

Energy Expenditure and Physical Activity Reference Notes

The Gold standard for measuring energy expenditure is Doubly labelled water (DLW) with heavy isotopes. The individual must drink the DLW and then measure decrease in concentration in urine, quite costly

Proxies include Heart rate MONITORING

Pedometers (or better, activity monitors)

Exercise diaries and more

Steve Blair is a good ref source as is Andrew Prentice

Measurement of Physical activity

Frequency – Duration – Intensity are the key concepts that determine Physical activity levels (PAL)

– most of the literature on physical activity is focused on prevention of overweight/obesity with the recommendation of 30 to 60 minutes of “moderate” to “vigorous” activity 3 to 4 times per week or “on most days of the week” (see TABLE 5.11 **Minimum frequency, duration and intensity of physical activity advocated by selected organizations – In FAO, WHO, 2001 Human Energy Requirements**)

There are very few references that I could find that aim to measure the “do no harm” aspect of increasing manual labor, so we need to break down the question we are asking.

- Did the intervention lead to greater energy expenditure of women (questions on time use/ duration, intensity and frequency of engagement in intervention activities – looking for substitution effect if any is possible)
- IF yes, did this lead to any changes in BMI? Did women become thinner? This would indicate that energy intakes did not compensate for greater activity levels.
- Did the intervention cause any other undesirable effects on time? Such as no time for child care, no time for relaxation/leisure? Less time for cooking? Etc.

Categories of physical activity

- Occupational
- Home
- Leisure/Recreation
- Travel

Desired characteristics of measurement : Intensity (moderate, vigorous) – duration (minutes) – frequency (number of days per week)

There are several questionnaires – mainly from US and Europe – link to database on Physical activity questionnaires - <http://appliedresearch.cancer.gov/resource/collection.html>

GLOBAL PHYSICAL ACTIVITY QUESTIONNAIRE (GPAQ)

<http://www.who.int/chp/steps/GPAQ/en/index.html>

Department of Chronic Diseases and Health Promotion/Surveillance and Population-Based Prevention/World Health Organization

20 Avenue Appia, 1211 Geneva 27, Switzerland. For further information:
www.who.int/chp/steps

5.4.2 Recommendation for daily energy intake

Dietary energy intake of a healthy, well-nourished population should allow for maintaining an adequate BMI at the population's usual level of energy expenditure. At the individual level, a normal range of 18.5 to 24.9 kg/m² BMI is generally accepted (WHO 1995 and 2000). At a population level, a median BMI of 21.0 was recently suggested by the joint WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases (WHO/FAO, 2002).

ANNEX 5: ENERGY COSTS OF ACTIVITIES

ACTIVITY	MALES		FEMALES	
	Average PAR	PAR Range	Average PAR	PAR Range
General personal activities				
Sleeping ^a	1.0		1.0	
Lying ^a	1.2		1.2	
Sitting quietly ^a	1.2		1.2	
Standing ^a	1.4		1.5	
Dressing	2.4	1.6–3.3	3.3	
Washing hands/ face and hair	2.3			
Plaiting hair			1.8	
Eating and drinking	1.4		1.6	
Means of transport				
Walking around/ strolling	2.1	2.0–2.2	2.5	2.1–2.9
Walking slowly	2.8	2.6–3.0	3.0	
Walking quickly	3.8			
Walking uphill	7.1	5.5–8.6	5.4	4.8–6.1
Walking downhill	3.5	3.1–4.0	3.2	
Climbing stairs	5.0			
Sitting on a bus/train	1.2			
Cycling	5.6	3.8–8.6	3.6	
Cycling on a dirt road	7.0	5.0–9.0		
Driving a motor cycle	2.7	2.4–3.0		
Driving a car/truck	2.0			
Paddling a canoe	3.0			
Pulling a rickshaw (one person/no load)	5.3	4.0–6.6		
Pulling a rickshaw (2 persons)	7.2	6.7–7.8		
Horseback riding (slow)	3.6			
Horseback riding (trotting)	5.2	4.8–5.5		
Activities involving weight bearing				
Walking with 15–20 kg load			3.5	3.4–3.5
Walking with 25–30 kg load			3.9	3.8–4.1
Carrying 20–30 kg load on head	3.5	2.4–4.2		
Carrying 35–60 kg load on head	5.8	5.0–7.0		
Carrying 27 kg load with shoulder straps – varying gradients	5.0	2.3–7.7		
Carrying 27 kg load with forehead strap – varying gradients	5.32	2.4–8.0		
Loading 9 kg sack on to a truck	5.78			
Loading 16 kg sack on to a truck	9.65			
Pulling hand cart – unloaded	4.82			
Pulling hand cart with 185–370 kg load	8.3	7.0–9.6		
Domestic chores				
Cooking/preparing food				
Collecting wood (for fuel)	3.3			
Collecting water (from well)			4.5	
Chopping wood (for fuel)	4.2	2.3–6.5		
Kneading dough			3.4	
Making tortillas			2.4	
Peeling vegetables	1.9	1.3–2.4	1.5	
Pounding grain			5.6	5.0–6.3

