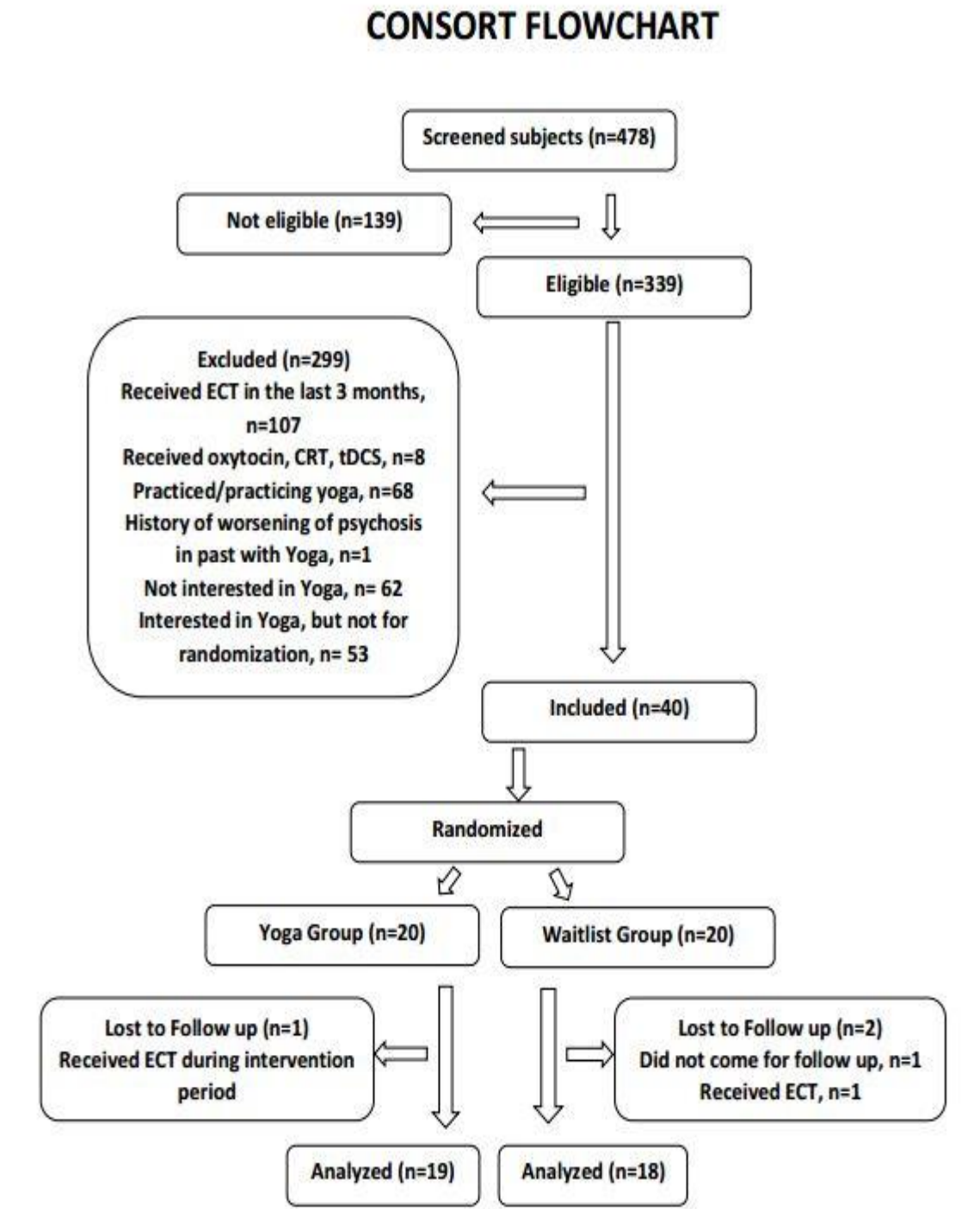


**Chapter 7.0**  
**RESULTS**

## 7.0 RESULTS

The trial profile is depicted in CONSORT flowchart in Fig-7.1.



