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Dietary Reference Intakes for Energy and Physical Activity

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The Institute of Medicine of the National Academies' Food and Nutrition Board in conjunction with Health Canada recently released the sixth in a series of reports on dietary reference values for the intake of energy and macronutrients.[1] This paper discusses the Dietary Reference Intakes (DRIs) for energy and physical activity. Several new approaches were used with the DRIs for the macronutrients. Those discussed in this paper include:

- **Estimated Energy Requirements (EER) at four levels of energy expenditure based on doubly labeled water measurements of total energy expenditure (TEE).**
- **Recommendations for levels of physical activity to decrease the risk of chronic disease.**

Key words: DRIs, Macronutrients, Energy, Physical activity

INTRODUCTION

The Institute of Medicine of the National Academies' Food and Nutrition Board in conjunction with Health Canada recently released the sixth in a series of reports on dietary reference values for the intake of nutrients.[1] This paper discusses the Dietary Reference Intakes (DRIs) for energy and physical activity. The DRIs replace the Recommended Dietary Allowances, last published in 1989.[2] The process of determining the DRIs for the macronutrients began in September 1999 when a panel of 20 U.S. and Canadian research scientists, clinicians and epidemiologists with expertise in energy, physical activity, protein, amino acids, carbohydrate,

Panel on Macronutrients

- JOANNE R. LUPTON, *Chair*, Texas A&M University, College Station
- GEORGE A. BROOKS, University of California at Berkeley
- NANCY F. BUTTE, Baylor College of Medicine/USDA
- BENJAMIN CABALLERO, Johns Hopkins University
- J.P. FLATT, University of Massachusetts Medical Center
- SUSAN K. FRIED, Rutgers University
- PETER J. GARLICK, SUNY Stony Brook
- SCOTT M. GRUNDY, University of Texas Southwestern Medical Center at Dallas
- SHEILA M. INNIS, University of British Columbia
- DAVID A. JENKINS, University of Toronto
- RACHEL K. JOHNSON, University of Vermont
- RONALD M. KRAUSS, University of California at Berkeley
- PENNY KRIS-ETHERTON, The Pennsylvania State University
- ALICE H. LICHTENSTEIN, Tufts University/USDA
- PAUL B. PENCHARZ, University of Toronto
- F. XAVIER PI-SUNYER, St. Luke's Hospital Center, New York, New York
- WILLIAM M. RAND, Tufts University School of Medicine
- PETER J. REEDS (deceased), University of Illinois, Champaign-Urbana
- ERIC B. RIMM, Harvard School of Public Health
- SUSAN B. ROBERTS, Tufts University/USDA

Paula Trumbo, Senior Program Officer
Sandra Schlicker, Senior Program Officer

Fig. 1 Panel on Macronutrients

Dietary Reference Intakes

Recommended Dietary Allowance (RDA): the average daily dietary nutrient intake level sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) healthy individuals in a particular life stage and gender group.

Adequate Intake (AI): the recommended average daily intake level based on observed or experimentally determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate – used when an RDA cannot be determined.

Tolerable Upper Intake Level (UL): the highest average daily nutrient intake level that is likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the UL, the potential risk of adverse effects may increase.[1]

Estimated Average Requirement (EAR): the average daily nutrient intake level estimated to meet the requirement of half the healthy individuals in a particular life stage and gender group.[1]

Fig. 2 Dietary Reference Intakes*

*Institute of Medicine of The National Academies: Dietary Reference Intakes: energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids, Washington, DC, The National Academies Press, 2002.

1) In the case of energy, an Estimated Energy Requirement (EER) is provided: it is the average dietary energy intake that is predicted to maintain energy balance in a healthy adult of a defined age, gender, weight, height and level of physical activity, consistent with good health. In children and pregnant and lactating women, the EER is taken to include the needs associated with the deposition of tissues or the secretion of milk at rates consistent with good health.

