# CHAPTER 5

# RESULTS

## 5.1. Qualitative Results

### 5.1.1. Observations by therapists and parents

The yoga intervention took place over a period of two years between June and March, with a gap of 2 months summer holidays (April and May). There were minor interruptions during the regular school days, such as holidays and sudden closure of the school for some reasons. Unique feature of the study is that there was no dropout.

This section presents the results of the assessments done, using the test battery mentioned in Table 5. The behavioural parameters selected for the study were Eye to Eye Gaze (EEG), Sitting Tolerance (ST), Body Posture (BP), Body Awareness (BA), Depth Perception and Balance (DPB), Imitation (IM), Repetitive Self-stimulatory and Self-injurious Behaviour (RSB), Receptive Skills Related to Special Relationships (RSSR). During a pilot study done by the researcher (Radhakrishna S, 2006 [63]) obvious changes in the Imitation (IM) and Repetitive Self-stimulatory and Self-injurious Behavior (RSB) were noted. An in-depth study of these behaviours was carried out by administering a modified IM and RSB Battery with sub scale given in Table 5 (checklist 2 and 3). IAYT effects are examined in relation to a wide range of behaviors mentioned above. Analyses are descriptive because of the small sample size. Qualitative baseline data for both yoga and non-yoga group is given in the Table 8.

**Table 8: Qualitative Baseline Data for both Yoga and Non-Yoga Group**

- All displayed poor eye contact and sitting tolerance.
- All displayed poor balance and awkward body posture.
- None could identify or point to their own body parts.
- None could climb stairs without falling.
- All displayed poor imitation skills.
- All displayed object, body and hand stereotypes such as body rocking, hand flapping and twiddling sticks.
- All displayed self-injurious behavior such as hitting and biting self, pulling hairs.

All displayed poor receptive skills related to spatial relationships

The core behavior characteristics addressed in the research was a significant issue for parents and staff. From the parental perspective, lack of eye contact, hyperactivity, resistance to change (a child exhibited high resistance by head banging and other self injurious behavior when there was slight change in the color of the clothes that he wore, food and place. He insisted on the same clothes, same food and same classroom), was something they found particularly difficult to cope with. From the staff perspective, more emphasis was placed on the lack of eye contact to gain attention, lack of imitation skill, poor sitting tolerance and temper tantrums, as this was likely to have a negative impact on their learning.

By the end of the research substantial qualitative changes were reported by the parents and the class – teachers in response to the questionnaire given and is given in Table 9.

**Table 9: Qualitative post Data for Yoga Group**

- All displayed good eye contact and sitting tolerance.
- All displayed better balance and improved body posture.
- All could identify and point to their own body parts.
- All could climb stairs without falling.
- All displayed better imitation skills.
- None displayed object, body and hand stereotypes such as body rocking, hand flapping and twiddling sticks in classroom situation.
- None displayed self-injurious behavior such as hitting and biting self, pulling hairs in classroom situation.
- All displayed good receptive skills related to spatial relationships.

According to parents and teachers children started responding to their names when called, could respond to their names by raising hands during attendance and look at the person during conversation. Parents could take children to social functions where they could sit for some time and teachers report that children could sit in the classroom for 45 minutes at length. Body posture and balance improved to such an extent that strangers could not make out that they are autistic by the way they walk. Parents also reported that they could play games with their peers imitating the action of other children. There was a reduction in the stereotyped repetitive restricted behavior in terms of not becoming anxious when there is a change in the routine. Hand biting and head banging behaviors reduced dramatically and parents felt comfortable to handle children.

## 5.2 Quantitative Results

Many behaviors emerged during IAYT and in the classroom, in the experimental group, which were consistent with the response given by staff and parents during initial interviews.

In the initial 12 sessions there was no observable change in the eye-to-eye gaze, sitting tolerance and imitation skills. As the number of sessions increased, subtle changes in behavior were reported and recorded by observers and parents.

### 5.2.1. Eye to Eye Gaze

Graph 1 and table 10 demonstrates changes in the eye gaze from base to mid and post sessions. During midsession, observable behavioral changes were seen in eye-to-eye gaze (by training the eyes to stay focused on an object such as lighted candle, focus circle or color mat). By the end of the yoga intervention, all the participants would look at the person or object with a steady gaze. Children started focusing on the yoga therapist as she gave counts with a drumbeat. Children also started responding their names by looking at the person calling them.

**Graph 1**

**Change in Eye to Eye Gaze at pre, mid and post of yoga and non-yoga group**

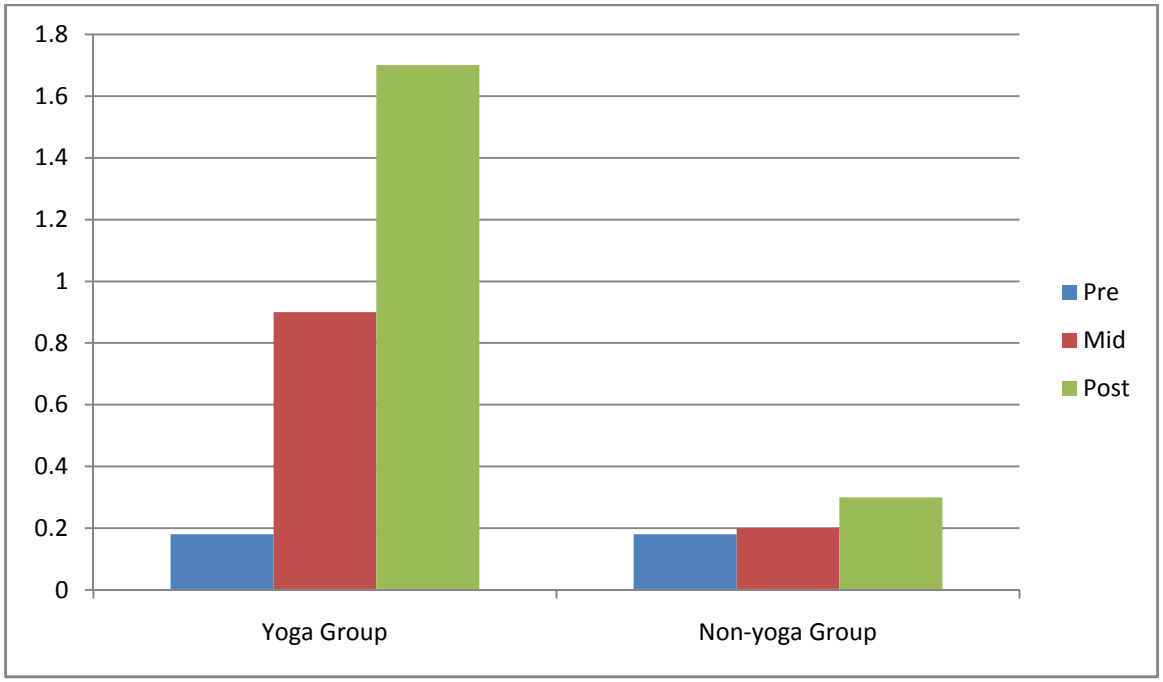

**Table 10**

**Percentage of change in Eye to Eye Gaze from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Eye to Eye Gaze | Baseline | Mid | % change | Post | % change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.17 | 0.9 | 429 | 1.75 | 94.44 | 929 |
| Non-Yoga Group | 0.17 | 0.25 | 47.05 | 0.3 | 20 | 76.47 |

### 5.2.2. Sitting Tolerance

Graph 2 and Table 11 demonstrate changes in the sitting tolerance from base to mid and post sessions. At baseline, participants' sitting tolerance was very poor (less than 5 min). By midsession, they could sit in vajrasana for a period of 10 min. and by the end of the yoga intervention, they could complete the yoga session of one hour. Class teacher reported reduction in requests for breaks during the period by the participants. All six children in yoga group were enjoying 30 to 45 minutes of IAYT therapy. During this period they all displayed increased intention to remain in close proximity to the therapist and could participate in performing most of the asanas and breathing exercises.

