

# Comparative the Diurnal Changes in the Cognitive Abilities of Patients with Parkinson's Disease, from Morning to Afternoon.

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## ABSTRACT

**Introduction:** Parkinson's Diseases is primarily caused by damage of dopaminergic neurons in the nigrostriatal pathway and accumulation of aggregated  $\alpha$ -synuclein in specific brain stem, spinal cord, and cortical region. The loss of dopamine is predominantly severe in the putamen, which explains the motor manifestations of the disease; other dopaminergic projections are also affected and contribute to the development of cognitive impairment. Cognitive dysfunction is common in Parkinson's disease and predicts poor clinical outcomes. It is associated primarily with pathologic involvement of basal forebrain cholinergic and prefrontal dopaminergic systems. Impairments in executive functions, attention, and visuospatial abilities are its hallmark features with eventual involvement of memory and other domains.

**Aim:** Compare the diurnal changes in cognitive abilities of patients with Parkinson's Disease over morning versus evening

**Methodology:** Patients were selected for this study in the sample size of 30. The Mean age group of Parkinson's patients lie in between 60- 70 year. Random sampling was done, Collection of Data from SAM global University, Bilkheriya. In the inclusion criteria MMSE Score is equal to 25, well understand the Hindi and English language, with having normal hearing capacity. In the exclusion criteria patient with wheel chair excluded and having Severe cognitive impairments or presence of any psychiatric impairments

**Result:** Difference in cognition on the total score of PDCRS between Morning to Evening. ( $<0.05$ ). There was considerable cognitive decline seen as the day wears out

**Conclusions:** Diurnal variation present in the subjects with Parkinson's disease seeing that there were significant variations in the scores of the patients on the cognitive rating scale from morning to evening.

**Keywords:** Rigidity, MSME, Cognitive, Parkinson's diseases, Bradykinesia,

## Introduction:

Cognitive impairments are known to occur in Parkinson's disease, and they can manifest even in the early stages of the disease. These cognitive impairments can affect various cognitive functions, including memory, attention, processing speed, and executive function. The involvement of subcortical structures, particularly the basal ganglia, plays a role in these cognitive changes. Fatigue is one of the common non-motor complaints among patients with neurologic disorders including PD. Mental fatigue is strongly related with decrease in cognitive task performance of Parkinson's patients. This fatigue may cause fluctuations in cognitive abilities in course of a day. Generally in PD patients' mental fatigue is persistent and seems to be an independent symptom that develops analogous to the progressive neurodegenerative

disorder of PD. This mental fatigue can affect the course and progression of rehabilitation programme. Neuropsychological investigations of patient with Parkinson have shown definite cognitive impairments at near the beginning stages of disease. These impairments' in the disease are because of the involvement of subcortical structures mainly basal ganglia. Basal ganglia has modulatory role, these disorders might result from more fundamental deficits concerning the allocation of attentional resources..

**Objective:** Evaluation of the diurnal changes in cognitive abilities of patients with Parkinson's disease over the course of the day

**Methodology:**

Study design: Observational Study

Sample size: 30.

Sample design: Random sampling

Source of data: SAM global University

Population: Parkinson's population between the age group of 60- 70 year.

**Inclusion criteria:**

Males and females, between the age group of 60-70 years

MMSE score=25

Subjects who are non-demented

Subjects should be well educated to understand Hindi and English

Subjects with normal hearing abilities

**Exclusion Criteria:**

Wheelchair or bedridden subjects.

Severe cognitive impairments or presence of any psychiatric impairments.

**Procedure:**

Patients aged 60 or older with a diagnosis of PD were recruited from the out patient department of SAM global University, Department of Physiotherapy. The study was explained to each subject and an informed consent was obtained using "Mini mental Scale examination" for screening their cognitive ability and the scores were recorded. Subjects who scored 24-25 were included for the study. Subjects were tested at three different times of the (morning, afternoon and in the evening). Testing was done by using PD-CRS questionnaire. Each session lasted for 10-15 minutes.

**Outcome measure:**

Parkinson's disease cognitive rating scale

The Parkinson's disease cognitive rating scale is a reliable and valid PD-specific battery that truthfully diagnosed PDD and identified subtle fronto-subcortical deficits. Presentation on the PD-CRS reflected that PDD is characterized by the addition of cortical dysfunction upon a major plus developing frontal-sub-cortical mutilation.