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Table 1. Uses of Dietary Reference Intakes for Health Individuals and Groups*

Type of Use	For an Individual[a]	For a Group[b]
Assessment	EAR: Use to examine the probability that usual energy intake is inadequate	EAR: Use to estimate the prevalence of inadequate intakes within a group.
	EER[d]: Use to examine the probability that usual energy intake is inadequate	EER: Use to estimate the prevalence of inadequate energy intakes within a group.
	RDA: Usual intake at or above this level has a low probability of inadequency.	RDA: Do not use to assess intakes of groups.
	AI[c]: Usual intake at or above this level has a low probability of inadequacy.	AI[c]: Mean usual intake at or above this level implies a low prevalence of inadequate intakes.
	UL: Usual intake above this level may place an individual at risk of adverse effects from excessive nutrient intake.	UL: Use to estimate the percentage of the population at potential risk of adverse effects from excess nutrient intake.
Planning	RDA: aim for this intake.	EAR: Use to plan an intake distribution with a low prevalence of inadequate intakes.
		EER: Use to plan an energy intake distribution with a low prevalence of inadequate intakes.
	AI[c]: aim for this intake.	AI[c]: Use to plan mean intakes.
	UL: use as a guide to limit intake; chronic intake of higher amounts may increase the potential risk of adverse effects.	UL: use to plan intake distributions with a low prevalence of intakes potentially at risk of adverse effects.

*Institute of Medicine of The National Academies: Dietary Reference Intakes: energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids, Washington, DC, The National Academies Press, 2002.
RDA=Recommended Dietary Allowance EAR=Estimated Average Requirement AI=Adequate intake UL=Tolerable Upper Level
a: Evaluation of true status requires clinical, biochemical, and anthropometric data.
b: Requires statistically valid approximation of distribution of usual intakes.
c: For the nutrients in this report, AIs are set for infants for all nutrients, and for other age groups for fiber, *n*-6, and *n*-3 fatty acids. The AI may be used as a guide for infants as it reflects the average intake from human milk. Infants consuming formulas with the same nutrient composition as human milk are consuming an adequate amount after adjustments are made for differences in bioavailability. When the AI for a nutrient is not based on mean intakes of healthy popuations, this assessment is made with less confidence.
d: Estimated Energy Requirement (EER) may be used as the EAR for these applications

fiber, sugars, and lipids were appointed to a panel by the President of the National Academy of Sciences (Fig. 1).[1] In order to understand the DRIs, it is important to review the standard definitions for the reference values (Fig. 2).[1] as well as the uses of the DRIs for healthy individuals and groups (Table 1).[1]

Several new approaches were used with the DRIs for the macronutrients. Those discussed in this paper include:

- Estimated Energy Requirements (EER) at four levels of energy expenditure based on doubly labeled water measurements of total energy expenditure (TEE).
- Recommendations for levels of physical activity to decrease the risk of chronic disease.

ENERGY

The DRIs established estimated energy requirements (EER) for infants, children, men and women as well as pregnant and lactating women. The EERs were based on prediction equations developed from a database of measurements of TEE in more than 1,600 men, women, and children of all ages and body composition (normal weight, overweight, and obese) from investigators around the world. More than 20 investigators provided TEE measurements from free-living people using double