**Graph 2**

**Change in Sitting Tolerance at pre, mid and post of yoga and non-yoga group**

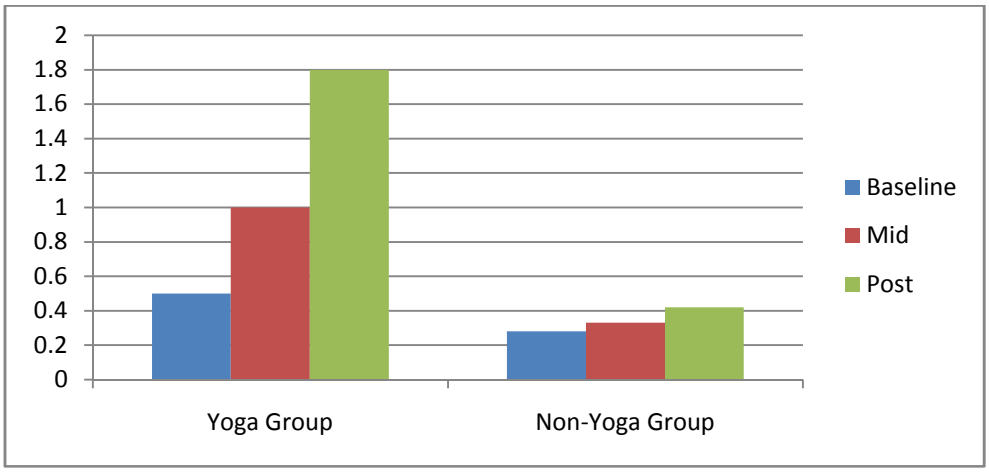

**Table 11**

**Percentage of change in Sitting Tolerance from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Sitting Tolerance | Baseline | Mid | % change | Post | % change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.5 | 1 | 100 | 1.8 | 80 | 260 |
| Non-Yoga Group | 0.25 | 0.33 | 32 | 0.40 | 21.21 | 60 |

### 5.2.3. Body Posture

Graph 3 and Table 12 demonstrate changes in the body posture from base to mid and post sessions. At baseline, children were awkward and clumsy in appearance. They had difficulty in walking, throwing, kicking, running and jogging. By midsession there was an appreciable change in their walking and posture and by the end of the yoga intervention, their body posture was normal. As reported by parents, strangers could not make out that they are differently abled.

**Graph 3**

**Change in Body Pasture at pre, mid and post of yoga and non-yoga group**

**Table 12**

**Percentage of change in Body Pasture from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Body Posture | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.5 | 1 | 100 | 1.75 | 75 | 250 |
| Non-Yoga Group | 0.4 | 0.41 | 2.5 | 0.50 | 21.95 | 25 |

### 5.2.4. Body Awareness

Graph 4 and Table 13 demonstrate changes in the body awareness from base to mid and post sessions. At baseline, children could not identify or point to their body parts in response to verbal request. By the end of the intervention, all the participants in the yoga group identified and pointed to their own body parts as well as pictures.

**Graph 4**

**Change in Body Awareness at pre, mid and post of yoga and non-yoga groups**

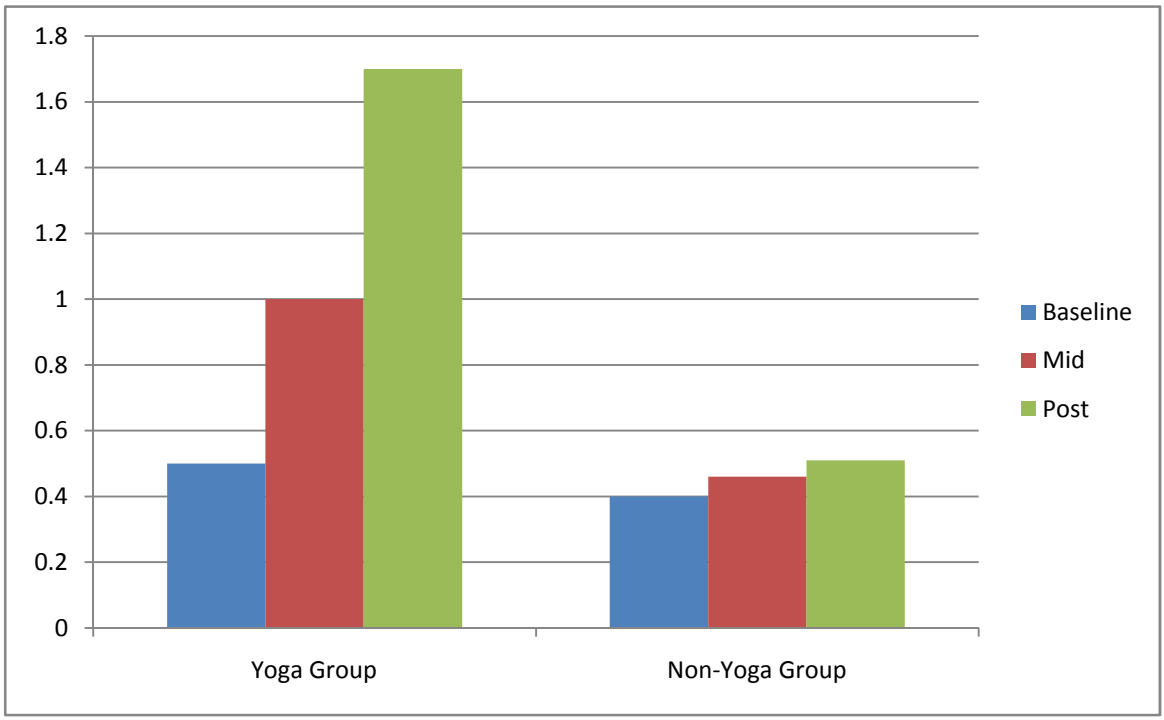

**Table 13**

**Percentage of change in Body Awareness from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Body Awareness | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.17 | 0.6 | 252.94 | 1.75 | 191.66 | 929.41 |
| Non-Yoga Group | 0.17 | 0.17 | 0 | 0.17 | 0 | 0 |

### 5.2.5. Depth Perception and Balance

Graph 5 and Table 14 demonstrate changes in the body awareness from base to mid and post sessions. At baseline, children could not climb and get down the stairs without any assistance, displayed fear of climbing spiral ladder, chair or bench. By the end of yoga intervention, these behaviors disappeared.