**Data Analysis:**

Descriptive statistical analysis using mean has been carried out for the current study. Results for related samples are presented on Mean and standard deviation.

Statistical Tests: ANOVA and paired t-test has been used to compare the variation in the scores in the related sample with in the day.

**FORMULA**

Mean =  $\frac{\sum x}{n}$

Where x is a given variable n is total number of subjects Standard Deviation =  $\sqrt{\frac{\sum (x - \bar{x})^2}{N}}$  Where x= Individual Score

$\bar{x}$  = the Mean Score

N = Total number of subject

**ONE- WAY ANOVA F-TEST:**

F =  $\frac{\text{between- group variability}}{\text{within- group variability}}$

F=  $\frac{Msb}{Msw}$

Msw

MSB = between Group mean square MSw = Within Group mean square The test statistic is calculated as: where:

d bar is the mean difference,

S<sup>2</sup> is the sample variance,

n is the sample size and t is a student quantile

n-1 degrees of freedom.

Level of significance is set at p<0.05

An experimental study with 30 subjects tested for the presence of cognitive ability changes was done to determine the diurnal change in cognitive abilities of patients with PD over the course of the day.

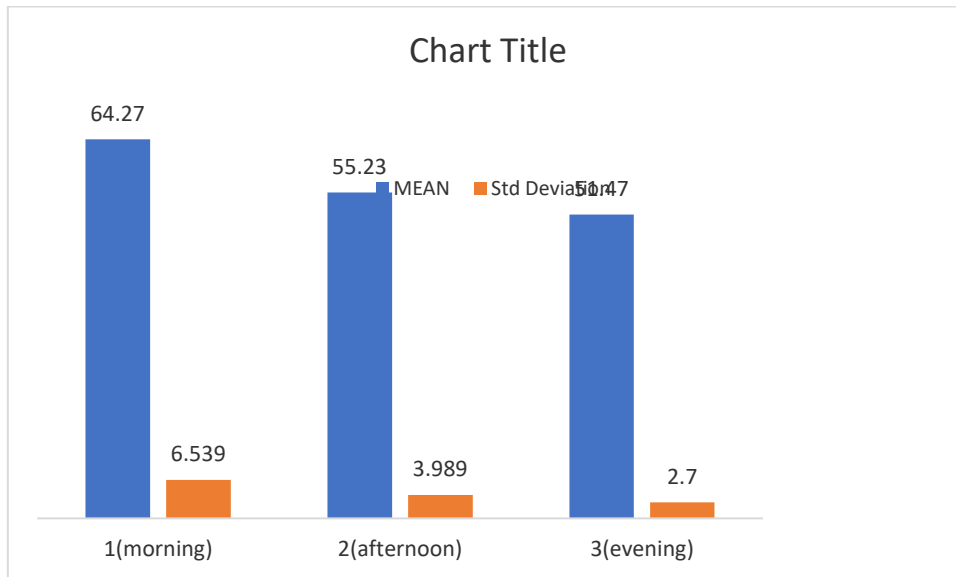
**TABLE 1: DESCRIPTIVE STATISTICS OF PDCRS SCORES (MEAN AND STANDARD DEVIATION):**

GROUP	N	MEAN	Std Deviation	SIGNIFICANCE
1(morning)	30	64.27	6.539	F=59.05 P= 0.000
2(afternoon)	30	55.23	3.989	
3(evening)	30	51.47	2.7	

The above table shows descriptive statistics of PDCRS score of subjects in morning (group1), afternoon (group2) and evening (group3).

After applying ANOVA test it is found that there is a highly significant difference between the 3 groups as p< .05 i.e p= 0.000. and according to the mean and standard deviation of grp1 which is 64.27 and 6.539 respectively, mean and SD of grp2 is 55.23 and 3.989 respectively and mean and SD of grp3 is 51.47 and 2.7 respectively, suggesting a clear diurnal pattern in declination of cognitive abilities from morning to afternoon of PD. These diurnal variations were considerable in afternoon and evening.

**GRAPH 1: DESCRIPTIVE ANALYSIS OF THE SCORES**



The above graph shows the variation in mean and standard deviation of the subjects at three different times of the day.

