An individual-specific heart-rate monitoring method of determining daily physical activity pattern in minutes

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Introduction: While the evaluation of national physical activity (PA) recommendations requires the assessment of PA in minutes, there is concern over the reliability and validity of physical activity questionnaires (PAQs). This has resulted in the need for objective quantification of PA pattern in minutes. Objective measures previously used assess energy expenditure (EE) in kilocalories, for example Caltrac accelerometry[1]. Heart rate monitoring (HRM: Figure 1) in conjunction with individual calibration enables quantification of time spent in different intensities of PA and is therefore a more valuable method of validating PAQs.

Aim: To develop a clinically accessible method for quantifying individuals' PA levels and patterns.

Method: 24 subjects were individually calibrated according to their HR at 3 levels of PA: a light walk (normal respiratory rate (RR), stair-climb (slightly out of breath) and jog (greater increase in RR). Mid-points between these HRs were used to create cut-off points for light, moderate and vigorous intensity PA (Figure 2). HR data was collected for a full waking day.

Figure 1: Heart-Rate Monitoring Equipment

Figure 2: Method of data analysis

PA	HR during PA (bpm)	HR cut-off	Intensity description
Jog ⟶	162		Vigorous
		136	
Stair-climb ⟶	110		Moderate
		93.5	
Light walk ⟶	77		Light
		70	
Rest ⟶	63		Rest

Results: Table 1 and Figure 3 show two contrasting examples of the percentage of the day spent by subjects in each intensity category of PA.

Table 1: PA pattern, total activity time and EE of Subjects 1 and 2

	Rest %	Light %	Moderate %	Vigorous %	Total time (hrs)	Total PA EE (kcal)
1	82.5	12.6	4.3	0.6	15:08	423
2	24.5	70.0	4.9	0.5	12:51	2660

Chart 1: Waking day activity pattern of Subjects 1 and 2

Subject 1

- ☐ Rest %
- ☐ Light %
- ☐ Moderate %
- ☐ Vigorous %

Subject 2

- ☐ Rest %
- ☐ Light %
- ☐ Moderate %
- ☐ Vigorous %
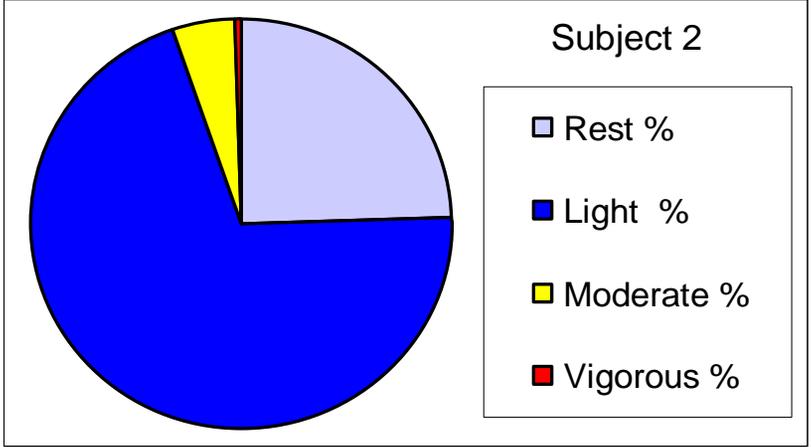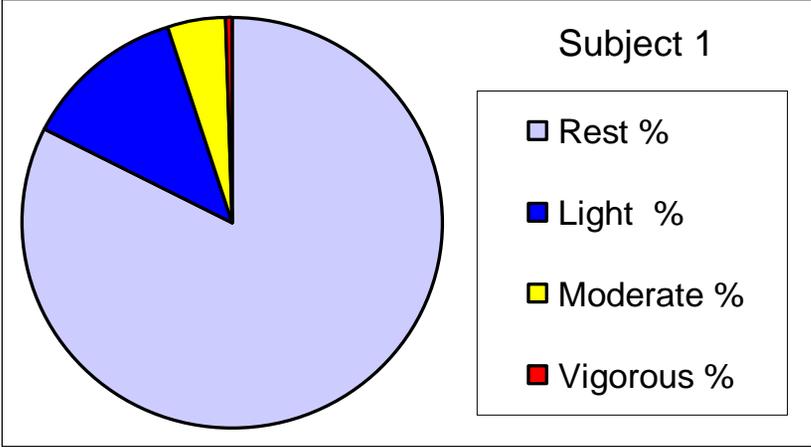
Conclusion: This method enables demonstration of varied activity levels and patterns in different individuals. It is objective and clinically accessible, for example in work with Cystic Fibrosis patients and weight management programs. This method provides the most comprehensive method of assessing the reliability and validity of PA questionnaires.

1.   Epstein, L., Paluch, R., Coleman, K., Vito, D. & Anderson, K. (1996) Determinants of physical activity in obese children assessed by accelerometer and self-report. *Medicine and Science in Sports and Exercise* **28**, 1157-1164.