**Graph 5**

**Change in Depth Perception and Balance at pre, mid and post of yoga and non-yoga group**

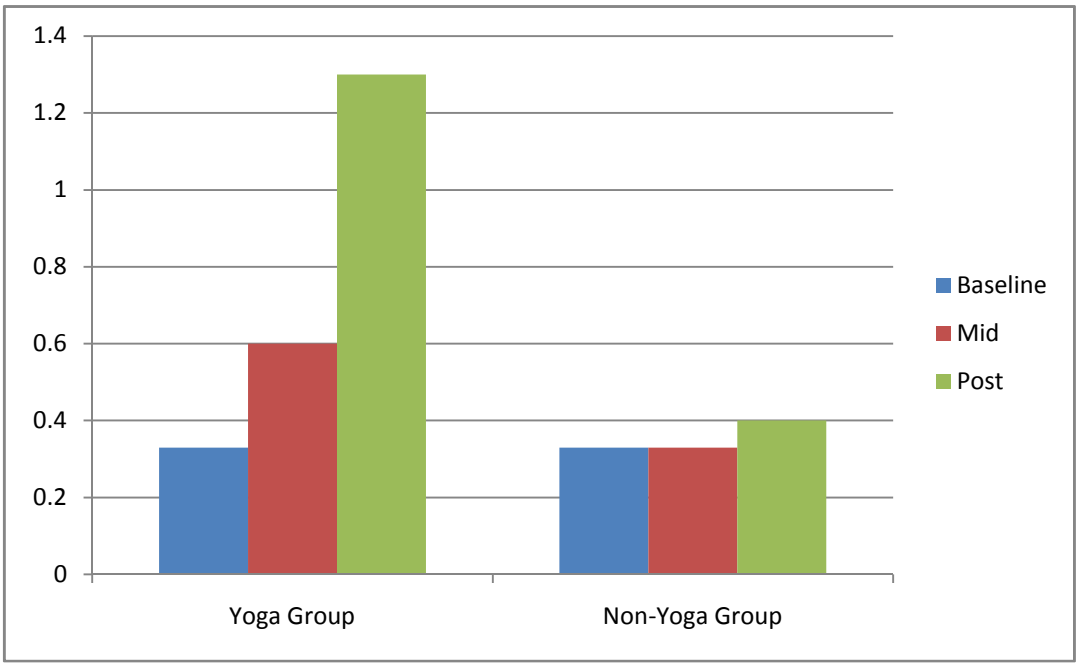

**Table 14**

**Percentage of change in Depth Perception and Balance from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Depth Perception and Balance | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.33 | 0.6 | 81.82 | 1.3 | 116.67 | 293.93 |
| Non-Yoga Group | 0.33 | 0.33 | 0 | 0.4 | 21.21 | 21.21 |

### 5.2.6. Imitation Skills

Graph 6 to 11 and Table 15 to 20 demonstrate changes in the imitation skills from base to mid and post sessions. At baseline, children never imitated gross motor action, vocalizations, two phase complex movements, or oral facial movements. They could not imitate adult "breathing in and breathing out" model. By the end of the yoga intervention, there was a dramatic change in the imitation behavior in the yoga group. Children could run, walk in a line, imitate a "two to three phase" action, exhibited increased vocal imitation skills by imitating vowels "a, e, i o, u" and "OM". As the vocalization improved, their social interaction showed significant improvements. Children could greet the therapist with a smile and vocalize the word **"namasthe"** (with folded hands) and they could verbalize **"om shanthi"** (let there be peace) at the end of the therapy session. Those who were not aware of their breath gradually learnt to breathe in and breathe out and also deepen their breathing. Hand held mirrors, blowing toy materials, candles, soap bubbles, straw to drink water etc., were used at this stage. A noticeable change in the breathing pattern (slower and quieter) was seen in the last few sessions. During slow mantra chanting, there was an appreciable increase in the imitation skills of oral-facial movements. Efforts were made to make yoga a fun. For example: during tiger breathing children smiled or roared and imitated the therapist. During Sarvangasana the teacher blew candles and children enjoyed and imitated her. During the post sessions, a significant change in communication, language, play and joint attention was seen in the yoga group. Initially mothers manually guided the child to imitate the movement. Slowly,

manual manipulation decreased and children started imitating complex motor movements spontaneously.

**Graph 6**

**Change in Imitation Skills at pre, mid and post of yoga and non-yoga group**

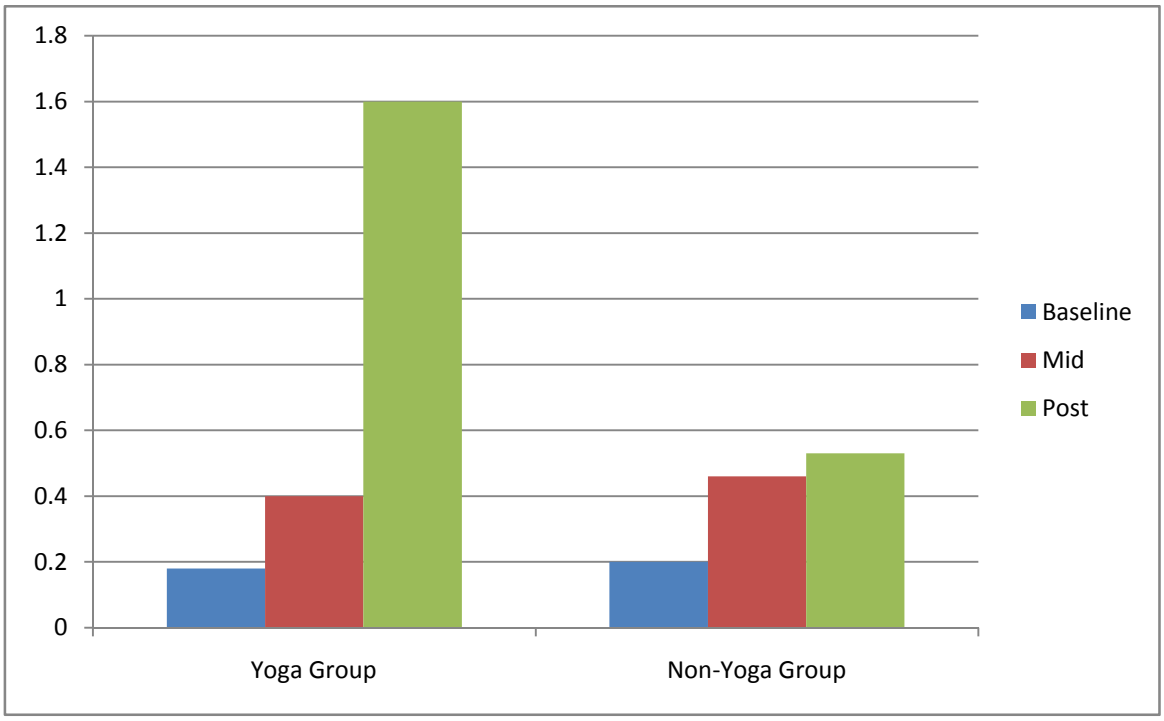


**Table 15**

**Percentage of change in Imitation Skills from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Imitation Skills | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.17 | 0.4 | 135.29 | 1.6 | 300 | 841.17 |
| Non-Yoga Group | 0.25 | 0.41 | 64 | 0.5 | 21.95 | 100 |