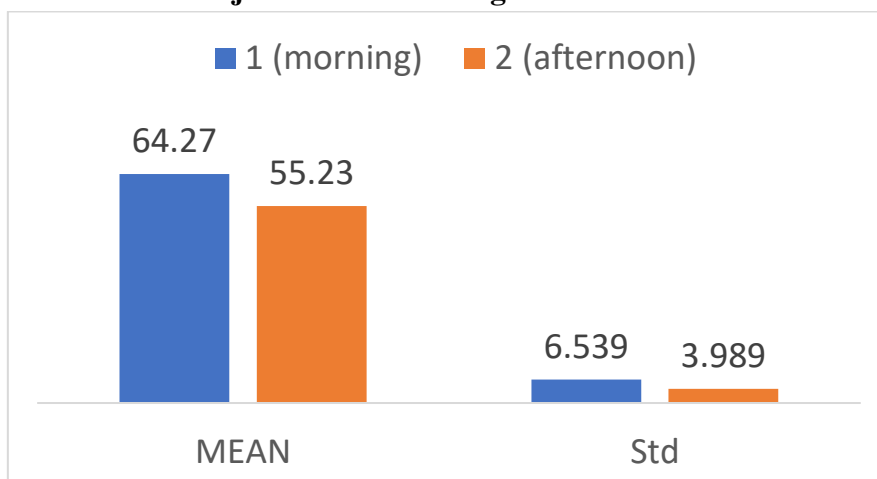
**TABLE 2: COMPARISON IN MEAN FOR PD-CRS (Morning & afternoon)**

GROUP	N	MEAN	Std	SIGNIFICANCE
1 (morning)	30	64.27	6.539	t=7.480 p=0.000
2 (afternoon)	30	55.23	3.989	

The above table and graph shows the mean values and standard deviation of PDCRS score of the subjects in the morning and afternoon.

After applying paired t-test it is found that there is a significant differences in the cognitive abilities on the total score of PDCRS between morning to afternoon as  $p < 0.05$  i.e  $p = 0.000$  in the subjects with Parkinson's disease.

**GRAPH 2: The above graph shows the mean values and standard deviation of PDCRS score of the subjects in the morning and afternoon.**



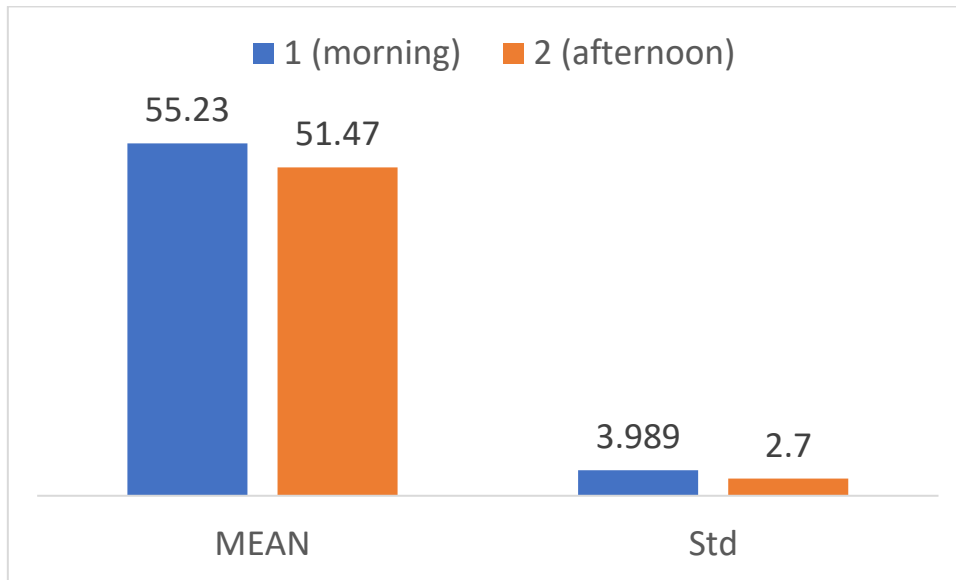
**TABLE 3: COMPARISON IN MEAN FOR PD- CRS (Afternoon & Evening)**

GROUP	N	MEAN	Std Dev	SIGNIFICANCE
1(Afternoon)	30	55.23	3.989	t = 5.150 p=0.000
2(evening)	30	51.47	2.7	

The above table and graph shows the mean values and standard deviation of PDCRS score of the subjects in the afternoon and evening.

After applying paired t-test it is found that there is a significant differences in the cognitive abilities on the total score of PDCRS between afternoon and evening as  $p < 0.05$  i.e  $p = 0.000$  in the subjects with Parkinson's disease.

**GRAPH 3:**



The above graph shows the mean values and standard deviation of PDCRS score of the subjects in the afternoon and evening.

