ACTIVITY MONITORING FOR ENERGY EXPENDITURE

UNIT I PART III

INTRODUCTION

Human consumption and expenditure of energy, alongside any change in the body's macronutrient stores (fat, protein, and carbohydrate) is summarised by the energy balance equation:

Change in macronutrient stores = Energy consumed – Energy expended

- The parts of the equation can be expressed as kilocalories (kcal), equivalent to 4.2 kilojoules (kJ), and are usually expressed per unit of time, for example kcal per day
- The kJ is preferred as it is a measure of energy; however kcal (a measure of heat) is also commonly used

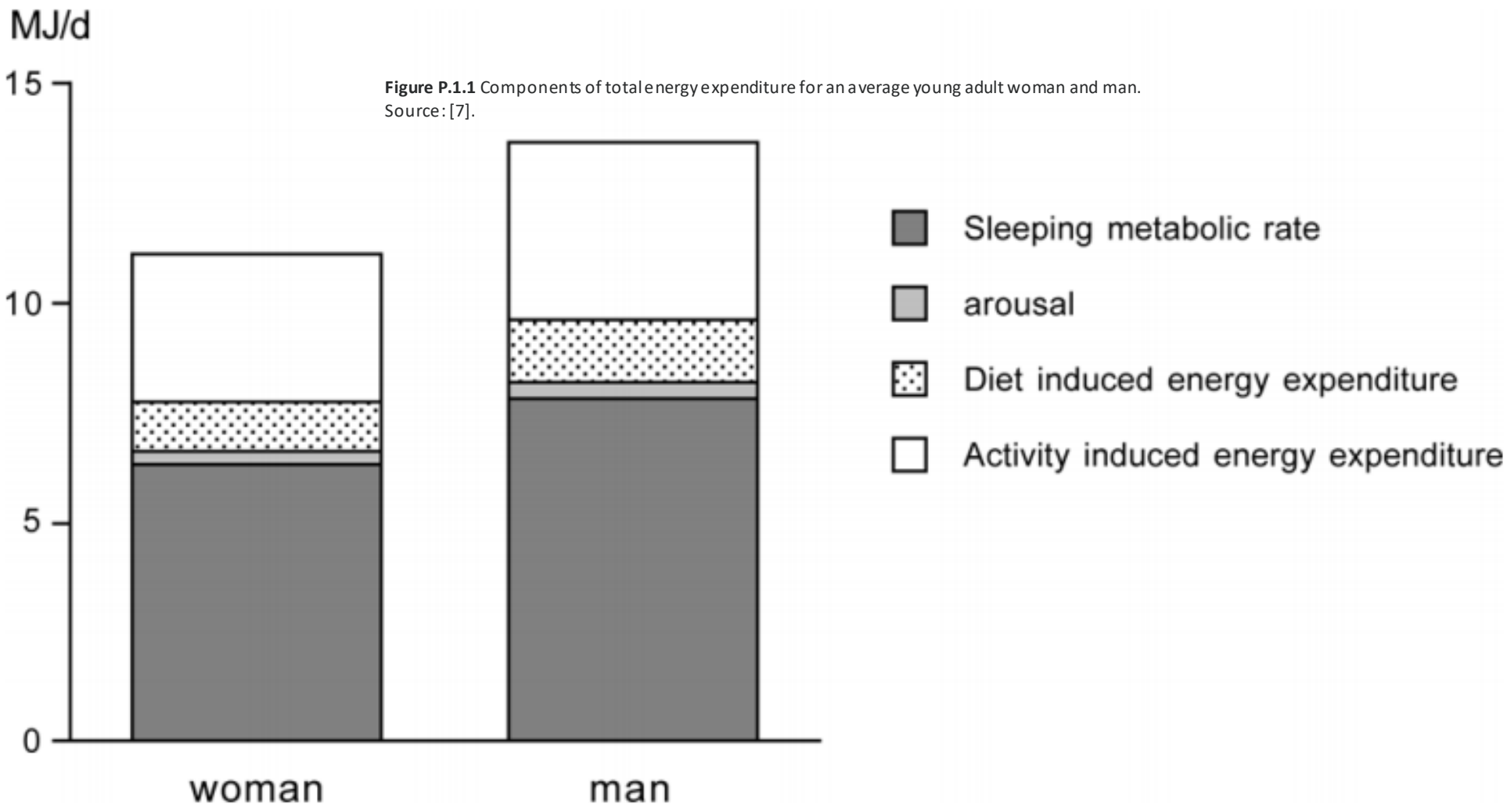


Figure P.1.1 Components of total energy expenditure for an average young adult woman and man.
Source: [7].

TOTAL HUMAN ENERGY EXPENDITURE CONSISTS OF THE FOLLOWING ELEMENTS:

- PHYSICAL ACTIVITY ENERGY EXPENDITURE (PAEE), THE ENERGY EXPENDED DURING BODY MOVEMENT
- DIET-INDUCED ENERGY EXPENDITURE (ALSO KNOWN AS THE THERMIC EFFECT OF FOOD), WHICH IS ASSOCIATED WITH DIGESTION, ABSORPTION AND STORAGE OF FOOD
- BASAL ENERGY EXPENDITURE, WHICH IS MEASURED IN THE FASTED STATE AT COMPLETE REST THE MORNING AFTER SLEEP. THIS IS THE ENERGY REQUIRED TO MAINTAIN CELLULAR FUNCTION.