**Figure -7.1 Trial profile**

Note: ECT-Electroconvulsive therapy; tDCS-transcranial Direct Current Stimulation; CRT- Cognitive Remediation Therapy

Outpatients and inpatients of psychiatry department at NIMHANS were screened for eligibility. Out of the 478 subjects screened, 339 were found to be eligible. From the eligible subjects, 299 were excluded for various reasons (107 patients received ECT in the last 3 months; 8 subjects received oxytocin/tDCS-transcranial Direct Current Stimulation/CRT-Cognitive Remediation Therapy; 68 subjects were practicing yoga already; 62 subjects had no interest in practicing yoga; 53 subjects wanted yoga immediately and did not opt for randomization and one subject had worsening of psychosis with Sudarshan Kriya Yoga in the past). Forty subjects were recruited finally and randomized to yoga group (20) and waitlist group (20). Two subjects dropped in the waitlist group (one received ECT; one did not turn for follow up). In the yoga group one subject dropped (received ECT during the intervention period). Thirty-seven subjects were available for the final analysis (19-yoga group & 18 Waitlist group)

### **7.1 BASELINE AND DEMOGRAPHIC DATA (Table -7.1)**

Subjects were compared for age, sex, marital status, years of education, duration of illness, illness severity, medication dosage (CPZ equivalents), clinical symptoms and social and functioning level at baseline. All the variables were comparable at baseline for the yoga and waitlist group.

### **7.2 SOCIAL COGNITION COMPOSITE SCORE (SCCS)**

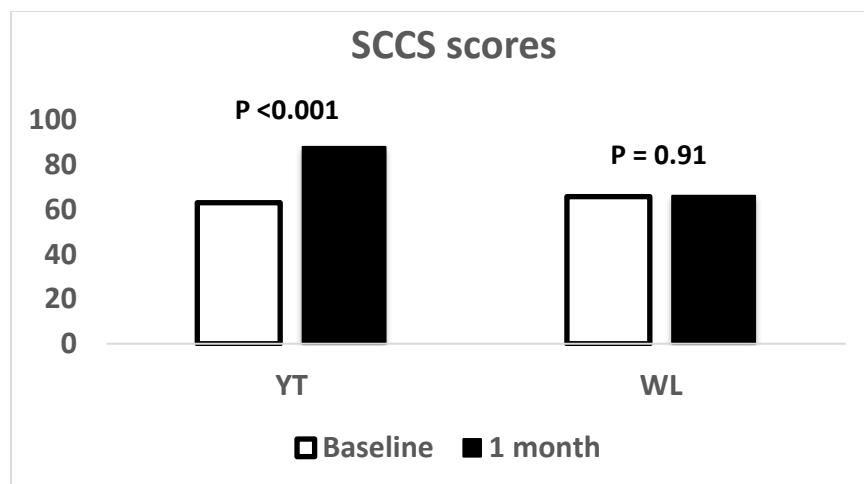
Mean & standard deviation for the groups at baseline and after one month is given in table-7.2. Data was found to be normally distributed and Repeated Measures ANOVA (RMANOVA) was applied with time and group as within and between factors respectively. RM ANOVA showed significant increase in Social Cognition Composite Score (SCCS) over time ( $F=26.89[1,34]$ ,  $P<0.001$ , partial eta squared=0.44) with a significant between group difference ( $F=11.87[1]$ ,  $P=0.002$ , partial eta squared=0.25) favouring yoga intervention. There was significant interaction between time and group ( $P<0.001$ ). Refer table-7.3 & Fig-7.2

**Table-7.1 Baseline and Sociodemographic data**

Variables	YT(N=20) Mean(SD)	WL(N=20) Mean(SD)	t/ $\chi^2$	P
Age in Years	32.70[7.0]	31.45[6.0]	0.6	0.55
*Sex ratio, M: F	13:07	14:06	0.11	0.73
*Married: Single	6:14	8:12	0.44	0.5
Years of Education	13.1[2.7]	12.2[3.7]	0.81	0.42
Duration of illness	9.2[6.0]	7.1[4.5]	1.2	0.21
CGI illness severity	4.7[1.0]	5.1[0.7]	-1.47	0.14
Antipsychotic dosage	586.2[344.4]	477.5[169.0]	1.26	0.21
SCCS score	63.09[11.8]	65.79[11.5]	-0.842	0.4
Total SANS score	51.11[12.0]	45.59[14.0]	1.27	0.21
Total SAPS score	31.21[13.5]	28.59[13.6]	0.48	0.63
GSDS score	43.42[11.0]	40.88[9.2]	0.3	0.76

