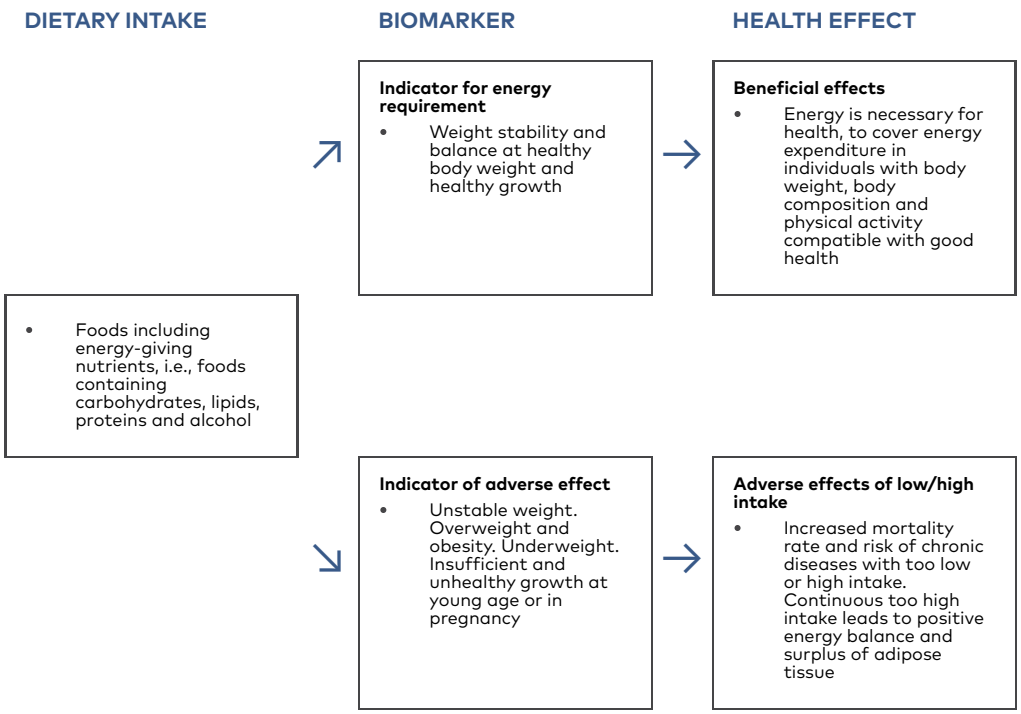
Energy



Reference values for PAL 1.6 (MJ/d)	Females	Males
	9	11.3

For more information about the health effects of dietary intake of foods including energy-giving nutrients, please refer to the background paper by Lieselotte Cloetens and Lars Ellegård (Cloetens & Ellegård, 2023).

Dietary intake. The average energy intake ranges from 6.5 to 11.2 MJ/d (Lemming & Pitsi, 2022).

Main functions. Energy is needed by all cells in the body. It is stored as chemical energy and metabolised to adenosine triphosphate (ATP) units of energy that are used for cellular functions in the body. This average energy intake should give energy balance for adults of healthy body weight and composition, and a positive energy balance or building of energy containing

tissue in growing infants, children and adolescents as well as pregnant and lactating women (Cloetens & Ellegård, 2023). Energy in foods is largely in the form of carbohydrates and proteins (both approximately 16.7 kJ/g [4 kcal/g]), fats (37.7 kJ/g [9 kcal/g]), and dietary fibre (8 kJ/g [2 kcal/g]). The recommended intake of energy-yielding nutrients is expressed in intervals of E% with the sum of 100%. Alcohol also yields energy of 29 kJ/g (7 kcal/g), but is not included in the recommendation. The available energy from dietary fibre depends on the type and nature of the fibre.

The energy requirement of the body is determined by: The basal energy expenditure (BEE), proximately measured as resting energy expenditure (REE), which accounts for the major part of the energy requirement (up to 70-80% in adults) and is mainly based on 1) body fat free mass (FFM); 2) energy expenditure from physical activity level (PAL), which varies between 20-40%; and 3) diet induced thermogenesis (DIT), which is approximately 10% of the energy requirement (Cloetens & Ellegård, 2023; NASEM, 2023).

Additional energy intake and a positive energy balance is needed for tissue building i.e., in growth and tissue building for infants, children, adolescents and pregnant women, and for milk production in lactating women (Cloetens & Ellegård, 2023; NASEM, 2023). There is convincing evidence for a causal association between high BMI and risk for cardiovascular disease and type 2 diabetes (Cloetens & Ellegård, 2023; NASEM, 2023; WCRF/AICR, 2018b, f), as well as for an increased risk of cancer in oesophagus (adenocarcinoma), pancreas, liver, colon, breast (at postmenopausal age), endometrium and kidney. There is also probable evidence for an association between fatness in adulthood and lower risk for premenopausal breast cancer and between fatness in young adulthood and breast cancer in general (WCRF/AICR, 2018f).

Indicator for energy requirement. Weight stability and balance at healthy body weight and healthy growth (NASEM, 2023). Energy requirement covers energy expenditure in individuals with body weight, body composition and physical activity compatible with good health. In childhood, pregnancy and lactation, the energy requirement includes energy for growth and milk production.

Deficiency and risk groups. Frail older adults are at risk of low energy intake.

Main data gaps. Studies to evaluate body weight stability over time and methods to measure energy intake correctly, besides the doubly labelled water (DLW) method, are needed. Studies on energy requirements of different age groups are needed.

Dietary reference values. Reference energy requirements for adult females and males are estimated from updated weight and height data using the Henry equation (Henry, 2005) and a PAL value of 1.6 (Appendix 4). Reference heights and weights for children 0-5 years old and height data for those 6–17 years old are from five Nordic and Baltic countries (Juliusson et al., 2013; National Institute for Health Development, 2021; Pitsi, 2017; Salm et al., 2013; Saari et al., 2011; Tinggaard et al., 2014; Wikland et al., 2002). For 6–17-year olds, reference weights were calculated from the 50^{th} percentile of BMI according to WHO growth reference curves for school-aged children and adolescents (de Onis et al., 2007). The reference body heights for adults are from seven recent Nordic and Baltic national dietary surveys (Abel & Totland, 2020; Amcoff et al., 2012; Gr̃inberga et al., 2020; Gunnarsdottir et al., 2022; Nurk et al., 2017; Pedersen et al., 2015; Valsta et al., 2018), and reference weights for adults are calculated to BMI = 23 kg/m^2.

The total energy requirement is 11.3 MJ/day for males and 9 MJ/day for females (PAL 1.6).