



Original Article

## Effectiveness of Early Low Intensity Multifaceted Autism Intervention (ELIMA) for Preschool Children with Autistic Spectrum Disorder

Dr Abhinav Chandran<sup>1</sup>, Dr Neethu P S<sup>2</sup>

<sup>1,2</sup>Assistant professor, Department of paediatrics, Dr Moopens Medical College Meppadi, Wayanad, Kerala, India

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### Corresponding Author:

**Dr Neethu P S**

Assistant professor, Department of paediatrics, Dr Moopens Medical College Meppadi, Wayanad, Kerala, India

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### ABSTRACT

**INTRODUCTION:** Autism Spectrum Disorder (ASD) is a life-long neurodevelopment disorder characterized by impairments in social interaction, verbal and non-verbal communication, and a restricted repetition of activities and interests. Many international studies have proven the efficacy of developmental interventions and have recommended such interventions as an integral part of the treatment of children with ASD. Majority of these interventions are high in their intensity (mean of 30 hours per week). The current study aimed to evaluate the effectiveness of a low intensity intervention over 12 months in children belonging to the age group of 2 to 6 years diagnosed with autism.

**OBJECTIVES:** To assess the outcome of Early Low Intensity Multifaceted Autism Intervention (ELIMA) program on Autistic symptoms and Developmental domains

**METHODOLOGY:** This was a prospective observational study, done in the Child Development Centre, Pushpagiri Institute of medical sciences, Thiruvalla, Kerala during December 2017 to May 2019. Sample size was 32 and children between 2 – 6 years diagnosed with ASD, enrolled for treatment program in CDC were studied. They were initially assessed by CARS (Childhood Autism Rating Scale). Their developmental quotient in each developmental domain (gross motor, fine motor, personal social) was found out using DDST (Denver Developmental Screening Test). Receptive language quotient and expressive language quotient was found out using REELS (Receptive – Expressive Emergent Language Scale). These children were followed throughout the ELIMA program. After 12 months of therapy each of them was reassessed using the same tools. Scores before and after the intervention was entered in MS excel and analysis was done using SPSS software. Test of significance used to calculate p value was Wilcoxon Signed rank test.

**RESULTS:** Each child received an average 5.89 hours of intervention per week for 12 months. Their mean CARS score reduced from 35.55(SD- 1.69) to 31.7(SD-1.91) after 12 months of therapy and the significance was high ( $p < 0.001$ ). This significant decrease in scores suggests that there is significant reduction in severity of autism symptoms in the subjects. There was statistically significant improvement in all the development domains ( $p < 0.001$ ). Compared to motor domains it is found that the rate of improvement is more in personal social and language domains.

**CONCLUSION:** Early low Intensity Multifaceted Autism Intervention – ELIMA, reduces the severity of autism in children between 2 and 6 years significantly. This intervention program also helps in significant improvement of all the four developmental domains, in children with ASD.

**Keywords:** Autism; Early Intervention; Effectiveness, low intensity interventions

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### INTRODUCTION

Autism Spectrum Disorder (ASD) is a life-long neurodevelopmental disorder characterized by impairments in social interaction, verbal and non-verbal communication, and a restricted repetition of activities and interests. Previously described disorders such as early infantile autism, childhood autism, Kanner autism, atypical autism, Asperger disorder and pervasive developmental disorder, all come under the Autism Spectrum Disorders<sup>1</sup>.

ASD poses a serious developmental disadvantage to the child in the form of poor schooling, social function and productivity. Prevalence of ASD is rising world wide, both in developed as well as developing nations. Recent INCLIN (International Clinical Epidemiology Network) study suggest the prevalence of autism in India is between 0.4 and 1.2 %<sup>2</sup>. The average age of diagnosis of ASD in India is around 3–6 years and a time delay of 2 years from symptom recognition to treatment initiation is observed<sup>3</sup>.

There is no known cure or universally accepted intervention approach for ASD. However, the idea that early intervention is critical to improve long-term outcomes is widely accepted<sup>4-6</sup>. Many international studies have proven the efficacy of developmental interventions and have recommended such interventions as an integral part of the treatment of children with ASD<sup>7,8</sup>. Majority of these interventions are high in their intensity (mean of 30 hours per week) and of long duration compared to low intensity interventions (mean of 12 hours per week). More recent studies have documented that low intensity interventions in preschool children with autism can bring about reasonable improvement<sup>9</sup>.