\*Ratios; YT-Yoga Therapy; WL-Wait List

SCCS-Social Cognition Composite Score; SANS-Scale for Assessing Negative Symptoms; SAPS-Scale for Assessing Positive Symptoms; GSDS-Groningen Social Disability Scale; CGI-Clinical Global Impression

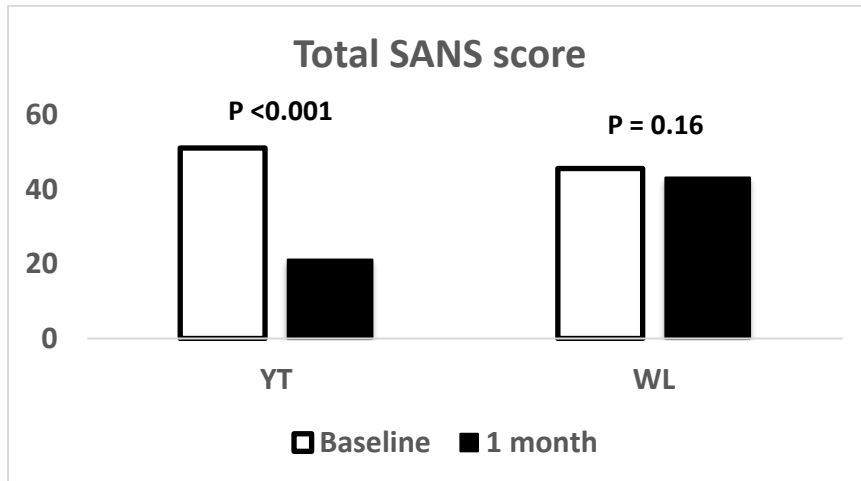


**Figure- 7.2 Change in Social Cognition Composite Score (SCCS) in percentage (Note: P value is for paired t test)**

### 7.3 TOTAL SANS SCORE

Mean & standard deviation for the groups at baseline and after one month is given in table-7.2. Data was found to be normally distributed and Repeated Measures ANOVA (RMANOVA) was applied with time and group as within and between factors respectively. RM ANOVA showed significant decrease in Total SANS Score over time ( $F= 142.13[1,33]$ ,  $P<0.001$ , partial eta squared=0.81) with a significant between group difference ( $F= 4.57[1]$ ,  $P=0.04$ ,

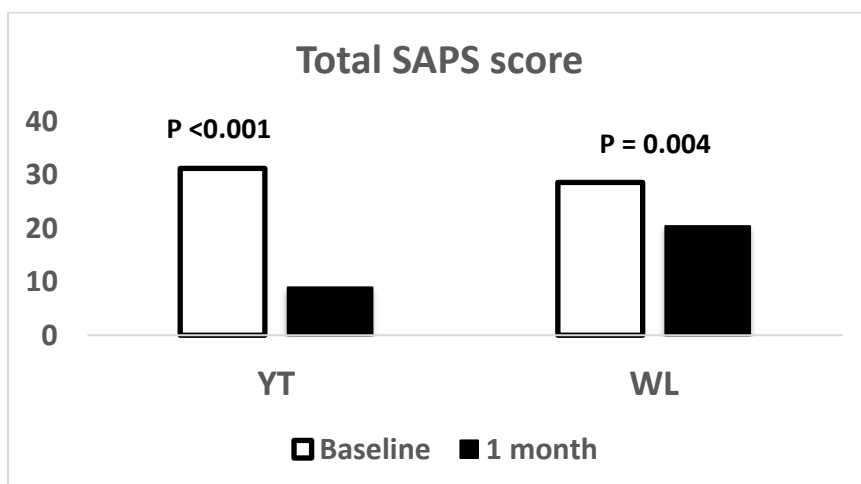
partial eta squared=0.12) favouring yoga intervention. There was significant interaction between time and group ( $P < 0.001$ ). (Refer table-7.3 & Fig-7.3)



