

Daily Energy Expenditure and Physical Activity Measured in Parkinson's Disease Patients With and Without Weight Loss

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Background

Patients with Parkinson's disease (PD) commonly exhibit weight loss (WL) which investigators attribute to various factors, including elevated resting energy expenditure. This study tests the hypothesis that daily energy expenditure (DEE) and its components, resting energy expenditure (REE) and physical activity (PA), are elevated in the WL group compared with the weight stable (WS) group of PD patients.

Methods

DEE and PA were measured in 10 WL patients and 10 WS PD patients using doubly labeled water (DLW), activity monitors (waist and wrist), and activity questionnaires (Yale Activity Questionnaire [YALE] and Physical Activity Scale for the Elderly [PASE]).

All twenty subjects met the following criteria:

- levodopa responsive PD patients
- absence of severe dyskinesias and
- normal diet consumption (i.e. not protein restriction).

The Doubly Labeled Water Method:

- following a controlled urine sample, participants ingest a water drink containing the naturally occurring stable isotopes deuterium (²H) and oxygen-18 (¹⁸O)
- urine samples collected 3-hours post and in the mornings 1, 7, and 14 days post-ingestion of DLW
- measures DEE in free-living subjects over a period of days/weeks
- energy expenditure calculated from the isotope decay curves

Results

Table 1. Description of the Study Population

Variable	Weight Stable (WS)	Weight Loss (WL)	Total
N	10	10	20
Age (yr)	74.6 ± 3.6	71.5 ± 10.2	72.9 ± 7.9
Height (cm)	174.7 ± 14.8	172.3 ± 9.0	173.4 ± 11.7
Body mass (lbs)	182.0 ± 15.7	160.7 ± 20.4*	170.3 ± 20.95
Fat mass (kg)	22.8 ± 4.3	15.5 ± 6.9*	18.8 ± 6.81
Fat-Free mass (kg)	55.2 ± 7.8	53.8 ± 5.0	54.4 ± 6.28
Percent Body Fat (%)	28.30 ± 5.8	20.75 ± 8.01*	24.16 ± 7.9

Values are mean ± SD
*p<0.05

- WL patients had a significantly lower body mass (p=0.019) and significantly lower fat mass (p=0.013) than the WS group.
- The mean percent body fat of WL group was 20% whereas the mean percent body fat of WS group was 28% (p=0.029).
- WL patients were not different in age and height from the WS patients.
- 9 of 10 patients in the WL group and 1 of 10 in the WS group reported tremor as a major problem.

Table 2. Daily Energy Expenditure (DEE), Energy Intake, Resting Energy Expenditure (REE) and Physical Activity estimated with Doubly Labeled Water, Activity Monitors (AMs) and Physical Activity Questionnaires (PAQs) in Weight Stable and Weight Loss Groups.

Variable	Weight Stable (WS)	Weight Loss (WL)	Total
N	10	10	20
DEE (kcal/day)	2,206.4 ± 560.1	2,261.2 ± 492.1	2236.5 ± 510.2
PA-DLW (kcal/day)	582 ± 420	622 ± 539	520.9 ± 510.1
PA Waist (act. beats)	49 ± 30	63 ± 36	57 ± 33
PA Wrist (act. beats)	101 ± 69	167 ± 61*	140 ± 71
PA sum (act. beats)	79 ± 54	110 ± 47	97 ± 51
PASE	121.9 ± 71.7	130.6 ± 72.0	126.7 ± 70.1
YALE (kcal/day)	407.4 ± 228.7	372.0 ± 217.2	387.9 ± 217.2
REE (kcal/day)	1500.9 ± 208.7	1486.2 ± 178.9	1492.8 ± 187.8
EI (kcal/day)	1839.0 ± 611.5	2273.4 ± 409.4	2,081.8 ± 544.1

Values are mean ± SD
*p<0.05

- There was no difference in daily energy expenditure (DEE) between the WS and WL groups measured with doubly labeled water.
- Energy intake, energy expenditure, and fat-free mass were not significantly different between groups.
- WL group showed significantly higher physical activity than the WS group (p<0.042) only when using activity monitors placed around the wrist.

Table 3. Spearman Correlation Coefficients Between Daily Energy Expenditure (DEE) and Physical Activity estimated with Doubly Labeled Water, Activity Monitors (AMs) and Physical Activity Questionnaires (PAQs)

Variable	Act. wrist	Act. waist	Act. sum	PA DLW	PA YALE	PA PASE
DEE	.460*	.528*	.556**	.954**	.435*	.110
Act. Wrist	1.000	.901**	.964**	.471*	.165	.284
Act. Waist		1.000	.932**	.471*	.313	.558*
Act. sum			1.000	.492*	.289	.482*
PA (DLW)				1.000	.412*	.066
YALE					1.000	.468*

* p<0.05 level (1-tailed).
** p<0.01 level (1-tailed).

- There was a significant positive relationship between DEE (r=0.548; p<0.05) as well as PA and caloric intake (and r=0.563; p<0.01).
- PA measured with doubly labeled water was positively related with activity measured with activity monitors placed both around the waist (r=0.471; p<0.05) and wrist (r=0.471; p<0.05).
- Only the YALE questionnaire significantly correlated with PA measured with doubly labeled water methods.
- There was a strong correlation between the two different accelerometer (waist and wrist) placements (r=0.901; p<0.05).
- Investigators also used an averaged measurement of the two accelerometers in order to increase the reliability of the measurement. (Table 3).

Conclusions

- Daily energy expenditure (DEE) and physical activity (PA) measured by doubly labeled water did not show any differences between the WS and WL group. This suggests that weight loss in these patients cannot be explained by abnormal elevated energy expenditure.
- Activity monitors placed on the wrist revealed significantly higher activity in WL patient than WS. This might indicate that more of the energy expenditure in WL group is associated with upper extremity involuntary movements.
- From the two PA questionnaires used in the study, only the YALE questionnaire significantly correlated with PA measured with the doubly labeled water method. YALE slightly underestimated the patients' physical activity levels. Investigators need a physical activity questionnaire specifically developed for Parkinson's disease patients.