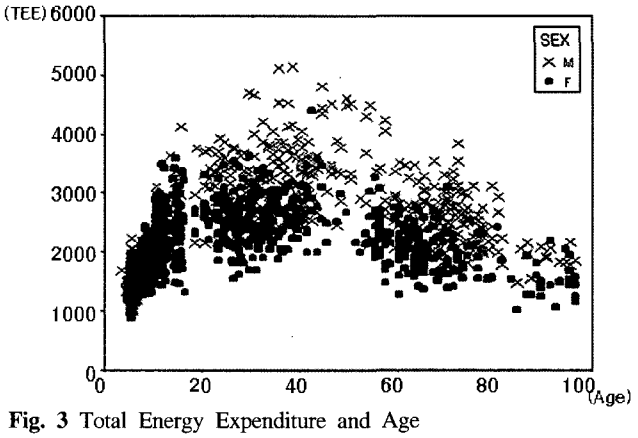

Fig. 3 Total Energy Expenditure and Age

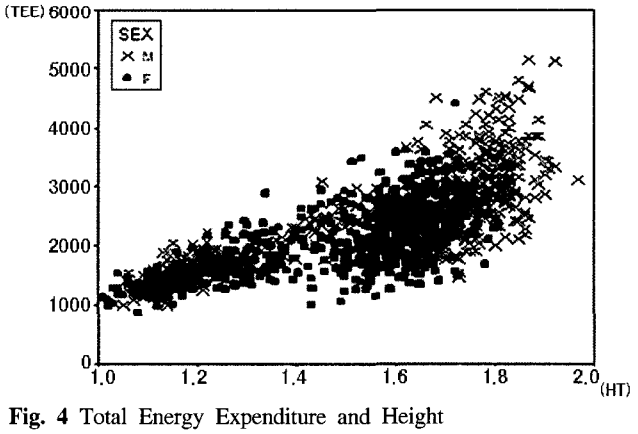

Fig. 4 Total Energy Expenditure and Height

Table 2. Estimated Energy Expenditure[1] Prediction Equations at Four Physical Activity Levels[2]

EER for infants and Young Children 0-2 Years (Within the 3rd-97th Percentile for Weight-for-Height)

EER=TEE[3]+Energy deposition
0-3 months (89×Weight of infant [kg]-100)+175 (kcal for energy depostion)
4-6 months (89×Weight of infant [kg]-100)+56 (kcal for energy depostion)
7-12 months (89×Weight of infant [kg]-100)+22 (kcal for energy depostion)
13-35 months (89×Weight of child [kg]-100)+20 (kcal for energy depostion)

EER for Boys 3-8 Years (Within the 5th-85th Percentile for BMI[4])

EER=TEE+Energy deposition
EER=88.5-61.9×Age (yr)+PA×(26.7×Weight [kg]+903×Height [m])+20 (kcal for energy depostion)

EER for Boys 9-18 Years (Within the 5th-85th Percentile for BMI)

EER=TEE+Energy deposition
EER=88.5-61.9×Age (yr)+PA×(26.7×Weight [kg]+903×Height [m])+25 (kcal for energy depostion)
where PA=Physical activity coefficient for boys 3-18 years:
PA=1.0 if PAL is estimated to be $\geq 1.0 < 1.4$ (Sedentary)
PA=1.13 if PAL is estimated to be $\geq 1.4 < 1.6$ (Low active)
PA=1.26 if PAL is estimated to be $\geq 1.6 < 1.9$ (Active)
PA=1.42 if PAL is estimated to be $\geq 1.9 < 2.5$ (Very Active)

EER for Girls 3-8 Years (Within the 5th-85th Percentile for BMI)

EER=TEE+Energy deposition
EER=135.3-30.8×Age (yr)+PA×(10×Weight [kg]+934×Height [m])+20 (kcal for energy depostion)

EER for Girls 9-18 Years (Within the 5th-85th Percentile for BMI)

EER=TEE+Energy deposition
EER=135.3-30.8×Age (yr)+PA×(10×Weight [kg]+934×Height [m])+25 (kcal for energy depostion)
where PA=Physical activity coefficient for girls 3-18 years:
PA=1.0 if PAL is estimated to be $\geq 1.0 < 1.4$ (Sedentary)
PA=1.16 if PAL is estimated to be $\geq 1.4 < 1.6$ (Low active)
PA=1.31 if PAL is estimated to be $\geq 1.6 < 1.9$ (Active)
PA=1.56 if PAL is estimated to be $\geq 1.9 < 2.5$ (Very Active)

EER for Men 19 Years and Older (BMI 18.5-25 kg/m^2)