**TABLE 4: COMPARISON OF MEAN PD-CRS**

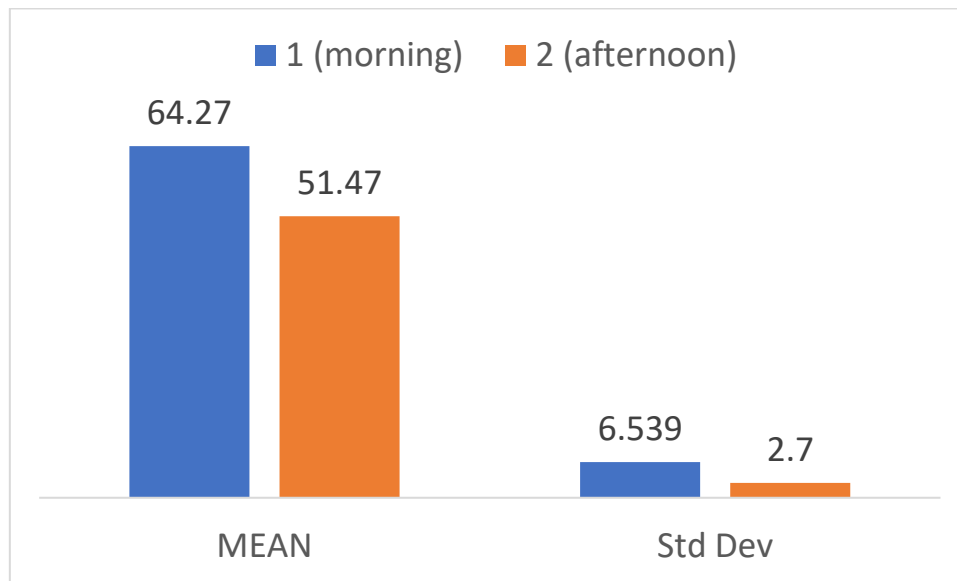
(Morning & Evening)

GROUP	N	MEAN	Std Dev	SIGNIFICANCE
1(Morning)	30	64.27	6.539	t=10.727
2(Evening)	30	51.47	2.7	P=0.000

The above table and graph shows the mean values and standard deviation of PDCRS score of the subjects in the morning and evening.

After applying paired t-test it is found that there is a significant differences in the cognitive abilities on the total score of PDCRS between morning and evening as  $p < 0.05$  i.e  $p = 0.000$  in the subjects with Parkinson's disease.

GRAPH 4:



The above graph shows the mean values and standard deviation of PDCRS score of the subjects in the morning and evening.

**Result:**

With the current study, the results showed that there was a noteworthy difference in cognition on the total score of PDCRS between Morning to afternoon. (<0.05) There was considerable cognitive decline seen as the day wears out.

**Discussion:**

Chaudhri et.al suggested that alteration in the neurotransmitter equilibrium into the basal ganglia and related structures upset the process of integration of limbic input pertaining to emotional status and resultant motor output. Isolation of motivation from executive motor movement could lead to unwillingness to act and appearance of fatigue. Absence of drive is the significant predictor of fatigue. It links with the ascending serotonin pathway as PD patients with fatigue had appreciably lesser serotonin transporter binding than patients with no fatigue in the caudate, putamen, ventral striatum and thalamus.

Fatigue in PD is weakly understood. Several suppositions have been put forward for it. One of the mechanism is under activity of hypothalamus - pituitary-adrenal axis with changes in neurotransmitters and their transmission within the CNS. Hence, from the results observed with the current study it can be concluded that the cognitive variations are considerable in subjects with Parkinson's disease because of high prevalence of mental fatigue in the those subjects.

Our results must be inferred with some carefulness. We did not control for medications, the existence of other co morbidities, other variables. Though, studies show inconsistent effects of medication on fatigue in PD. Recent study showed no correlation of fatigue and antiparkinsonian drugs. This study showed significant changes in cognitive abilities of PD patients within a day but as the sample size was small results cannot take a broad view. Therefore, large sample size and taking other confounding factors into consideration would give better results in the future research.

Limitation of the study:

- Small sample size.

- No control of medication. Future scope for studies

This study can be done by taking large sample size and considering the dosage of medications as might have influenced the results

### Conclusion

Diurnal variation present in the subjects with Parkinson's disease seeing that there were significant variations in the scores of the patients on the cognitive rating scale from morning to evening.

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