**Figure-7.3 Changes in Total SANS scores (Note: P value is for paired t test)**

#### 7.4 TOTAL SAPS SCORE

Mean & standard deviation for the groups at baseline and after one month is given in table-7.2 Data was found to be normally distributed and Repeated Measures ANOVA (RMANOVA) was applied with time and group as within and between factors respectively. RM ANOVA showed significant decrease in Total SAPS Score over time ( $F = 56.73[1,34]$ ,  $P < 0.001$ , partial eta squared=0.62) with a non-significant between group difference ( $F = 1.97[1]$ ,  $P = 0.16$ , partial eta squared=0.05). There was significant interaction between time and group ( $P = 0.001$ ). (Refer table-7.3 & Fig-7.4)



**Figure-7.4 Changes in Total SAPS scores (Note: P value is for paired t test)**

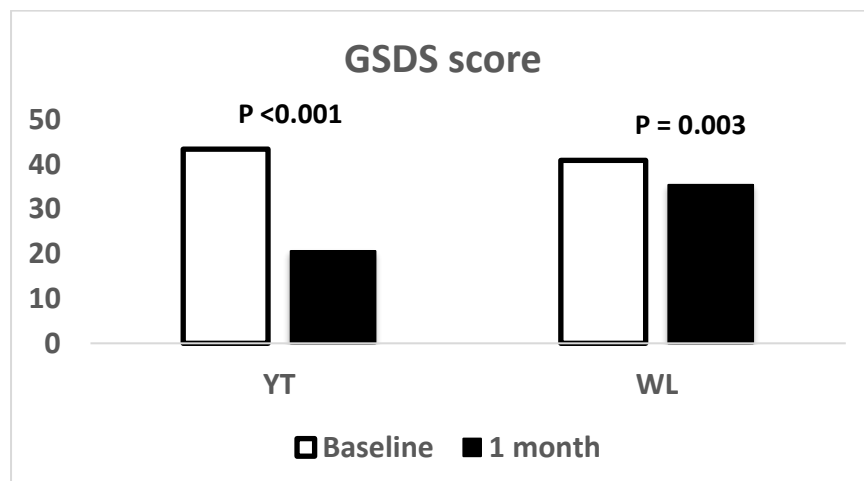
## 7.5 GSDS SCORE

Mean & standard deviation for the groups at baseline and after one month is given in table-7.2. Data was found to be normally distributed and Repeated Measures ANOVA (RMANOVA) was applied with time and group as within and between factors respectively. RM ANOVA showed significant increase in Total GSDS Score over time ( $F=78.20[1,34]$ ,  $P<0.001$ , partial eta squared=0.69) with a significant between group difference ( $F=4.82[1]$ ,  $P=0.03$ , partial eta squared=0.12) favouring yoga intervention. There was significant interaction between time and group ( $P<0.001$ ). (Refer table-7.3 & Fig- 7.5)

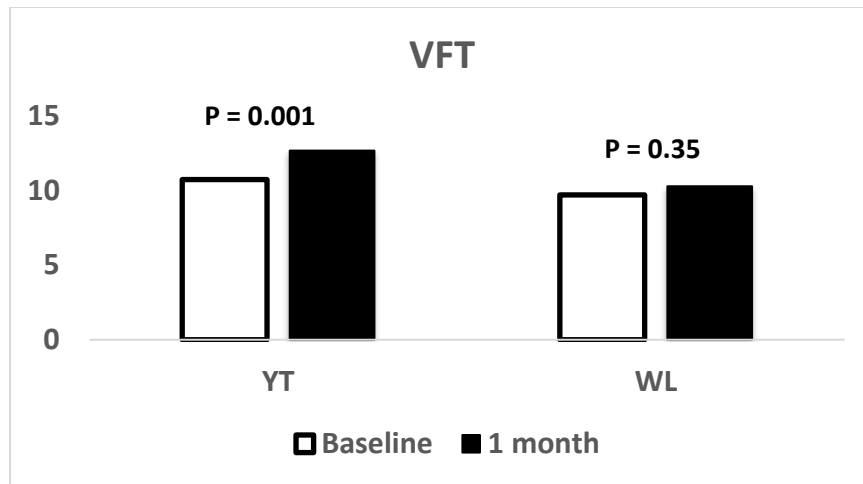
## 7.6 BCATS (NEUROPSYCHOLOGICAL ASSESSMENTS)