EER=TEE
EER=622-9.53×Age (yr)+PA×(15.91×Weight [kg]+539.6×Height [m])
where PA=Physical activity coefficient
PA=1.0 if PAL is estimated to be $\geq 1.0 < 1.4$ (Sedentary)
PA=1.11 if PAL is estimated to be $\geq 1.4 < 1.6$ (Low active)
PA=1.25 if PAL is estimated to be $\geq 1.6 < 1.9$ (Active)
PA=1.48 if PAL is estimated to be $\geq 1.9 < 2.5$ (Very Active)

EER for Women 19 Years and Older (BMI 18.5-25 kg/m^2)

EER=TEE
EER=354-6.91×Age (yr)+PA×(9.36×Weight [kg]+726×Height [m])
where PA=Physical activity coefficient
PA=1.0 if PAL is estimated to be $\geq 1.0 < 1.4$ (Sedentary)
PA=1.12 if PAL is estimated to be $\geq 1.4 < 1.6$ (Low active)
PA=1.27 if PAL is estimated to be $\geq 1.6 < 1.9$ (Active)
PA=1.45 if PAL is estimated to be $\geq 1.9 < 2.5$ (Very Active)

EER for Pregnant Women

14-18 years: EER=Adolescent EER+Pregnancy energy deposition
First trimester=Adolescent EER+0 (Pregnancy energy deposition)
Second trimester=Adolescent EER+160 kcal (8 kcal/wk×20 wk)+180 kcal
Third trimester=Adolescent EER+272 kcal (8 kcal/wk×34 wk)+180 kcal

19-50 years: EER=Adult EER+Pregnancy energy deposition
First trimester=Adult EER+0 (Pregnancy energy deposition)
Second trimester=Adult EER+160 kcal (8 kcal/wk×20 wk)+180 kcal
Third trimester=Adult EER+272 kcal (8 kcal/wk×34 wk)+180 kcal

EER for Lactating Women

14-18 years: EER=Adolescent EER+Milk energy output-Weight loss
First 6 months=Adolescent EER+500-170 (Milk energy output-Weight loss)
Second 6 months=Adolescent EER+400-0 (Milk energy output-Weight loss)

19-50 years: EER=Adult EER+Milk energy output-Weight loss
First 6 months=Adult EER+500-170 (Milk energy output-Weight loss)
Second 6 months=Adult EER+400-0 (Milk energy output-Weight loss)

Table 2.* Estimated Energy Expenditure[1] Prediction Equations at Four Physical Activity Levels[2] (cont'd)