The current study aimed to evaluate the effectiveness of an low intensity intervention over 12 months in children belonging to the age group of 2 to 6 years diagnosed with autism.

## METHODOLOGY

This prospective observational study was conducted at the Child Development Centre, Department of Pediatrics, Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla, Kerala. Children aged 2–6 years diagnosed with Autism Spectrum Disorder (ASD) and enrolled in the centre's therapy program between December 2017 and May 2018 were included in the study and followed up for 12 months. The minimum required sample size was calculated assuming a 99% confidence interval and 10% allowable error, based on a previously reported mean difference of 8.02 and standard deviations of 8.7745 (pre-intervention) and 6.9923 (post-intervention), yielding a required sample of 32 participants. Children aged 2–6 years with a confirmed diagnosis of ASD and enrolled in the CDC therapy program were included, while those with other neurodevelopmental disorders or significant visual, hearing, motor, or physical impairments were excluded. Written informed consent was obtained from parents or guardians prior to enrollment.

Baseline demographic and clinical data including age, sex, gestational age (preterm or term), history of twinning, birth asphyxia, and seizures were recorded. Diagnosis of ASD was confirmed using the Childhood Autism Rating Scale (CARS), with a score  $\geq 33$  considered diagnostic as recommended for the Indian population. Developmental assessment was performed using the Denver Developmental Screening Test (DDST) to determine developmental quotients in gross motor, fine motor, and personal-social domains, and the Receptive–Expressive Emergent Language Scale (REELS) to assess receptive and expressive language quotients.

All participants underwent the ELIMA (Early Low Intensity Multidisciplinary Autism) program, an indigenously developed multidisciplinary early intervention model delivered by trained therapists at the Child Development Centre. The intervention included behavioural therapy, speech therapy, occupational therapy, music and visual therapy, and structured group therapy. Behavioural therapy was based on Applied Behaviour Analysis principles and focused on improving compliance and social behavior. Speech therapy targeted verbal and non-verbal communication using techniques such as shaping, modeling, prompting, and Picture Exchange Communication System for non-verbal children. Occupational therapy addressed sensory integration, fine motor skills, activities of daily living, and reduction of stereotypical behaviors. Music and visual therapy aimed at improving sensory stimulation and communication, while group therapy focused on social interaction and school readiness. Each session lasted 45 minutes, with a total therapy exposure of approximately 6.75 hours per week. After 12 months of intervention, children were reassessed using the same standardized tools.

## RESULTS

32 children were initially entered in the study. 2 of the children were excluded from the study as they did not come for regular follow up. The data of 30 children who completed 12 months of therapy were analyzed and results are presented as follows.