### *Verbal Fluency Test (VFT)*

Mean & standard deviation for the groups at baseline and after one month is given in table-7.2. Data was found to be normally distributed and Repeated Measures ANOVA (RMANOVA) was applied with time and group as within and between factors respectively. RM ANOVA showed significant increase in VFT Score over time ( $F= 10.95[1,34]$ ,  $P=0.002$ , partial eta squared=0.24) with a non-significant between group difference ( $F= 3.19[1]$ ,  $P=0.08$ , partial eta squared=0.08) favouring yoga intervention. There was significant interaction between time and group ( $P=0.08$ ). (Refer table-7.3 & Fig-7.6)



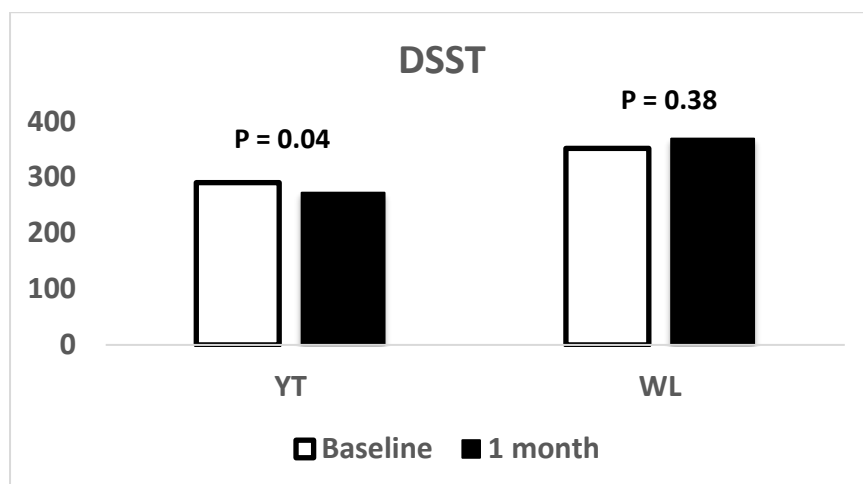
**Fig-7.5 Changes in GSDS scores (Note: P value is for paired t test )**



**Fig-7.6 Changes in VFT scores (Note: P value is for paired t test)**

***Digit symbol Substitution Test (DSST)***

Mean & standard deviation for the groups at baseline and after one month is given in table-7.2 Data was found to be normally distributed and Repeated Measures ANOVA (RMANOVA) was applied with time and group as within and between factors respectively. RM ANOVA showed a non-significant decrease in time required to complete DSST over time ( $F= 2.93[1,34]$ ,  $P=0.9$ , partial eta squared=0.01) with a significant between group difference ( $F= 5.26[1]$ ,  $P=0.02$ , partial eta squared=0.13) favouring yoga intervention. There was no significant interaction between time and group ( $P=0.09$ ). (Refer table-7.3 & Fig-7.7)



**Fig- 7.7 Changes in DSST scores (in Seconds) (Note: P value is for paired t test)**

### Colour trials test-B(CT-B)

Mean & standard deviation for the groups at baseline and after one month is given in table-7.2. Data was found to be normally distributed and Repeated Measures ANOVA (RMANOVA) was applied with time and group as within and between factors respectively. RM ANOVA showed a non-significant decrease in time required to complete colour trials B over time ( $F= 2.0[1,33]$ ,  $P=0.01$ , partial eta squared=0.05) with a significant between group difference ( $F= 9.9[1]$ ,  $P=0.003$ , partial eta squared=0.23) favouring yoga intervention. There was no significant interaction between time and group ( $P=0.2$ ). Refer table-7.3 & Fig-7.8