Weight Maintenance TEE for Overweight and At-Risk for Overweight Boys 3-18 Years (BMI>85th Percentile for overweight)
TEE=114-50.9×Age (yr)+PA×(19.5×Weight [kg]+1161.4×Height [m])
where PA=Physical Activity coefficient
PA=1.0 if PAL is estimated to be ≥ 1.0 < 1.4 (Sedentary)
PA=1.12 if PAL is estimated to be ≥ 1.4 < 1.6 (Low active)
PA=1.24 if PAL is estimated to be ≥ 1.6 < 1.9 (Active)
PA=1.45 if PAL is estimated to be ≥ 1.9 < 2.5 (Very Active)
Weight Maintenance TEE for Overweight and At-Risk for Overweight Girls 3-18 Years (BMI>85th Percentile for overweight)
TEE=389-41.2×Age (yr)+PA×(15×Weight [kg]+701.6×Height [m])
where PA=Physical Activity coefficient
PA=1.0 if PAL is estimated to be ≥ 1.0 < 1.4 (Sedentary)
PA=1.18 if PAL is estimated to be ≥ 1.4 < 1.6 (Low active)
PA=1.35 if PAL is estimated to be ≥ 1.6 < 1.9 (Active)
PA=1.60 if PAL is estimated to be ≥ 1.9 < 2.5 (Very Active)
Overweight and Obese Men 19 Years and Older (BMI ≥ 25 kg/m^2)
TEE=1086-10.1×Age (yr)+PA×(13.7×Weight [kg]+416×Height [m])
where PA=Physical Activity coefficient
PA=1.0 if PAL is estimated to be ≥ 1.0 < 1.4 (Sedentary)
PA=1.12 if PAL is estimated to be ≥ 1.4 < 1.6 (Low active)
PA=1.29 if PAL is estimated to be ≥ 1.6 < 1.9 (Active)
PA=1.59 if PAL is estimated to be ≥ 1.9 < 2.5 (Very Active)
Overweight and Obese Women 19 Years and Oldrer (BMI ≥ 25 kg/m^2)
TEE=448-7.95×Age (yr)+PA×(11.4×Weight [kg]+619×Height [m])
where PA=Physical activity coefficient
PA=1.0 if PAL is estimated to be ≥ 1.0 < 1.4 (Sedentary)
PA=1.16 if PAL is estimated to be ≥ 1.4 < 1.6 (Low active)
PA=1.27 if PAL is estimated to be ≥ 1.6 < 1.9 (Active)
PA=1.44 if PAL is estimated to be ≥ 1.9 < 2.5 (Very Active)
Normal and Overwight or Obese Men 19 Years and Older (BMI ≥ 18.5 kg/m^2)
TEE=864-9.72×Age (yr)+PA×(14.2×Weight [kg]+503×Height [m])
where PA=Physical activity coefficient
PA=1.0 if PAL is estimated to be ≥ 1.0 < 1.4 (Sedentary)
PA=1.12 if PAL is estimated to be ≥ 1.4 < 1.6 (Low active)
PA=1.27 if PAL is estimated to be ≥ 1.6 < 1.9 (Active)
PA=1.54 if PAL is estimated to be ≥ 1.9 < 2.5 (Very Active)
Normal and Overwight or Obese Women 19 Years and Older (BMI ≥ 18.5 kg/m^2)
TEE=387-7.31×Age (yr)+PA×(10.9×Weight [kg]+660.7×Height [m])
where PA=Physical activity coefficient
PA=1.0 if PAL is estimated to be ≥ 1.0 < 1.4 (Sedentary)
PA=1.14 if PAL is estimated to be ≥ 1.4 < 1.6 (Low active)
PA=1.27 if PAL is estimated to be ≥ 1.6 < 1.9 (Active)
PA=1.45 if PAL is estimated to be ≥ 1.9 < 2.5 (Very Active)

*From the Institute of Medicine, Food and Nutrition Board: *Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids,* Washington, DC, 2002, The National Academies Press, www.nap.edu.

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1) Estimated energy expenditure (EER) is the average dietary energy intake that is predicted to maintain energy balance in a healthy adult of a defined age, gender, weight, height, and level of physical activity consistent with good health. In children and pregnant and lactating women, the EER includes the needs associated with the deposition of tissues or the secretion of milk at rates consistent with good health.

2) Physical activity level (PAL) is the physical activity level that is the ratio of the total energy expenditure to the basal energy expenditure.

3) Total energy expenditure (TEE) is the sum of the resting energy expenditure, energy expended in physical activity, and the thermic effect of food.

4) Body mass index (BMI) is determined by dividing the weight (in kilograms) by the square of the height (in meters).

labeled water (DLW). This was a major advance as the DLW measurements provided a closer approximation to actual energy expenditure than the past practice of basing energy recommendations on either a factorial method (resting energy expenditure multiplied by an activity factor) or self-reported measures of energy intake.[2] Not surprisingly, among these subjects TEE declined with age (Fig. 3) and increased with height (Fig. 4).[1]

Specific equations for determining EER for people in each lifestyle group are shown in Table 2.[3] The EER equations are specific for gender, age, weight, height and physical activity level. Among Infants and children, EER is determined as TEE plus the energy required to support growth. Likewise, prediction equations for pregnant and

lactating women include TEE and the caloric requirements for energy deposition during pregnancy and the energy cost of milk output during lactation. TEE equations instead of EER equations are used to estimate energy requirements for the maintenance of body weight for children ages 3 through 18 years who are at risk of overweight and overweight (BMI > 85th percentile) and for overweight/obese adults (BMI ≥ 25 kg/m^2).[1)]