ACTIVITY	MALES		FEMALES	
	Average PAR	PAR Range	Average PAR	PAR Range
Cooking/preparing food (cont.)				
Shopping			4.6	
Squeezing coconut			2.4	
Washing dishes			1.7	1.6-1.9
Child care				
Child care (unspecified)			2.5	
Bathing child (standing)			3.5	
Carrying child			1.9	
House cleaning				
Housework (unspecified)			2.8	2.5-3.0
Beating mats/carpets			6.2	5.1-7.4
Bed making (tropical climate)			3.4	
Bed making (cold climate)			4.9	4.6-5.1
Mopping/washing floor			4.4	3.4-6.5
Polishing floor			4.4	
Sweeping			2.3	2.0-2.5
Vacuuming			3.9	
Window cleaning	3.0	2.8-3.3		
Laundry				
Washing clothes (sitting/squatting)			2.8	2.6-3.0
Hanging washing out to dry			4.4	4.3-4.6
Ironing clothes	3.5		1.7	
Sewing/knitting	1.6		1.5	1.3-1.8
Care of the yard/garden				
Cleaning/sweeping yard	3.7	2.9-4.5	3.6	
Weeding garden	3.3	2.4-5.1	2.9	2.7-3.6
Shovelling snow from driveway	7.9			
Agricultural activities				
General activities				
Digging	5.6		5.7	
Driving a tractor	2.1	1.9-2.3		
Fertilizing (spreading manure)	5.2	4.9-5.4		
Gleaning			4.5	
Grinding grain using a mill stone			4.6	
Hoeing	4.2	3.6-4.6	5.3	4.7-6.5
Loading sacks on to a truck	6.6			
Ploughing with horse	4.8			
Ploughing with tractor	3.4			
Ploughing with buffalo			3.6	
Spraying crops	4.3			
Weeding	4.0	2.6-4.7	3.7	3.7-3.8
Cocoa crop				
Collecting cocoa			2.9	
Pruning	2.4			
Splitting cocoa			2.0	
Activities for coconut crop				
Collecting (climbing trees)	4.2			
Husking	5.6			
Bagging and splitting	3.9			

Human energy requirements: Report of a Joint FAO/WHO/UNU Expert Consultation

ACTIVITY	MALES		FEMALES	
	Average PAR	PAR Range	Average PAR	PAR Range
Fruit crops (apple, orange)				
Picking (with pole)			3.8	
Picking by hand	3.4			
Pruning trees	3.6			
Groundnut crop				
Harvesting	4.7			
Planting	3.1			
Shelling	1.6			
Sorting	1.9			
Weeding	3.2			
Maize crop				
Harvesting	5.1			
Planting	4.1			
Rice crop				
Bundling rice	3.7		3.0	
Fertilizing	3.1			
Harvesting	3.5	2.4-4.2	3.8	3.5-4.4
Planting	3.7	3.5-4.0	3.6	2.6-4.7
Spraying	5.2			
Threshing	5.4	4.6-5.0	5.1	4.8-5.4
Transplanting seedlings	3.3	3.1-3.4	3.7	3.5-4.0
Winnowing	2.9	2.3-3.6	2.7	2.5-2.9
Sugar cane crop				
Cutting	7.0	6.6-7.9		
Loading on to wagon	5.6			
Tying cane	3.0			
Tuber crops				
Harvesting	4.4	3.5-5.7	3.0	2.8-3.4
Planting	5.0		3.9	3.6-5.0
Sorting (kneeling)	2.2	1.6-2.7		
Animal husbandry				
Carrying straw	3.1			
Cleaning equipment	4.0			
Cutting straw	5.0			
Feeding animals	3.6			
Grooming horses	5.5	3.8-7.1		
Milking by hand	3.6	3.1-4.1		
Milking by machine	3.2			
Tending animals (feeding, watering, cleaning stable)	4.6			
Hunting/fishing				
Crabbing			4.51	
Fishing with a line ^b	1.9			
Fishing with a spear	2.3			
Fishing with hands			3.94	
Hunting (bats, birds, pigs) ^b	3.2			
Occupational categories				
Bakery work			2.5	
Brewery work			2.9	

ACTIVITY	MALES		FEMALES	
	Average PAR	PAR Range	Average PAR	PAR Range
Brickmaker				
Earth cutting	5,6	5,5–5,7		
Making mud bricks (squatting)	3,0			
Bullder				
Carrying wood	6,6			
Cement mixing with shovel	5,3			
Chipping cement walls	3,3			
Chiselling	5,0			
Nailing	3,0			
Planing softwood	5,7	4,4–7,1		
Planing hardwood	8,0			
Roofing	2,9			
Sandpapering	2,9			
Sawing softwood	5,3	5,0–5,6		
Sawing hardwood	6,6			
Painting	3,6			
Firefighter				
Dragging fire hose	9,8			
Climbing steps with full gear	12,2			
Flight attendant (serving food, beverages and galley work) ^b	3,0		3,1	
Forester				
Tree cutting	6,9	5,4–8,0		
Sawing	5,7			
Planting trees	4,1			
Nursery work	3,6			
Military training				
Digging trenches	6,4	4,6–7,9		
Drill	4,5	4,1–4,8		
March (slow)	3,18			
March 2–4 m/h (3,2–6,4 km/h) with 27 kg load ^b	4,9			
Obstacle course	5,7	5,0–6,3		
Miner				
Drilling with jackhammer	3,9			
Loading operations	3,2			
Shovelling	4,6			
Office worker				
Filing	1,3		1,5	
Reading	1,3		1,5	
Sitting at desk ^a	1,3			
Standing/moving around ^a	1,6			
Typing	1,8		1,8	
Writing	1,4		1,4	
Postal worker				
Climbing stairs	8,9	7,7–10,7		
Sorting parcels (habitual)	5,4			
Shoemaker	2,6		2,2	
Tailor^b	2,5			
Textile factory worker (average of spinning, weaving, dyeing) ^b	3,1		2,2	