PHYSICAL ACTIVITY ENERGY EXPENDITURE

- PHYSICAL ACTIVITY IS DEFINED AS ANY BODILY MOVEMENT PRODUCED BY SKELETAL MUSCLES RESULTING IN ENERGY EXPENDITURE
- PHYSICAL ACTIVITY ENERGY EXPENDITURE DEPENDS ON THE AMOUNT OF BODY MOVEMENT AND THE SIZE OF THE BODY, SINCE IT TAKES MORE ENERGY TO MOVE MORE MASS
- TOTAL PHYSICAL ACTIVITY ENERGY EXPENDITURE FOR A DEFINED TIME-FRAME (BE IT AN HOUR, DAY, WEEK ETC.) IS THE PRODUCT OF THE INTENSITY, DURATION AND FREQUENCY OF BODY MOVEMENT

RATE OF PHYSICAL ACTIVITY ENERGY EXPENDITURE

- THE RATE OF PHYSICAL ACTIVITY ENERGY EXPENDITURE PER UNIT TIME IS COMMONLY REFERRED TO AS ACTIVITY INTENSITY
- THE RATE OF ENERGY EXPENDITURE OR INTENSITY SPECTRUM (SEE FIGURE P.1.2) RANGES FROM BEHAVIOURS WITH VERY LOW ENERGY EXPENDITURE, SUCH AS SLEEP, TO VIGOROUS ACTIVITIES WITH HIGH ENERGY EXPENDITURE SUCH AS SPRINTING
- PHYSICAL ACTIVITY IS THE BROAD LABEL THAT ENCOMPASSES ALL MOVEMENT OF AT LEAST LIGHT INTENSITY, AND EXTENDS TO MOVEMENT OF MODERATE AND VIGOROUS INTENSITY