Table 3. Physical Activity Level Categories and Walking Equivalence*

PAL Category	PAL Values	Walking Equivalence (miles/day at 3-4 mph)[1)]
Sederitary	1-1.39	
Low active	1.4-1.59	1.5, 2.2, 2.9 for PAL=1.5
Active	1.6-1.89	3, 4.4, 5.8 for PAL=1.6
		5.3, 7.3, 9.9 for PAL=1.75
Very active	1.9-2.5	7.5, 10.3, 14 for PAL=1.9
		12.3, 16.7, 22.5 for PAL=2.2
		17, 23, 31 for PAL=2.5

* From the Institute of Medicine of The National Academies: *Dietary reference intakes for energy, carbohydrate, fiber, fat, fathy acids, cholesterol, protein, and amino acids,* Washington, DC, 2002, The National Academies Press. Reprinted from Krause's Food Nutrition, & Diet Therapy. 11th edition. Elsevier, Saunder, USA. Mahan L.K., Escott-Stump S. pages 30-32. 2004 with permission from Elsevier.

1) In addition to energy spent for the generally unscheduled activities that are part of a normal daily life. The low, middle, and high miles/day values apply to relatively heavyweight (120 kg), midweight (70 kg), and lightweight (44 kg) individuals, respectively.

Physical activity is the most variable component of TEE. Thus, the EER equations include a physical activity coefficient (PA) for all groups except infants and young children (Table 2).[3)] PA coefficients correspond to a person's physical activity level (PAL). Four categories were identified: *sedentary, low active, active and very active.* The sedentary category is the energy spent during activities of daily living. Categories that include activity levels beyond sedentary were determined according to the energy expended by an adult walking at a set pace (Table 3).[3)] The PAL value range corresponds to the walking equivalents for each physical activity category. Thus the *low-active, active, and very active* categories correspond to an average weight adult walking, on average, 2, 7 and 17 miles per day (at 3 to 4 miles per hour) respectively. The DRI report recommends achieving the active category of physical activity in order to reduce the risk of chronic disease.[1)] The more a person weighs, the less they have to walk in order to achieve a particular PAL category (Table 3).[3)] For example a 120 kg person can walk three miles to be considered active while a 70 kg person would have to walk 4.4 miles.

ESTIMATED ENERGY REQUIREMENTS FOR PREGNANT WOMEN

EER equations were developed for pregnant women using a DLW database that consisted of longitudinal measurements of TEE throughout pregnancy. Since TEE changes very little and weight gain is very small during the first trimester, the prepregnant EER is to be used. In contrast, during the second and third trimesters additional energy intake is recommended. The median change in TEE was 8 kilocalories/week plus the energy deposition during pregnancy of 180 kilocalories/day. Hence, the EERs for pregnancy are:[1,3)]

1st trimester = Prepregnant EER+0
2nd trimester = Prepregnant EER+160 kcal (8 kcal/week × 20 weeks)+180 kcal
3rd trimester = Prepregnant EER+272 kcal (8 kcal/week × 34 weeks)+180 kcal

ESTIMATED ENERGY REQUIREMENTS FOR LACTATING WOMEN

The EER during lactation are estimated from TEE, milk energy output, and energy mobilization from tissue stores (weight loss). In the first six months postpartum, well-nourished lactating women have an average weight loss of 0.8 kg/month or 170 kcal/day. Lactating women are assumed to be weight stable after six months postpartum. Milk production rates average 0.78 L/day from birth through six months of age and 0.6 L/day from seven through 12 months of age. At 0.67 kcal/gm milk, the milk energy output would be 523 kcal/day, which was rounded to 500 kcal/day, in the first six months and 402 kcal/day, which was rounded to 400 kcal/day, in the second six months of lactation. Hence, the EERs for lactation are:[1,3)]

EER = Adult EER + milk energy output - weight loss
1st six months = Adult EER + 500 - 170 (milk energy output - weight loss)
2nd six months = Adults EER + 400 - 0 (milk energy output - weight loss)

UPPER LEVEL FOR ENERGY

No upper level was set for energy. Obviously, if people have energy intakes above their EER it will result in weight gain. If a person is consuming their EER and gaining or losing weight it may be necessary to recalculate their physical activity coefficient. However, the EERs should be a very close prediction of actual requirements.