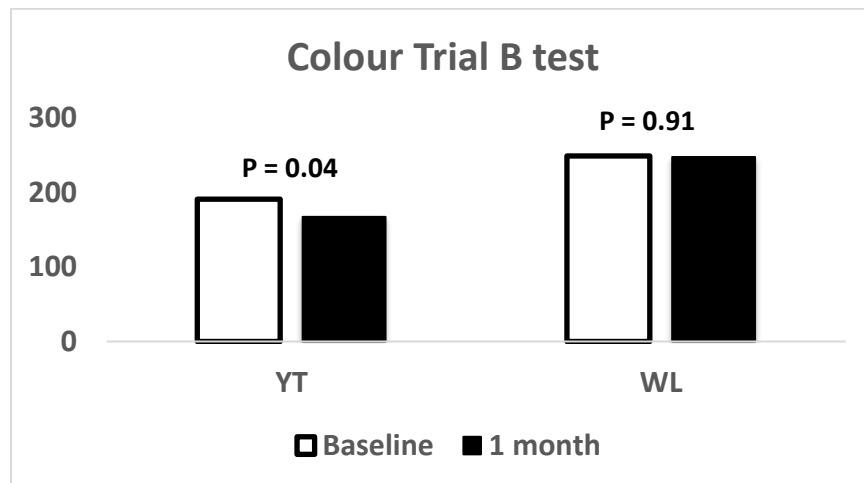


Fig-7.8 Changes in Colour Trials B scores (in Seconds)

Table-7.2 Mean and Standard deviation of outcome variables

Variables	YT(N=20)		WL(N=20)	
	Baseline Mean[SD]	1 month Mean[SD]	Baseline Mean[SD]	1 month Mean[SD]
SCCS	63.09[11.8]	88.00[10.2]	65.79[11.5]	66.14[10.5]
Total SANS	51.11[12.0]	21.17[8.3]	45.59[14.0]	43.18[13.3]
Total SAPS	31.21[13.5]	8.95[4.7]	28.59[13.6]	20.41[10.7]
GSDS	43.42[11.0]	20.63[9.2]	40.88[9.2]	35.41[8.6]
VFT	10.73[3.2]	12.68[3.4]	9.7[2.8]	10.29[2.7]
DSST	290.05[61.9]	272.15[65.8]	351.11[131.71]	368.82[150.2]
CT-B	190.72[56.5]	167.11[58.6]	248.94[81.9]	247.35[79.9]

**Table-7.3 Results of RM-ANOVA for the outcome variables**

Variables (N)	Within Group (time)		Between Group (intervention)	
	F (df <sub>time</sub> , df <sub>error</sub> )	P value	F(df)	P value
SCCS (YT-19, WL-17)	26.89[1,34]	<0.001	11.87[1]	0.002
Total SANS (YT-18, WL-17)	142.13[1,33]	<0.001	4.57[1]	0.04
Total SAPS (YT-19, WL-17)	56.73[1,34]	<0.001	1.97[1]	0.16
GSDS (YT-19, WL-17)	78.20[1,34]	<0.001	4.82[1]	0.03
VFT (YT-19, WL-17)	10.95[1,34]	0.002	3.19[1]	0.08
DSST (YT-19, WL-17)	2.93[1,34]	0.9	5.26[1]	0.02
CT-B (YT-18, WL-17)	2.0[1,33]	0.1	9.9[1]	0.003

SCCS-Social Cognition Composite Score; SANS-Scale for Assessing Negative Symptoms; SAPS-Scale for Assessing Positive Symptoms; GSDS-Groningen Social Disability Scale; VFT-Verbal Fluency Test; DSST-Digit Symbol Substitution Test; CT-B- Colour Trials B; YT-Yoga Therapy; WL-Wait List

Note: Numbers beside YT or WL represents the sample size analysed

## 7.7 MIRROR NEURON ACTIVITY(MNA)

[with fNIRS in Left ventral Pre-Motor Cortex (LvPMC)]

Mean and standard deviation of the BOLD signal for the Yoga Group, Waitlist Group and Combined (YT+WL) are given before intervention and after intervention in tables-7.4, 7.5, 7.6 respectively.