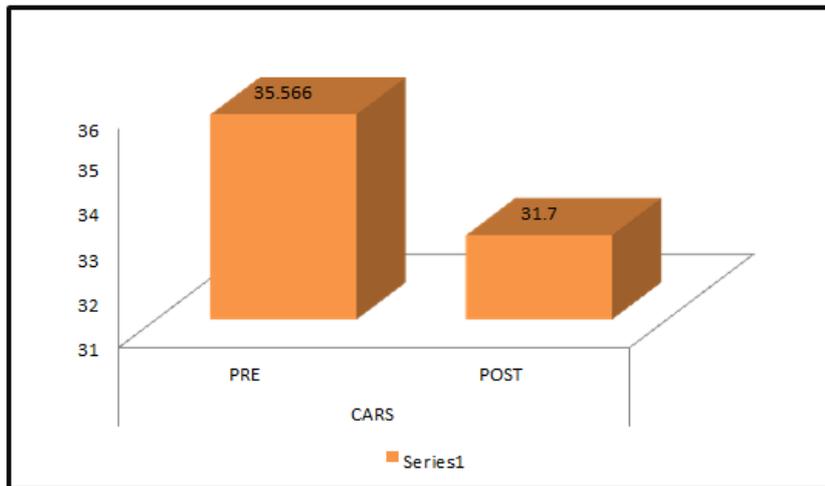


Figure 1: Comparison between CARS Scores before and after intervention

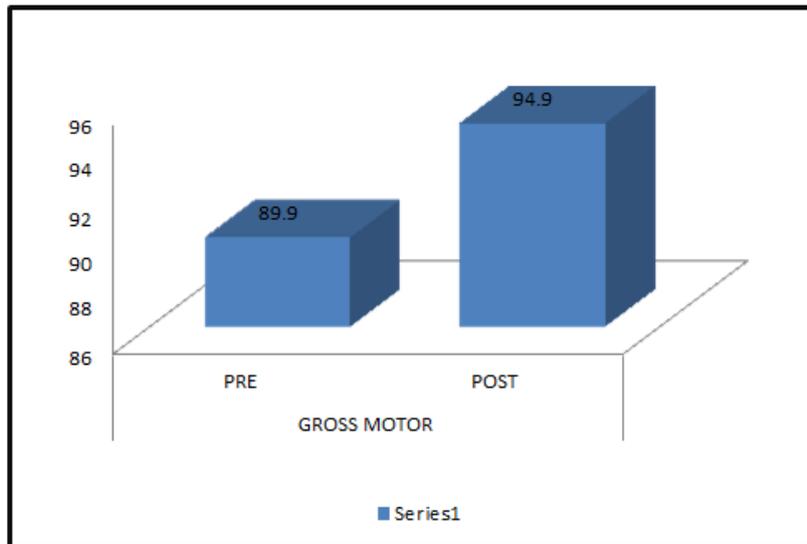


Figure 2: Comparison between gross motor development quotients before and after intervention

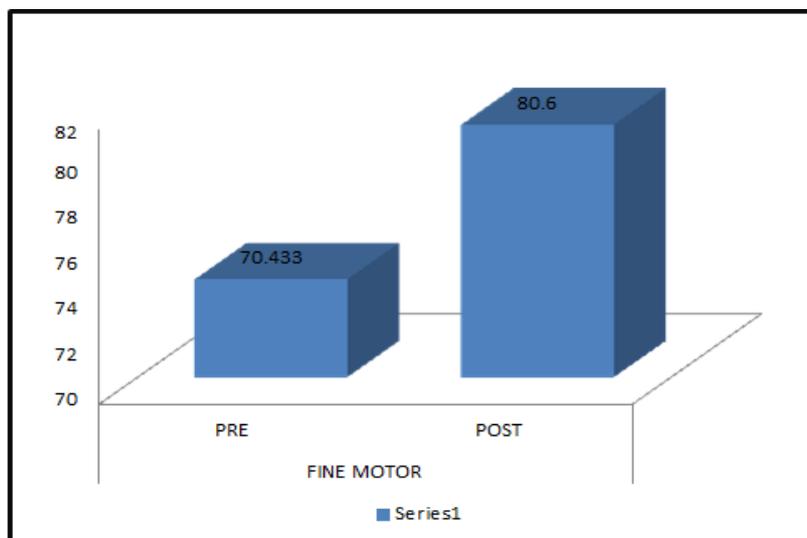
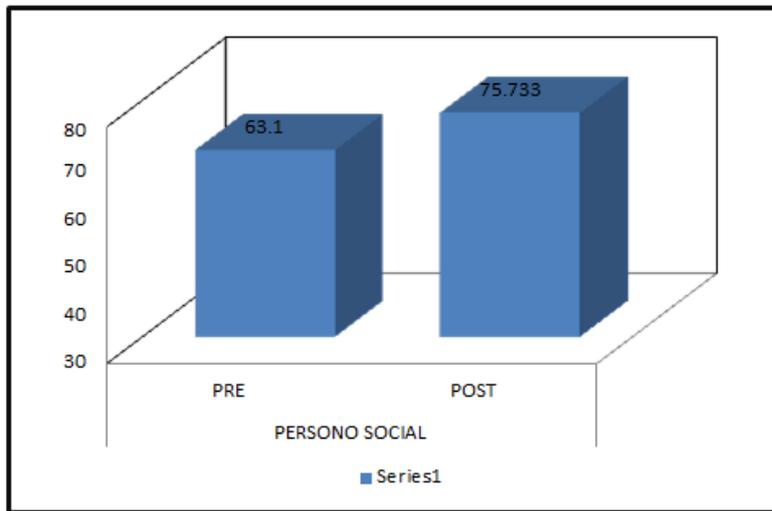
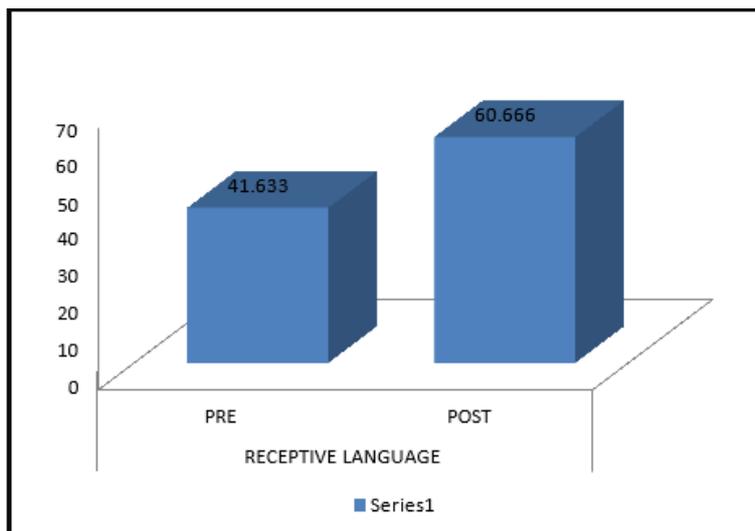