**Graph 7**

**Change in Imitating Gross Motor Action (IGMA) at pre, mid and post of yoga and non-yoga group**

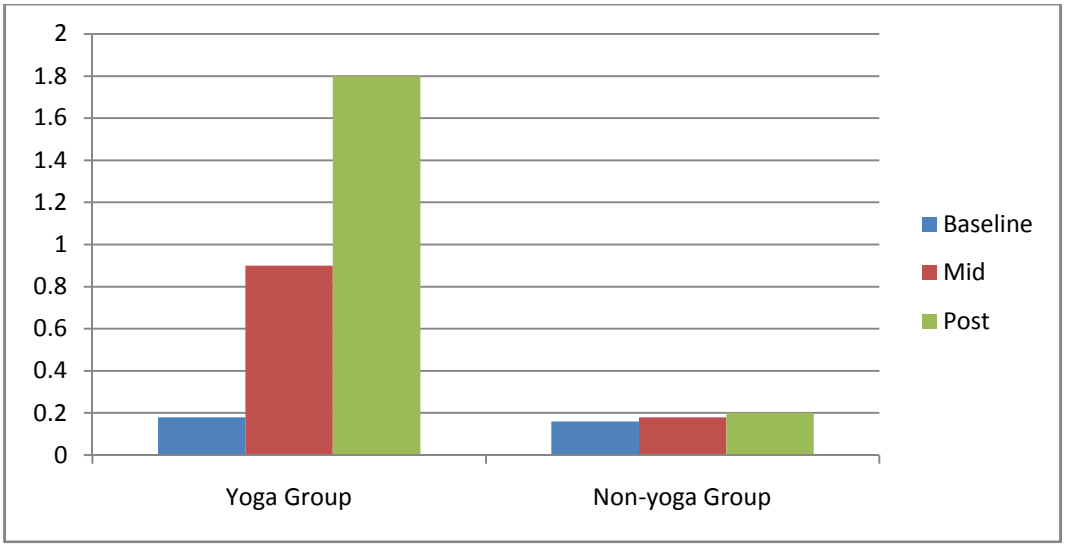


**Table16**

**Percentage of change in Imitating Gross Motor Action (IGMA) from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Imitating Gross Motor Action (IGMA) | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.18 | 0.9 | 400 | 1.8 | 100 | 900 |
| Non-Yoga Group | 0.16 | 0.18 | 12.5 | 0.2 | 11.11 | 25 |

**Graph 8**

**Change in Imitating Vocalization (IV) at pre, mid and post of yoga and non-yoga group**

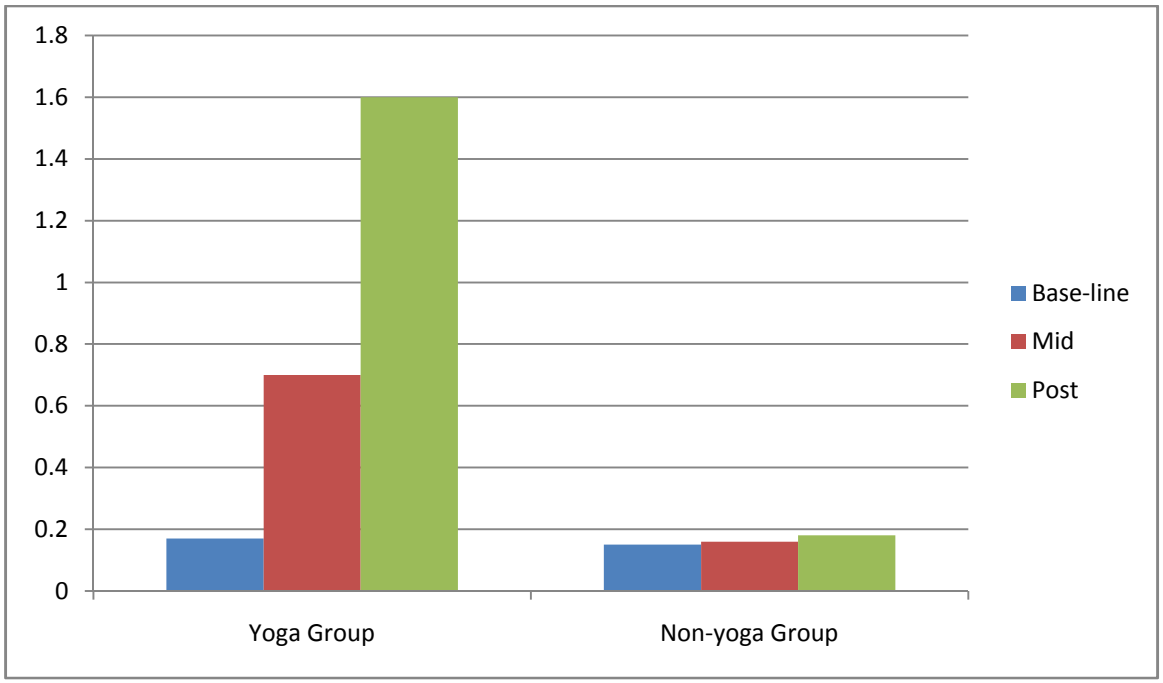


**Table 17**

**Percentage of change in Imitating Vocalization (IV) from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Imitating Vocalization (IV) | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.17 | 0.7 | 311.76 | 1.6 | 128.57 | 841.17 |
| Non-Yoga Group | 0.15 | 0.16 | 6.6 | 0.18 | 12.5 | 20 |