**Table- 7.4 Mean & Standard deviation of BOLD signal for yoga group before and after intervention**

Conditions	Mean	SD
Pre_Static	0.00004809	0.000373
Pre_Action_obs	-0.00002691	0.000333723
Pre_eAction_obs	-0.0000394	0.000081555
Pre_perform	0.00001087	0.000365725
Post_Static	-0.000013	0.000453122
Post_Action_obs	-0.00023327	0.000467637
Post_eAction_obs	0.00024014	0.000499206
Post_perform	0.00018185	0.000373899

**Table-7.5 Mean & Standard deviation of BOLD signal for wait-list group before and after intervention**

Conditions	Mean	SD
Pre_Static	-0.00022713	0.00038
Pre_Action_obs	-0.00016347	0.00025766
Pre_eAction_obs	0.00038109	0.000571971
Pre_perform	0.00022941	0.000553726
Post_Static	0.00005443	0.000322586
Post_Action_obs	0.00005581	0.000433092
Post_eAction_obs	0.00015522	0.000306423
Post_perform	0.00008785	0.000600126

**Table-7.6 Mean & Standard deviation of BOLD signal for yoga & wait-list group before and after intervention**

Conditions	Mean	SD
Pre_Static_overall	-0.00015906	.000370635
Pre_Action_obs_overall	-0.00012991	.000298404
Pre_eAction_obs_overall	.00014898	.000433141
Pre_perform_overall	.00012391	.000477240
Post_Static_overall	.00003419	.000363494
Post_Action_obs_overall	-.00001568	.000390869
Post_eAction_obs_overall	.00002174	.000435942
Post_perform_overall	-0.000088	0.00042

Pre-before yoga intervention; post-after yoga intervention  
 Static-observing static image; Action\_obs-observing goal directed action (video); eAction\_obs- observing emotion embedded goal directed action (video) perform- motor task performance (opening & locking the lock)

*MNA calculation*

Presence of MNA was assessed by comparing the BOLD signal elicited by viewing a static image with that of goal directed video observation with or without emotion embedding and during motor task performance (opening &

locking a lock). MNA is said to be present if the BOLD signal in observing vs Goal directed action (video), Goal directed action emotion embedded (video) and motor task performance is significantly greater than the BOLD signal elicited by observing a static image.

All the data were non-normally distributed and hence Wilcoxon sign rank test was applied for comparison.

***Yoga Group (before intervention)***

*Observing static image vs Goal directed Action observation(video):*

There was no statistically significant difference in the BOLD signal between Observing static image vs Goal directed Action observation(video) and hence no MNA was present (P=0.57)

*Observing static image vs Goal directed Action observation (emotion embedded video):*

There was no statistically significant difference in the BOLD signal between Observing static image vs Goal directed emotion embedded action observation(video) and hence no MNA was present (P=0.81)

*Observing static image vs motor task performance:*

There was no statistically significant difference in the BOLD signal between Observing static image vs motor task performance and hence no MNA was present (P=0.73)

***Yoga Group (after intervention)***

*Observing static image vs Goal directed Action observation(video):*

There was no statistically significant difference in the BOLD signal between Observing static image vs Goal directed Action observation(video) and hence no MNA was present (P=0.08). P value is closer to significance level, but in the opposite direction (static >Action\_obs)

*Observing static image vs Goal directed Action observation (emotion embedded video):*

There was no statistically significant difference in the BOLD signal between Observing static image vs Goal directed emotion embedded action observation(video) and hence no MNA was present (P=0.25)

*Observing static image vs motor task performance:*

There was no statistically significant difference in the BOLD signal between Observing static image vs motor task performance and hence no MNA was present (P=0.19)

***Wait List Group (before intervention)***

*Observing static image vs Goal directed Action observation(video):*

There was no statistically significant difference in the BOLD signal between Observing static image vs Goal directed Action observation(video) and hence no MNA was present (P=0.17)

*Observing static image vs Goal directed Action observation (emotion embedded video):*

There was statistically significant difference in the BOLD signal between Observing static image vs Goal directed emotion embedded action observation(video) and hence MNA was present (P=0.004) for this condition.