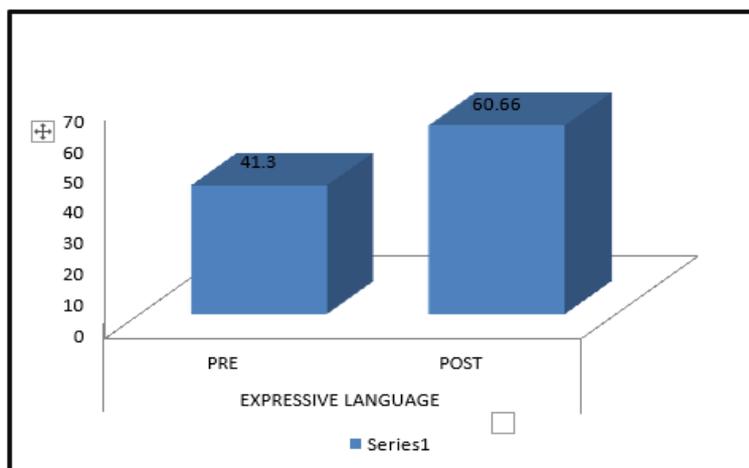
Figure 3: Comparison between fine motor development quotients before and after intervention



**Figure 4: Comparison between personal social development quotients before and after intervention**



**Figure 5: Comparison between receptive language quotients before and after intervention**



**Figure 6: Comparison between expressive language quotient before and after intervention**

## DISCUSSION

This study evaluated the effectiveness of an indigenous early intervention program, ELIMA (Early Low Intensity Multifaceted Autism Intervention), in improving autism severity and major developmental domains among children with Autism Spectrum Disorder (ASD). The findings demonstrate that even a low-intensity, multidisciplinary intervention can produce significant improvements in autism symptoms and developmental outcomes.

The mean duration of intervention was 282.93 hours over 12 months, translating to approximately 5.89 hours per week per child. This intensity is considerably lower than that reported in most previous studies, which have primarily examined moderate- to high-intensity interventions exceeding 15 hours per week. Despite this comparatively lower intensity, significant improvements were observed in both symptom severity and developmental domains.

The mean Childhood Autism Rating Scale (CARS) score significantly decreased from 35.55 (SD 1.69) at baseline to 31.7 (SD 1.91) after 12 months of therapy ( $p < 0.001$ ), indicating a meaningful reduction in autism severity. This finding is comparable to results from other intervention studies. Pratibha Karanth et al., in a study conducted in Bangalore evaluating the Communication DEALL program (15 hours/week over 8 months), reported significant reductions in CARS scores along with improvements in developmental domains. Similarly, Rivard et al. in Canada demonstrated a reduction in mean CARS scores following 12 months of high-intensity behavioral intervention (16–20 hours/week).<sup>10</sup>

Parent-mediated interventions have also shown positive outcomes. Harshini Manohar et al. at Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER) reported significant reduction in CARS scores after 12 weeks of home-based intervention averaging 8.37 hours per week, with improvements correlating positively with intervention hours.<sup>11</sup> Although these studies generally involved higher weekly intervention hours than the present study, the magnitude of improvement observed in our cohort is noteworthy given the lower intensity of 5.89 hours per week. This suggests that structured, multifaceted, culturally contextualized intervention models like ELIMA may be effective even at lower intensity levels.