**Graph 9**

**Change in Imitating Complex Motor Action (ICMA) at pre, mid and post of yoga and non-yoga group**

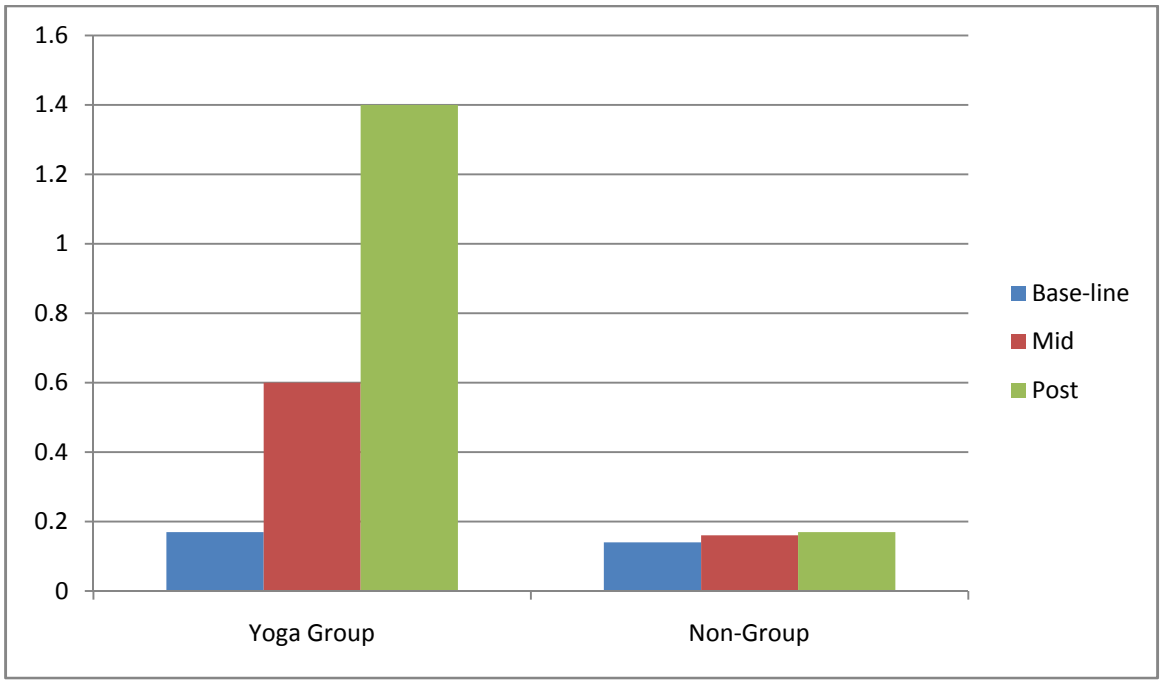


**Table 18**

**Percentage of change in Imitating Complex Motor Action (ICMA) from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Imitating Complex Motor Action (ICMA) | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.17 | 0.6 | 252.94 | 1.4 | 133.33 | 723.52 |
| Non-Yoga Group | 0.14 | 0.16 | 14.28 | 0.17 | 6.25 | 21.42 |

**Graph 10**

**Change in Imitating Oral Facial Movements (IOFM) at pre, mid and post of yoga and non-yoga group**

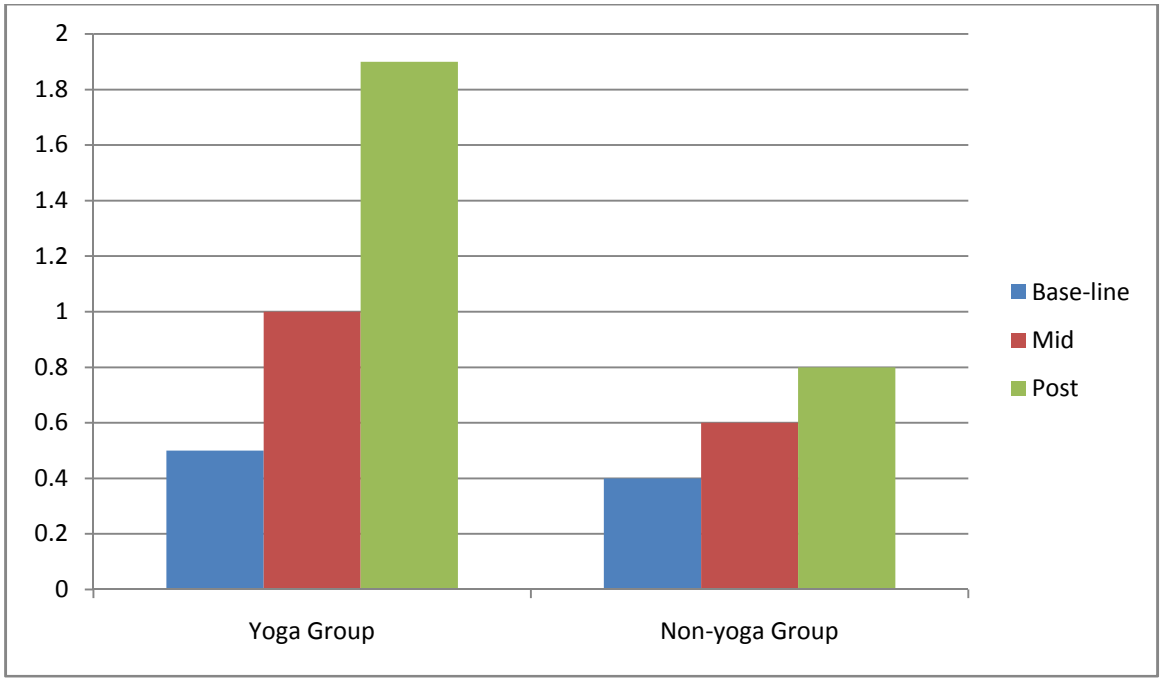


**Table 19**

**Percentage of change in Imitating Oral Facial Movements (IOFM) from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Imitating Oral Facial Movements (IOFM) | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.5 | 1 | 100 | 1.9 | 90 | 280 |
| Non-Yoga Group | 0.4 | 0.6 | 50 | 0.8 | 33.33 | 100 |