PHYSICAL ACTIVITY

In recognition of the importance of physical activity in the maintenance healthy weights and optimal health, for the first time the Institute of Medicine (IOM) established a recommendation for physical activity. The DRIs state that "to prevent weight gain and accrue additional weight-independent health benefits of physical activity, the equivalent of 60 minutes of daily moderate intensity physical activity above sedentary is recommended for both children and adults".[1] This level of activity corresponds to the *active* category of physical activity. The physical activity recommendation was based on studies of how much energy was expended on average each day by people who maintain a healthy weight.

Physical activity is cumulative and includes daily activities such as climbing stairs and housecleaning plus moderate to vigorous exercise such as walking or running. As the intensity of the physical activity increases, a person can spend less time engaged in the activity and still remain in the same category of physical activity (Fig. 5).[1] For example, a 60 kg person could walk at two miles/hour for 68 minutes or run at four miles/hour for 30 minutes and achieve the same level of physical activity.

CONCLUSION

The new EER prediction equations supported by DLW studies, estimate energy requirements for people by life-stage groups. The equations were developed to maintain current body weight for all subsets of the population. Among infants and children the energy cost of growth and among pregnant women the energy costs of maternal and fetal tissue growth are added to TEE. Prediction equations for lactating women include TEE, the energy cost of milk output as well as the energy mobilized from tissue stores (i.e. weight loss) during the first 6 months postpartum. As weight becomes more stable after 6 months postpartum only the energy cost of milk output is considered. The prediction equations include a physical activity coefficient (PA) for all groups except infants and young children which corresponds to a person's physical activity level (PAL). Recommendations to include regular physical activity help to improve health and decrease the risk of many chronic diseases.

The full text of the Dietary Reference Intakes for Energy, Carbohydrates, Fiber, Fat, Protein and Amino Acids (Macronutrients) can be read online at www.nap.edu/books. Printed copies can be ordered from the National Academy press at www.nap.edu or by telephone at 1-800/624-6242. In addition, the Journal of the American Dietetic Association recently published a summary of the DRIs for the macronutrients.[4]

Literature Cited

1) Institute of Medicine of The National Academies. Dietary Reference Intakes: Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. The National Academies Press, Washington, D.C., 2002.
2) Recommended Dietary Allowances 10th edition. National Academy Press, Washington, D.C., 1989.
3) Frary CD and Johnson RK. Energy, Chapter 2. In: Mahan L.K., Escott-Stump S. Krause's Food Nutrition, & Diet Therapy. 11th edition. Elsevier; Saunder, USA, 2004.
4) Trumbo P, Schlicker S, Yates AA, Poos M. Food and Nutrition Board of the Institute of Medicine, The National Academies. Dietary Reference Intakes for Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein, and Amino Acids. *J Am Diet Assoc* 102:1621-30, 2002.

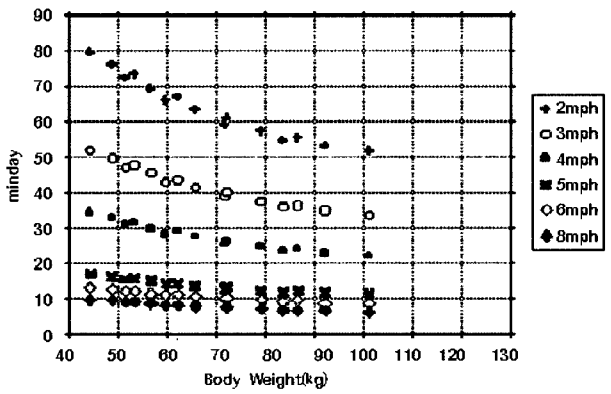

Fig. 5 Body Weight and Time to increase PAL by 0.10