

Energy Needs per Kilogram Across the Lifespan and in Disease

Billy Craig | Independent researcher | Version 1.0

Narrative evidence synthesis and proposed research. Not peer reviewed.

Abstract

Energy expressed per kilogram is used across development and clinical nutrition, but the numerator changes between maternal additional energy, infant growth requirements, adult expenditure and delivered medical nutrition. This working paper assembles a selected reference map and proposes a harmonised research dataset. Its central hypothesis is that age, body composition, growth and illness phase modify the usefulness of intake/body mass.

Gestation to birth

FAO pregnancy estimates add approximately 85, 285 and 475 kcal/day across successive trimesters under stated maternal assumptions. [1] They are not fetal kcal/kg values. A maternal intake divided by fetal mass has no consistent interpretation as fetal requirement.

Before birth, maternal and fetal accounting must remain separate. This source set does not establish a comparable week-by-week human fetal kcal/kg requirement. That is an explicit evidence gap, not a zero requirement. A future fetal extension would need human measurements of nutrient transfer, oxygen consumption and tissue deposition, with gestational age and placental metabolism distinguished.

At birth, transition and prematurity matter. Healthy growing preterm infants have an ESPGHAN resting-expenditure estimate of approximately 60–70 kcal/kg/day and an enteral-intake range of 115–140. [3] These are not immediate day-one feeding targets or measurements of in-utero requirements.

Reference map: growth

FAO combined-feeding infant estimates are 110 kcal/kg/day at month 1, 81 at month 6 and 80 at month 12. [2] They include growth and are population reference estimates.

FAO boys/girls reference values are 82.4/80.1 at 1–2 years; 74.5/71.5 at 5–6; 64.6/57.8 at 10–11; and 50.3/44.1 kcal/kg/day at 17–18. [4] These illustrative age points use the report's growth and activity assumptions; they do not define universal minimums.

Adulthood and later life

Pontzer et al. describe developmental phases in body-composition-adjusted expenditure, with relative stability through much of adulthood and decline later in life. [5] This does not imply that an individual's intake/kg or RMR/kg must be constant.

ESPEN uses 30 kcal/kg/day as a guide for older persons, with individual adjustment. [6] A falling total expenditure should be evaluated alongside function and body composition, not automatically labelled pathological or beneficial.

Reference map: disease

Cancer guidance uses 25–30 kcal/kg/day where individual expenditure is not measured. [7] ICU guidance distinguishes early illness from later delivery and favours measured expenditure where feasible. [8] These examples illustrate different clinical tasks, not one disease-wide requirement. Renal, liver and other disease-specific requirements are outside this initial map.

A harmonised dataset

Each record should specify life stage, gestational or postnatal age where relevant, sex, disease, treatment phase, weight convention, FFM method, feeding route and measurement interval. The energy field must identify intake, delivered nutrition, RMR, TEE or additional maternal cost. Growth-related energy should be marked separately where available.

Retain kcal/day and kg as original fields alongside calculated ratios. Do not combine actual, ideal and adjusted weights into one variable. Record missing data explicitly. Measured and predicted expenditure should remain distinguishable. This structure would permit a later downloadable evidence table without implying that heterogeneous estimates form one reference curve.

Proposed analysis

Analyse development, stable adulthood, older age and each disease group separately before modelling cross-group interactions. Compare ratio models with models containing energy and mass separately; include body composition where available. Assess growth in children and function in adults using prespecified, appropriate outcomes.

A meaningful result would be improved prediction in external data with acceptable calibration within each population. A single line through incomparable reference values would not be such a result. If apparent age effects disappear after consistent measurement and body-composition adjustment, that finding should constrain the hypothesis.

Connections and limits

EPK–001 supplies the descriptive exposure, EPK–004 and 005 supply functional questions, and EPK–006 motivates later-life outcomes. The disease connection to EPK–007 is conceptual and does not validate an immune mechanism. This selected narrative map is neither a systematic review nor a clinical feeding protocol. No new experimental data are reported. Sources were checked on 11 September 2026.

References and publication record

[1] FAO/WHO/UNU (2004). Human energy requirements, chapter 6: Pregnancy.

[Open source](#)

[2] FAO/WHO/UNU (2004). Human energy requirements, chapter 3, Table 3.3.

[Open source](#)

[3] Embleton et al. (2023). Enteral Nutrition in Preterm Infants (2022): ESPGHAN position paper.

[Open source](#)

[4] FAO/WHO/UNU (2004). Human energy requirements, chapter 4, Tables 4.2 and 4.3.

[Open source](#)

[5] Pontzer et al. (2021). Daily energy expenditure through the human life course.

[Open source](#)

[6] Volkert et al. (2022). ESPEN practical guideline: Clinical nutrition and hydration in geriatrics.

[Open source](#)

[7] Muscaritoli et al. (2021). ESPEN practical guideline: Clinical Nutrition in cancer.

[Open source](#)

[8] Singer et al. (2023). ESPEN practical and partially revised guideline: Clinical nutrition in the intensive care unit.

[Open source](#)

Publication and reuse

Published by EPK Research, 11 September 2026. This is a new version 1.0 supplement. It does not replace EPK–001 to EPK–007. No DOI has yet been assigned.

© 2026 Billy Craig. Author-owned text is licensed under Creative Commons Attribution-NoDerivatives 4.0 International (CC BY-ND 4.0). Third-party publications retain their own rights. Sources are linked, not reproduced.

[Read the licence](#) · [EPK paper archive](#)