**Graph 11**

**Change in Imitating Breathing Exercises (IBE) at pre, mid and post of yoga and non-yoga group**

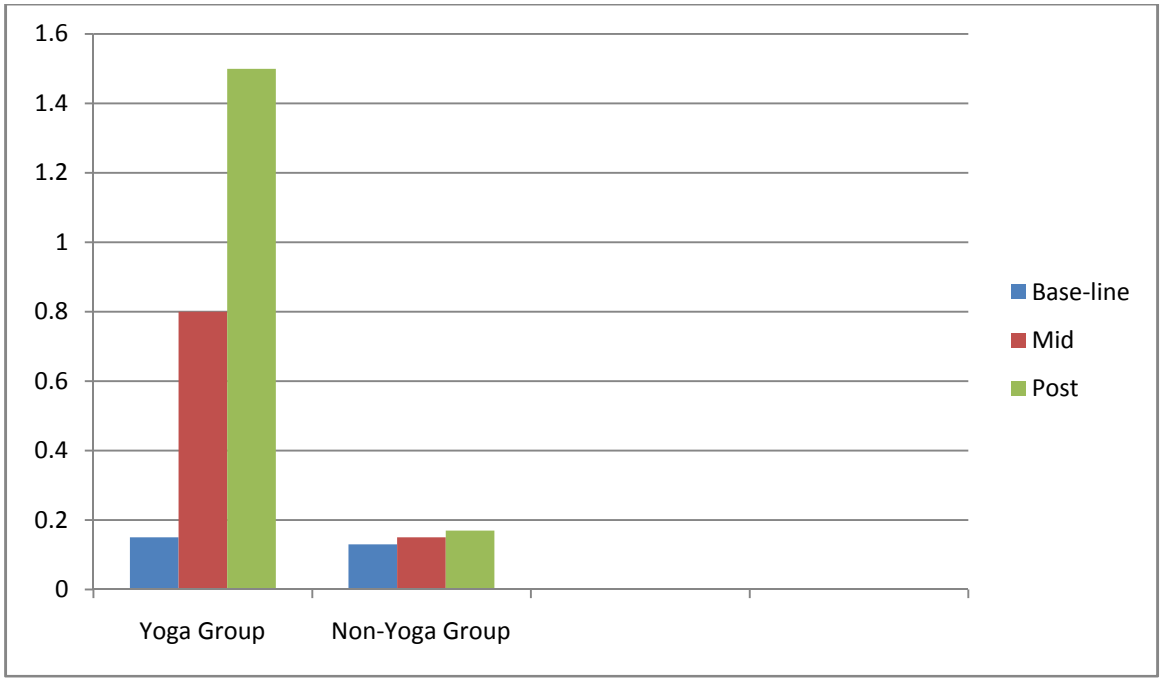


**Table 20**

**Percentage of change in Imitating Breathing Exercises (IBE) from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Imitating Breathing Exercises (IBE) | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.15 | 0.8 | 433.33 | 1.5 | 87.5 | 900 |
| Non-Yoga Group | 0.13 | 0.15 | 15.38 | 0.17 | 13.33 | 30.76 |

### 5.2.7. Self Stimulatory Behavior

Graph 12 and Table 21 demonstrate changes in the self stimulatory behavior from base to mid and post sessions. At baseline, participants in both groups demonstrated body rocking, hand flapping, turning in circles and twidling objects. By the end of the yoga intervention, these behaviors disappeared in the classroom. Children who sought to sit out

of the mat, spin or jump on the mat in the initial sessions, demonstrated discipline by sitting in *vajrasana* whenever a gentle touch was given on their lower back. With this decreased RSB in the therapeutic sessions, we could move on to use additional inputs from peer model. Children started looking at peer models resulting in higher control over their RSB.

**Graph 12**

**Change in Self Stimulatory Behavior at pre, mid and post of yoga and non-yoga groups**

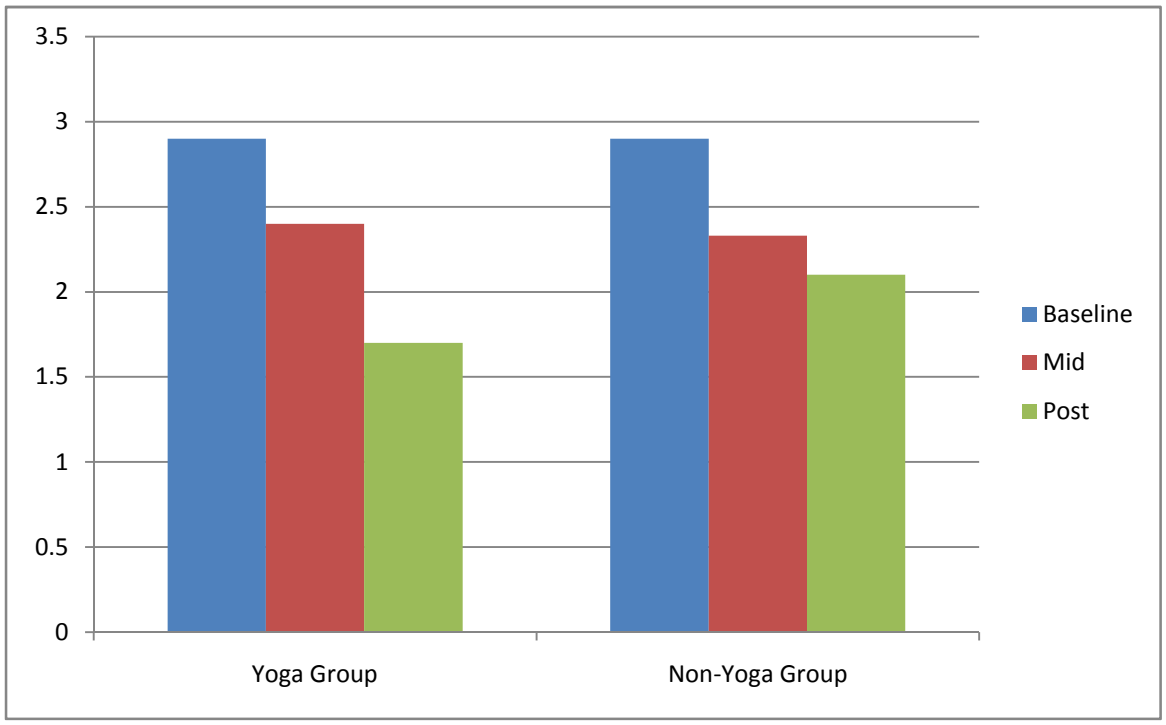


**Table 21**

**Percentage of change in Self Stimulatory Behavior from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Self Stimulatory Behavior | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 2.9 | 2.4 | 17.24 | 1.75 | 27.08 | 39.65 |
| Non-Yoga Group | 2.9 | 2.33 | 19.66 | 2.1 | 9.87 | 27.58 |

### 5.2.8. Self Injurious Behavior

Graph 13 and Table 22 demonstrate changes in the self injurious behavior from base to mid and post sessions. At baseline, participants in both groups demonstrated self injurious behavior like hitting head, hitting self against a surface, biting self and pulling hair. By the end of the yoga intervention, these behaviors were not observed in the classroom.