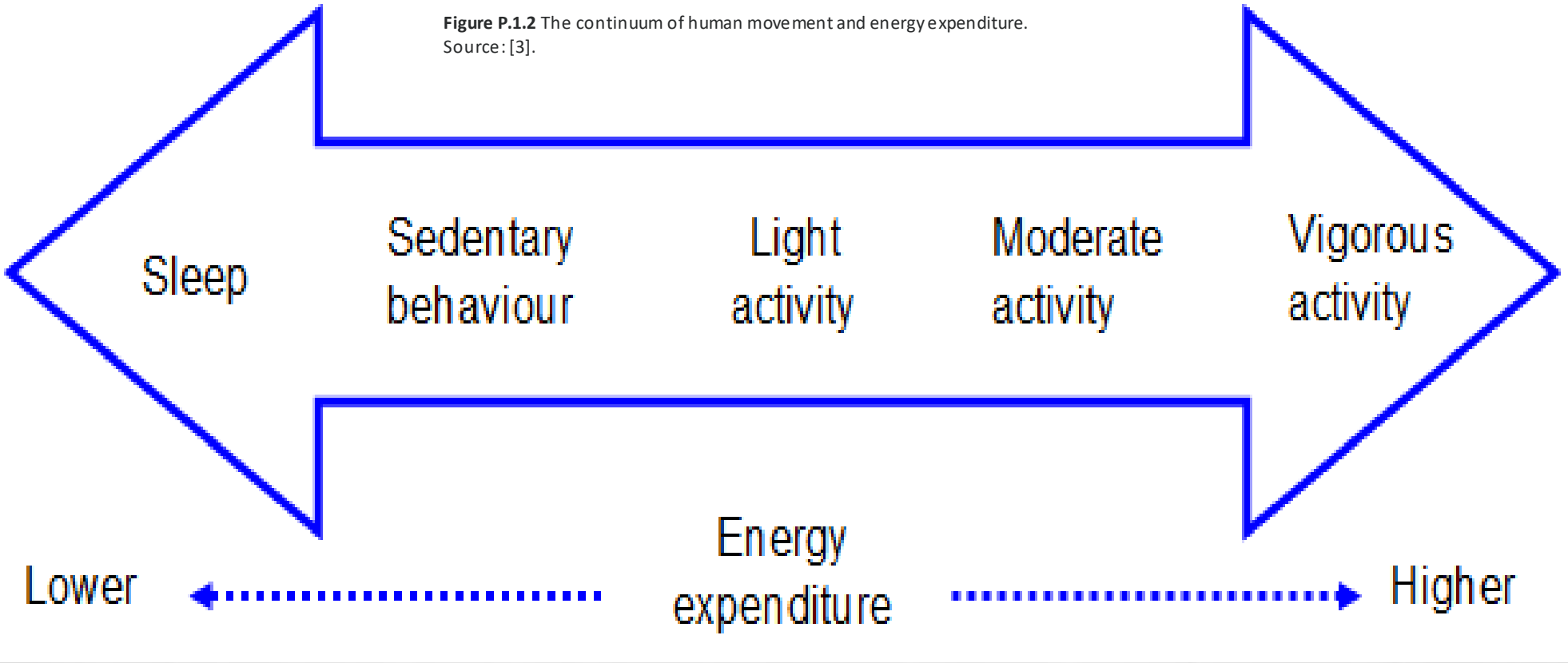


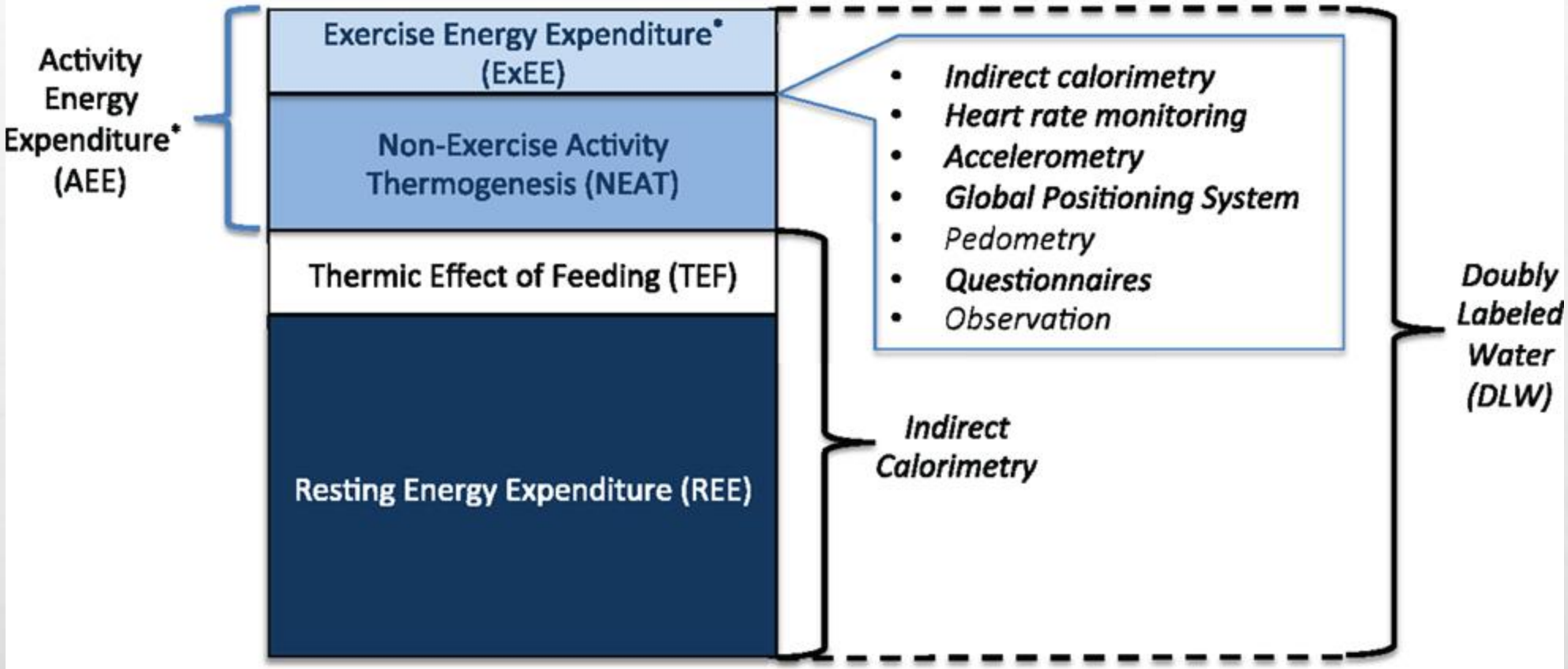
Figure P.1.2 The continuum of human movement and energy expenditure.
Source: [3].

WHAT IS ENERGY EXPENDITURE PHYSICAL ACTIVITY?

- PHYSICAL ACTIVITY ENERGY EXPENDITURE (PAEE), **THE ENERGY EXPENDED DURING BODY MOVEMENT**. DIET-INDUCED ENERGY EXPENDITURE (ALSO KNOWN AS THE THERMIC EFFECT OF FOOD), WHICH IS ASSOCIATED WITH DIGESTION, ABSORPTION AND STORAGE OF FOOD

Total Daily Energy Expenditure (TEE)

TEE = REE + TEF + AEE



** ExEE and thus AEE are the most variable components of TEE. Therefore, the proportions of TEE and of REE, TEF and AEE differ between individuals.*

HOW DO YOU MONITOR ENERGY EXPENDITURE

- ENERGY EXPENDITURE CAN BE ESTIMATED BY **MEASURING MACRONUTRIENT OR OXYGEN CONSUMPTION, OR HEAT PRODUCTION OR CARBON DIOXIDE PRODUCTION**. MOST MEASUREMENT APPROACHES IN USE TODAY INVOLVE THE MEASUREMENT OF OXYGEN CONSUMPTION AND/OR PRODUCTION OF CARBON DIOXIDE VIA INDIRECT CALORIMETRY.