*Observing static image vs motor task performance:*

There was statistically significant difference in the BOLD signal between Observing static image vs motor task performance and hence MNA was present (P=0.006)

***Wait List Group (after intervention)***

*Observing static image vs Goal directed Action observation(video)*

There was no statistically significant difference in the BOLD signal between Observing static image vs Goal directed Action observation(video) and hence no MNA was present (P=0.56).

*Observing static image vs Goal directed Action observation (emotion embedded video)*

There was no statistically significant difference in the BOLD signal between Observing static image vs Goal directed emotion embedded action observation(video) and hence MNA was not present ( $P=0.004$ ) for this condition.

*Observing static image vs motor task performance*

There was no statistically significant difference in the BOLD signal between Observing static image vs motor task performance and hence MNA was not present ( $P=0.86$ )

***Yoga Group + Wait List Group (before intervention)***

*Observing static image vs Goal directed Action observation(video)*

There was no statistically significant difference in the BOLD signal between Observing static image vs Goal directed Action observation(video) and hence no MNA was present ( $P=0.6$ ).

*Observing static image vs Goal directed Action observation (emotion embedded video)*

There was statistically significant difference in the BOLD signal between Observing static image vs Goal directed emotion embedded action observation(video) and hence MNA was present ( $P=0.01$ ) for this condition.

*Observing static image vs motor task performance*

There was statistically significant difference in the BOLD signal between Observing static image vs motor task performance and hence MNA was present ( $P=0.01$ )

***Yoga Group + Wait List Group (after intervention)***

*Observing static image vs Goal directed Action observation(video)*

There was no statistically significant difference in the BOLD signal between Observing static image vs Goal directed Action observation(video) and hence no MNA was present ( $P=0.87$ ).

*Observing static image vs Goal directed Action observation (emotion embedded video)*

There was no statistically significant difference in the BOLD signal between Observing static image vs Goal directed emotion embedded action observation(video) and hence no MNA was present (P=0.44) for this condition.

*Observing static image vs motor task(performance)*

There was no statistically significant difference in the BOLD signal between Observing static image vs motor task performance and hence no MNA was present (P=0.49)

**Table-7.7 Wilcoxon Sign Rank test for Yoga Group**

Conditions	N	P
Pre_Static-Action_obs	15	0.57
Pre_Static-eAction_obs	12	0.81
Pre_Static-perform	14	0.73
Post_Static-Action_obs	15	0.08
Post_Static-eAction_obs	16	0.25
Post_Static-perform	16	0.19

Static-observing static image; Action\_obs-observing goal directed action (video) eAction\_obs- observing emotion embedded goal directed action (video) perform- motor task performance (opening & locking the lock)

**Table-7.8 Wilcoxon Sign Rank test for Wait-List Control Group**

Conditions	N	P
Pre_Static-Action_obs	15	0.17
Pre_Static-eAction_obs	16	0.004
Pre_Static-perform	15	0.006
Post_Static-Action_obs	16	0.56
Post_Static-eAction_obs	14	0.43
Post_Static-perform	15	0.86

**Table-7.9 Wilcoxon Sign Rank test for Yoga & Wait-List Control Group together**

Conditions	N	P
Pre_Static-Action_obs_overall	30	0.6
Pre_Static-eAction_obs_overall	28	0.01
Pre_Static-perform_overall	29	0.01
Post_Static-Action_obs_overall	29	0.87
Post_Static-eAction_obs_overall	28	0.44
Post_Static-perform_overall	29	0.49

## **7.8 COMPARISON OF MNA BETWEEN BEFORE AND AFTER YOGA INTERVENTION**

As there was no MNA detected for majority of the contrast, further analysis of comparing the MNA between before and after yoga was not done.