**Graph 13**

**Change in Self Injurious Behavior at pre, mid and post of yoga and non-yoga group**

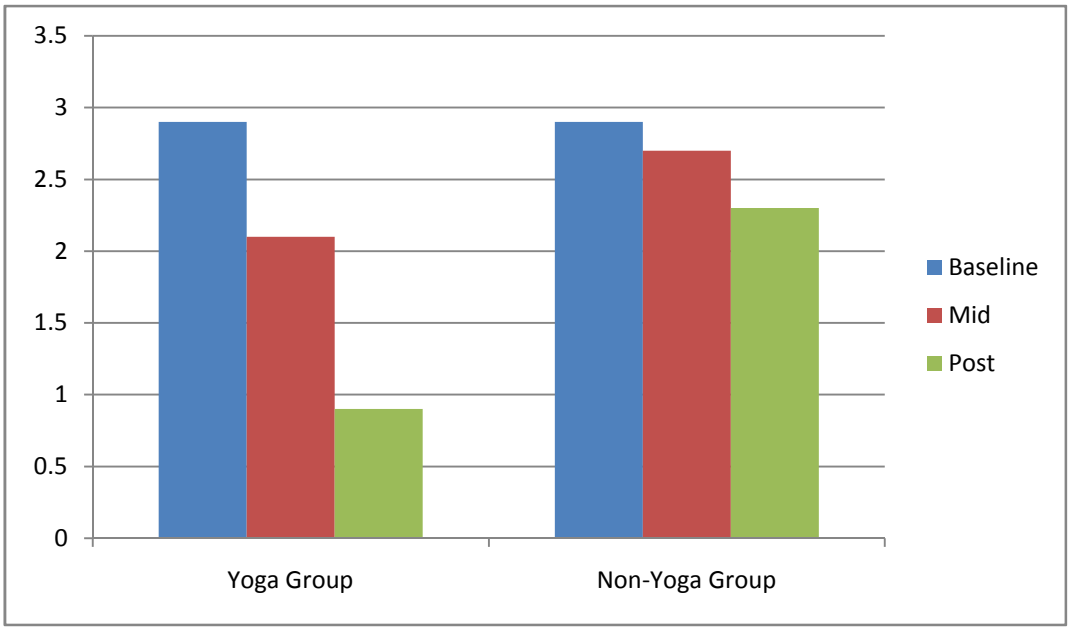


**Table 22**

**Percentage of change in Self Injurious Behavior from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Self Injurious Behavior | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 2.9 | 2.1 | 27.87 | 0.9 | 57.14 | 68.96 |
| Non-Yoga Group | 2.9 | 2.33 | 6.90 | 2.1 | 14.81 | 27.58 |

### 5.2.9 Restricted Behavior

Graph 14 and Table 23 demonstrate changes in the restricted behavior from base to mid and post sessions. At baseline, participants in both groups demonstrated pre-occupation with one activity (e.g. Lining cars obsession with tearing paper etc,), strongly attached to one teacher and fascination to things that move. By the end of the yoga intervention, these behaviors disappeared in the classroom. Children managed to work with other teachers fascination to moving objects reduced and they could play with different materials.

**Graph 14**

**Change in Restricted Behavior at pre, mid and post of yoga and non-yoga group**

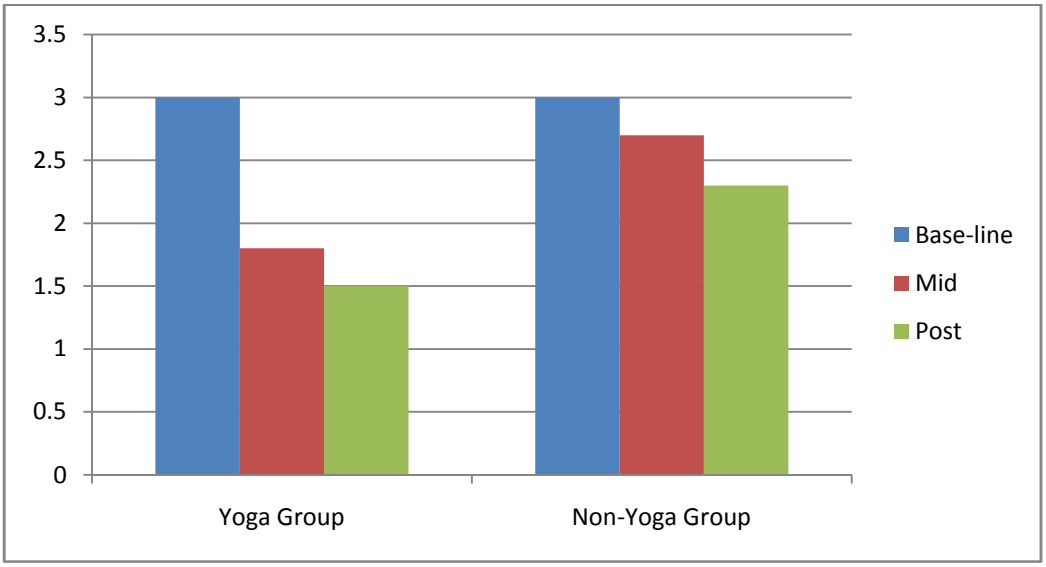


**Table 23**

**Percentage of change in Restricted Behavior from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Restricted Behavior | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 3 | 1.8 | 40 | 1.5 | 16.66 | 50 |
| Non-Yoga Group | 3 | 2.7 | 10 | 2.3 | 14.81 | 23.33 |

### 5.2.10. Sameness Behavior

Graph 15 and Table 24 demonstrate changes in the sameness behavior from base to mid and post sessions. At baseline, participants in both groups' insisted that things remain in the same place (for e.g. furniture in the home, chair in the classroom etc.), insisted to sit in the same place, disliked changes in dress (same uniform all days), difficulty with transition from one activity to other, insisted walking on the same route from school to home etc. By the end of the yoga intervention, these behaviors reduced. Parents reported that they are in a better position to handle the day today affairs.

**Graph 15**

**Change in Sameness Behavior at pre, mid and post of yoga and non-yoga group**

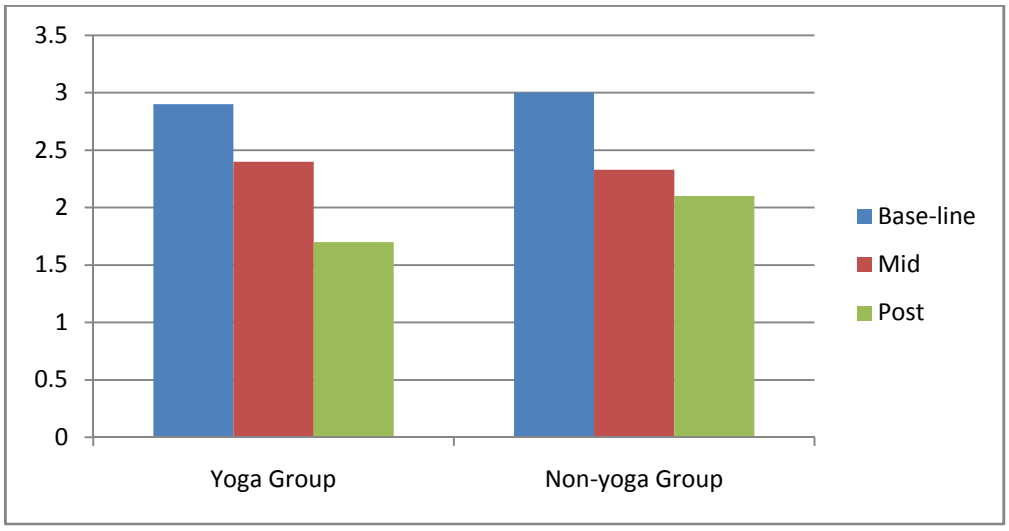


**Table 24**

**Percentage of change in Sameness Behavior from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Sameness Behavior | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 3 | 2.4 | 20 | 1.7 | 29.19 | 43.33 |
| Non-Yoga Group | 3 | 2.33 | 22.33 | 2.1 | 9.87 | 30 |

### 5.2.11. Repetitive Behavior

Graph 16 and Table 25 demonstrate changes in the repetitive behavior from base to mid and post sessions. At baseline, participants in both demonstrated repetition of words, sentences and even events. They simply repeated the question asked (for e.g. what is your name? is repeated instead of giving name.) By the end of the yoga intervention, this behavior was not seen in the school situation. However, Parents reported moderate reduction in this behavior at home and other situations.

