has been quantified in elite senior rugby league (RL) and rugby union (RU) players using multiple measures, with criterion measures lacking in RU and academy players. Robust measures of TEE are required as prediction equations used to estimate energy requirements are often unsuitable for athletes. This study quantified TEE of 27 elite male English academy (U16 and U20) and senior (U24) RL and RU players during a 14-day in-season period using doubly labelled water (DLW). Resting metabolic rate (RMR), using indirect calorimetry, and physical activity level (PAL) was also measured (TEE:RMR). Predicted TEE, determined by published equations, was compared to measured TEE by age group. Differences in TEE (RL, 4369 ± 979; RU, 4365 ± 1122; U16, 4010 ± 744; U20, 4414 ± 688; U24, 4761 ± 1523 Kcal·day^{-1}) and PAL (overall mean 2.0 ± 0.4) were *unclear*. RMR was *very likely* greater for RL (2366 ± 296 Kcal·day^{-1}) than RU players (2123 ± 269 Kcal·day^{-1}). Relative RMR for U16, U20 and U24 (27 ± 4, 23 ± 3 and 26 ± 5 Kcal.Kg^{-1}.day^{-1}) was *very likely* greater for U20 than U24 players. Differences in TEE estimated by the Schofield, Cunningham and Harris-Benedict equations compared with DLW were *unclear, likely* and

unclear for U16 (187 ± 614; -489 ± 564 and -90 ± 579 Kcal.day^{-1}), *likely, very likely* and *likely* for U20 (-449 ± 698; -785 ± 650 and -452 ± 684 Kcal.day^{-1}) and all *unclear* for U24 players (-428 ± 1292; -605 ± 1493 and -461 ± 1314 Kcal.day^{-1}). Due to large variability between individuals, negligible differences in TEE were observed by code, and ~350-400 Kcal$^.$day^{-1} differences between consecutive age groups were *unclear*. Differences in RMR may be due to training exposure and match play. The remaining components of TEE (i.e. thermic effect of feeding and activity thermogenesis) may reflect the differences in contact demands between codes, as RU players typically engage in more static exertions than RL players during match play. Prediction equations are currently insufficient to differentiate between individual variability in TEE. The importance of practitioners providing individual support for the elite rugby player is highlighted. Finally, the TEE measured in this study using the gold standard DLW method can be used as reference data for elite rugby players of different codes and ages, during an in-season training period.