Significant improvements were also observed across all developmental domains. Gross motor developmental quotient improved from 89.9% to 94.9% ( $p < 0.001$ ), and fine motor quotient improved from 70.4% to 80.6% ( $p < 0.001$ ). Personal-social quotient showed marked improvement from 63.1% to 75.7% ( $p < 0.001$ ). Language domains demonstrated substantial gains, with receptive language quotient increasing from 41.6% to 60.6% and expressive language quotient from 41.3% to 60.6% ( $p < 0.001$  for both).

Notably, improvements were more pronounced in personal-social and language domains compared to motor domains. This pattern aligns with findings from Juneja et al., who reported significant improvements in developmental, social, expressive, and receptive language quotients following parent-mediated intervention.<sup>12</sup>

The present findings reinforce the importance of early intervention in ASD. Theories of genetic vulnerability and neuroplasticity suggest that early developmental periods offer critical windows during which intervention can significantly alter developmental trajectories. Our results support this concept, demonstrating that early, structured, multidisciplinary intervention—even at relatively low intensity—can lead to meaningful reductions in autism severity and improvements across developmental domains.

In the present study, 80% of the enrolled children were males, indicating a marked male predominance. This finding is consistent with the well-established higher prevalence of Autism Spectrum Disorder (ASD) among males, as reported in epidemiological literature worldwide.<sup>13</sup>

Regarding prematurity, 5 children (16.7%) in our cohort were born preterm. Prematurity has been recognized as an important risk factor for ASD. A meta-analysis conducted by Wang et al. (2016), which analyzed 17 studies globally, identified gestational age  $\leq 36$  weeks as a significant risk factor for autism. This supports the observation in our study that a proportion of children with ASD had a history of preterm birth.<sup>14</sup>

With respect to family history, 2 children (6.7%) had a positive family history of autism, both having an elder sibling diagnosed with ASD. Familial aggregation of ASD has been well documented. A meta-analysis by Ding et al. reported that the risk of autism in siblings is approximately 7% if the affected child is female and 4% if the affected child is male. Furthermore, if a second child is diagnosed with ASD, the recurrence risk increases substantially to 25–35%. It is estimated that about 2–3% of families have more than one affected child.<sup>15</sup>

Similarly, a population-based study conducted in Sweden by Sven et al. estimated the heritability of ASD to be approximately 50%. The study demonstrated that the risk of autism increases nearly 10-fold if a sibling is affected and about 2-fold if a cousin has the diagnosis. These findings highlight the significant genetic contribution to ASD and are consistent with the familial occurrence observed in our cohort.<sup>16</sup>

In our study, 2 children (6.7%) had an associated seizure disorder, and both were receiving antiepileptic treatment. The association between epilepsy and ASD is well recognized. Volkmar et al., in a study conducted in Philadelphia, reported a 3- to 22-fold increased risk of seizures among individuals with autism compared to the general population. The study also noted that the risk of seizures was highest during early childhood, although it remained elevated during early adolescence.<sup>17</sup>

Overall, this prospective observational study provides evidence that the ELIMA program is effective in improving autism symptoms and developmental outcomes in young children with ASD. Importantly, it highlights that low-intensity, culturally adapted, and resource-feasible intervention models may be beneficial in settings where high-intensity programs are not practical. The secondary observations in our study—including male predominance, history of prematurity, familial clustering, and comorbid seizure disorder—are consistent with established epidemiological and genetic evidence regarding Autism Spectrum Disorder.

## CONCLUSION

The present study demonstrates that the Early Low Intensity Multifaceted Autism Intervention (ELIMA) program is effective in reducing the severity of autism symptoms among children aged 2–6 years. A statistically significant reduction in CARS scores following 12 months of intervention indicates meaningful clinical improvement in autism severity.

In addition, the ELIMA program produced significant improvements across all major developmental domains, including gross motor, fine motor, personal-social, and language (receptive and expressive) skills. These findings suggest that a structured, multidisciplinary, low-intensity early intervention model can positively influence developmental outcomes in children with Autism Spectrum Disorder.

## LIMITATIONS

The study had a small sample size, limiting generalizability. The absence of a control group makes it difficult to distinguish the intervention effect from natural developmental progress. Additionally, lack of assessor blinding may have introduced observer bias.

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