**Graph 16**

**Change in Repetitive Behavior at pre, mid and post of yoga and non-yoga group**

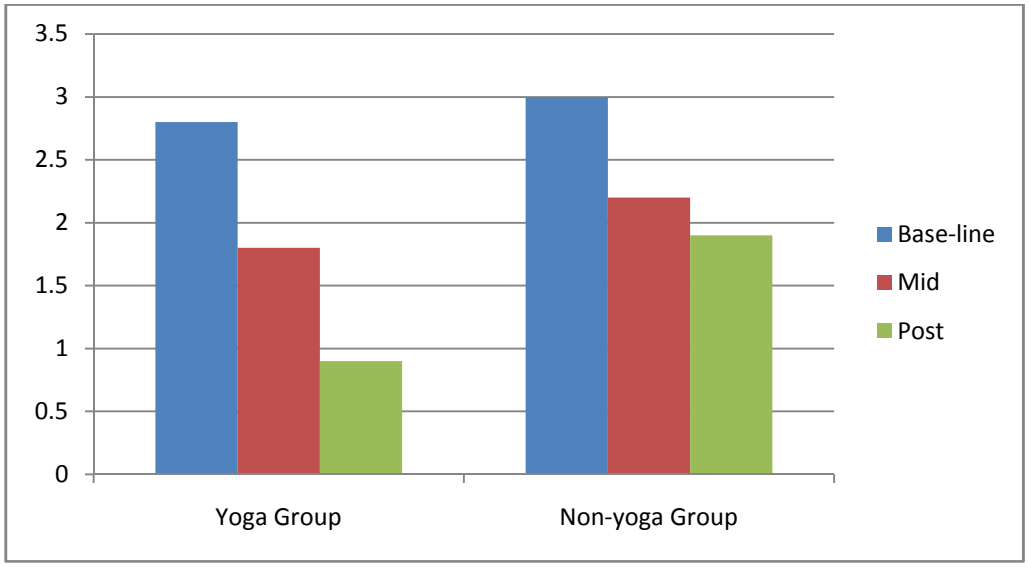


**Table 25**

**Percentage of change in Repetitive Behavior from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Repetitive Behavior | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 2.8 | 1.8 | 35.71 | 0.9 | 50 | 67.85 |
| Non-Yoga Group | 3 | 2.2 | 26.66 | 1.9 | 13.63 | 36.66 |

### 5.2.12. Receptive Skills regarding Spatial Relation

Graph 17 and Table 26 demonstrate changes in the receptive skills regarding spatial relation from base to mid and post sessions. At baseline participants in both groups demonstrated difficulty in understanding verbal commands such as turn right, left, down, up, below, under, back, front etc…While performing *trikonoasana* (triangle position) and *uttanasana,* Class teachers reported difficulty in drawing simple lines. By the end of the yoga intervention, all the participants demonstrated an understanding of the above commands and class teachers reported commencement of the basics of writing skill.

**Graph 17**
**Change in Receptive Skills regarding Spatial Relation at pre, mid and post of yoga and non-yoga group**

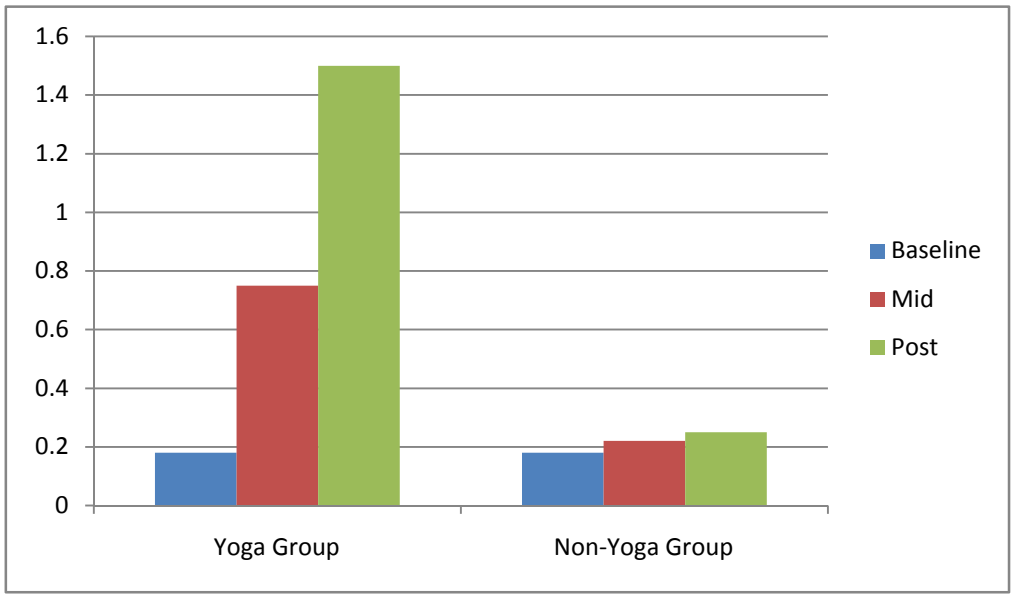


**Table 26**
**Percentage of change in Receptive Skills regarding Spatial Relation from Baseline – Mid – Post Yoga and Non-Yoga Group**

| Receptive Skills regarding Spatial Relation | Baseline | Mid | % Change | Post | % Change | % change from base-line to Post |
|---|---|---|---|---|---|---|
| Yoga Group | 0.17 | 0.75 | 341.17 | 1.5 | 100 | 782.35 |
| Non-Yoga Group | 0.17 | 0.25 | 47.05 | 0.25 | 0 | 47.05 |

### 5.2.13. Other Behavior Changes

During the post assessment session children demonstrated certain observable behavior change such as enjoying the proximity of adults. Those who could not connect with the therapist started coming closer to the therapist when continuous chanting of mantras took place. They seemed to have fun with chants, as it encouraged a sense of rhythm and a means to work on co-ordination.

A gentle touch or pressure gave them a different experience and the mother could use tactile stimulus to help them learn to control head banging behavior. The child started enjoying and developed interest in the therapy sessions because of this change in the perceptual dynamics. Consequently, all children started to display early shared attention behaviors such as looking at the peers, making eye contact with the therapist, offering no resistance to the therapist to guide their hand movements. All the six children in the yoga group started to indicate their preferences for asanas for e.g.: Shavasana (corpse pose), Parvathasana (mountain pose), a progressive change indicating needs. They progressed from the early resistance to passive tolerance to active participation and enjoying the therapy sessions. Over the course of yoga therapy children started to trust, share, initiate and reciprocate.

Children could indicate their basic needs better by using gestures. They reported improvement in their ability to interact with other members of the family and other children during play situation and increased sitting tolerance during all activities including feeding, playing, watching TV etc.

No significant changes were seen in any of the domains discussed above in the control group as reported by the special educators of the three schools.